UNCLASSIFIED

JUSTIFICATION OF ESTIMATES

Research, Development, Test, and Evaluation, Defensewide (Volume 1)

Advanced Research Projects Agency
Ballistic Missile Defense Organization
Chemical and Biological Defense Program

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DTIC QUALITY INSPECTED 5

Department of Defense Budget for Fiscal Years 1996 and 1997
February 1995

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REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503

1. AGENCY USE ONLY *(Leave blank,*

2. REPORT DATE
February 1995

4. TITLE AND SUBTITLE
JUSTIFICATION OF ESTIMATES
RDT&E,DEFENSEWIDE (VOLUME 1)ARPA, BMDO, CHEMICAL AND BIOLOGICAL DEFENSE PROGRAM

5. FUNDING NUMBERS

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
Advanced Research Projects Agency
3701 N. Fairfax Drive
Arlington, Va. 22203-1714

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT
APPROVED FOR PUBLIC RELEASE, DISTRIBUTION IS UNLIMITED

APPROVED FOR PUBLIC RELEASE;
DISTRIBUTION IS UNLIMITED (A)

12b. DISTRIBUTION CODE
(A)

13. ABSTRACT *(Maximum 200 words)*
FY 1996 BUDGET JUSTIFICATION BOOK MATERIAL FOR THE CONGRESS. DESCRIPTIVE SUMMARIES.

14. SUBJECT TERMS
ARPA, BMDO, CHEMICAL, BUDGET DESCRIPTIVE SUMMARIES

15. NUMBER OF PAGES

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
SAR	SAR	SAR	SAR

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Line No	Program Element Number	Item	Act	Thousands of Dollars FY 1994	FY 1995	FY 1996	FY 1997	Sec
1	0601101D	In-House Laboratory Independent Research	1	2,257	2,331	3,551	2,265	U
2	0601101E	Defense Research Sciences	1	85,889	87,552	89,732	92,521	U
3	0601103D	University Research Initiatives	1	240,155	249,734	236,165	247,047	U
4	0601110D	Focused Research Initiatives	1	11,485	5,909	14,009	21,062	U
5	0601384BP	Chemical and Biological Defense Program	1			23,947	25,676	U
	Basic Research			339,786	345,526	367,404	388,571	
6	0602160D	Counterproliferation Support	2			9,952		U
7	0602173C	Support Technologies/Follow-on Technologies Exploratory Development	2		81,406	93,308	105,313	U
8	0602227D	Medical Free Electron Laser	2	20,389	23,385	13,258	24,661	U
9	0602228D	Historically Black Colleges and Universities (HBCU) Science and Engineer	2		22,540	14,779	15,095	U
10	0602234D	Lincoln Laboratory Research Program	2			19,903	21,099	U
11	0602301E	Computing Systems and Communications Technology	2	321,216	388,991	403,875	384,777	U
12	0602384BP	Chemical and Biological Defense Program	2		10,000	60,665	55,270	U
13	0602702E	Tactical Technology	2	90,053	121,667	113,168	124,649	U
14	0602708E	Integrated Command and Control Technology	2	84,490	81,554	48,000	67,603	U
15	0602712E	Materials and Electronics Technology	2	261,174	274,114	226,045	269,658	U
16	0602715H	Defense Nuclear Agency	2	234,226	218,938	219,003	230,724	U
17	0602787D	Medical Technology	2	9,265	7,643	7,501	6,532	U
18	0305108K	Command and Control Research	2	1,801	1,687	1,999	2,110	U
	Exploratory Development			1,022,614	1,231,925	1,231,456	1,307,491	

Line No	Program Element Number	Item	Act	Thousands of Dollars FY 1994	FY 1995	FY 1996	FY 1997	Sec
39	0603736D	CALS Initiative	3	8,461	13,886	6,545	6,461	U
40	0603738D	Cooperative DoD/VA Medical Research	3	19,446	44,533			U
41	0603739E	Advanced Electronics Technologies	3	377,801	409,763	419,863	443,458	U
42	0603744E	Advanced Simulation	3	27,107	29,537	5,799	14,614	U
43	0603745E	Semiconductor Manufacturing Technology	3	89,000	89,227	89,554		U
44	0603746E	Maritime Technology	3	38,750	52,000	49,657	49,708	U
45	0603747E	Electric Vehicles	3	46,250	15,000			U
46	0603748E	Natural Gas Vehicles	3	15,000				U
47	0603749E	Earth Conservancy	3	10,000				U
48	0603750D	Advanced Concept Technology Demonstrations	3		31,741	63,251	80,734	U
49	0603755D	High Performance Computing Modernization Program	3	44,119	65,059	89,682	116,878	U
50	0603756D	Consolidated DoD Software Initiative	3	22,036	24,492			U
51	0603771S	Industrial Preparedness Manufacturing Technology	3		19,650	7,007	6,967	U
52	0603800E	Joint Advanced Strike Technology - Dem/Val	3			30,675	80,925	U
53	0603832D	Joint Wargaming Simulation Management Office	3	72,467	54,390	77,690	79,750	U
54	0303132G	Global Grid Communications	3					U
55	0304211G	National Activities	3					U
56	0305166G	Special Development	3					U
57	0305889E	Counterdrug Intelligence Support	3	30,123				U
	Advanced Development			4,804,229	2,443,778	2,313,432	2,291,790	

Line No	Program Element Number	Item	Act	FY 1994	FY 1995	FY 1996	FY 1997	Sec
				Thousands of Dollars				
78	0604705D	Mobile Offshore Base Analysis	4	16,529				U
79	0201135J	CINC C2 Initiatives	4	7,506				U
		Demonstration and Validation		231,415	1,927,513	1,733,071	1,247,225	
80	0604160D	Counterproliferation Support - EMD	5		2,000	2,786	2,787	U
81	0604384BP	Chemical and Biological Defense Program - EMD	5		15,200	95,324	102,938	U
82	0604771D	Joint Tactical Information Distribution System (JTIDS)	5	47,500	83,469	62,068	46,784	U
83	0604861C	Theater High-Altitude Area Defense System - TMD - EMD	5				664,000	U
84	0604864C	Battle Management and C4I for TMD Acquisition - EMD	5		534	14,301	17,976	U
85	0604865C	Patriot PAC-3 Theater Missile Defense Acquisition - EMD	5		275,683	247,921	160,070	U
86	0604866C	ERINT/Patriot PAC-3 Risk Reduction - TMD - EMD	5		74,000	19,485	9,760	U
87	0604867C	Navy Lower Tier TMD Acquisition - EMD	5			237,473	193,600	U
88	0604889K	Counterdrug Engineering and Manufacturing Development Projects	5	414				U
		Engineering and Manufacturing Development		47,914	450,886	679,358	1,197,915	
89	0603710D	Classified Program - C3I	6	4,494	8,002	2,510	2,430	U
90	0603712S	Generic Logistics R&D Technology Demonstrations	6			16,800	18,600	U
91	0605104D	Technical Studies, Support and Analysis	6	25,079	24,372	39,302	39,019	U
92	0605110D	Technical Support to USD(A)--Critical Technology	6	1,711	2,630	2,651	2,884	U
93	0605114E	BLACK LIGHT	6	4,875	4,875	4,745	4,730	U
94	0605117D	Foreign Material Acquisition and Exploitation	6	98,583	103,731	46,338	46,088	U

Line No	Program Element Number	Item	Act	FY 1994	FY 1995	FY 1996	FY 1997	Sec
				Thousands of Dollars				
113	0303126K	Long-Haul Communications (DCS)	7	38,500	27,629	20,538	19,368	U
114	0303127K	Support of the National Communications System	7	3,864	4,229	4,062	4,042	U
115	0303131K	Minimum Essential Emergency Communications Network (MEECN)	7	2,825	2,998	2,269	2,179	U
116	0303140D	Information Systems Security Program	7			23,884	11,027	U
117	0303140G	Information Systems Security Program	7					U
118	0303153K	Joint Spectrum Center	7			4,859	4,883	U
119	0303154J	WWMCCS ADP Modernization	7	1,995				U
120	0305098L	Defense Support Activity - IPSG	7					U
121	0305106LC	Consolidated Imagery Activities	7					U
122	0305107LC	Tactical Imagery Activities	7					U
123	0305127V	Foreign Counterintelligence Activities	7					U
124	0305139B	DMA Mapping, Charting, and Geodesy (MC&G) Production System Improveme	7	56,792	56,763	80,131	83,932	U
125	0305141D	Joint Remotely Piloted Vehicles Program	7	81,814				U
126	0305154D	Defense Airborne Reconnaissance Program	7		655,269	515,148	391,246	U
127	0305154G	Defense Airborne Reconnaissance Program	7					U
128	0305154I	Defense Airborne Reconnaissance Program	7	334,519				U
129	0305157I	Land Remote Sensing Satellite System	7	34,506				U
130	0305159B	Defense Reconnaissance Support Activities	7	10,808	19,548			U
131	0305159G	Defense Reconnaissance Support Activities	7					U
132	0305159I	Defense Reconnaissance Support Activities	7	12,011	46,715	59,183	59,588	U

Defensewide
FY 1996/1997 R D T & E Program

Exhibit R-1

Summary

Date: FEB 1995

Thousands of Dollars

	FY 1994	FY 1995	FY 1996	FY 1997
Summary Recap of Defensewide				
Defense Mapping Agency	67,600	76,311	80,131	83,932
Special Operations Command	281,101	200,632	140,306	126,467
Chemical and Biological Defense Program		26,900	243,017	268,688
Ballistic Missile Defense Organization	2,605,089	2,467,593	2,442,199	2,483,619
Office of Secretary/Defense	1,162,853	1,923,214	1,602,059	1,592,078
Advanced Research Projects Agcy	2,648,563	2,731,867	2,639,234	2,572,339
National Security Agency	274,929	255,001	252,974	262,649
Defense Nuclear Agency	381,036	46,715	59,183	59,588
Defense Support Project Office	10,693	4,159	1,784	1,485
Joint Chiefs of Staff	88,634	82,177	66,356	64,449
Defense Information Systems Agency				
Defense Intelligence Agency				
Central Imagery Office	37,131	77,084	81,548	84,658
Defense Logistics Agency				
Defense Investigative Service				
Total Research Development Test & Eval Defwide	8,680,495	9,025,453	8,802,881	8,750,162

Advanced Research Projects Agency (ARPA)

ADVANCED RESEARCH PROJECTS AGENCY
RESEARCH, DEVELOPMENT, TEST AND EVALUATION, DEFENSEWIDE
SUMMARY BY BUDGET ACTIVITY
($ In Thousands)

FY 1996 PRESIDENT'S BUDGET

Budget Activity	Title	FY 1994 Actual	FY 1995 Estimate	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate
1	Basic Research	85,809	87,552	89,732	92,521	95,444	99,386	103,531	110,286
2	Exploratory Development	757,013	866,326	791,088	846,687	933,652	918,397	1,048,830	1,169,925
3	Advanced Development	1,773,286	1,742,896	1,721,026	1,594,520	1,573,065	1,447,164	1,569,741	1,756,275
6	RDT&E Management Support	32,455	35,093	37,388	38,611	39,497	40,808	41,308	41,987
	TOTAL RDT&E - DIRECT	2,648,563	2,731,867	2,639,234	2,572,339	2,641,658	2,505,755	2,763,410	3,078,473
	Reimbursements	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000
	TOTAL PROGRAM	2,658,563	2,741,867	2,649,234	2,582,339	2,651,658	2,515,755	2,773,410	3,088,473

ADVANCED RESEARCH PROJECTS AGENCY
RESEARCH, DEVELOPMENT, TEST AND EVALUATION, DEFENSEWIDE
DETAIL BY BUDGET ACTIVITY
($ In Thousands)

FY 1996 PRESIDENT'S BUDGET

Element Code	Title	FY 1994 Actual	FY 1995 Estimate	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate
1									
6.1	Basic Research	85,809	87,552	89,732	92,521	95,444	99,386	103,531	110,286
0601101E	Defense Research Sciences	85,809	87,552	89,732	92,521	95,444	99,386	103,531	110,286
2									
6.2	Exploratory Development	757,013	866,326	791,088	846,687	933,652	918,397	1,048,830	1,169,925
0602301E	Computing Systems & Communications Tech	321,216	388,991	403,875	384,777	417,522	387,760	451,891	484,827
0602702E	Tactical Technology	90,133	121,667	113,168	124,649	149,574	153,979	165,220	188,386
0602708E	Integrated Command & Control Tech	84,490	81,554	48,000	67,603	68,000	68,000	68,000	68,000
0602712E	Materials & Electronics Technology	261,174	274,114	226,045	269,658	298,556	308,658	363,719	428,712
3									
6.3	Advanced Development	1,773,286	1,742,896	1,721,026	1,594,520	1,573,065	1,447,164	1,569,741	1,756,275
0603226E	EEMIT	599,914	671,792	618,005	595,873	566,784	572,265	642,430	765,299
0603569E	Advanced Submarine Technology	43,839	32,381	7,473	9,942	5,449	5,430	26,230	35,530
0603570E	Defense Reinvestment	495,502	443,196	500,000	400,000	400,000	400,000	400,000	400,000
0603739E	Advanced Electronics Technologies	377,801	409,763	419,863	443,458	446,910	435,469	470,081	527,446
0603744E	Advanced Simulation - National Guard	27,107	29,537	5,799	14,614	20,000	15,000	15,000	18,000
0603745E	Semiconductor Manufacturing Technology	89,000	89,227	89,564	0	0	0	0	0
0603746E	MARITIME Technology	38,750	52,000	49,657	49,708	50,000	0	0	0
0603747E	Electric Vehicles	46,250	15,000	0	0	0	0	0	0
0603748E	Natural Gas Vehicles	15,000	0	0	0	0	0	0	0
0603749E	Earth Conservancy	10,000	0	0	0	0	0	0	0
0603800E	Joint Advanced Strike Technologies	0	0	30,675	80,925	83,922	19,000	16,000	10,000
0603889E	Counterdrug	30,123	0	0	0	0	0	0	0
6									
6.5	RDT&E Management Support	32,455	35,093	37,388	38,611	39,497	40,808	41,308	41,987
0605114E	Blacklite	4,875	4,875	4,745	4,730	4,683	5,000	5,000	5,000
0605898E	Management Headquarters (R&D)	27,580	30,218	32,643	33,881	34,814	35,808	36,308	36,987
	Total ARPA	2,648,563	2,731,867	2,639,234	2,572,339	2,641,658	2,505,755	2,763,410	3,078,473

ADVANCED RESEARCH PROJECTS AGENCY
RESEARCH, DEVELOPMENT, TEST AND EVALUATION, DEFENSEWIDE
PROJECT LEVEL SUMMARY REPORT
($ in millions)

FY 1996 PRESIDENT'S BUDGET

PE	PROJ	TITLE	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001
61101E	CCS-02	INFORMATION SCIENCES	33.219	23.863	24.776	28.443	30.805	32.300	34.500	35.700
	ES-01	ELECTRONIC SCIENCES	28.725	35.224	42.600	40.150	37.578	39.233	43.778	47.533
	MS-01	MATERIALS SCIENCES	23.865	28.465	22.356	23.928	27.061	27.853	25.253	27.053
	61101E	DEFENSE RESEARCH SCIENCES	85.809	87.552	89.732	92.521	95.444	99.386	103.531	110.286
62301E	ST-01	JASONS	1.240	1.227	1.195	1.196	1.190	1.200	1.200	1.200
	ST-11	INTELLIGENT SYSTEMS & SOFTWARE	68.357	75.981	95.038	100.228	142.394	108.807	138.407	155.007
	ST-19	HIGH PERFORMANCE COMPUTING	191.928	241.220	234.614	224.235	230.260	247.503	289.034	303.484
	ST-22	SOFTWARE ENGINEERING TECHNOLOGY	37.415	40.354	19.177	19.088	18.678	20.250	23.250	25.136
	ST-23	MONITORING TECHNOLOGIES	22.276	20.209	18.851	15.030	0.000	0.000	0.000	0.000
	ST-24	DEFENSIVE INFORMATION WARFARE	0.000	10.000	35.000	25.000	25.000	10.000	0.000	0.000
	62301E	COMPUTING SYS & COMM TECHNOLOGY	321.216	388.991	403.875	384.777	417.522	387.760	451.891	484.827
62702E	TT-03	NAVAL WARFARE TECHNOLOGY	26.421	49.423	39.688	55.913	70.410	58.687	59.407	69.173
	TT-04	ADVANCED LAND SYSTEMS TECHNOLOGY	15.194	30.239	34.087	25.973	30.136	50.000	54.686	66.686
	TT-05	ADVANCED TARGETING TECHNOLOGY	8.518	5.848	0.000	0.000	0.000	0.000	0.000	0.000
	TT-06	ADVANCED TACTICAL TECHNOLOGY	27.293	36.157	39.393	42.763	49.028	45.292	51.127	52.527
	TT-07	AERONAUTICS TECHNOLOGY	12.707	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	62702E	TACTICAL TECHNOLOGY	90.133	121.667	113.168	124.649	149.574	153.979	165.220	188.386
62708E	IC-03	INTEGRATED COMMAND & CONTROL TECH	84.490	81.554	48.000	67.603	68.000	68.000	68.000	68.000
62712E	MPT-01	MATERIALS PROCESSING TECHNOLOGY	129.053	148.627	122.741	146.258	160.887	167.249	175.494	214.240
	MPT-02	MICROELECTRONIC DEVICE TECHNOLOGIES	94.333	92.942	62.221	81.942	92.291	98.214	136.179	155.972
	MPT-06	CRYOGENIC ELECTRONICS	37.788	17.672	11.996	12.193	13.240	5.183	7.546	10.000
	MPT-07	MILITARY MEDICAL/TRAUMA CARE TECHNOLOGY	0.000	14.873	29.087	29.265	32.138	38.012	44.500	48.500
	62712E	MATERIALS & ELECTRONICS TECHNOLOGY	261.174	274.114	226.045	269.658	298.556	308.658	363.719	428.712
63226E	EE-21	COMMAND & CONTROL INFORMATION SYSTEMS	0.500	55.002	61.361	38.624	31.300	39.237	41.687	46.034
	EE-24	ASTOVL/COTL COMMON AFFORD LIGHTWEIGHT FIGHTER	25.712	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	EE-27	ADVANCED SPACE TECHNOLOGY PROGRAM	68.662	62.785	0.000	0.000	0.000	0.000	0.000	0.000
	EE-34	GUIDANCE TECHNOLOGY	10.809	10.120	26.150	29.673	32.000	21.600	17.000	20.000
	EE-36	ADVANCED SHIP/SENSOR SYSTEMS	17.180	34.348	16.502	33.513	45.614	51.550	53.050	68.050
	EE-37	ADVANCED SIMULATION	58.001	82.656	79.065	44.329	34.367	40.853	67.653	75.353
	EE-39	UNMANNED UNDERSEA VEHICLE SYSTEMS	23.850	37.430	16.836	17.469	17.395	18.115	21.115	26.115
	EE-40	CRITICAL MOBILE TARGETS	117.424	117.338	117.759	112.842	118.387	128.860	133.860	147.860
	EE-41	AIR DEFENSE INITIATIVE	24.642	34.718	23.476	24.777	35.029	31.989	46.989	68.989

ADVANCED RESEARCH PROJECTS AGENCY
RESEARCH, DEVELOPMENT, TEST AND EVALUATION, DEFENSEWIDE
PROJECT LEVEL SUMMARY REPORT
($ in millions)

FY 1996 PRESIDENT'S BUDGET

PE	PROJ	TITLE	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001
	EE-45	GLOBAL GRID COMMUNICATIONS	19.209	43.979	45.188	44.584	43.592	23.916	22.935	29.549
	EE-46	DEFENSE SIMULATION INTERNET (DSI)	31.617	16.622	27.514	37.175	0.000	0.000	0.000	0.000
	EE-CLS	CLASSIFIED	202.308	176.794	204.154	212.887	209.100	216.145	238.141	283.349
	63226E	**EEMIT**	**599.914**	**671.792**	**618.005**	**595.873**	**566.784**	**572.265**	**642.430**	**765.299**
63569E	**AS-01**	**ADVANCED SUBMARINE TECHNOLOGY**	**43.839**	**32.381**	**7.473**	**9.942**	**5.449**	**5.430**	**26.230**	**35.530**
63570E	PT-01	DUAL USE TECHNOLOGY PARTNERSHIPS	171.502	245.000	0.000	0.000	0.000	0.000	0.000	0.000
	PT-03	COM-MIL INTEGRATION PARTNERSHIPS	100.000	100.000	0.000	0.000	0.000	0.000	0.000	0.000
	PT-04	REGIONAL TECHNOLOGY ALLIANCES	100.000	48.196	0.000	0.000	0.000	0.000	0.000	0.000
	PT-06	AGILE MFG/ENTERPRISE INTEGRATION	35.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	PT-07	ADVANCED MATERIALS PARTNERSHIP	30.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	PT-08	ADVANCED MANUFACTURING TECH PARTNERSHIPS	30.000	30.000	0.000	0.000	0.000	0.000	0.000	0.000
	PT-10	MFG ENGINEERING EDUCATION PROGRAM	24.000	20.000	0.000	0.000	0.000	0.000	0.000	0.000
	PT-12	U.S. JAPAN MGMT TRAINING	5.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	PT-99	DEFENSE REINVESTMENT	0.000	0.000	500.000	400.000	400.000	400.000	400.000	400.000
	63570E	**DEFENSE REINVESTMENT**	**495.502**	**443.196**	**500.000**	**400.000**	**400.000**	**400.000**	**400.000**	**400.000**
63739E	MT-01	MICROELECTRONICS FABRICATION	0.000	0.000	1.907	26.534	46.800	65.250	70.550	78.900
	MT-02	MIMIC	79.631	20.472	0.000	0.000	0.000	0.000	0.000	0.000
	MT-03	INFRARED FOCAL PLANE ARRAY	41.429	44.116	36.744	19.276	0.000	0.000	0.000	0.000
	MT-04	ELECTRONIC MODULE TECHNOLOGY	115.524	119.084	134.473	133.814	150.089	163.372	209.064	233.034
	MT-05	TACTICAL INFORMATION SYSTEMS	9.263	14.652	20.164	17.721	14.835	21.646	23.000	27.500
	MT-06	MICROWAVE & ANALOG FRONT END TECHNOLOGY	0.000	22.253	50.741	52.921	54.981	55.201	62.467	68.012
	MT-07	CENTERS OF EXCELLENCE	23.837	38.377	23.642	19.936	10.000	10.000	5.000	5.000
	MT-08	MANUFACTURING TECHNOLOGY APPLICATIONS	7.186	54.738	78.942	91.248	89.905	70.000	55.000	70.000
	MT-10	ADVANCED LITHOGRAPHY	57.931	57.731	39.003	61.404	65.300	50.000	45.000	45.000
	MT-11	COMPUTER AIDED ACQ AND LOGISTICS SUPPORT (CALS)	43.000	38.340	34.247	20.604	15.000	0.000	0.000	0.000
	63739E	**ADVANCED ELECTRONICS TECHNOLOGIES**	**377.801**	**409.763**	**419.863**	**443.458**	**446.910**	**435.469**	**470.081**	**527.446**
63744E	**SM-01**	**ADVANCED SIMULATION - NATIONAL GUARD**	**27.107**	**29.537**	**5.799**	**14.614**	**20.000**	**15.000**	**15.000**	**18.000**
63745E	**EM-01**	**SEMICONDUCTOR MANUFACTURING TECHNOLOGY**	**89.000**	**89.227**	**89.554**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
63746E	**MR-01**	**MARITIME TECHNOLOGY**	**38.750**	**52.000**	**49.657**	**49.708**	**50.000**	**0.000**	**0.000**	**0.000**
63747E	**EV-01**	**ELECTRIC VEHICLES**	**46.250**	**15.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**

ADVANCED RESEARCH PROJECTS AGENCY
RESEARCH, DEVELOPMENT, TEST AND EVALUATION, DEFENSEWIDE
PROJECT LEVEL SUMMARY REPORT
($ in millions)

FY 1996 PRESIDENT'S BUDGET

PE	PROJ	TITLE	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001
63748E	GV-01	NATURAL GAS VEHICLES	15.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
63749E	EC-01	EARTH CONSERVANCY	10.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
63800E	JA-01	JOINT ADVANCED STRIKE TECHNOLOGIES	0.000	0.000	30.675	80.925	83.922	19.000	16.000	10.000
63889E	CD-01	COUNTERDRUG	30.123	0.000	0.000	0.000	0.000	0.000	0.000	0.000
65114E	BL-01	BLACKLITE	4.875	4.875	4.745	4.730	4.683	5.000	5.000	5.000
65898E	MH-01	MANAGEMENT HEADQUARTERS (R&D)	27.580	30.218	32.643	33.881	34.814	35.808	36.308	36.987
		AGENCY TOTAL	2648.563	2731.867	2639.234	2572.339	2641.658	2505.755	2763.410	3078.473
	BA-01	TOTAL	85.809	87.552	89.732	92.521	95.444	99.386	103.531	110.286
	BA-02	TOTAL	757.013	866.326	791.088	846.687	933.652	918.397	1048.830	1169.925
	BA-03	TOTAL	1773.286	1742.896	1721.026	1594.520	1573.065	1447.164	1569.741	1756.275
	BA-06	TOTAL	32.455	35.093	37.388	38.611	39.497	40.808	41.308	41.987
		AGENCY TOTAL	2648.563	2731.867	2639.234	2572.339	2641.658	2505.755	2763.410	3078.473

ARPA PROGRAM ELEMENT COMPARISON SUMMARY

INTRODUCTION AND EXPLANATION OF CONTENTS

PROGRAM ELEMENT	REMARKS
BUDGET ACTIVITY 3: ADVANCED DEVELOPMENT	
0603800E Joint Advanced Strike Technologies	This newly created program element funds ARPA's portion of the JAST program. The funds were previously budgeted in 0603226E for the ASTOVL program.

ADVANCED RESEARCH PROJECTS AGENCY
RESEARCH, DEVELOPMENT, TEST AND EVALUATION, DEFENSEWIDE
SUMMARY OF FY 1996 DEFENSE BUDGET ESTIMATES
($, in millions)

Appropriation Account Title	Direct Budget Plan (TOA)				Budget Authority				Outlays			
	FY 1994 Actual	FY 1995 Estimate	FY 1996 Estimate	FY 1997 Estimate	FY 1994 Actual	FY 1995 Estimate	FY 1996 Estimate	FY 1997 Estimate	FY 1994 Actual	FY 1995 Estimate	FY 1996 Estimate	FY 1997 Estimate
RDT&E, Defensewide	2,649	2,732	2,639	2,572	2,627	2,732	2,639	2,572	2,918	2,605	2,662	2,618

Exhibit PB-1

ADVANCED RESEARCH PROJECTS AGENCY
FY 1996/1997 PRESIDENT'S BUDGET

SCHEDULE OF CIVILIAN AND MILITARY PERSONNEL

	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001
I. CIVILIAN PERSONNEL								
RDT&E Defensewide								
US Direct Hire	154	182	182	182	182	182	176	172
Intergovermental Personnel Act (IPA)	34	35	35	35	35	35	35	35
Total, RDT&E	188	217	217	217	217	217	211	207
II. ACTIVE MILITARY PERSONNEL								
Officer, Army	3	3	3	3	3	3	3	3
Officer, Navy	4	4	4	4	4	4	4	4
Officer, Air Force	15	11	11	11	11	11	11	11
Enlisted, Air Force	0	1	1	1	1	1	1	1
Total Air Force	15	12	12	12	12	12	12	12
Total Military	22	19	19	19	19	19	19	19
TOTAL	210	236	236	236	236	236	230	226

Exhibit PB-4
February, 1995

ADVANCED RESEARCH PROJECTS AGENCY
ANALYSIS OF PAY INCREASE COSTS
FISCAL YEAR 1995
(Thousands of Dollars)

Organizational Unit and Account Title	Increase in Direct Pay and Other Related Costs			Payments To ( )	Reimbursements From ( )	Net Cost	Gross Absorption Within Available Funds	Additional Appropriation Required
	Direct Pay	Related Costs	Total Cost					
RDT&E, Defensewide								
Civilian Personnel								
Classified	233	39	272	0	0	272	272	0
Total	233	39	272	0	0	272	272	0

Exhibit PB-05
February 1995

CONSULTING SERVICES

PB-15 Exhibit

ADVANCED RESEARCH PROJECTS AGENCY

Appropriation: RDT&E Defensewide

(Dollars in Thousands)

		FY 1994	FY 1995	FY 1996
I.	Management & Professional Support Services	40,679	33,500	33,900
II.	Studies, Analysis, & Evaluations	9,029	8,900	9,000
III.	Engineering & Technical Services	0	0	0
	Totals	49,708	42,400	42,900

Prepared by: L. Golobic
(703) 696-2396
February 1995

MANAGEMENT HEADQUARTERS

ADVANCED RESEARCH PROJECTS AGENCY

	FY 1994 Actual				FY 1995 Estimate				FY 1996 Estimate				FY 1997 Estimate			
	Mil ES	Civ ES	Tot ES	Total Oblig	Mil ES	Civ ES	Tot ES	Total Oblig	Mil ES	Civ ES	Tot ES	Total Oblig	Mil ES	Civ ES	Tot ES	Total Oblig
Departmental Activities																
Military Services																
Military																
U.S. Army	3		3	207	3		3	211	3		3	211	3		3	214
U.S. Navy	4		4	302	4		4	299	4		4	305	4		4	309
U.S. Air Force	15		15	1,050	12		12	966	12		12	875	12		12	876
			22	1,559			19	1,476			19	1,391			19	1,399
Defense Agencies																
RDT&E Defensewide																
Civilian																
U.S. Direct Hire		154	154	12,099		182	182	14,318		182	182	15,225		182	182	15,775
IPA's			34	3,413			35	4,970			35	5,215			35	5,495
Other Costs				12,068				10,930				12,203				12,611
			188	27,580			217	30,218			217	32,643			217	33,881
TOTAL END STRENGTH			210				236				236				236	

(Dollars in Thousands; End Strengths in Whole Numbers)

Exhibit PB-22
February 1995

Advanced Research Projects Agency
SUMMARY OF FUNDS BUDGETED FOR ENVIRONMENTAL PROJECTS
FY 1996/FY 1997 PRESIDENT'S BUDGET

($ In Thousands)

Environmental Programs		FY 1994 Actual	FY 1995 Estimate	FY 1996 Estimate	FY 1997 Estimate	*Change FY 95/96*	*Change FY 96/97*
Environmental Cleanup	Not Applicable						
Environmental Compliance	Not Applicable						
Environmental Conservation	Not Applicable						
Pollution Prevention	Not Applicable						
Environmental Technology							
Appropriation:	RDT&E Defensewide						
	Conservation						
	Coal Utilization	5,000					
	Earth Conservancy	10,000					
	Nuclear Waste Monitoring	250					
	Pollution Prevention						
	Supercritical Fluid Technology	2,349	725			*-725*	
	Hazardous Waste Management	7,820	8,000			*-8,000*	
	Technology for a Sustainable Future	50					
	Environmental Super Critical Water Oxidation		6,975	7,598	7,801	*623*	*203*
	Joint Casting Emissions Reduction	13,500	12,000			*-12,000*	
	Environmental Green		1,787	3,558	7,900	*1,771*	*4,342*
	Fire Protection Technology	250	50			*-50*	
	Environmentally Conscious Elec Sys Mfg.	20,000					
	CFC Free Manufacturing (SEMATECH)	14,000	9,000	9,000			*-9,000*
	Bioremediation			3,916	6,598	*3,916*	*2,682*
	Environmental Sensors	4,886					
Base Realignment and Closure	Not Applicable						
	Grand Total	78,105	38,537	24,072	22,299	*-14,465*	*-1,773*

Justification for Changes

The outyear funding changes reflect contract profiles relative to work being performed.

The SEMATECH grant ends in FY 1997.

Hazardous Waste Management ($8M) and Joint Casting Emissions Reduction ($12M) are FY 1995 Congressional adds.

Advanced Research Projects Agency
SUMMARY OF FUNDS BUDGETED FOR ENVIRONMENTAL PROJECTS
FY 1996/FY 1997 PRESIDENT'S BUDGET

($ in Thousands)

Environmental Programs		FY 1998	FY 1999	FY 2000	FY 2001
Environmental Cleanup	Not Applicable				
Environmental Compliance	Not Applicable				
Environmental Conservation	Not Applicable				
Pollution Prevention	Not Applicable				
Environmental Technology					
Appropriation:	RDT&E Defensewide				
	Conservation				
	Coal Utilization				
	Earth Conservancy				
	Nuclear Waste Monitoring				
	Pollution Prevention				
	Supercritical Fluid Technology				
	Hazardous Waste Management				
	Technology for a Sustainable Future				
	Environmental Super Critical Water Oxidation				
	Joint Casting Emissions Reduction				
	Environmental Green	11,936	12,000	0	0
	Fire Protection Technology				
	Environmentally Conscious Elec Sys Mfg.				
	CFC Free Manufacturing (SEMATECH)				
	Bioremediation	8,202	8,494	0	0
	Environmental Sensors				
Base Realignment and Closure	Not Applicable				
	Grand Total	20,138	20,494	0	0

Exhibit PB-28 (page 2 of 2)

Prepared by: Ann Morgan
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February 2, 1995

DEPARTMENT OF DEFENSE
ADVANCED RESEARCH PROJECTS AGENCY
CIVILIAN PERSONNEL BUDGET CALCULATION
FY 1996/1997 PRESIDENT'S BUDGET
Fiscal Year 1994

SUMMARY	Full-Time Equivalent End Strength	Work Years	In thousands of dollars Compensation O.C. 11	Benefits O.C. 12	Total Compensation	Average Compensation
Direct Hire Civilians,United States:						
Classified and administrative	154	146	10442	1657	12099	82.87
Other:						
Intergovernmental Personnel Act (IPA)	34	25	3413	0	3413	136.52
Total United States	188	171	13855	1657	15512	90.71
Total Civilian Personnel Costs	188	171	13855	1657	15512	90.71
RDT&E Defensewide						
Direct Hire Civilians,United States:						
Classified and administrative	154	146	10442	1657	12099	82.87
Other:						
Intergovernmental Personnel Act (IPA)	34	25	3413	0	3413	136.52
Total United States	188	171	13855	1657	15512	90.71

EXHIBIT PB 31-R
FEBRUARY 1995

DEPARTMENT OF DEFENSE
ADVANCED RESEARCH PROJECTS AGENCY
CIVILIAN PERSONNEL BUDGET CALCULATION
FY 1996/1997 PRESIDENT'S BUDGET
Fiscal Year 1995

SUMMARY	Full-Time Equivalent End Strength	Work Years	In thousands of dollars Compensation O.C. 11	Benefits O.C. 12	Total Compensation	Average Compensation
Direct Hire Civilians,United States:						
Classified and administrative	182	168	12330	1988	14318	85.23
Other:						
Intergovernmental Personnel Act (IPA)	35	35	4970	0	4970	142.00
Total United States	217	203	17300	1988	19288	95.01
Total Civilian Personnel Costs	217	203	17300	1988	19288	95.01
RDT&E Defensewide						
Direct Hire Civilians,United States:						
Classified and administrative	182	168	12330	1988	14318	85.23
Other:						
Intergovernmental Personnel Act (IPA)	35	35	4970	0	4970	142.00
Total United States	217	203	17300	1988	19288	95.01

EXHIBIT PB 31-R
FEBRUARY 1995

DEPARTMENT OF DEFENSE
ADVANCED RESEARCH PROJECTS AGENCY
CIVILIAN PERSONNEL BUDGET CALCULATION
FY 1996/1997 PRESIDENT'S BUDGET
Fiscal Year 1996

SUMMARY	Full-Time Equivalent End Strength	Work Years	In thousands of dollars Compensation O.C. 11	Benefits O.C. 12	Total Compensation	Average Compensation
Direct Hire Civilians,United States:						
Classified and administrative	182	175	13101	2124	15225	87.00
Other:						
Intergovernmental Personnel Act (IPA)	35	35	5215	0	5215	149.00
Total United States	217	210	18316	2124	20440	97.33
Total Civilian Personnel Costs	217	210	18316	2124	20440	97.33
RDT&E Defensewide						
Direct Hire Civilians,United States:						
Classified and administrative	182	175	13101	2124	15225	87.00
Other:						
Intergovernmental Personnel Act (IPA)	35	35	5215	0	5215	149.00
Total United States	217	210	18316	2124	20440	97.33

EXHIBIT PB 31-R
FEBRUARY 1995

DEPARTMENT OF DEFENSE
ADVANCED RESEARCH PROJECTS AGENCY
CIVILIAN PERSONNEL BUDGET CALCULATION
FY 1996/1997 PRESIDENT'S BUDGET
Fiscal Year 1997

SUMMARY	Full-Time Equivalent End Strength	Work Years	In thousands of dollars Compensation O.C. 11	Benefits O.C. 12	Total Compensation	Average Compensation
Direct Hire Civilians,United States:						
Classified and administrative	182	175	13564	2211	15775	90.14
Other:						
Intergovernmental Personnel Act (IPA)	35	35	5495	0	5495	157.00
Total United States	217	210	19059	2211	21270	101.29
Total Civilian Personnel Costs	217	210	19059	2211	21270	101.29
RDT&E Defensewide						
Direct Hire Civilians,United States:						
Classified and administrative	182	175	13564	2211	15775	90.14
Other:						
Intergovernmental Personnel Act (IPA)	35	35	5495	0	5495	157.00
Total United States	217	210	19059	2211	21270	101.29

EXHIBIT PB 31-R
FEBRUARY 1995

DoD Aeronautics Budget
Advanced Research Projects Agency

($ in Thousands)

Appropriation Summary:	FY 1994 Actual	FY 1995 Estimate	FY 1996 Estimate	FY 1997 Estimate
Research Development, Test and Evaluation, Defensewide	37,107	0	54,599	94,674

Program Data:

Program Title	Program Element	FY 1994 Actual	FY 1995 Estimate	FY 1996 Estimate	FY 1997 Estimate
Aeronautics Technology	0602702E	5,956	0	0	0
ASTOVL/COTL	0603226E	25,712	0	0	0
Tier III	0603226E	5,439	0	23,924	13,749
Joint Advanced Strike Technology	0603800E	0	0	30,675	80,925

Exhibit PB-52A
DoD Aeronautics Budget
February 1995

DoD Space Budget
Advanced Research Projects Agency

($ In Thousands)

Appropriation Summary:

	FY 1994 Actual	FY 1995 Estimate	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999-2001 Estimate
Research Development, Test and Evaluation, Defensewide	65,662	58,785	0	0	0	0

Program Data:

Program Element	Program Title	Appropriation Code	Factor	Category	FY 1994 Actual	FY 1995 Estimate	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999-2001 Estimate
0603226E	Advanced Spac Technology	RDT&E, DA	100%	Communication	2,950	3,576	0	0	0	0
				Launch Vehicle	49,845	0	0	0	0	0
				Surveillance	12,270	55,000				
				Support RDT&E	597	209	0	0	0	0

ADVANCED RESEARCH PROJECTS AGENCY
FY 1996/1997 PRESIDENT'S BUDGET
BUDGETED MILITARY AND CIVILIAN PAY RAISE AMOUNTS
($ in Thousands)

			FY 1995	FY 1996	FY 1997
MILITARY PERSONNEL	N/A		0	0	0
CIVILIAN PERSONNEL					
RDT&E Defensewide					
Classified					
	Effective	Percent			
FY 1995	1-Jan-95	3.07%	272	363	363
FY 1996	1-Jan-96	2.4%	0	264	352
FY 1997	1-Jan-97	3.1%	0	0	354
Total			272	627	1069
TOTAL PERSONNEL			272	627	1,069

Exhibit PB-53
February 1995

ADVANCED RESEARCH PROJECTS AGENCY
CIVILIAN PERSONNEL COSTS
FY 1996/1997 PRESIDENT'S BUDGET
FY 1994/95/96/97
($ In Thousands)

APPROPRIATION: RESEARCH AND DEVELOPMENT

DATE: February 1995

OP-08 Civilian Personnel

Prior Year (PY) = 1994

RES	DP CD	LN IT	DESCRIPTION	PY BEGIN STRENGTH	PY END STRENGTH TOTAL	PY END STRENGTH FTP	WORK YEARS TOTAL	WORK YEARS FTP	PY BASIC COMP	PY OVER TIME	PY HOL PREM	PY OTHER OC 11	PY TOTAL VARIAB	PY TOTAL OC 11	PY BENEFIT OC 12	PY TOTAL COST
400	50	1	Senior Executive Schedule	22	23	22	21	20	2304	0	0	141	141	2445	323	2768
400	50	3	General Schedule	115	131	130	125	121	7706	48	2	241	291	7997	1334	9331
400	50		Subtotal	137	154	152	146	141	10010	48	2	382	432	10442	1657	12099
400	50		Subtotal (Rate)						68.56164				0.04316	71.52055	0.16553	82.86986
400	50	4	Special Schedule (IPA)	17	34	34	25	25	3413					3413		3413
400	50		IPA (Rate)						136.52000					136.52000		136.52000
400	50		Total Civilian	154	188	186	171	166	13423	48	2	382	432	13855	1657	15512
400	50		Total Civilian (Rate)						78.49708				0.03218	81.02339	0.12344	90.71345

ADVANCED RESEARCH PROJECTS AGENCY
CIVILIAN PERSONNEL COSTS
FY 1996/1997 PRESIDENT'S BUDGET
FY 1994/95/96/97
($ in Thousands)

DATE: February 1995

APPROPRIATION: RESEARCH AND DEVELOPMENT

OP-08 Civilian Personnel

Current Year (CY) = 1995

TRES	DP CD	LN IT	DESCRIPTION	CY BEGIN STRENGTH	CY END STRENGTH TOTAL	CY END STRENGTH FTP	WORK YEARS TOTAL	WORK YEARS FTP	CY BASIC COMP	CY OVER TIME	CY HOL PREM	CY OTHER OC 11	CY TOTAL VARIAB	CY TOTAL OC 11	CY BENEFIT OC 12	CY TOTAL COST
400	50	1	Senior Executive Schedule	23	25	24	23	22	2548	0	0	180	180	2728	398	3126
400	50	3	General Schedule	131	157	156	145	143	9266	51	3	282	336	9602	1590	11192
400	50		Subtotal	154	182	180	168	165	11814	51	3	462	516	12330	1988	14318
400	50		Subtotal (Rate)						70.32143				0.04368	73.39286	0.16827	85.22619
400	50	4	Special Schedule (IPA)	34	35	35	35	35	4970					4970		4970
400	50		IPA (Rate)						142.00000					142.00000		142.00000
400	50		Total Civilian	188	217	215	203	200	16784	51	3	462	516	17300	1988	19288
400	50		Total Civilian (Rate)						82.67980				0.04368	85.22167	0.11845	95.01478

ADVANCED RESEARCH PROJECTS AGENCY
CIVILIAN PERSONNEL COSTS
FY 1996/1997 PRESIDENT'S BUDGET
FY 1994/95/96/97
($ in Thousands)

APPROPRIATION: RESEARCH AND DEVELOPMENT

DATE: February 1995

OP-08 Civilian Personnel

Budget Year Plus One (BY1) = 1996

TRES	DP OD	LN IT	DESCRIPTION	BY BEGIN STRENGTH	BY1 END STRENGTH TOTAL	BY1 END STRENGTH FTP	WORK YEARS TOTAL	WORK YEARS FTP	BY1 BASIC COMP	BY1 OVER TIME	BY1 HOL PREM	BY1 OTHER OC 11	BY1 TOTAL VARIAB	BY1 TOTAL OC 11	BY1 BENEFIT OC 12	BY1 TOTAL COST
400	50	1	Senior Executive Schedule	25	25	24	23	22	2609	0	0	189	189	2798	424	3222
400	50	3	General Schedule	157	157	156	152	150	9946	54	3	300	357	10303	1700	12003
400	50		Subtotal	182	182	180	175	172	12555	54	3	489	546	13101	2124	15225
400	50		Subtotal (Rate)						71.74286				0.04349	74.86286	0.16918	87.00000
400	50	4	Special Schedule (IPA)	35	35	35	35	35	5215					5215		5215
400	50		IPA (Rate)						149.00000					149.00000		149.00000
400	50		Total Civilian	217	217	215	210	207	17770	54	3	489	546	18316	2124	20440
400	50		Total Civilian (Rate)						84.61905				0.04349	87.21905	0.11953	97.33333

ADVANCED RESEARCH PROJECTS AGENCY
CIVILIAN PERSONNEL COSTS
FY 1996/1997 PRESIDENT'S BUDGET
FY 1994/95/96/97
($ in Thousands)

DATE: February 1995

APPROPRIATION: RESEARCH AND DEVELOPMENT

OP-08 Civilian Personnel

Budget Year Plus Two (BY2) = 1997

TRES	DP CD	LN IT	DESCRIPTION	BY BEGIN STRENGTH	BY2 END STRENGTH TOTAL	BY2 END STRENGTH FTP	WORK YEARS TOTAL	WORK YEARS FTP	BY2 BASIC COMP	BY2 OVER TIME	BY2 HOL PREM	BY2 OTHER OC 11	BY2 TOTAL VARIAB	BY2 TOTAL OC 11	BY2 BENEFIT OC 12	BY2 TOTAL COST
400	50	1	Senior Executive Schedule	25	25	24	23	22	2807	0	0	194	194	3001	442	3443
400	50	3	General Schedule	157	157	156	152	150	10187	57	3	316	376	10563	1769	12332
400	50		Subtotal	182	182	180	175	172	12994	57	3	510	570	13564	2211	15775
400	50		Subtotal (Rate)						74.25143				0.04387	77.50857	0.17016	90.14286
400	50	4	Special Schedule (IPA)	35	35	35	35	35	5495					5495		5495
400	50		IPA (Rate)						157.00000					157.00000		157.00000
400	50		Total Civilian	217	217	215	210	207	18489	57	3	510	570	19059	2211	21270
400	50		Total Civilian (Rate)						88.04286				0.04387	90.75714	0.11958	101.28571

DEPARTMENT OF DEFENSE
ADVANCED RESEARCH PROJECTS AGENCY (ARPA)
FY 1996/97 BUDGET ESTIMATES
EXECUTIVE SUMMARY ON INFORMATION TECHNOLOGY

1. Activities: Information technology (IT) activities provide direct support to a total agency staff of over two hundred personnel engaged in making research investments in new technologies considered to be critical to the nation's defense. ARPA IT support is provided for the functions of office automation and decision support. These functions accomplish four IT goals: (1) to provide products for externally required reporting (e.g., Defense budget input); (2) to support internal management processes (e.g., research investment strategy decisions); (3) to provide an in-house base for various information system research prototypes, and (4) to provide an efficient and effective work environment. ARPA IT is viewed as three inter-linked systems providing this functional support: Desktop Automation, Central Processing, and Network Communications. Desktop Automation provides office desktop tools such as word processing, spreadsheets, and presentation graphics. Central Processing provides the presentation of financial data through both an executive information system and through data manipulation software. It also provides other local information to support administrative processes such as the handling of ARPA funding documents prior to entering the Defense Finance and Accounting System , National Science Foundation and external reporting requirements, internal management requirements, and internal management controls. Network Communications provides productivity products such as electronic mail, centralized calendaring and management of meetings, and on-line access to policy, forms, and historic data. The Network further provides both the linking of internal systems and access to external communications such as the Defense Data Network.

2. Initiatives: No significant initiatives have been started or planned. The greatest influences on the current estimates are general, evolutionary development/modernization (dev/mod) and increases in Agency personnel and work flow.

IT dev/mod includes technology upgrades to take advantage of newly available commercial products which are cost-effective and which broaden functional support. Procurement choices are made to maintain a balance between functional expansion and expenditures. This balance works to maximize staff productivity and work-quality gains while keeping a positive return on investment. The budget estimates also reflect the recognition that sufficient resources must be directed toward dev/mod. Resources are directed toward dev/mod at the earliest point at which the benefit from dev/mod exceeds the benefit from operations/maintenance. In this context, dev/mod is assumed to entail increases in functional support

Agency-wide personnel increases and the stresses of an expanding research and development budget have dramatically

increased IT support requirements. In addition to the acquisition of desktop computer systems for new personnel, enhanced networking capabilities, portable computing, and new software functions have been added to bridge the widening gap between mission tasks and personnel available to accomplish them.

3. Changes: While no significant (± 30%) changes have occurred, the FY 1994 total IT resources shown in this budget reflects a minor increase from the previous estimate due to cost increases incurred to support newly programmed, additional Agency personnel. Other year figures have been increased by approximately 3% to reflect the impact of this growth.

ADVANCED RESEARCH PROJECTS AGENCY
REPORT ON INFORMATION TECHNOLOGY (IT) RESOURCES
FY 1996/1997 PRESIDENT'S BUDGET
(Dollars in Thousands)

	FY94	FY95	FY96	FY97
1. Equipment ($000)				
A. Capital Purchases *	2031	1730	1779	1884
B. Purchases/leases *	0	0	0	0
Subtotal	**2031**	**1730**	**1779**	**1884**
2. Software ($000)				
A. Capital Purchases *	0	0	0	0
B. Purchases/leases *	364	374	385	408
Subtotal	**364**	**374**	**385**	**408**
3. Services ($000)				
A. Communications	0	0	0	0
B. Processing	0	0	0	0
C. Other	0	0	0	0
Subtotal	**0**	**0**	**0**	**0**
4. Support Services ($000)				
A. Software	1265	1300	1338	1417
B. Equipment Maintenance	373	383	394	418
C. Other	2506	2576	2650	2806
Subtotal	**4144**	**4260**	**4382**	**4640**
5. Supplies ($000)	34	35	36	38
6. Personnel (Compensation, Benefits) ($000)				
A. Software	0	0	0	0
B. Processing	0	0	0	0
C. Other	455	461	472	482
Subtotal	**455**	**461**	**472**	**482**
7. Other (Non-FIP Resources) ($000)				
A. Capital Purchases *	0	0	0	0
B. Purchases/leases *	168	204	210	222
Subtotal	**168**	**204**	**210**	**222**
8. Intra-Governmental Payments ($000)				
A. Software	0	0	0	0
B. Equipment Maintenance	0	0	0	0
C. Processing	0	0	0	0
D. Communications	70	72	74	78
E. Other	0	0	0	0
Subtotal	**70**	**72**	**74**	**78**
9. Intra-Governmental Collections ($000)				
A. Software	0	0	0	0
B. Equipment Maintenance	0	0	0	0
C. Processing	0	0	0	0
D. Communications	0	0	0	0
E. Other	0	0	0	0
Subtotal	**0**	**0**	**0**	**0**
NET IT RESOURCES (sum 1-8 above)	7266	7136	7338	7753
Workyears	5	5	5	5

Appropriation: All funding is RDT&E, Defensewide

* FY 1994 estimates reflect a $25 thousand investment/expense threshold; FY 1995 estimates reflect a $50 thousand investment/expense threshold; and FY 1996 and the outyear estimates adhere to the centrally managed criteria.

ADVANCED RESEARCH PROJECTS AGENCY
INFORMATION TECHNOLOGY (IT) RESOURCES BY CIM FUNCTIONAL AREA
FY 1996/1997 PRESIDENT'S BUDGET
(Dollars in Thousands)

	FY94	FY95	FY96	FY97
A. Science and Technology				
1. Major Systems/Initiatives	0	0	0	0
2. Non Major Systems/Initiatives	0	0	0	0
3. All Other				
Development/Modernization	3396	3095	3144	3249
Current Services	3870	4041	4194	4504
Subtotal	7266	7136	7338	7753
Appropriation/Fund - RDT&E, Defensewide				
4. TOTAL Science and Technology				
Total Development/Modernization	3396	3095	3144	3249
Total Current Services	3870	4041	4194	4504
Subtotal	7266	7136	7338	7753
Appropriation/Fund - RDT&E, Defensewide				
B. CIM Grand Total				
Development/Modernization	3396	3095	3144	3249
Current Services	3870	4041	4194	4504
Subtotal	7266	7136	7338	7753
Appropriation/Fund - RDT&E, Defensewide				

ADVANCED RESEARCH PROJECTS AGENCY
SECURITY ACTIVITIES (SA-1, Physical Security)

MANPOWER

	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001
Military Personnel								
a. Officers								
End Strength	0	0	0	0	0	0	0	0
Average Strength								
b. Enlisted								
End Strength	0	0	0	0	0	0	0	0
Average Strength								
c. Total Military								
End Strength	0	0	0	0	0	0	0	0
Average Strength								
Civilian Personnel								
a. Direct Hire								
End Strength	1	1	1	1	1	1	1	1
Workyears								
b. Indirect Hire								
End Strength	0	0	0	0	0	0	0	0
Workyears								
c. Total DoD Civilians								
End Strength	1	1	1	1	1	1	1	1
Workyears								
TOTAL DOD MANPOWER								
End Strength	1	1	1	1	1	1	1	1
Contract Personnel								
Workyears	1	1	1	1	1	1	1	1

Exhibits SA-1 (Page 1 of 3)

ADVANCED RESEARCH PROJECTS AGENCY
SECURITY ACTIVITIES (SA-1, Physical Security)

TOTAL OBLIGATIONAL AUTHORITY
(Dollars in Millions)

	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001
OPERATING & SUPPORT COSTS						
a. Personnel						
(1) Military (Active)						
(2) Military (National Guard)						
(3) Military (Reserve)						
(4) O&M, Active						
(5) O&M, National Guard						
(6) O&M, Reserve						
(7) Other - PE 0605898E						
(a) Direct Hire, Civilian	.054	.056	.058	.060	.063	.065
(b) Contract	.062	.064	.066	.069	.072	.075
Subtotal Personnel Costs	.116	.120	.124	.129	.135	.140
b. Security Equipment						
(1) O&M, Active						
(2) O&M, National Guard						
(3) O&M, Reserve						
(4) Other - PE 0605898E	.149	.151	.130	.047	.042	.043
Subtotal Security Equipment Costs	.149	.151	.130	.047	.042	.043
c. Miscellaneous	0	0	0	0	0	0
TOTAL OPERATING & SUPPORT COSTS	.265	.271	.254	.176	.177	.183

ADVANCED RESEARCH PROJECTS AGENCY
SECURITY ACTIVITIES (SA-1, Physical Security)

TOTAL OBLIGATIONAL AUTHORITY
(Dollars in Millions)

	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001
INVESTMENT COSTS						
a. Security Equipment						
(1) Other Procurement						
(2) O&M, Active						
(3) O&M, National Guard						
(4) O&M, Reserve						
(5) Defense Business Operations Funds						
(6) Other						
Subtotal Security Equipment	0	0	0	0	0	0
b. Security RDT&E, Defensewide						
(1) 6.1 (Research)						
(2) 6.2 (Exploratory Development)						
(3) 6.3 (Advanced Development)						
(4) 6.4 (Engineering Development)						
(5) 6.5 (Management & Support)						
Subtotal Security RDT&E	0	0	0	0	0	0
c. Security Construction						
(1) Military Construction appropriation						
(2) O&M appropriation						
Subtotal Security Construction	0	0	0	0	0	0
TOTAL INVESTMENT COSTS	0	0	0	0	0	0
TOTAL TOA FOR ARPA	.265	.271	.254	.276	.277	.283

Exhibit SA-1 (Page 3 of 3)

ADVANCED RESEARCH PROJECTS AGENCY
SECURITY ACTIVITIES (SA-2, Classified Management Security)

MANPOWER

	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001
Military Personnel								
a. Officers								
End Strength	0	0	0	0	0	0	0	0
Average Strength								
b. Enlisted								
End Strength	0	0	0	0	0	0	0	0
Average Strength								
c. Total Military								
End Strength	0	0	0	0	0	0	0	0
Average Strength								
Civilian Personnel								
a. Direct Hire								
End Strength	1	1	1	1	1	1	1	1
Workyears								
b. Indirect Hire								
End Strength	0	0	0	0	0	0	0	0
Workyears								
c. Total DoD Civilians								
End Strength	1	1	1	1	1	1	1	1
Workyears								
TOTAL DOD MANPOWER								
End Strength	1	1	1	1	1	1	1	1
Contract Personnel								
Workyears	3	3	3	3	3	3	3	3

ADVANCED RESEARCH PROJECTS AGENCY
SECURITY ACTIVITIES (SA-2, Classified Management Security)

TOTAL OBLIGATIONAL AUTHORITY
(Dollars in Millions)

	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001
OPERATING & SUPPORT COSTS						
a. Personnel						
(1) Military (Active)						
(2) Military (National Guard)						
(3) Military (Reserve)						
(4) O&M, Active						
(5) O&M, National Guard						
(6) O&M, Reserve						
(7) Other - PE 06058898E						
(a) Direct Hire, Civilian	.054	.056	.058	.060	.063	.065
(b) Contract	.186	.192	.198	.207	.216	.225
Subtotal Personnel Costs	.240	.248	.256	.267	.279	.290
b. Security Equipment						
(1) O&M, Active						
(2) O&M, National Guard						
(3) O&M, Reserve						
(4) Other						
Subtotal Security Equipment Cost	0	0	0	0	0	0
c. Miscellaneous	0	0	0	0	0	0
TOTAL OPERATING & SUPPORT COSTS	.240	.248	.256	.267	.279	.290

ADVANCED RESEARCH PROJECTS AGENCY
SECURITY ACTIVITIES (SA-2, Classified Management Security)

TOTAL OBLIGATIONAL AUTHORITY
(Dollars in Millions)

	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001
INVESTMENT COSTS						
a. Security Equipment						
(1) Other Procurement						
(2) O&M, Active						
(3) O&M, National Guard						
(4) O&M, Reserve						
(5) Defense Business Operations Funds						
(6) Other (Specifically identify each applicable appropriation/account)						
Subtotal Security Equipment	0	0	0	0	0	0
b. Security RDT&E, Defensewide						
(1) 6.1 (Research)						
(2) 6.2 (Exploratory Development)						
(3) 6.3 (Advanced Development)						
(4) 6.4 (Engineering Development)						
(5) 6.5 (Management & Support)						
Subtotal Security RDT&E	0	0	0	0	0	0
c. Security Construction						
(1) Military Construction appropriation						
(2) O&M appropriation						
Subtotal Security Construction	0	0	0	0	0	0
TOTAL INVESTMENTS COSTS	0	0	0	0	0	0
TOTAL TOA FOR ARPA	.240	.248	.256	.267	.279	.290

Exhibit SA-2 (Page 3 of 3)

ADVANCED RESEARCH PROJECTS AGENCY
SECURITY ACTIVITIES (SA-3, Communications Security)

MANPOWER

	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001
Military Personnel								
a. Officers								
End Strength	0	0	0	0	0	0	0	0
Average Strength								
b. Enlisted								
End Strength	0	0	0	0	0	0	0	0
Average Strength								
c. Total Military								
End Strength	0	0	0	0	0	0	0	0
Average Strength								
Civilian Personnel								
a. Direct Hire								
End Strength	1	1	1	1	1	1	1	1
Workyears								
b. Indirect Hire								
End Strength	0	0	0	0	0	0	0	0
Workyears								
c. Total DoD Civilians								
End Strength	1	1	1	1	1	1	1	1
Workyears								
TOTAL DOD MANPOWER								
End Strength	1	1	1	1	1	1	1	1
Contract Personnel								
Workyears	0	0	0	0	0	0	0	0

ADVANCED RESEARCH PROJECTS AGENCY
SECURITY ACTIVITIES (SA-3, Communications Security)

TOTAL OBLIGATIONAL AUTHORITY
(Dollars in Millions)

	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001
OPERATING & SUPPORT COSTS						
a. Personnel						
(1) Military (Active)						
(2) Military (National Guard)						
(3) Military (Reserve)						
(4) O&M, Active						
(5) O&M, National Guard						
(6) O&M, Reserve						
(7) Other - PE 0605898E						
(a) Direct Hire, Civilian	.054	.056	.058	.060	.063	.065
(b) Contract	0	0	0	0	0	0
Subtotal Personnel Costs	.054	.056	.058	.060	.063	.065
b. Security Equipment						
(1) O&M, Active						
(2) O&M, National Guard						
(3) O&M, Reserve						
(4) Other						
Subtotal Security Equipment Cost	0	0	0	0	0	0
c. Miscellaneous	0	0	0	0	0	0
TOTAL OPERATING & SUPPORT COSTS	.054	.056	.058	.060	.063	.065

ADVANCED RESEARCH PROJECTS AGENCY
SECURITY ACTIVITIES (SA-3, Communications Security)

TOTAL OBLIGATIONAL AUTHORITY
(Dollars in Millions)

	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001
INVESTMENT COSTS						
a. Security Equipment						
(1) Other Procurement						
(2) O&M, Active						
(3) O&M, National Guard						
(4) O&M, Reserve						
(5) Defense Business Operations Funds (Asset Capitalization Program Only)						
(6) Other						
Subtotal Security Equipment	0	0	0	0	0	0
b. Security RDT&E, Defensewide						
(1) 6.1 (Research)						
(2) 6.2 (Exploratory Development)						
(3) 6.3 (Advanced Development)						
(4) 6.4 (Engineering Development)						
(5) 6.5 (Management & Support)						
Subtotal Security RDT&E	0	0	0	0	0	0
c. Security Construction						
(1) Military Construction appropriation						
(2) O&M appropriation						
Subtotal Security Construction	0	0	0	0	0	0
TOTAL INVESTMENTS COSTS	0	0	0	0	0	0
TOTAL TOA FOR ARPA	.054	.056	.058	.060	.063	.065

Exhibit SA-3 (Page 3 of 3)

ADVANCED RESEARCH PROJECTS AGENCY
SECURITY ACTIVITIES (SA-4, Automated Information Systems)

MANPOWER

	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001
Military Personnel								
a. Officers								
End Strength	0	0	0	0	0	0	0	0
Average Strength								
b. Enlisted								
End Strength	0	0	0	0	0	0	0	0
Average Strength								
c. Total Military								
End Strength	0	0	0	0	0	0	0	0
Average Strength								
Civilian Personnel								
a. Direct Hire								
End Strength	0	0	0	0	0	0	0	0
Workyears								
b. Indirect Hire								
End Strength	0	0	0	0	0	0	0	0
Workyears								
c. Total DoD Civilians								
End Strength	0	0	0	0	0	0	0	0
Workyears								
TOTAL DOD MANPOWER								
End Strength	0	0	0	0	0	0	0	0
Contract Personnel								
Workyears	1	1	1	1	1	1	1	1

ADVANCED RESEARCH PROJECTS AGENCY
SECURITY ACTIVITIES (SA-4, Automated Information Systems)

TOTAL OBLIGATIONAL AUTHORITY
(Dollars in Millions)

	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001
OPERATING & SUPPORT COSTS						
a. Personnel						
(1) Military (Active)						
(2) Military (National Guard)						
(3) Military (Reserve)						
(4) O&M, Active						
(5) O&M, National Guard						
(6) O&M, Reserve						
(7) Other - PE 0605898E						
(a) Direct Hire, Civilian	0	0	0	0	0	0
(b) Contract	.062	.064	.066	.069	.072	.075
Subtotal Personnel Costs	.062	.064	.066	.069	.072	.075
b. Security Equipment						
(1) O&M, Active						
(2) O&M, National Guard						
(3) O&M, Reserve						
(4) Other						
Subtotal Security Equipment Cost	0	0	0	0	0	0
c. Miscellaneous	0	0	0	0	0	0
TOTAL OPERATING & SUPPORT COSTS	.062	.064	.066	.069	.072	.075

ADVANCED RESEARCH PROJECTS AGENCY
SECURITY ACTIVITIES (SA-4, Automated Information Systems)

TOTAL OBLIGATIONAL AUTHORITY
(Dollars in Millions)

	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001
INVESTMENT COSTS						
a. Security Equipment						
(1) Other Procurement						
(2) O&M, Active						
(3) O&M, National Guard						
(4) O&M, Reserve						
(5) Defense Business Operations Funds						
(6) Other						
Subtotal Security Equipment	0	0	0	0	0	0
b. Security RDT&E, Defensewide						
(1) 6.1 (Research)						
(2) 6.2 (Exploratory Development)						
(3) 6.3 (Advanced Development)						
(4) 6.4 (Engineering Development)						
(5) 6.5 (Management & Support)						
Subtotal Security RDT&E	0	0	0	0	0	0
c. Security Construction						
(1) Military Construction appropriation						
(2) O&M appropriation						
Subtotal Security Construction	0	0	0	0	0	0
TOTAL INVESTMENTS COSTS	0	0	0	0	0	0
TOTAL TOA FOR ARPA	.062	.064	.066	.069	.072	.075

Exhibit SA-4 (Page 3 of 3)

ADVANCED RESEARCH PROJECTS AGENCY
SECURITY ACTIVITIES (SA-7, Personnel Security)

MANPOWER

	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001
Military Personnel								
a. Officers								
End Strength	0	0	0	0	0	0	0	0
Average Strength								
b. Enlisted								
End Strength	0	0	0	0	0	0	0	0
Average Strength								
c. Total Military								
End Strength	0	0	0	0	0	0	0	0
Average Strength								
Civilian Personnel								
a. Direct Hire								
End Strength	1	1	1	1	1	1	1	1
Workyears								
b. Indirect Hire								
End Strength	0	0	0	0	0	0	0	0
Workyears								
c. Total DoD Civilians								
End Strength	1	1	1	1	1	1	1	1
Workyears								
TOTAL DOD MANPOWER								
End Strength	1	1	1	1	1	1	1	1
Contract Personnel								
Workyears	15	15	15	15	15	15	15	15

ADVANCED RESEARCH PROJECTS AGENCY
SECURITY ACTIVITIES (SA-7, Personnel Security)

TOTAL OBLIGATIONAL AUTHORITY
(Dollars in Millions)

	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001
OPERATING & SUPPORT COSTS						
a. Personnel						
(1) Military (Active)						
(2) Military (National Guard)						
(3) Military (Reserve)						
(4) O&M, Active						
(5) O&M, National Guard						
(6) O&M, Reserve						
(7) Other - PE 0605898E						
(a) Direct Hire, Civilian	.054	.056	.058	.060	.063	.065
(b) Contract	.930	.960	.990	1.035	1.080	1.125
Subtotal Personnel Costs	.984	1.016	1.048	1.095	1.143	1.190
b. Security Equipment						
(1) O&M, Active						
(2) O&M, National Guard						
(3) O&M, Reserve						
(4) Other (Specifically identify each applicable appropriation/account)						
Subtotal Security Equipment Cost	0	0	0	0	0	0
c. Miscellaneous	0	0	0	0	0	0
TOTAL OPERATING & SUPPORT COSTS	.984	1.016	1.048	1.095	1.143	1.190

ADVANCED RESEARCH PROJECTS AGENCY
SECURITY ACTIVITIES (SA-7, Personnel Security)

TOTAL OBLIGATIONAL AUTHORITY
(Dollars in Millions)

	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001
INVESTMENT COSTS						
a. Security Equipment						
(1) Other Procurement						
(2) O&M, Active						
(3) O&M, National Guard						
(4) O&M, Reserve						
(5) Defense Business Operations Funds						
(6) Other						
Subtotal Security Equipment	0	0	0	0	0	0
b. Security RDT&E, Defensewide						
(1) 6.1 (Research)						
(2) 6.2 (Exploratory Development)						
(3) 6.3 (Advanced Development)						
(4) 6.4 (Engineering Development)						
(5) 6.5 (Management & Support)						
Subtotal Security RDT&E	0	0	0	0	0	0
c. Security Construction						
(1) Military Construction appropriation						
(2) O&M appropriation						
Subtotal Security Construction	0	0	0	0	0	0
TOTAL INVESTMENTS COSTS	0	0	0	0	0	0
TOTAL TOA FOR ARPA	.984	1.016	1.048	1.095	1.143	1.190

Exhibit SA-7 (Page 3 of 3)

ADVANCED RESEARCH PROJECTS AGENCY
SECURITY ACTIVITIES (SA-10, Special Access Programs Oversight)

MANPOWER

	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001
Military Personnel								
a. Officers								
End Strength	0	0	0	0	0	0	0	0
Average Strength								
b. Enlisted								
End Strength	0	0	0	0	0	0	0	0
Average Strength								
c. Total Military								
End Strength	0	0	0	0	0	0	0	0
Average Strength								
Civilian Personnel								
a. Direct Hire								
End Strength	2	2	2	2	2	2	2	2
Workyears								
b. Indirect Hire								
End Strength	0	0	0	0	0	0	0	0
Workyears								
c. Total DoD Civilians								
End Strength	2	2	2	2	2	2	2	2
Workyears								
TOTAL DOD MANPOWER								
End Strength	2	2	2	2	2	2	2	2
Contract Personnel								
Workyears	2	2	2	2	2	2	2	2

ADVANCED RESEARCH PROJECTS AGENCY
SECURITY ACTIVITIES (SA-10, Special Access Programs Oversight)

TOTAL OBLIGATIONAL AUTHORITY
(Dollars in Millions)

	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001
OPERATING & SUPPORT COSTS						
a. Personnel						
(1) Military (Active)						
(2) Military (National Guard)						
(3) Military (Reserve)						
(4) O&M, Active						
(5) O&M, National Guard						
(6) O&M, Reserve						
(7) Other - PE 0605898E						
(a) Direct Hire, Civilian	.108	.112	.116	.120	.126	.130
(b) Contract	.124	.128	.132	.138	.144	.150
Subtotal Personnel Costs	.232	.240	.248	.258	.270	.280
b. Security Equipment						
(1) O&M, Active						
(2) O&M, National Guard						
(3) O&M, Reserve						
(4) Other						
Subtotal Security Equipment Cost	0	0	0	0	0	0
c. Miscellaneous	0	0	0	0	0	0
TOTAL OPERATING & SUPPORT COSTS	.232	.240	.248	.258	.270	.280

ADVANCED RESEARCH PROJECTS AGENCY
SECURITY ACTIVITIES (SA-10, Special Access Programs Oversight)

TOTAL OBLIGATIONAL AUTHORITY
(Dollars in Millions)

	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001
INVESTMENT COSTS						
a. Security Equipment						
(1) Other Procurement						
(2) O&M, Active						
(3) O&M, National Guard						
(4) O&M, Reserve						
(5) Defense Business Operations Funds						
(6) Other						
Subtotal Security Equipment	0	0	0	0	0	0
b. Security RDT&E						
(1) 6.1 (Research)						
(2) 6.2 (Exploratory Development)						
(3) 6.3 (Advanced Development)						
(4) 6.4 (Engineering Development)						
(5) 6.5 (Management & Support)						
Subtotal Security RDT&E	0	0	0	0	0	0
c. Security Construction						
(1) Military Construction appropriation						
(2) O&M appropriation						
Subtotal Security Construction	0	0	0	0	0	0
TOTAL INVESTMENTS COSTS	0	0	0	0	0	0
TOTAL TOA FOR ARPA.	.232	.240	.248	.258	.270	.280

ADVANCED RESEARCH PROJECTS AGENCY
SECURITY ACTIVITIES (SA-11, Policy/Oversight)

MANPOWER

	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001
Military Personnel								
a. Officers								
End Strength	0	0	0	0	0	0	0	0
Average Strength								
b. Enlisted								
End Strength	0	0	0	0	0	0	0	0
Average Strength								
c. Total Military								
End Strength	0	0	0	0	0	0	0	0
Average Strength								
Civilian Personnel								
a. Direct Hire								
End Strength	8	8	8	8	8	8	8	8
Workyears								
b. Indirect Hire								
End Strength	0	0	0	0	0	0	0	0
Workyears								
c. Total DoD Civilians								
End Strength	8	8	8	8	8	8	8	8
Workyears								
TOTAL DOD MANPOWER								
End Strength	8	8	8	8	8	8	8	8
Contract Personnel								
Workyears	23	23	23	23	23	23	23	23

ADVANCED RESEARCH PROJECTS AGENCY
SECURITY ACTIVITIES (SA-11, Policy/Oversight)

TOTAL OBLIGATIONAL AUTHORITY
(Dollars in Millions)

	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001
OPERATING & SUPPORT COSTS						
a. Personnel						
(1) Military (Active)						
(2) Military (National Guard)						
(3) Military (Reserve)						
(4) O&M, Active						
(5) O&M, National Guard						
(6) O&M, Reserve						
(7) Other - PE 0605898E						
(a) Direct Hire, Civilian	.434	.451	.469	.487	.506	.526
(b) Contract	1.424	1.485	1.547	1.612	1.677	1.744
Subtotal Personnel Costs	1.858	1.936	2.016	2.099	2.183	2.270
b. Security Equipment						
(1) O&M, Active						
(2) O&M, National Guard						
(3) O&M, Reserve						
(4) Other - PE 0605898E	.149	.151	.130	.047	.042	.043
Subtotal Security Equipment Cost	.149	.151	.130	.047	.042	.043
c. Miscellaneous	0	0	0	0	0	0
TOTAL OPERATING & SUPPORT COST	2.006	2.087	2.146	2.146	2.225	2.313

ADVANCED RESEARCH PROJECTS AGENCY
SECURITY ACTIVITIES (SA-11, Policy/Oversight)

TOTAL OBLIGATIONAL AUTHORITY
(Dollars in Millions)

	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001
INVESTMENT COSTS						
a. Security Equipment						
(1) Other Procurement						
(2) O&M, Active						
(3) O&M, National Guard						
(4) O&M, Reserve						
(5) Defense Business Operations Funds						
(6) Other						
Subtotal Security Equipment	0	0	0	0	0	0
b. Security RDT&E						
(1) 6.1 (Research)						
(2) 6.2 (Exploratory Development)						
(3) 6.3 (Advanced Development)						
(4) 6.4 (Engineering Development)						
(5) 6.5 (Management & Support)						
Subtotal Security RDT&E	0	0	0	0	0	0
c. Security Construction						
(1) Military Construction appropriation						
(2) O&M appropriation						
Subtotal Security Construction	0	0	0	0	0	0
TOTAL INVESTMENTS COSTS	0	0	0	0	0	0
TOTAL TOA FOR ARPA.	2.006	2.087	2.146	2.146	2.225	2.313

ADVANCED RESEARCH PROJECTS AGENCY
Civilian Personnel Workyear Report

	FY 1994 Actual	FY 1995 Est	FY 1996 Est	FY 1997 Est	FY 1998 Est	FY 1999 Est	FY 2000 Est	FY 2001 Est
RDT&E DEFENSEWIDE								
Straight Time Workyears:	171	203	210	210	210	210	204	200
DIRECT FUNDED:								
US - Direct Hire	171	203	210	210	210	210	204	200
Total Direct Hire	171	203	210	210	210	210	204	200
Total DIRECT FUNDED Workyears	171	203	210	210	210	210	204	200

Advanced Research Projects Agcy
FY 1996/1997 R D T & E Program

Exhibit R-1

Appropriation: 0400 D Research Development Test & Eval Defwide

Date: FEB 1995

Line No	Program Element Number	Item	Act	FY 1994	FY 1995	FY 1996	FY 1997	Sec
				Thousands of Dollars				
2	0601101E	Defense Research Sciences	1	85,889	87,552	89,732	92,521	U
	Basic Research			85,889	87,552	89,732	92,521	
11	0602301E	Computing Systems and Communications Technology	2	321,216	388,991	403,875	384,777	U
13	0602702E	Tactical Technology	2	90,053	121,667	113,168	124,649	U
14	0602708E	Integrated Command and Control Technology	2	84,490	81,554	48,000	67,603	U
15	0602712E	Materials and Electronics Technology	2	261,174	274,114	226,045	269,658	U
	Exploratory Development			756,933	866,326	791,088	846,687	
28	0603226E	Experimental Evaluation of Major Innovative Technologies	3	599,914	671,792	618,005	595,873	U
30	0603569E	Advanced Submarine Technology	3	43,839	32,381	7,473	9,942	U
32	0603570E	Defense Reinvestment	3	495,502	443,196	500,000	400,000	U
41	0603739E	Advanced Electronics Technologies	3	377,801	409,763	419,863	443,458	U
42	0603744E	Advanced Simulation	3	27,107	29,537	5,799	14,614	U
43	0603745E	Semiconductor Manufacturing Technology	3	89,000	89,227	89,554		U
44	0603746E	Maritime Technology	3	38,750	52,000	49,657	49,708	U
45	0603747E	Electric Vehicles	3	46,250	15,000			U
46	0603748E	Natural Gas Vehicles	3	15,000				U
47	0603749E	Earth Conservancy	3	10,000				U
52	0603800E	Joint Advanced Strike Technology - Dem/Val	3			30,675	80,925	U
55	0305889E	Counterdrug Intelligence Support	3	30,123				U
	Advanced Development			1,773,286	1,742,896	1,721,026	1,594,520	

Advanced Research Projects Agcy
FY 1996/1997 R D T & E Program

Exhibit R-1

Appropriation: 0400 D Research Development Test & Eval Defwide

Date: FEB 1995

Line No	Program Element Number	Item	Act	Thousands of Dollars FY 1994	FY 1995	FY 1996	FY 1997	Sec
91	0605114E	BLACK LIGHT	6	4,875	4,875	4,745	4,730	U
101	0605898E	Management Headquarters (Research and Development	6	27,580	30,218	32,643	33,881	U
		RDT&E Management Support		32,455	35,093	37,388	38,611	
Total		Advanced Research Projects Agcy		2,648,563	2,731,867	2,639,234	2,572,339	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: February 1995

APPROPRIATION/BUDGET ACTIVITY
RDT&E, Defensewide
BA 2 Exploratory Development

R-1 ITEM NOMENCLATURE
Defense Research Sciences,
PE 0601101E

COST (In Thousands)	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	Cost to Complete	Total Cost
Defense Research Sciences	**85.809**	**87.552**	**89.732**	**92.521**	**95.444**	**99.386**	**103.531**	**110.286**	**Continuing**	**Continuing**
Information Sciences CCS-02	33,219	23,863	24,776	28,443	30,805	32,300	34,500	35,700	Continuing	Continuing
Electronic Sciences ES-01	28,725	35,224	42,600	40,150	37,578	39,233	43,778	47,533	Continuing	Continuing
Materials Sciences MS-01	23,865	28,465	22,356	23,928	27,061	27,853	25,253	27,053	Continuing	Continuing

(U) **Mission Description**: The Defense Research Sciences program element is budgeted in the Basic Research Budget Activity because it provides the technical foundation for long-term improvements through the discovery of new phenomena and the exploration of the potential of such phenomena for military, national security and commercial applications. It supports the scientific study and experimentation that is the basis for more advanced knowledge and understanding in information, electronic and materials sciences.

(U) The Information Sciences project supports the scientific study and experimentation that is the basis for more advanced knowledge in software technology, intelligent systems technology, human-computer interaction technology, facets of microelectronic sciences, and varied aspects of high performance computing.

(U) The Electronic Sciences project explores and demonstrates electronic and optoelectronic device, circuit, and processing concepts that will provide: (1) new technical options for future electronic and optical systems used in information transmission, gathering and processing; and (2) a substantial increase in performance and cost reduction per function.

(U) The Materials Sciences project is concerned with the development and exploitation of: biosensors for biological warfare (CBW) defense; development of high power/energy density electrochemical power sources (batteries and fuel cells). Other areas of focus are research on field-driven physicochemical and bioremediation tools for remediation of toxic chemical waste, waste source reduction for DoD-relevant manufacturing processes, and training of DoD personnel in hazardous waste management. In addition research is focused on basic concepts for development of holographic data storage systems, advanced magnetic materials and devices, and sequence specific heteropolymers for countering chemical warfare agents.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1995
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 1 Basic Research	R-1 ITEM NOMENCLATURE Defense Research Sciences, PE 0601101E

COST (In Thousands)	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	Cost to Complete	Total Cost
Information Sciences CCS-02	33,219	23,863	24,776	28,443	30,805	32,300	34,500	35,700	Continuing	Continuing

(U) **Mission Description**: This project supports the scientific study and experimentation that is the basis for more advanced knowledge and understanding in Information Sciences related to long-term national security and commercial needs.

(U) Software technology develops advanced concepts for methods and tools to produce high assurance software, language concepts that facilitate the rapid specification and evolution of systems, and techniques to manage shared complex structured data objects in larger heterogeneous, distributed information systems. Intelligent systems technology focuses on advanced techniques for knowledge representation, reasoning, and machine learning to enable computer understanding of spoken and written language and images, to advance methods for planning, scheduling, and resource allocation. Human computer interaction technology focuses on design methods and enabling technology for more natural interaction between people and computers. Microelectronic science calibrates fundamental concepts to produce reliable, testable, and high performance design. High Performance Computing (HPC) science generates concepts and methods for validating and verifying design components, and unique approaches to rapidly develop high performance libraries across multiple HPC architectures.

(U) **Program Accomplishments and Plans**:

(U) FY 1994 Accomplishments:

- Developed benchmark problems, metrics, and test data sets for advanced research in information sciences. ($2.0M)
- Developed advanced concepts for machine learning, automated reasoning, and knowledge representation for spoken language understanding, written language understanding, image understanding and large-scale planning, scheduling, and resource allocation methods. ($1.7M)
- Explored the utility of advanced information processing methods in spoken language understanding, written language understanding, and automated planning systems. ($5.3M)
- Developed design concepts for interactive, dialogue-based human computer interaction. ($4.8M)
- Developed process model approaches for prototyping large-scale software systems. ($1.0M)

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1995
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 1 Basic Research	R-1 ITEM NOMENCLATURE Defense Research Sciences, PE 0601101E, Project CCS-02

- Developed advanced concepts for image understanding, high assurance, and software engineering foundations system composition. ($5.2M)
- Developed advanced concepts for heterogeneous, distributed software system architectures and tools to support construction and maintenance of software systems. ($2.9M)
- Developed design concepts of advanced components needed for highly reliable computing systems including mobile, high performance, and graphical systems. ($6.0M)
- Developed advanced concepts for high performance libraries to support multiple parallel architectures and integrated with compiler technology. ($4.3M)

(U) FY 1995 Program:

- Experimentally evaluate advanced information processing methods in spoken language understanding, written language understanding, and automated planning systems. ($5.2M)
- Develop initial tool kits for interactive, dialogue-based human computer interaction and demonstrate them in a clinical environment. ($5.7M)
- Develop initial language-based methods for image understanding, high assurance, and software engineering system composition. ($5.0M)
- Experimentally evaluate process model approaches for prototyping large-scale software environments systems. ($2.0M)
- Experimentally evaluate library research that supports multiple parallel architectures. ($1.8M)
- Demonstrate health information network using South Florida Clinic. ($1.0M)
- Develop initial planning and decision aids prototypes for heterogeneous, distributed software system architectures and tools to support construction and maintenance of advanced intelligent systems. ($3.2M)

(U) FY 1996 Program:

- Refine and enhance benchmark problems, metrics, and test data sets and conduct experimental evaluations involving multiple intelligent systems and software engineering foundations technologies, utilizing knowledge acquisition. ($6.0M)
- Enhance advanced information processing methods in spoken language understanding, written language understanding and automated planning systems. ($4.2M)
- Experimentally evaluate tool kits for interactive, dialogue-based human computer interaction. ($5.2M)
- Experimentally evaluate language-based methods for image understanding, high assurance, and software environments system composition. ($2.5M)

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1995
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 1 Basic Research	R-1 ITEM NOMENCLATURE Defense Research Sciences, PE 0601101E, Project CCS-02

- Refine and begin experimental evaluation of design technology to include high performance computational prototyping of systems. ($4.6M)
- Experimentally evaluate planning and decision aids prototypes for heterogeneous, distributed software system architectures and tools to support construction and maintenance of advanced intelligent systems. ($2.3M)

(U) FY 1997 Program:

- Develop initial tools and tool kits for development and evaluation of highly interactive, agent and dialogue-based human computer interactions. ($4.7M)
- Demonstrate a multi-language architecture definition and simulation framework for software environments composition. ($2.5M)
- Provide suite of tools to generate focused software, on demand, for image understanding. ($3.0M)
- Advance the capabilities of spoken and written language understanding to solve real-world problems and provide widely usable human-computer interface functionality. ($4.7M)
- Extend and evaluate large-scale statistical modeling, machine learning, and knowledge representation methods for spoken and written language understanding and develop hub formalization that will infuse existing programming languages with new advances in formal methods. ($1.6M)
- Continue the experimental evaluation of design technology for high performance computational prototyping of systems. ($6.1M)
- Usable methods/tools for capture of design/development histories and architecture "cliches" in legacy systems to support software engineering foundations system evolution. ($5.8M)

(U) Program Change Summary: *(In Millions)*

	FY 1994	FY 1995	FY 1996	FY 1997
President's Budget	33.7	24.3	26.0	31.6
Appropriated	33.7	23.9	N/A	N/A
Current Budget	33.2	23.9	24.8	28.4

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1995
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 1 Basic Research	R-1 ITEM NOMENCLATURE Defense Research Sciences, PE 0601101E, Project CCS-02

(U) **Change Summary Explanation**:

FY 1994-97 Reflects minor program repricing.

(U) **Other Program Funding Summary Cost**: N/A

(U) **Schedule Profile**: N/A

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: February 1995

APPROPRIATION/BUDGET ACTIVITY: RDT&E, Defensewide
BA 1 Basic Research

R-1 ITEM NOMENCLATURE: Defense Research Sciences,
PE 0601101E

COST (In Thousands)	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	Cost to Complete	Total Cost
Electronic Sciences ES-01	28,725	35,224	42,600	40,150	37,578	39,233	43,778	47,533	Continuing	Continuing

(U) **Mission Description**: This project explores and demonstrates electronic and optoelectronic device, circuit, and processing concepts that will provide: (1) new technical options for future electronic and optical systems used in information transmission, gathering and processing; and (2) a substantial increase in performance and cost reduction per function. Research areas include new electronic and optoelectronic device and circuit concepts, innovative optical arrayed interconnects and smart pixels, optical memory research, artificial neural network (ANN) research, and microelectromechanical systems (MEMS) technology. This basic research project creates the vital new concepts for advanced electronic, optoelectronic, and MEMS components to meet future DoD needs.

(U) **Program Accomplishments and Plans**:

(U) FY 1994 Accomplishments:

- Determined applicability of lattice gas computing architecture to nanoelectronics. ($1.0M)
- Demonstrated self-assembled molecular wiring of 10 nanometer lengths. ($.7M)
- Delivered process simulator computer program with two-dimensional capability for GaAs and silicon-based devices. ($2.0M)
- Demonstrated fabrication of abrupt semiconductor interfaces using limited reaction processing. ($1.0M)
- Fabricated array of <15 nm channels with <25 nm spacing using nanochannel glass. ($.5M)
- Completed design for compressed-size, two-dimensional edge detector using nanoelectronics. ($1.0M)
- Demonstrated fabrication steps for lateral resonant tunneling. ($1.3M)
- Explored applicability of single electron transistors to ultra-dense logic and memory. ($1.0M)
- Demonstrated nanometer scale critical dimensions of devices grown on patterned substrates. ($.5M)
- Fabricated SiGeC samples to explore use in silicon-based nanoelectronics. ($.4M)
- Demonstrated patterning using self-assembled monolayers. ($.3M)
- Demonstrated 10X reduction in ultra-low-power laser size. ($2.0M)
- Demonstrated components for chip-to-chip and on-chip optical interconnects. ($2.8M)
- Developed semiconductor laser diodes with minimum relative intensity noise (RIN) for analog modulation. ($1.0M)

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1995
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 1 Basic Research	R-1 ITEM NOMENCLATURE Defense Research Sciences, PE 0601101E, Project ES-01

- Investigated charge transport across quantum well interface for high speed photonic operation. ($1.0M)
- Investigated crystalline and quantum well nonlinear polymer devices. ($1.0M)
- Developed biologically-based neural network algorithms for early vision processing. ($1.2M)
- Developed novel neural network techniques for pattern recognition, temporal processing, and adaptive control applications. ($1.7M)
- Developed microsensor CAD/CAM and process simulation tools and initiate multi-project, common fabrication infrastructure for Microelectromechanical Systems (MEMS). ($8.3M)

(U) FY 1995 Program:

- Initiate Phase II of the Nanoelectronics program. Thrusts will include combined nanoelectronics and conventional electronics, silicon-based nanoelectronics, chemical self-assembly, and molecular beam epitaxy (MBE) process control and other fabrication techniques. ($13.5M)
  - Demonstrate power reduction by a factor of five through the combination of nanoelectronics and conventional devices.
  - Explore compressed circuitry using multi-valued logic and nanoelectronics.
  - Demonstrate improved process control of MBE, controlling temperature to within 2 degrees and thickness to within 1 nanometer.
  - Determine optimum materials systems for fabricating silicon-based nanoelectronics.
  - Develop chemical self-assembly techniques for electronically active materials.
  - Develop voltage measurement capability suited to nanoelectronics (better than 100 nanometer spatial resolution and 50GHz temporal resolution).
  - Explore compressed circuitry using multi-valued logic and nanoelectronics.
  - Demonstrate utility of nanochannel glasses in fabricating nanoelectronic structures.
  - Utilize nanostructures for high resolution electron and ion-beam technology.
  - Demonstrate three-terminal lateral resonant tunneling transistor.
  - Demonstrate feasibility of magnetic memory with nanometer scale devices.
- Develop material for short wavelength light emitters and demonstrate green/blue light and nonlinear optical material for optical modulation and switching emission. ($1.8M)
- Demonstrate smart pixel arrays capable of input-output and simple logic functions. ($2.5M)
- Demonstrate optical interconnect for shared memory application. ($2.5M)
- Develop functional optoelectronic modules for free space optoelectronic processor. ($2.3M)
- Develop low-power, high-speed analog neural network hardware for accelerating early vision processing algorithms. ($1.5M)

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1995
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 1 Basic Research	R-1 ITEM NOMENCLATURE Defense Research Sciences, PE 0601101E, Project ES-01

- Establish theoretical foundations for specific neural network architectures, and develop improved architectures for pattern recognition, temporal processing, and adaptive control applications. ($1.2M)
- Develop high-yield, high-uniformity fabrication processes for microelectromechanical system (MEMS) devices and merge MEMS with related fabrication technologies in optics, optoelectronics and microwave devices and initiate low-bandwidth, large-scale MEMS-based sensor networks. ($6.8M)
- Initiate low-power electronics technology. ($3.1M)

(U) FY 1996 Program:

- Continue nanoelectronics program with emphasis on combined nanoelectronics and conventional electronics, silicon-based nanoelectronics, chemical self-assembly, and molecular beam epitaxy (MBE) process control and other fabrication techniques. ($13.3M)
  - Develop designs with improved power, performance, and lowered part count compared with circuits using only conventional devices.
  - Explore applications of multi-valued logic to special purpose processing.
  - Demonstrate compressed-area multi-valued logic adder with binary input and output.
  - Demonstrate functional silicon-based nanoelectronic devices.
  - Demonstrate submicron pattern transfer using low-cost elastopolymeric stamps and explore use of self-assembled monolayers for nanoelectronics and for protection of semiconductor wafers during processing.
  - Design prototype hardware and improve user interface software for MBE process control.
  - Develop methods for converting electrical designs to processing protocols.
  - Continue development of lateral patterning techniques.
- Demonstrate materials and device designs to achieve ultra low threshold, high speed direct modulated laser and demonstrate high speed optoelectronic technologies for optical switching applications. ($4.3M)
- Demonstrate photonic device applications of non-semiconductor thin films doped with optically active ions and explore material technologies for monithically integrated optoelectronic components. ($4.0M)
- Fabricate electron-beam microcolumn. ($1.4M)
- Initiate development of green, blue, ultraviolet gallium-nitride based LED's and lasers for high density memory, lightweight countermeasures, covert communication and warfare sensing. ($5.6M)
- Continue development of high-density integrated electrical/mechanical systems along with requisite developments of CAD tools, materials data base, test and characterization methods, and manufacturing processes. ($7.2M)
- Develop CAD tools incorporating component and subsystem power estimation and algorithm driven, low power circuit synthesis rules. ($5.8M)

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1995
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 1 Basic Research	R-1 ITEM NOMENCLATURE Defense Research Sciences, PE 0601101E, Project ES-01

- Assess thermal response characteristics of thin film ferroelectric material for improved sensitivity uncooled infrared detectors. ($1.0M)

(U) FY 1997 Program:

- Continue the nanoelectronics program with emphasis on the following thrusts: combined nanoelectronics and conventional electronics, silicon-based nanoelectronics, chemical self-assembly, and molecular beam epitaxy (MBE) process control and other fabrication techniques. ($11.0M)
  - Explore concepts for ultra high density memory, design combined nanoelectronic and conventional circuits for information processing and demonstrate 20X increase in speed-power performance of mux/demux circuits.
  - Optimize silicon-based nanoeloectronics fabrication and device design.
  - Demonstrate potential for chemical self-assembled films' use in nanoelectronics.
  - Demonstrate precision process control of semiconductor heterostructures for advanced nanoelectronic devices.
- Demonstrate monolithically integrated optoelectronics for information processing and demonstrate feasibility of three-dimensional optically addressed memory. ($6.5M)
- Determine the limits of high speed modulation of semiconductor lasers. ($3.3M)
- Demonstrate precision process control of semiconductor heterostructures for advanced optical devices. ($3.0M)
- Develop and demonstrate blue light-emitting diodes in gallium-nitride system. Identify relationship between lifetime and defect density and applicability to military applications such as lightweight countermeasures. ($6.5M)
- Fabricate small (5X5) infrared sensitive arrays as verification of material properties. ($2.0M)
- Explore thermal and electric conductivity properties of thermo-electric materials for use in battery operated infrared detector coolers. ($1.0M)
- Develop and demonstrate efficient low-voltage conversion/distribution circuits and self-regulating, use-driven power allocation systems. ($6.8M)

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1995
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 1 Basic Research	R-1 ITEM NOMENCLATURE Defense Research Sciences, PE 0601101E, Project ES-01

(U) **Program Change Summary**: *(In Millions)*

	FY 1994	FY 1995	FY 1996	FY 1997
President's Budget	28.9	41.9	42.1	40.8
Appropriated	28.7	35.4	N/A	N/A
Current Budget	28.7	35.2	42.6	40.1

(U) **Change Summary Explanation**:

FY 1994-97 Minor repricing adjustments.

(U) **Other Program Funding Summary Cost**: N/A

(U) **Schedule Profile**: N/A

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1995
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 1 Basic Research	R-1 ITEM NOMENCLATURE Defense Research Sciences, PE 0601101E

COST *(In Thousands)*	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	Cost to Complete	Total Cost
Materials Sciences MS-01	23,865	28,465	22,356	23,928	27,061	27,853	25,253	27,053	Continuing	Continuing

(U) **Mission Description**: This project is concerned with the development and exploitation of: biosensors for battlefield trauma care; design, synthesis and production of designer heteropolymer molecules for passive chemical and biological warfare (CBW) defense; development of forward combat casualty care medical technologies; development of high power/energy density electrochemical power sources (batteries and fuel cells). Other areas of focus are research on field-driven bioremediation tools for cost-effective in situ toxic waste conversion; waste source reduction for DoD-relevant manufacturing processes, and training of DoD personnel in hazardous waste management. In addition, research is focused on basic concepts for development of holographic data storage systems for use in precision guided munitions.

(U) **Program Accomplishments and Plans**:

(U) FY 1994 Accomplishments:

- Electrochemistry ($16.3M): Developed high energy density/power density electrochemical power sources for a variety of military applications. Utilized supercritical water oxidation to destroy DoD toxic wastes.
  - Demonstrated high efficiency direct oxidation fuel cell power module.
  - Completed program for rapid prototyping of solid polymer electrolyte rechargeable ambient temperature batteries which provide power for a wide range of manportable military electronic equipment.
  - Constructed supercritical water oxidation (SCWO) processor for destruction of toxic wastes. Demonstrated destruction of live chemical warfare agent, agent stimulant, and propellant using SCWO technology.
  - Initiated a hazardous substance research center to develop technologies aimed at removing hazardous waste from DoD bases and facilities and training DoD and DOE personnel in hazardous waste management.
  - Initiated a program to develop a logistic fuel cell for mobile electric power. Evaluated fuel reformer catalysts and processor components.
- Biomedical ($6.2M): Utilized biological technologies to enhance various aspects of military medicine.
  - Initiated a program in medical technology concerned with developing medical sensors and the use of advanced information technologies to enhance battlefield trauma care.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1995
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 1 Basic Research	R-1 ITEM NOMENCLATURE Defense Research Sciences, PE 0601101E, Project MS-01

- Demonstrated binding affinity, reagent stability, and cellular uptake of oligonucleotide reagents for treatment of combat related infectious disease.
- Demonstrated efficacy of computer-screening of enzyme inhibitors and methodology to activate immune response for prevention of combat related infectious disease.
- Plans reviewed and approved by Armed Services Biomedical Research Evaluation and Management (ASBREM).
- Developed computer simulation of human anatomy for training of military surgeons in surgical procedures for battlefield casualties.

• Optical materials ($1.4M): Develop aluminum-free laser diode arrays.
- Demonstrated multiple page fully digital holographic data storage system.

(U) FY 1995 Program:

• Electrochemistry ($18.9M): Concentrates on use of logistic fuels (hydro-carbon based) in advanced energy sources (fuel cells) for military applications.
- Evaluate novel logistic fuel catalysts, electrolytes, and electrodes.
- Develop fuel cell components capable of operating on reformed logistics fuel.
- Construct a sub-scale, supercritical water oxidation reactor (1 gal./min.) and begin testing for the destruction of chemical warfare agents, propellants and other DoD hazardous wastes.
- Expand support of five hazardous substance centers to develops technologies for removing DoD hazardous waste and to train DoD and DOE personnel in hazardous waste management.

• Biomedical ($9.6M): Exploit technology base developments in microelectronics, sensors, communications, imaging and simulation to enhance far-forward combat casualty care. This project provides component and modular additions to the Personnel Status Monitor (PSM) under development in PE 0602712E, project MPT-07.
- Continue modular development of the personnel status monitor (PSM) to include secondary sensors of non-invasive blood chemistries; initial miniaturization of power supply and electronic packaging; involves field testing and evaluation. Development of field medical communication network of cellular and regional control units; integration of small antenna design; asynchronous transfer mode protocol and electronic firmware and software development.
- Develop advanced human health monitoring for the critical care pod and integrate with telecommunications throughout the battlefield over wireless network.
- Develop miniaturized direct digital imaging technologies; begin electronic miniaturization and packaging.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1995
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 1 Basic Research	R-1 ITEM NOMENCLATURE Defense Research Sciences, PE 0601101E, Project MS-01

- Develop battlefield surgical simulation for injuries to the torso, including complex physiologic representation.
- Continue development of virtual environment for the individual soldier in order to test and evaluate the efforts of training, equipment, etc. on the health of the soldier.
- Develop and incorporate advanced manipulation and sensory feedback into a telepresence surgery system; explore methods for diminishing latency in tele-manipulation; field testing and evaluation.

(U) FY 1996 Program:

- Electrochemistry. ($10.5M)
  - Develop a high efficiency fuel reformer for fuel cell applications to process logistic fuel.
  - Demonstrate fuel cell operation using methanol with performance adequate for electric vehicle and soldier applications.
  - Test a novel direct oxidation logistics fuel cell concept.
- Biomedical. ($2.8M)
  - Develop miniaturized, conformal design and rechargeable polymer power sources for the Personnel Status Monitor (PSM).
  - Develop pharmacologic mixture which results in suspended animation, meaningful for vital organs following battlefield trauma.
- Heteropolymers. ($3.5M)
  - Demonstrate high yield synthesis of long chain hetropolymers that have specific monomeric sequences of 50-100 molecules.
  - Demonstrate computer algorithms for heteropolymer folding at fifty molecule chain length.
- Magnetic Materials and Devices. ($2.2M)
  - Enhance magneto-resistance ratio at low magnetic fields for greater sensitivity of devices.
- Bioremediation. ($3.4M) Field-driven technology development for environmental cleanup of hazardous waste sites.
  - Quantify soil type and contaminant mixture effects on biodegration rates, bioavailability, and rate limiting process steps.
  - Characterize field sites.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1995
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 1 Basic Research	R-1 ITEM NOMENCLATURE Defense Research Sciences, PE 0601101E, Project MS-01

(U) **FY 1997 Program:**

- Electrochemistry. ($9.0M)
  - Develop integrated fuel cell stack and reformer which operates on logistics fuel.
  - Demonstrate direct, liquid-feed methanol fuel cell stack operation with performance adequate for soldier applications.
- Biomedical. ($4.4M)
  - Develop knowledge based control algorithms for the Personal Status Monitor.
  - Develop "smart"-catheters for battlefield blood chemistry assessments.
- Heteropolymers. ($3.9M)
  - Initiate synthesis of sequence specific heteropolymers to construct organophosphate "sponge" (used in countering chemical warfare agents).
- Magnetic Materials and Devices. ($1.5M)
  - Optimize performance of spin transistor for use in high density memory devices.
- Bioremediation. ($5.1M)
  - Complete bioremediation process design models, and implement cost models.
  - Conduct field evaluations of bioremediation processes.
  - Complete process design model validation and refinement.

(U) **Program Change Summary:** *(In Millions)*

	FY 1994	FY 1995	FY 1996	FY 1997
President's Budget	23.9	21.5	22.0	20.6
Appropriated	23.9	28.5	N/A	N/A
Current Budget	23.9	28.5	22.4	23.9

(U) **Change Summary Explanation:**

FY 1996-97 Adjustments reflect minor program repricing.

(U) **Other Program Funding Summary Cost:** N/A

(U) **Schedule Profile:** N/A

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1995
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 2 Exploratory Development	R-1 ITEM NOMENCLATURE Computing Systems and Communications Technology, PE 0602301E

COST (In Thousands)	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	Cost to Complete	Total Cost
Computing Systems and Communications Technology	**321.216**	**388.991**	**403.875**	**384.777**	**417.522**	**387.760**	**451.891**	**484.827**	**Continuing**	**Continuing**
JASON ST-01	1,240	1,227	1,195	1,196	1,190	1,200	1,200	1,200	Continuing	Continuing
Intelligent Systems & Software ST-11	68,357	75,981	95,038	100,228	142,394	108,807	138,407	155,007	Continuing	Continuing
High Performance Computing ST-19	191,928	241,220	234,614	224,235	230,260	247,503	289,034	303,484	Continuing	Continuing
Software Engineering Technology ST-22	37,415	40,354	19,177	19,088	18,678	20,250	23,250	25,136	Continuing	Continuing
Monitoring Technologies ST-23	22,276	20,209	18,851	15,030	0	0	0	0	0	N/A
Defensive Information Warfare ST-24	0	10,000	35,000	25,000	25,000	10,000	0	0	0	N/A

(U) **Mission Description**: This program element is budgeted in the Exploratory Development Budget Activity because it funds projects directed toward the application of advanced, innovative computing systems and communications technologies. These programs include:

(U) ARPA leadership of the Federal High Performance Computing and Communications Initiative to develop technologies to allow computer systems to function at a trillion operations per second and a billion bits per second networking to ensure availability for future defense needs. This technology will be incorporated into advanced applications to solve critical defense problems such as distributed C^3 systems.

(U) The efforts funded in the Intelligent Systems and Software project focus on the development of new information processing technology concepts that lead to fundamentally new software and intelligent system capabilities. Emphases

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are in autonomous systems, interactive problem solving, source integration, software development, and manufacturing automation and design engineering.

(U) The Software Engineering Technology project supports the Software Engineering Institute (SEI) and Software Technology for Adaptable, Reliable Systems (STARS). SEI works to transition, introduce and promulgate modern software in the defense industry. The STARS program develops large-scale software products that have commercial as well as military capabilities.

(U) The Monitoring Technologies project provides the technology to collect and fuse surveillance sensor data, with particular focus on those technologies needed by the U.S. to support the Comprehensive Nuclear Test Ban Treaty (CTBT) negotiations which began in 1994, the Non-Proliferation Treaty conference which convenes in 1995, and the regimes established to verify these treaties.

(U) The Defensive Information Warfare project develops the technology base underlying the solutions to protecting DoD's mission-critical information systems against attack upon or through the supporting infrastructure. These technologies lead to generations of stronger protection, higher performance, and more cost-effective security solutions scalable to several thousand sites and to high-performance computing technologies.

(U) The JASON Group supports studies for the national security community.

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APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 2 Exploratory Development	R-1 ITEM NOMENCLATURE Computing Systems and Communications Technology, PE 0602301E

COST *(In Thousands)*	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	Cost to Complete	Total Cost
JASON ST-01	1,240	1,227	1,195	1,196	1,190	1,200	1,200	1,200	Continuing	Continuing

(U) **Mission Description**: This project supports the JASONs, an independent group of distinguished scientists and technical researchers that provides analysis of critical National Security issues. JASON membership is carefully balanced to provide a wide spectrum of scientific expertise and technical analysis in theoretical and experimental physics, materials, information sciences, and other allied disciplines. The JASON process ensures senior government leaders have available the full range of U.S. academic expertise on issues critical to National Security involving all classified and unclassified information.

(U) **Program Accomplishments and Plans**:

(U) FY 1994 Accomplishments:

- Conducted extensive technical investigations in areas such as: advanced sensors for surveillance and strike; shallow water acoustic Anti-Submarine Warfare (ASW); advanced concepts for lightweight survivable combat vehicles; advanced materials; and signal processing.
- Specific conclusions on counterproliferation, radar technology and automated target recognition had provided the foundation for the definition of research objectives and programs in these areas.

(U) FY 1995 Program:

- Continue investigations involving: structural acoustics; advanced land combat vehicles; precision strike; ASW; nuclear weapon proliferation; counterproliferation; joint U.S.-Russian space exploration and global surveillance and communications.

(U) FY 1996 Program:

- Continue studies in: nuclear and chemical weapons proliferation, precision strike weapons, global surveillance and communications; counter drug surveillance techniques; shallow water ASW; and advanced signal processing.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1995
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 2 Exploratory Development	R-1 ITEM NOMENCLATURE Computing Systems and Communications Technology, PE 0602301E, Project ST-01

(U) **FY 1997 Program:**

- Continue studies in: counterproliferation of nuclear, chemical and biological weapons, precision deep strike weapons, counter drug and law enforcement surveillance techniques; third world shallow water ASW; advanced sensor technologies; and global surveillance and intelligence.

(U) **Program Change Summary:** *(In Millions)*

	FY 1994	FY 1995	FY 1996	FY 1997
President's Budget	1.2	1.2	1.2	1.2
Appropriated	1.2	1.2	N/A	N/A
Current Budget	1.2	1.2	1.2	1.2

(U) **Change Summary Explanation:** No change.

(U) **Other Program Funding Summary Cost:** N/A

(U) **Schedule Profile:** N/A

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1995
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 2 Exploratory Development	R-1 ITEM NOMENCLATURE Computing Systems and Communications Technology, PE 0602301E

COST *(In Thousands)*	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	Cost to Complete	Total Cost
Intelligent Systems and Software ST-11	68,357	75,981	95,038	100,228	142,394	108,807	138,407	155,007	Continuing	Continuing

(U) **Mission Description**: Develop new information processing technology concepts that lead to fundamentally new software and intelligent systems capabilities. This will enable advanced information systems (involving both humans and computers) to more effectively accomplish decision-making tasks in stressful, time sensitive situations and create efficient software systems supporting computer and software intensive defense systems. Major areas of technical emphasis are in: (a) intelligent systems (artificial intelligence) including autonomous systems, image understanding, interactive problem solving and intelligent integration of information from heterogeneous sources; (b) software development technology including languages, algorithms, data and object bases, domain specific software architectures, software prototype technology, software design tools, software reuse, and advanced software engineering environments; (c) manufacturing automation and design engineering, including the development of advanced software systems which support sharing of engineering knowledge, advanced product and process design representations, integrated product and process design, software tools for design process management, manufacturing process planning, manufacturing process control and demonstrations; and (d) organizing resources to obtain access to multiple systems and decision aids that provide logistical information when it is needed and where it is needed.

(U) **Program Accomplishments and Plans**:

(U) FY 1994 Accomplishments:

- Developed test case scenarios and internet accessible software testbeds that typify the type of advanced information processing requirements in DoD systems such as autonomous systems, command and control, and manufacturing systems. ($8.8M)
- Experimentally evaluated the integration of multiple intelligent systems and software technologies in an autonomous vehicle. ($1.0M)
- Released the beta version of the Image Understanding Environment (IUE); initial development of RADIUS photo-intelligence testbed installed at the National Photographic Intelligence Center (NPIC); and initial reconnaisance, surveillance, and target acquisition (RSTA) results demonstrated for the Unmanned Ground Vehicle (UGV). ($15.7M)

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1995
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 2 Exploratory Development	R-1 ITEM NOMENCLATURE Computing Systems and Communications Technology, PE 0602301E, Project ST-11

- Developed initial capabilities for human-aided machine translation, document understanding, and robust speech understanding in adverse acoustic conditions. ($11.8M)
- Developed advanced real-time planning and control algorithms. ($4.2M)
- Developed knowledge-based decision aids to support the rapid construction of crisis action plans. ($9.8M)
- Developed advanced methods for information fusion, aggregation, summarization, and explanation. ($3.4M)
- Developed initial language-based methods for describing domain-specific software architecture and tools that facilitated composing a software system based on a domain specific architecture. ($4.7M)
- Developed initial advanced software environment that supports tools for composing softwares, integration, and software development and testing using animation techniques. ($1.6M)
- Developed fundamental evaluation and design concepts to support highly distributed, wide bandwidth information processing applications that require persistent objects. ($3.8M)
- Enhanced agent-based architectures for sharing design knowledge, manufacturing process planning, and manufacturing control. ($3.6M)

(U) FY 1995 Program:

- Experimentally evaluate the integration of multiple advanced intelligent systems and software technologies in multiple autonomous vehicles. ($3.6M)
- Initiate transition in focus from image understanding to image exploition for vision guided navigation, photo-intelligence, and target detection. Continue multidisciplinary vision research with Office of Naval Research. ($10.5M)
- Develop initial prototype implementations for human-aided machine translation, document understanding, and robust speech understanding in adverse acoustic conditions. ($12.1M)
- Develop initial prototype implementations of advanced real-time planning and control algorithms. ($4.1M)
- Enhance knowledge based planning and decision aids to support the rapid construction of multiple crisis action plans. ($7.2M)
- Develop initial prototype implementations of advanced intelligent integration methods for information fusion, aggregation, summarization and explanation. ($4.8M)
- Experimentally evaluate language-based methods for describing domain specific software architecture and tools that facilitate composing a software system based on a domain specific architecture. ($4.6M)
- Experimentally evaluate advanced software environment that supports composition tools for composing softwares, integration, and software development and testing using animation techniques. ($3.9M)
- Develop prototype to support highly distributed, wide bandwidth information processing applications that require persistent objects. ($5.0M)

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1995
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 2 Exploratory Development	R-1 ITEM NOMENCLATURE Computing Systems and Communications Technology, PE 0602301E, Project ST-11

- Enhance intelligent product and process representations and apply to a scalable framework for large complex systems. ($1.5M)
- Develop information infrastructure services for manufacturing, including network access to engineering analysis and rapid prototyping services and experimentally evaluate agent-based architectures for sharing design knowledge, manufacturing process planning, and manufacturing control. ($9.5M)
- Initiate development of a modular testbed for human computer interaction technology insertion for testing, evaluating and demonstrating. ($4.4M)
- Support software initiatives at the Software Institute Johnstown. ($4.8M)

(U) FY 1996 Program:

- Enhance advanced image understanding methods for vision guided navigation, cartographic modelling, and target detection and identification, and facilitate transition and adoption of the resulting technology. ($11.5M)
- Experimentally evaluate implementations for human-aided machine translation, document understanding, and robust speech understanding in adverse acoustic conditions. ($12.5M)
- Experimentally evaluate implementations of advanced real-time planning and control algorithms. ($4.1M)
- Evaluate knowledge-based planning and decision aids to support the rapid construction of multiple crisis action plans in an operational exercise. ($10.4M)
- Experimentally evaluate advanced intelligent integration methods for information fusion, aggregation, summarization, and explanation. ($7.7M)
- Experimentally evaluate prototype implementations to support highly distributed, wide bandwidth information processing applications that require persistent objects. ($3.7M)
- Experimentally evaluate scalable machine intelligent methods for machine learning, automated reasoning and real-time problem solving and expand network design and manufacturing services to include factory simulation and reusable product/process design libraries. ($12.0M)
- Continue the human computer interaction heterogenous testbed product development and insertion. Test, evaluate and demonstrate enhancements to the user community. ($10.5M)
- Define consensus Architecture Description Language and Interactive Architecture Synthesis Tools and initiate development of tools and initiate development of tools for complex system. ($4.0M)
- Develop Knowledge Rover Proof of Principle; Human Computer Interaction testbed; capability to integrate Defense Logistics Agency (DLA) sustainment models into DoD wide logistics databases and models; reusable Logistics Anchor Desk (LAD) Software Framework services and information available to other extension service

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1995
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 2 Exploratory Development	R-1 ITEM NOMENCLATURE Computing Systems and Communications Technology, PE 0602301E, Project ST-11

providers in the nationwide network; and demonstrate the feasibility of mechanisms to increase the non-Federal cost share for operating the regional satellites. ($4.7M)

- Develop a software environments rapid construction facilities for robust software and intelligent systems technology prototypes. ($4.0M)
- Support software initiatives at the Software Institute, Johnstown. ($9.9M)

(U) FY 1997 Program:

- Continue development of human-computer interaction, heterogeneous testbed products and insertion. Test, evaluate and demonstrate enhancements to the developer and user communities. ($11.7M)
- Pursue software engineering of real-time systems that would lead to a significant reduction in development costs, and experimentally evaluate Real Time Planning and Control algorithms for multi-agent systems. ($5.9M)
- Evaluate distributed design tools and demonstrate multi-agent manufacturing process planning and manufacturing control. ($15.0M)
- Develop modular Human Language Technologies to support easy, low-cost, rapid technology transfer and application development for Document Understanding, Machine Translation, and Speech Understanding. ($8.9M)
- Develop in the Intelligent Integration of Informaiton area,tools and techniques to enable the rapid construction of information fusion, aggregation, and summarization software. ($8.7M)
- Develop knowledge-acquisition tools for planning and decision aids systems. ($7.0M)
- Extend Architecture Description Language for complex systems to include performance and context information. ($8.0M)
- Complete Knowledge Rover Proof of Principle; complete reusable LAD Software Framework; complete capability to integrate DLA sustainment models into Army, Navy, and TRANSCOM and DLA logistics databases and models. ($9.3M)
- Demonstrate a software environment rapid construction facilities for robust software and intelligent systems technology prototypes. ($6.5M)
- Complete the experimental evaluated prototype implementations to support highly distributed, wide bandwidth information processing applications that require persistent objects. ($1.9M)
- Support software initiatives at the Software Institute, Johnstown. ($9.9M)

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1995
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 2 Exploratory Development	R-1 ITEM NOMENCLATURE Computing Systems and Communications Technology, PE 0602301E, Project ST-11

- Image understanding applications effort that will transition results in automatic target recognition,terrain modeling for simulation, video surveillance, image database retrieval, and integrated reconnaisance and operations planning to other DoD agencies; continue multidisciplinary vision research with Office of Naval Research. ($7.4M)

(U) **Program Change Summary**: *(In Millions)*

	FY 1994	FY 1995	FY 1996	FY 1997
President's Budget	68.2	93.7	107.7	116.3
Appropriated	68.4	79.9	N/A	N/A
Current Budget	68.4	76.0	95.0	100.2

(U) **Change Summary Explanation**:

FY 1995 Decreased to finance TRP earmarks.
FY 1996-97 Reflects program reprioritization.

(U) **Other Program Funding Summary Cost**: N/A

(U) **Schedule Profile**: N/A

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: February 1995

APPROPRIATION/BUDGET ACTIVITY: RDT&E, Defensewide
BA 2 Exploratory Development

R-1 ITEM NOMENCLATURE: Computing Systems and Communications Technology, PE 0602301E

COST *(In Thousands)*	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	Cost to Complete	Total Cost
High Performance Computing ST-19	191,928	241,220	234,614	224,235	230,260	247,503	289,034	303,484	Continuing	Continuing

(U) **Mission Description**: This project develops the computing, networking, and associated software technology base underlying the solutions to computational and information-intensive applications for future defense and federal needs. These technologies lead to successive generations of more secure, higher performance, and more cost-effective systems scalable to trillions of operations per second (teraops) and billions of bits per second (gigabits) networking, associated software technologies, advanced information infrastructure technology and prototype experimental applications critical to defense operations as well as the federal government. Each component of this program will integrate capabilities developed under the Defensive Information Warfare initiative (ST-24) to satisfy defense requirements for secure systems. Results will be used in other ARPA and defense programs for experimental application to critical defense problems.

(U) The Defense Information Enterprise component develops underlying computing systems technology that enables applications developers to demonstrate prototype solutions to national and global-scale defense problems. These include network-based information services, application demonstrations, mobile information systems, and experimental capabilities supporting computing systems developmental efforts. The component is strongly supported across other DoD and federal agencies.

(U) The Systems Environments component develops scalable software which is tailored toward easing the use of systems by applications programmers. This includes languages, runtime services, scalable software library technologies, and experimental applications.

(U) The Networking component develops high performance networking technologies and associated capabilities. Research is coordinated with network technology and service deployments made by DoD, NASA, and other federal agencies.

(U) The Scalable Systems and Software component develops software and hardware technologies leading to a secure scalable computing and communications technology base for systems configured over a wide performance range, from mobile handheld devices to desktop workstations to the largest-scale, highest performance systems.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1995
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 2 Exploratory Development	R-1 ITEM NOMENCLATURE Computing Systems and Communications Technology, PE 0602301E, Project ST-19

(U) The Microsystems component develops design tools, environments, and design infrastructure to support the research and development of advanced scalable parallel computing components and embedded computing systems. Microsystems leverages the scalable computing technology base to accelerate and support the design of complex electronic systems. Microsystems also supports innovative system prototyping techniques in hardware and software as well as early small-scale architecture experiments leveraging scalable computing technology, micro-architectures, low-energy components and processes, optimization techniques, and advanced packaging technology.

(U) Defense Technology Integration and Infrastructure combines state-of-the-art computing and information technologies focused on critical defense applications. These include developing embeddable systems based upon scalable technologies, and projects which accelerate technology transition of advanced research to intelligence, command and control, and other major ARPA and DoD programs.

(U) In order to place emphasis on emerging technology areas and those of critical defense importance, the ST-19 areas were restructured in FY 1995. The existing program areas remain in FY 1994 while FY 1995 and outyears reflect the new structure.

(U) **Program Accomplishments and Plans**:

(U) FY 1994 Accomplishments:

- Scalable Computing Systems. ($48.1M)
  - Developed foundations for petaoperations (10^{15}) per second and terabits (10^{12}) systems.
  - Demonstrated sustained operations exceeding 200 Gigaops per second on significant defense applications.
  - Demonstrated first multicomputer system containing multiprocessor nodes.
  - Developed 10 gigaflops/cu.ft. militarized, embeddable scalable computing system.
- Microsystems. ($34.8M)
  - Developed and demonstrated semiconductor virtual process design coupled to actual fabrication line for real-time process control.
  - Enhanced and demonstrated direct support of rapid prototyping of Multichip Module (MCM) technology.
  - Fabricated submicron vertical Field Effect Transistor (FET) for ultra-high-density, read-only memory.
  - Demonstrated 200 MHz superpipelined processor as part of continuing architectural exploration of high performance system.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1995
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 2 Exploratory Development	R-1 ITEM NOMENCLATURE Computing Systems and Communications Technology, PE 0602301E, Project ST-19

- Developed and demonstrated tools and environments to support the design of low power and wireless computing systems.

• Scalable Software. ($28.2M)
- Demonstrated scalable software libraries for defense-critical problems, such as computational physics and image processing.
- Developed and distributed HPC software, documentation, performance measurements, and prototype applications using a wide-area file system.
- Demonstrated distributed Ada programming language on scalable HPC systems.
- Prototyped HPC programming environments for standard languages like C++ and Fortran.
- Tested and extended functional and advanced object-oriented languages.
- Demonstrated early prototype of advanced secure operating system concepts such as domain/type enforcement, controlled execution, and security audits.

• Information Infrastructure Software and Services. ($10.1M)
- Extended Privacy Enhanced Mail (PEM) to include abilities for multimedia attachments, multiple encryption methods, and alternative digital signature algorithms.
- Developed prototype suite of advanced data storage and access tools, for secure sharing of files in distributed and replicated file systems supporting intermittent communications.

• Information Infrastructure Applications Demonstrations. ($3.9M)
- Demonstrated initial national-level digital library for exchange of technical reports between five major universities, ARPA, and the Library of Congress.
- Initiated, in conjunction with NSF and NASA, a broader initiative to expand digital library technology in the areas of information indexing, remote access, and storage management.

• Networking. ($40.1M)
- Demonstrated C^3 systems technology with scalable high performance network technology enabling full multimedia real-time information exchange using early gigabit networks.
- Demonstrated prototypes of gigabit Synchronous Optical Network/Asynchronous Transfer Mode technology operating over fiber and satellite media.
- Conducted demonstration of all-optical Local Area Networks (LANs).
- Demonstrated medical, terrain visualization, and modeling applications on 100 Mbit and GBit-class networks.
- In-laboratory demonstration of 30 gigabit-per-second transmission technology.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1995
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 2 Exploratory Development	R-1 ITEM NOMENCLATURE Computing Systems and Communications Technology, PE 0602301E, Project ST-19

- Defense Applications and Infrastructure. ($26.7M)
  - Developed and demonstrated initial prototype of scalable modular command and control center.
  - Developed initial experimental capabilities employing advanced high performance computing technologies for highly classified special applications in a secure environment.
  - Demonstrated prototype of command and control of weapons systems using embedded high performance technologies for Navy applications.

(U) FY 1995 Program:

- Defense Information Enterprise. ($28.4M)
  - Develop initial prototype of common authentication, authorization, and accounting services infrastructure based on security mechanisms in Defensive Information Warfare (ST-24) program.
  - Demonstrate prototypes of distributed digital library technology including techniques for scalable storage management and data repositories, persistent object bases, and multimedia objects.
  - Demonstrate copyright management system, providing proof of concept including fully electronic copyright registration, recordation, rights transfer, and management.
  - Demonstrate mobile computing system Computer Aided Design (CAD) environment through the design of early prototype, high bandwidth, pico-cellular, and wireless access points to the wireline infrastructure.
  - Demonstrate network-based access to Multichip Module fabrication services.
- Systems Environments. ($29.5M)
  - Demonstrate prototype integrated HPC programming environment for Fortran and C++ on which applications run transparently on several distinct scalable computer architectures without change.
  - Completed detailed study of I/O characteristics of scalable computers under real application load, identifying significant bottlenecks.
  - Demonstrate tools for performance tuning of application software using dynamically-collected statistics.
  - Demonstrate portable scalable software libraries across three major computer architectures applied to semiconductors device simulation.
- Networking. ($31.6M)
  - Demonstrate bandwidth, delay, and service reservation guarantees for networks in support of real-time control and critical services.
  - Demonstrate Synchronous Optical Network (SONET) and Asynchronous Transfer Mode (ATM) encryption technologies at 155 Mbps (OC-3c).

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1995
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 2 Exploratory Development	R-1 ITEM NOMENCLATURE Computing Systems and Communications Technology, PE 0602301E, Project ST-19

- Deploy small-scale, initial prototype of gigabit-per-second-class, nation-spanning infrastructure in support of high performance computing applications.
- Demonstrate advanced network capabilities, including multicast-based services and next generation Internet protocols with improved ease of use.

• Scalable Systems and Software. ($55.4M)
- Design system architectures incorporating components such as programmable protocol engines to support scalability and high performance.
- Demonstrate systems tools for on-line analysis of a real-time operating systems for scalable, distributed HPC systems.
- Demonstrate operating system ability to confine processes to isolated domains.
- Demonstrate first HPC single node operating at 1 Gflop.

• Microsystems. ($37.1M)
- Demonstrate derivation of electrical parameters from 3-D process models using early computational prototyping methods.
- Demonstrate prototype secure distributed design environment for electronic systems.
- Initial demonstration of microarchitectures for advanced packaging and scalable units of replication.
- Demonstrate scalable, high performance, low-latency switch technology for workstation clusters.

• Defense Technology Integration and Infrastructure. ($34.4M)
- Demonstrate use of advanced visualization environment in a defense application.
- Developed a set of communication benchmarks, communication protocols, and prototype for embedded, scalable military systems.
- First Message-Passing Interface (MPI) demonstration of cross-architecture application portability.
- Demonstrate integrated access to several different special, classified defense and intelligence information systems.
- Demonstrate 10 gigaflops/cu.ft. militarized HPC System.

• Additional FY 1995 Activities. ($24.8M)
- The Maui HPC Center Program increases the computing power available to defense scientists/engineers by providing the key commercial application software necessary to exploit scalable computing systems.
- The Intelligent MetaComputing Center will utilize existing defense experimental testbeds and defense-related applications to demonstrate the integration of scalable computing and high performance networks.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1995
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 2 Exploratory Development	R-1 ITEM NOMENCLATURE Computing Systems and Communications Technology, PE 0602301E, Project ST-19

- The Rome Lab Demonstration integrates existing decision support technology in a distributed networking environment to demonstrate the feasibility of effective mission planning across multiple networks.
- The Lifecycle Improvements by Networking Critical Manufacturing Technologies Program utilizes commercially-available software and advances in information technology to develop intelligent agents to search multiple databases with minimal user input and guidance.

(U) FY 1996 Program:

- Defense Information Enterprise. ($53.2M)
  - Demonstrate prototype toolkits supporting development of applications adaptive to changes in the computing and communication environment.
  - Demonstrate prototype of information services through a testbed incorporating electronic commerce and digital libraries, including experimental charging mechanisms.
  - Initial prototype of adaptive extensions to Internet services in support of mobility.
  - Initial prototypes of untethered node hardware/software architectures for mobile computing.
  - Initial prototype of active catalogues for commodity electronics brokering service.
  - Demonstrate design environments supporting simulation and synthesis of wireless systems spanning integrated circuits to network applications.
  - Demonstrate initial capabilities for intelligent information services for resource description, registration, and retrieval.
  - Complete the experimental evaluation of the integration of multiple advanced intelligent systems and software technologies in autonomous applications.
- Systems Environments. ($28.2M)
  - Evaluate small-scale teraops class systems and individual gigaops processors.
  - Evaluate first generation of fully scalable OS software and programming environments on small-scale versions of teraops computing systems.
  - Define second generation of High Performance Fortran with extensions for task parallelism and support for scalable I/O.
  - Demonstrate extensions of portable scalable libraries to incorporate object-oriented technology and a broader set of applications.
  - Enhance and experimentally evaluate advanced software environment that supports composition tools for software creation, integration, development, and testing using animation techniques.

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- Networking. ($31.3M)
  - Demonstrate higher level communication services that coordinate distributed computing resources across the network environment.
  - Prototype networks at greater than 40-gigabit-per-second speed using optical technologies and experimentally validate scalable network protocols at the higher speeds.
  - Prototype secure nomadic computing architecture integrated into existing wide area networks.
  - Deploy reference implementation of protocol-independent, multicast-capable infrastructure as basis for development of advanced services.
  - Demonstrate robust and secure network-level infrastructure protocols to include directory services and resource allocation.
  - Demonstrate technology for autonomous, node-level network management.
- Scalable Systems and Software. ($49.9M)
  - Demonstrate high-availability systems scalable in performance to 1 teraflop.
  - Demonstrate extensible modular operating system framework supporting real-time, distributed, and limited fault-tolerant scalable computing applications.
  - Demonstrate user-extensible microkernel operating system technology, integrating compiler and run-time support services.
  - Demonstrate computing node architectures that dramatically increase internal memory and communications bandwidths.
  - Demonstrate I/O enhancements to a scalable operating system that overcomes identified bottlenecks leading to significant improvements in throughput.
- Microsystems. ($36.3M)
  - Perform early demonstration of parallel, fully-hierarchical Automatic Test Generation for both combinational and sequential circuits.
  - Demonstrate fault-tolerant and reliability design tools supporting large-scale HPC systems developments.
  - Demonstrate message-passing/shared-memory hybrid architecture protocol accelerator component.
  - Demonstrate distributed computing architectures based on low-cost, low-latency switching technology.
  - Prototype emulation-enhanced system simulation capabilities for microsystem design.
  - Demonstrate integrated module-level synthesis capability.
- Defense Technology Integration and Infrastructure. ($35.7M)
  - Develop and provide experimental testbed services employing advanced high performance computing technologies for special defense users.

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- Prototype embedded computing system modules with scalability concepts containing memory hierarchy and power on a single unit of replication.
- Perform integration tests in key defense applications such as advanced distributed simulation, advanced distributed collaboration, advanced communications and control, and advanced human computer interfaces.
- Demonstrate improved solutions to two major classified, special computational challenges.
- Demonstrate first fine-grained high performance embedded and scalable computer system.
- Demonstrate graphical program environments for embedded systems.

(U) FY 1997 Program:

- Defense Information Enterprise. ($58.4M)
  - Demonstrate advanced software environment that supports tools for composing applications that operate over the distributed defense information infrastructure.
  - Interagency demonstration of prototype national-scale distributed digital library supporting multimedia objects, access control, and flexible micropayment system.
  - Demonstrate bandwidth-adaptive multimedia node for mobile computing.
  - Demonstrate advanced mobile networking algorithms and protocols.
  - Demonstrate transparent application relocation within mobile environment.
  - Network-based access to mature microelectronic fabrication services transitioned to self-sustaining basis.
  - Extend capabilities of intelligent information services architecture with multiple mechanisms for describing resource capabilities and with a uniform interface to hybrid search methods for resource retrieval; demonstrate in multiple applications.
- Systems Environments. ($26.3M)
  - Demonstrate optimizing compilers with 5-to-10 times runtime performance improvement through partial compilation and late optimization during program execution.
  - Demonstrate High Performance C++ with extensions for both Data Parallel and Task Parallel exploitation of concurrency.
  - Prototype common runtime services reducing burden on individual compiler R&D efforts.
  - Provide scalable versions of widely-used commercial engineering software, including MCS NASTRAN, leveraging scalable software library technology available to the defense community.
  - Evaluate prototype teraops systems using experimental defense applications in defense environments.

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- Demonstrate feasibility of utilizing advanced software environment that supports composition tools for composing software, integration, and software development and testing using animation techniques in military environment.

• Networking. ($29.2M)
- Demonstrate transport protocols for multigigabit networks.
- Demonstrate systems for coordinating sets of workstations as a single computing system.
- Deploy reference implementation of a common base set of network infrastructure protocols and services necessary for secure and reliable network operation.
- Demonstrate wide-area 40-gigabit-per-second and lab-prototype 100+ gigabit-per-second electro-optical transmission and switching systems.
- Develop advanced multicast-based services to include refinements of collaboration systems and autonomous network processes.

• Scalable Systems and Software. ($42.0M)
- Demonstrate scalability from distributed workstation clusters to teraflop supercomputers on the identical technology base.
- Demonstrate distributed cluster technology scalable to teraflops.
- Demonstrate advanced object management systems integrated with operating systems and applications to achieve efficient use of memory while enhancing execution speed.
- Demonstrate the prototype of a scalable operating system that incorporates high assurance capabilities for the Defensive Information Warfare program.

• Microsystems. ($31.2M)
- Demonstrate high-level, portable parallel test generation system.
- Develop fully-integrated, parameterized, constraint-driven design libraries.
- Demonstrate initial multisite collaborative design research environment for integrated circuit process simulation and remote experimentation over the NII.
- Demonstrate distributed shared memory components on cluster of workstations.

• Defense Technology Integration and Infrastructure. ($37.1M)
- Complete the developments and transition of experimental testbed services employing high performance computing technologies to special defense users.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1995
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 2 Exploratory Development	R-1 ITEM NOMENCLATURE Computing Systems and Communications Technology, PE 0602301E, Project ST-19

- Demonstrate integrating testbed architecture incorporating advanced distributed simulation, advanced distributed collaboration, advanced communications and control, and advanced human computer interfaces.
- Demonstrate enhanced feature, real-time distributed operating systems for embeddable HPC.
- Demonstrate 100 gigaops/cu. ft. militarized HPC.

(U) **Program Change Summary**: *(In Millions)*

	FY 1994	FY 1995	FY 1996	FY 1997
President's Budget	192.2	233.7*	224.6*	241.3*
Appropriated	192.2	238.7*	N/A	N/A
Current Budget	191.9	241.2	234.6	224.2

* Reflects transfer of Defensive Information Warfare program to ST-24.

(U) **Change Summary Explanation**:

FY 1994 Minor program repricing.
FY 1995 Increase due to funding TRP earmark for Lifecycle Networking Improvement.
FY 1996 Program repricing.
FY 1997 Program repricing and consolidation of Defensive Information Warfare in a single project, ST-24.

(U) **Other Program Funding Summary Cost**: N/A

(U) **Schedule Profile**: N/A

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: February 1995

APPROPRIATION/BUDGET ACTIVITY: RDT&E, Defensewide
BA 2 Exploratory Development

R-1 ITEM NOMENCLATURE: Computing Systems and Communications Technology, PE 0602301E

COST (In Thousands)	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	Cost to Complete	Total Cost
Software Engineering Technology ST-22	37,415	40,354	19,177	19,088	18,678	20,250	23,250	25,136	Continuing	Continuing

(U) **Mission Description**: Software technology is a DoD key technology because of increasing demands for quality software in DoD software-intensive systems, and the need for an advanced state of software engineering practice in their production. This project funds the Software Engineering Institute (SEI) and the Software Technology for Adaptable, Reliable Systems (STARS) program to address the Department's software shortfalls. SEI and STARS efforts are aimed at enabling future DoD software intensive weapon systems to meet mission requirements quickly and affordably.

(U) The SEI is a Federally Funded Research and Development Center, established in 1984 to address the DoDs software "crisis". It's emphasis is on identifying approaches that the DoD can use to improve software engineering in in-house facilities and by its contractors. It has been working with contractors and DoD services/agencies to provide the tools needed to improve software development processes and to identify, mature, and transition key technologies—including those for real-time scheduling, fault tolerance, architecture-based development, and software education and training.

(U) The STARS program is a technology development, integration and transition program to demonstrate a process driven, domain specific, reuse-based approach to software engineering that is supported by appropriate tool and environment technologies. STARS is generating three key integrating elements toward a family of large-scale "software factory" products: a set of Software Engineering Environments (SEEs); a set of modern adaptable software life-cycle process building blocks; and a software asset library capability to facilitate software productivity. The SEEs will be composed of commercially-supported products with open interfaces to stimulate the Computer Aided Software Engineering tools marketplace. The SEEs will reinforce use of modern process models, have seamless interfaces to asset libraries, and will be evaluated on current DoD programs. FY 1995 is the last year of STARS program funding.

(U) **Program Accomplishments and Plans**:

(U) FY 1994 Accomplishments:
- Participated with and supported Services in STARS demonstration projects. ($7.0M)
- Refine STARS concepts, processes, methods, and tools based on demonstration projects results. ($5.5M)

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APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 2 Exploratory Development	R-1 ITEM NOMENCLATURE Computing Systems and Communications Technology, PE 0602301E, Project ST-22

- Continued the development and integration efforts in process and reuse technology. ($2.7M)
- Operated and enhanced ASSET capabilities. ($3.8M)
- Refined technology transition strategies; continue support for the Technology Transition affiliates program; continue commercialization initiatives; and refine and extend software development plan 2000. ($2.0M)
- Produced updated Software Process Assessment and Software Capability Evaluation instruments. ($4.5M)
- Documented architecture studies in Guidebook for Real-Time Air Vehicle simulators. ($4.5M)
- Developed/conducted Risk Identification Training Course. ($4.0M)
- Initiated development of a "Technology Maturity Model" and "Human Resources Maturity Model". ($3.4M)

(U) FY 1995 Program:

- Continue support to Services in STARS demonstration projects. ($6.0M)
- Test and evaluate software architectures and application code developed using STARS Technologies on demo projects. ($5.7M)
- Finalize STARS concepts, processes, methods, tools based on demonstration projects results. ($4.0M)
- Refine technology transition strategies, continue support for the Technology Transition affiliates program; continue commercialization initiatives; and software development plan 2000 available for wide-spread use. ($4.0M)
- Operate and enhance ASSET capabilities. ($1.7M)
- Develop initial version of "Process Value Method" for determining anticipated business value of a process change. ($2.0M)
- Develop Risk Evaluation training course. ($2.0M)
- Produce guides to best model-based software engineering practice ($6.0M); to best reengineering practice ($5.0M); and an Open Systems Architecture Handbook. ($4.0M)

(U) FY 1996 Program:

- Initiate Capability Maturity Model (CMM) statistical validation and develop CMM Version 2. to support process improvement among DoD software developers. ($4.0M)
- Initiate CMM tailoring for small organizations to facilitate it's application to "second tier" DoD contractors. ($1.2M)
- Enhance risk assessment approaches and use to develop Software Acquisition Maturity Model (SAMM) for improvement of DoD acquisition organizations. ($3.0M)
- Revise best practices in software reengineering to guide DoD system evolution efforts based on pilot experiments conducted by DoD/Services. ($3.0M)

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APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 2 Exploratory Development	R-1 ITEM NOMENCLATURE Computing Systems and Communications Technology, PE 0602301E, Project ST-22

- Define approaches to evaluating software architectures and complete reference model for the comparative analysis of Architecture Definition Languages for use in DoD systems. ($4.0M)
- Develop Open System Standard for High Performance Networks and provide Open Systems course targeted at DoD acquisition officials. ($4.0M)

(U) FY 1997 Program:

- Complete System Engineering Capability Maturity Model (SECMM) and validate with NCOSE and Service representatives. ($.8M)
- Produce SECMM assessment training for DoD and Industry acquisition processes. ($3.0M)
- Populate risk repository with software risks and mitigation strategies in DoD programs and begin trial use of risk management as integral part of DoD software acquisition. (3.4M)
- Provide reference models and methods for evaluation of software architectures to support weapon systems, C3I applications, and large scale simulations. ($3.3M)
- Provide comprehensive network security risk assessment technique and improvement approach. ($2.8M)
- Produce an engineering framework for reengineering and continuous evolution of DoD systems including: a Measurement Handbook defining software metrics; analysis of the capabilities offered by various types of tools for software understanding and transformation, and; approaches to migrating systems to a common architecture. ($5.8M)

(U) **Program Change Summary:** *(In Millions)*

	FY 1994	FY 1995	FY 1996	FY 1997
President's Budget	37.5	40.2	19.6	19.2
Appropriated	37.5	40.4	N/A	N/A
Current Budget	37.4	40.4	19.2	19.1

(U) **Change Summary Explanation:**

FY 1994-97 Adjustments reflect minor repricings.

(U) **Other Program Funding Summary Cost:** N/A

(U) **Schedule Profile:** N/A

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1995
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 2 Exploratory Development	R-1 ITEM NOMENCLATURE Computing Systems and Communications Technology PE 0602301E

COST *(In Thousands)*	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	Cost to Complete	Total Cost
Monitoring Technologies ST-23 *	22,276	20,209	18,851	15,030	0	0	0	0	0	N/A

*The funding for the Counterproliferation portion of this project has been transferred to OSD PE 0605160D in FY 1996-2001.

(U) **Mission Description**: This program provides technologies to collect and fuse surveillance sensor data, with particular focus on those technologies needed by the US to support the Comprehensive Nuclear Test Ban Treaty (CTBT) negotiations which began in 1994, the Non-Proliferation Treaty conference which convenes in 1995, and the regimes established to verify these treaties.

(U) The objective of the CTBT Verification Readiness effort within the Monitoring Technologies Program is to develop and demonstrate new, applied technologies for the detection, location and identification of 1 kiloton nuclear explosions. A major part of this effort is to prototype a CTBT International Data Center (IDC), which is anticipated to become central to both US and international CTBT verification operations. The prototype IDC will be required to process and disseminate seismic, radionuclide, hydroacoustic and atmospheric infrasound data, with a total volume approximately ten times that of any existing nuclear test ban or earthquake monitoring system. These technologies will also be incorporated into US operational systems. The IDC will have significant responsibilities in the acquisition and management of data submitted by treaty parties and collected during on-site inspections, and in the management of unattended operation of distributed sensors and international communications. For the latter, ARPA is developing techniques for the remote control and automated processing of data from sensitive particulate and gaseous radionuclide sensors. Other technically challenging requirements for the IDC include the support of open, low-cost, secure and reliable operations; the establishment of an infrastructure that can adapt to the evolving demands of the CTBT monitoring regime (e.g., new areas of interest, data sources, analysis techniques, etc.); and the development and demonstration of multi-source data fusion/correlation techniques.

(U) To meet these requirements, ARPA is leveraging the framework of its Intelligent Monitoring System (IMS), with an increased focus on data authentication, automated processing and knowledge acquisition, reliable and secure distributed processing on UNIX systems, advanced data management technologies, effective graphic user interfaces for data visualization and access, and an open and modular system architecture. This effort also includes a two-year (FY 1995 - 1996) program that will focus the research capabilities of the university and small business communities that can be directly applied to the CTBT IDC. The IDC will be the centerpiece of a Conference on Disarmament monitoring

experiment (called GSETT-3) that started full-scale operations in January 1995. Much of this same system will be used at the US National Data Center for GSETT-3, which will be operated by the Air Force. The US has formally offered the product of ARPA's work to the negotiating body for use by the future international CTBT verification organization.

(U) The objective of the Sensor Development program is to develop advanced technologies to support the detection, monitoring, and interdiction of the proliferation of nuclear, chemical, and biological weapons. The effort will develop and provide demonstration of advanced sensors, information and intelligence processing, and modeling technologies to detect and monitor signatures of nuclear, chemical, and biological weapons proliferation. This includes their development, production, deployment, and use by a proliferator. This effort is critically needed to provide decision-makers with vastly increased flexibility in dealing with potential adversaries acquiring weapons of mass destruction.

(U) **Program Accomplishments and Plans**:

(U) FY 1994 Accomplishments:

- US CTBT Verification Readiness Program. ($11.9M)
  - Completed the first version and began international warm-up exercises of the seismic and non-seismic systems to be tested within the prototype IDC, including continuous data acquisition, distributed database management, automated/knowledge-based signal detection and event location, interactive visualization, convenient data access, and preliminary knowledge acquisition tools. First version technology was transferred to US Air Force. ($10.4M)
  - Explored technologies for automated seismic signal processing, threshold monitoring, network simulation, geographic information system, and identification of seismic events. ($1.5M)
- Sensor Development Program. ($10.4M)
  - Continued development of technologies for detection of trace evidence of nuclear weapon development - includes improved laboratory particle analysis techniques and development of nuclear radiation detection sensors, including high-resolution, room temperature sensors. ($5.1M)
  - Began joint monitoring instrumentation technology projects with scientific and engineering groups in the former Soviet Union. ($2.6M)
  - Deployed proof-of-concept prototype for a global atmospheric radionuclide monitoring system with data transfer to the International Data Center. ($2.7M)

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APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 2 Exploratory Development	R-1 ITEM NOMENCLATURE Computing Systems and Communications Technology PE 0602301E, Project ST-23

(U) FY 1995 Program:

- US CTBT Verification Readiness Program. ($14.5M)
  - Begin full-scale test of prototype IDC seismic system and continue warm-up exercises of the hydroacoustic, atmospheric acoustic and radionuclide systems, with continued focus on development of robust automated processing pipelines and automated knowledge acquisition tools, and new focus on multi-source data fusion. Continued technology transfer to US Air Force. ($11.8M)
  - Begin development of an integrated seismic event identification subsystem, with continued support for exploratory seismic research in the areas of automated seismic signal processing, global continuous threshold monitoring, network simulation, geographic information visualization, and seismic identification of small events. ($2.7M)
- Sensor Development Program. ($5.7M)
  - Continue development of joint chemical-nuclear monitoring instrumentation projects with laboratories in former Soviet Union. ($2.0M)
  - Demonstrate the operation of particle and air sampling monitoring systems with data transfer to the International Data Center as portions of an open global CTBT monitoring system. ($2.5M)
  - Demonstrate laboratory nanoscale particle analysis techniques and prototype operation of high-resolution, room temperature radiation sensors. ($1.2M)

(U) FY 1996 Program

- US CTBT Verification Readiness Program. ($18.9M)
  - Expand full-scale prototype IDC testing to include integrated, fused, knowledge-based processing and analysis of seismic, hydroacoustic, atmospheric acoustic and radionuclide data, with emphasis on expanding automatically the global CTBT data fusion knowledgebase. Continue technology transfer to US Air Force and begin transfer to international CTBT organization. ($15.9M)
  - Complete development and integrated of the seismic event identification subsystem, automated seismic signal processing algorithms, global continuous threshold monitoring subsystem, network simulation routines, geographic information visualization, and seismic identification of small events. ($3.0M)

(U) FY 1997 Program

- US CTBT Verification Readiness Program. ($15.0M)
  - Assuming the successful completion of CTBT negotiations in FY 1995 or early 1996, complete full-scale testing of multi-source prototype IDC and technology transfer to US Air Force and the international CTBT organization.

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(U) **Program Change Summary:** *(In Million)*

	FY 1994	FY 1995	FY 1996	FY 1997
President's Budget	22.3	40.8	51.2	60.7
Appropriated	22.3	17.6	N/A	N/A
Current Budget	22.3	20.2	18.9	15.0

(U) **Change Summary Explanation:**

FY 1995 Increase due to funding $3M increment to support the transition of seismic programs to DoE.
FY 1996-97 Adjustments reflect transfer of Counter-Proliferation portion of this project to OSD PE 0605160D and the addition of $2.5M in FY96 and $10.0M in FY97 to finance the shortfalls in the Comprehensive Test Ban Treaty Verification Program.

(U) **Other Program Funding Summary Cost:** N/A

(U) **Schedule Profile:** N/A

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1995
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 2 Exploratory Development	R-1 ITEM NOMENCLATURE Computing Systems and Communications Technology, PE 0602301E

COST *(In Millions)*	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	Cost to Complete	Total Cost
Defensive Information Warfare ST-24	0	10,000	35,000	25,000	25,000	10,000	0	0	0	105,000

(U) **Mission Description**: This project develops the technology base underlying the solutions to protect DoD's mission-critical information systems against attack upon or through the supporting infrastructure. These technologies lead to generations of stronger protection, higher performance, and more cost-effective security solutions scalable to several thousand sites and to high performance computing technologies. Technologies developed under this project will be exploited in High Performance Computing (ST-19) and other defense programs to satisfy defense requirements for secure systems. This program is an expansion of investments in information security made previously in High Performance Computing.

(U) Defensive Information Warfare focuses on early prototypes of software and hardware technologies leading to scalable protection for large-scale, heterogeneous systems usable over a wide range of performance in diverse threat environments. Network security tools will be developed consisting of security mechanisms and value-added security services for integration into network technologies. Secure computing systems will be developed that provide modular security services and mechanisms, allowing geographically-separated parts of an organization to interact as if they shared a common security perimeter. This also includes secure operating systems, secure configurations controls, firewalls, and security administration tools. Assurance and integration tools will allow the development of trusted systems that add expression of modular system structures, networking, and other distributed system protocols and the ability to reason about their security properties. National computing infrastructure vulnerabilities that could be exploited by an information warfare enemy will be identified and technologies developed to mitigate these vulnerabilities.

(U) **Program Accomplishments and Plans**:

(U) FY 1995 Program:

- Tools for Network Security. ($7.0M)
  - Develop basic authentication and authorization mechanisms based on digital signatures, cryptography, and privacy-enhanced mail for use in a common infrastructure.
  - Begin operation of certification authority supporting privacy-enhanced mail and other secure services.

- Complete prototype implementation of digital signature hierarchy toolkit and domain-name system enhancements.
- Demonstrate prototype signature/timestamp server with associated access tools for location-independent object security.

• Secure Computing Systems. ($3.0M)
- Complete proof-of-concept Asynchronous Transfer Mode (ATM) encryption units for use in experimental ATM networks.
- Demonstrate operating system capability for strict process separation.

FY 1996 Program:

• Tools for Network Security. ($8.3M)
- Demonstrate prototype of secured routing protocols.
- Release initial prototype of system security checking tools for use in security monitoring and incident response.

• Secure Computing Systems. ($10.1M)
- Demonstrate cryptographic-applications programming interface to allow secure applications to be built independent of the cryptography used.
- Demonstrate high-assurance microkernel for use in secure operating systems.

• Assurance and Integration. ($5.6M)
- Complete development of a prototype toolkit supporting secure distributed applications over a single administrative domain.

• Survivability and Vulnerabilities. ($11.0M)
- Small-scale demonstrations of techniques for survivability and recoverability in electronic, communications, and information systems of critical important to DoD.
- Demonstrate extensions of system design and analysis tools that provide increased robustness for application to defense-wide distributed systems.
- Techniques for permitting real-time tradeoffs between security, reliability, and recoverability ready for validation in critical defense experimental systems.

FY 1997 Program:

• Tools for Network Security. ($6.0M)
- Deploy reference implementation of key management infrastructure.
- Demonstrate incident response tools to detect corrupted code and signs of penetration.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1995
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 2 Exploratory Development	R-1 ITEM NOMENCLATURE Computing Systems and Communications Technology, PE 0602301E, Project ST-24

- **Secure Computing Systems.** ($8.0M)
  - Demonstrate auditing, intrusion detection, authentication and authorization components of firewalls.
  - Demonstrate transparent application interoperability across firewalls.
  - Develop services for defining and enforcing configurable security policies in secure operating systems.
- Assurance and Integration. ($4.0M)
  - Demonstrate enhancements to secure distributed application tools to support operation across multiple administrative domains.
- Survivability and Vulnerabilities. ($7.0M)
  - Validate techniques for permitting real-time tradeoffs between security, reliability, and recoverability in critical defense experimental systems.

(U) **Program Change Summary**: *(In Millions)*

	FY 1994	FY 1995	FY 1996	FY 1997
President's Budget	0	10.0*	10.0*	25.0*
Appropriated	0	10.0	N/A	N/A
Current Budget	0	10.0	35.0	25.0

*Previously included in ST-19

(U) **Change Summary Explanation**:

FY 1996-97 Increase reflects OSD-directed expansion of Defensive Information Warfare efforts.

(U) **Other Program Funding Summary Cost**: N/A

(U) **Schedule Profile**: N/A

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RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: February 1995

APPROPRIATION/BUDGET ACTIVITY: RDT&E, Defensewide
BA 2 Exploratory Development

R-1 ITEM NOMENCLATURE: Tactical Technology, PE 0602702E

COST (In Thousands)	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	Cost to Complete	Total Cost
Tactical Technology	**90.133**	**121.667**	**113.168**	**124.649**	**149.574**	**153.979**	**165.220**	**188.386**	**Continuing**	**Continuing**
Naval Warfare Technology TT-03	26,421	49,423	39,688	55,913	70,410	58,687	59,407	69,173	Continuing	Continuing
Advanced Land Systems Technology TT-04	15,194	30,239	34,087	25,973	30,136	50,000	54,686	66,686	Continuing	Continuing
Advanced Targeting Technology TT-05	8,518	5,848	0	0	0	0	0	0	0	N/A
Advanced Tactical Technology TT-06	27,293	*36,157	39,393	42,763	49,028	45,292	51,127	52,527	Continuing	Continuing
Aeronautics Technology TT-07	12,707	0	0	0	0	0	0	0	0	N/A

*TT-07 consolidated with TT-06 in FY 1995-01.

(U) **Mission Description**: This program element is budgeted in the Exploratory Development Budget Activity because it supports the advancement of concepts and technologies to enhance the next generation of tactical systems. The FY 1996 Tactical Technology program element funds a number of projects in the areas of Naval Warfare, Advanced Land Systems and Advanced Tactical technologies.

(U) The Naval Warfare Technology project is focusing on four areas: command, control, communications, and intelligence (C^3I)/synthetic environments; ship system automation; simulation based design; and transportation and logistics technologies. The C^3I/synthetic environment program will create a multi-user maritime network to provide a planning and simulation capability that will improve training, readiness, and operations planning. The Ship Systems Automation program is developing a highly integrated sensor, weapons control, and battle damage suite to reduce costly shipboard manning requirements. The Simulation Based Design program will provide the tools required to integrate cost, performance, and manufacturing considerations throughout the design process. Finally, the Transportation Technology program will develop the capability to assist the military transportation community in the simultaneous exploration of end-to-end solutions to 21st century transportation requirements.

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(U) The Advanced Land Systems Technology project supports three efforts: Small Low-cost Interceptor Device (SLID); Operations Other Than War (OOTW); and Battle Management Architecture, Data-Base Modeling and Technology Development. The SLID program will develop and test a system for providing protection against missiles and projectiles with explosive warheads. The OOTW program focuses on technological solutions to critical problems encountered in peacekeeping and non-combatant evacuation operations. Battle Management Architecture, Data-Base Modeling and Technology Development addresses command and control problems of highly mobile, joint contingency forces in very difficult early entry scenarios.

(U) Finally, the Advanced Tactical Technology project is exploring the application of compact lasers, microwave radiation and advanced mathematical algorithms to enhance the performance of radars, sensors, communications, and electronic warfare and target recognition systems. The technologies under development will improve infrared countermeasures, enable active infrared suppression, permit faster signal processing, improve target recognition, and create smaller, more capable microwave devices.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: February 1995

APPROPRIATION/BUDGET ACTIVITY: RDT&E, Defensewide
BA 2 Exploratory Development

R-1 ITEM NOMENCLATURE: Tactical Technology,
PE 0602702E

COST (In Thousands)	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	Cost to Complete	Total Cost
Naval Warfare Technology TT-03	26,421	49,423	39,688	55,913	70,410	58,687	59,407	69,173	Continuing	Continuing

(U) **Mission Description**: The Naval Warfare Technology project develops advanced technologies for application to a broad range of naval requirements. The enabling technologies include: virtual prototyping and advanced modeling to radically change the DoD acquisition process through integrated product and process design; Command, Control, Communications, and Intelligence/Synthetic Environments (C3I/SE) for littoral warfare; intermodal transportation and logistics technologies for strategic mobility; and integrated ship sensor, weapons and platform technologies to demonstrate the feasibility of reduced ship manning.

(U) The Simulation Based Design (SBD) area is developing and demonstrating a prototype system that will enable a revolutionary change in the acquisition process for large, complex systems. The objective of SBD is to integrate the technologies of distributed interactive simulation, physics-based modeling, and virtual environments and apply them to the design, acquisition, and life cycle support processes of complex systems. SBD will utilize virtual prototypes in synthetic environments to enable effective, integrated product and process development. Complete simulation from early in the concept formulation stage through verification of requirements to design, manufacture, operation, training, and logistics will be available prior to initiation of construction. This will permit realistic assessments of a candidate design throughout its lifetime. The system will provide significant cost savings through the reduction of the number of expensive physical mockups, the total time for product acquisition, and the manufacturing inefficiencies caused by inadequate design.

(U) In the C3I/SE area, advanced information and communications technologies are being developed in support of the situational assessment, planning, and maritime mobile communications functions inherent in Fleet Commander in Chief (CINC) Command Centers, major CONUS support commands ashore, and maritime mobile and theater shipboard Joint Task Force (JTF) Command Centers. The demonstration systems incorporate embedded internetted simulation capability for collaborative planning, evaluation, and rehearsal of all phases of operations including transportation, with Joint Task Force (JTF) mobile and fixed units. The demonstration systems will include capabilities for high-bandwidth communications to ships and aircraft at sea based on capitalizing on emerging commercial and military communications advancements. It also develops the Synthetic Test Range (STR), which in conjunction with the SBD development, is aimed at improving the acquisition process. The STR will also improve training, readiness, and operations planning and rehearsal of the maritime component of U.S. forces. The C3I/SE Program builds upon existing ARPA-developed planning tools such as the Capability Assessment and Evaluation System (CASES), the Acoustic Warfare Integration

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Laboratory (AWIL), and the Maritime Anchor Desk, while identifying and incorporating other emerging C3I and information system technologies.

(U) In the Ship Systems Automation (SSA) area, advanced, highly automated sensor, weapons control, and platform systems (including damage control) are being developed and demonstrated for submarine and surface ship applications. Through evolving sequential demonstrations of the technologies and their interactions, efforts in this area will show how an integrated system could achieve a significant reduction in crew size. Because personnel account for about 25% of ship life cycle costs, such a reduction would lead to immediate and long term cost savings for ship acquisition programs. SSA technology developments include intelligent command-level decision support components, scalable sensor integration work stations to fuse multi-source data and intelligently display the tactical situation on a tactical situation assessment system, cooperating expert systems conducting mission-context/sensor employment planning, and integrated internal condition sensor and control systems to intelligently display and control ship physical conditions on a ship's internal assessment system.

(U) TRANSTECH will develop the capability to assist the military transportation community in the simultaneous exploration of end-to-end solutions to 21st century transportation requirements. A transportation synthetic environment will allow planning, real-time operations execution, and re-planning, as well as infrastructure investment and policy decisions. This program has four primary technology development areas: TRANSim, the computer framework that enables the synthetic transportation environment; Operations and logistics tools that enable planning, rehearsal, and execution; Infrastrucure investment planning tools that enable investment and policy decisions to be made on the transportation infrastructure; and "modal technologies", those peculiar to the particular mode of transportation. This area is focused on gateways and enabling technologies, such as automated indentification technologies, cargo handling, at-sea off-load technology, and packaging technology.

(U) **Program Accomplishments and Plans**:

(U) FY 1994 Accomplishments:

- Conducted the final Simulation Based Design (SBD) feasibility demonstration showing real-time interaction in a virtual environment, seamlessly integrating component production from design through manufacture; initiated the development of key enabling technologies. ($8.4M)
- Initiated development of process models to enable agile manufacturing in shipyards. ($0.9M)
- Demonstrated a full fidelity acoustic synthetic ocean environment simulation capability and commenced development of a synthetic electromagnetic environment. ($3.2M)

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- Initiated development of an integrated situation assessment, planning, and planning assessment architecture and associated wideband communications antenna technologies for Fleet Commander in Chief (CINC) and shipboard Commander Joint Task Force (CJTF) command complexes. Demonstrated connectivity and initial assessment capabilities. ($5.9M)
- Developed the architecture for SSA in the four major operator/associate areas of Tactical Scene, Tactical Action, Platform Readiness, and Command & Control; conducted initial laboratory demonstration of the Tactical Scene Operator/Associate area. ($3.0M)
- Pursued new and follow-on efforts for the Center of Excellence for Research in Ocean Sciences (CEROS) ocean science efforts. ($5.0M)

(U) FY 1995 Program:

- Initiate SBD prototype development and conduct initial demonstration using the facilities of a regional design center. ($15.7M)
- Create a virtual prototype of a large complex system for application and analysis in the early requirements phase. ($3.1M)
- Conduct interim demonstrations of Simulation Based Design (SBD) critical enabling technologies. ($5.6M)
- Conduct demonstrations of distributed multiyard concepts for ship construction. ($.9M)
- Demonstrate an initial integrated Command, Control, Communication, and Intelligence/Synthetic Environment (C3I/SE) architecture in a selected maritime theater-wide planning/planning assessment scenario linked to an at-sea Commander Joint Task Force (CJTF) during JWID-95. Conduct at-sea demonstration of advanced technology wideband satellite network communications between the Commander-in-Chief (CINC) and mobile Commander Joint Task Force (CJTF) command complexes. ($6.6M)
- Expand synthetic environment development to include a complete electromagnetic environment creating a multi-spectral Maritime Synthetic Test Range (STR). Conduct initial high fidelity radar stimulation with an operational radar system. ($2.2M)
- Conduct Ship Systems Automation (SSA) demonstrations with emphasis on Platform Readiness, interactive component technologies, and force multiplier technologies that support significantly reduced manning on warships. ($8.3M)
- Initiate new and follow-on efforts for the Center of Excellence for Research in Ocean Sciences (CEROS) ocean science efforts. ($7.0M)

(U) FY 1996 Program:

- Conduct interim SBD prototype demonstrations on a complex application at a design center, using virtual prototyping technologies. ($10.3M)

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- Demonstrate multi-spectral Synthetic Test Range (STR) with multiple targets and dynamic weather in an advanced demonstration. ($1.7M)
- Demonstrate C3I/SE advanced littoral planning at the afloat numbered fleet commander and below. ($5.0M)
- Conduct land-based Navy laboratory simulation/stimulation demonstrations of SSA interactive component technologies in Platform Readiness and Combat Systems focused areas. ($6.8M)
- Demonstrate advanced SSA algorithm and integration verification in coordination with Navy and university laboratories. ($4.1M)
- Investigate and begin development of sonar system based on biological sonar architectures. ($.5M)
- Initiate development of a full fidelity transportation synthetic environment. ($6.1M)
- Complete assessment of Logistic Over the Shore (LOS) technology opportunities. ($1.0M)
- Investigate Total Asset Visibility (TAV) technology opportunities and initiate development of advanced tagging/location, systems and software. ($4.2M)

(U) FY 1997 Program:

- Conduct interim Simulation Based Design (SBD) prototype demonstrations on a complex application using advanced virtual prototyping technologies. ($11.4M)
- Conduct interim demonstrations of SBD enabling critical technologies. ($4.2M)
- Complete development of and demonstrate Command, Control, Communication, and Intelligence/Synthetic Environment (C3I/SE) maritime mission planner. ($5.9M)
- Demonstrate a full synthetic electromagnetic environment (Synthetic Test Range) for ship defense systems. ($2.1M)
- Conduct an integrated, fully-reactive interactive land-based demonstration of all Ship Systems Automation (SSA) Operator/Associate pairs interacting Combat and Platform Systems in a Ship Information Center (SIC) of the future facility. ($10.7M)
- Demonstrate distributed transportation simulation in support of military transportation planning/replanning for a major regional contingency. ($12.0M)
- Begin TAV/LOS technologies demonstration. ($9.6M)

(U) **Program Change Summary**: *(In Millions)*

	FY 1994	FY 1995	FY 1996	FY 1997
President's Budget	26.5	33.4	36.7	37.7
Appropriated	26.5	49.4	N/A	N/A
Current Budget	26.4	49.4	39.7	55.9

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(U) **Change Summary Explanation**:

FY 1994 Reduction of $0.1 million reflects minor repricing.
FY 1996-97 Increases reflect allocation of additional funds to emphasize and demonstrate intermodal transportation and logistics technologies to radically improve our DoD strategic lift and mobility.

(U) **Other Program Funding Summary Cost**: N/A

(U) **Schedule Profile**: N/A

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APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 2 Exploratory Development	R-1 ITEM NOMENCLATURE Tactical Technology PE 0602702E

COST *(In Thousands)*	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	Cost to Complete	Total Cost
Advanced Land Systems Technology TT-04	15,194	30,239	34,087	25,973	30,136	50,000	54,686	66,686	Continuing	Continuing

(U) **Mission Description**: This project is intended to develop technologies for contingency missions and military Operations-Other-Than-War (OOTW) to make U.S. combat forces more deployable, effective, survivable, and affordable. This project supports three main efforts: OOTW; Battle Management Architecture, Data-Base Modeling and Technology Development; and Small Low-cost Interceptor Device (SLID).

(U) Military OOTW is the aspect of military operations that focuses on deterring war, resolving conflicts and promoting peace. Example activities are peacekeeping, counterterrorism, countermine, noncombatant evacuation operation and counter insurgency. Military OOTW missions share many common needs and characteristics with Law Enforcement (LE) missions and share a similar vision: protecting the lives of friendly forces as they perform their mission; minimizing collateral damage to noncombatants; and operating in a multicultural/multinational/multilingual environment. Technologies will be developed to provide both civil and military usage.

(U) ARPA will focus on solutions that will improve our ability to conduct OOTW missions through affordable, advanced technologies. Technology developments are being conducted in personal armor, limited effects technology, sensor surveillance through wall and covered enclosures, concealed weapon detection, automatic language interpretation/translation, miniature geo-location, navigation and data transfer subsystems, mine detection and anti-mortar/anti-sniper sensors. Those technologies that minimize response time to achieve mission goals will be emphasized. Working with the potential user, the OOTW program will exploit ARPA simulation technologies to help define technology requirements. Memorandums of Understanding are in place, or under negotiation, with the Department of Justice and U.S. Special Operations Command.

(U) The Battle Management Architecture, Data-Base Modeling and Technology Development program addresses command and control problems of highly mobile, joint contingency forces in very difficult early entry scenarios. First to arrive units, which are usually out numbered, currently cannot obtain a joint relevant common picture of the battlefield and have few battle synchronization tools available. The goal of this effort is to determine commander's information needs and to develop technologies to allow synchronized Battle Management and to improve the command and control of the maneuver, fire support and intelligence functions of highly mobile joint contingency forces commanders in Early Entry. This project will initiate the interoperability, synchronization and battlespace expansion technology base

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APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 3 Advanced Development	R-1 ITEM NOMENCLATURE Tactical Technology, PE 0602702E, Project TT-04

for the Command and Control Information Systems project in PE 0603226E, project EE-21. The information processing and database modeling technologies will be exercised, tested and evaluated in the Early Entry environment being developed in project EE-37 which serves as one test and evaluation mechanism.

(U) The Small Low-cost Interceptor Device (SLID) program will develop and test a system for providing protection against missiles and projectiles with explosive warheads. This system will detect, track, and intercept these threats at a standoff distance sufficient to render them ineffective. Applications for the SLID system include self-defense of vehicles, high value fixed sites such as command centers, aircraft hangars, radars, and perhaps aircraft.

(U) **Program Accomplishments and Plans**:

(U) FY 1994 Accomplishments:

- Modified and enhanced Common Targeting System and Advanced Deep Operations Coordination System and integrated into Korea's Theater Automated Command and Control Information Management System. ($2.0M)
- Continued exploration of commercial communications leveraging opportunities and conducted brassboard test of applicability to dismounted/mounted operations. ($4.3M)
- Integrated helicopter detection and classification algorithms into the Army's wide area mine (WAM). Transitioned to Army. ($1.5M)
- Terminated Turbo-Roto-Compound engine and transitioned technology to industry. ($1.0M)
- Began risk-reduction phase of the SLID program. ($2.1M)
- Developed and demonstrated selected simulation-based design tools required to simultaneously address performance and producibility of new weapons concepts. Defined concept for integrated system of design workstations. Transitioned program to PE 0603226E, project EE-37. ($2.7M)
- Acquired exhaust and projectile acoustic and infrared signatures from mortars and sniper rifles against various background clutter situations. ($.1M)
- Identified and assessed potential means of providing extremities protection using advanced ARPA ceramic and other composite materials. ($.2M)
- Identified and assessed currently available demining systems and established plan for demining a test range. ($.3M)
- Identified and assessed potential sensors for performing countermine operations, wall penetration and weapon detection. ($.2M)
- Continued evaluation of advanced armor materials. ($0.3)
- Initiated Operations-Other-Than-War (OOTW) requirements and technology assessment. ($0.3M)

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APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 3 Advanced Development	R-1 ITEM NOMENCLATURE Tactical Technology, PE 0602702E, Project TT-04

- Initiated operations research and systems analysis for demining operations. ($.2M)

(U) FY 1995 Program:

- Initiate development of information processing and database modeling technology focused on siminary maneuver, fire support (Quick Draw) and intelligence (Smart Alarms) functions to support Command and Control Information System in EE-21 and design evaluation to be conducted by the Early Entry evaluation environment funded within EE-37. ($1.9M)
- Continue Phase I (risk reduction) efforts in the Small Low-Cost Interceptor Device (SLID) program and perform downselection for Phase II. ($8.6M)
- Identify and assess potential means of performing mortar and sniper localization using acquired signature data. ($.9M)
- Develop techniques and a testbed for advanced computerized speech processing and translation. ($1.3M)
- Develop advanced extremities protection technologies. ($1.2M)
- Develop and test advanced mine detection sensor concepts. ($3.5M)
- Develop advanced geolocating/data transfer technologies with near term demonstrations to user community. ($5.6M)
- Continue OOTW Program Planning Simulation and Assessment studies with users to confirm technology meets Service needs. ($0.9M)
- Initiate development of Anti-Mortar/Anti-Sniper Detection System. ($4.3M)
- Initiate development of Concealed Weapons/Through The Wall Surveillance systems. ($2.0M)

(U) FY 1996 Program:

- Continue development of information processing and database modeling technology to support Early Entry Command and Control Information System in EE-21 and transition technology to EE-21. Conduct initial demonstration of fire support (Quick Draw) in a field exercise. ($7.9M)
- Initiate SLID phase II effort with remaining contractors. Perform sub-system tests leading to static system tests. ($10.1M)
- Continue to develop technologies for anti-mortar and anti-sniper operations. ($3.5M)
- Continue to develop techniques and the testbed for advanced computerized language processing and translation. ($1.6M)
- Continue to develop and test advanced mine detection sensor concepts. ($1.5M)
- Continue development of concealed weapons detection and Through The Wall Surveillance technologies. ($1.2M)
- Continue to develop advanced armor protection technologies. ($2.5M)

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APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 3 Advanced Development	R-1 ITEM NOMENCLATURE Tactical Technology, PE 0602702E, Project TT-04

- Continue to develop advanced geolocating/data transfer technologies. ($1.5M)
- Continue Operations-Other-Than-War (OOTW) Simulation and Assessment studies with users to confirm technology meets Service needs. ($4.3M)

(U) FY 1997 Program:

- Continue Small Low-Cost Interceptor Device phase II effort. Conduct full system static tests and tests against slowly moving targets. Prepare for live-on-live tests. ($12.4M)
- Continue to develop technologies for anti-mortar and anti-sniper operations. ($2.4M)
- Continue to develop techniques and the testbed for advanced computerized speech processing and translation. ($2.5M)
- Continue to develop advanced extremities protection technologies. ($1.9M)
- Continue to develop and test advanced countermine, wall penetrating and weapon detection sensor concepts. ($3.0M)
- Continue to develop advanced geolocating/data transfer technologies. ($1.9M)
- Continue OOTW simulation and modeling studies. ($1.9M)

(U) **Program Change Summary**: *(In Millions)*

	FY 1994	FY 1995	FY 1996	FY 1997
President's Budget	14.9	33.2	32.7	31.5
Appropriated	14.9	30.2	N/A	N/A
Current Budget	15.2	30.2	34.1	26.0

(U) **Change Summary Explanation**:

FY 1994 Reflects minor program repricing.
FY 1995 Reflects Congressional undistributed reductions.
FY 1996-97 Reflects minor program repricing.

(U) **Other Program Funding Summary Cost**: N/A

(U) **Schedule Profile**: N/A

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DATE: February 1995

APPROPRIATION/BUDGET ACTIVITY: RDT&E, Defensewide
BA 2 Exploratory Development

R-1 ITEM NOMENCLATURE: Tactical Technology,
PE 0602702E

COST (In Millions)	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	Cost to Complete	Total Cost
Advanced Targeting Technology TT-05	8,518	5,848	0	0	0	0	0	0	0	N/A

(U) **Mission Description**: By integrating advanced algorithms (automatic target recognizers) and processing technologies with multiple imaging sensors, autonomous intelligent submunitions will enhance U.S. force projection by providing a flexible and accurate delivery of munitions on a wide range of targets. Damocles will demonstrate a lower cost, intelligent, and effective submunition against these targets. It will have the ability to cover a large footprint (greater than 1 sq.km.) once deployed from a carrier vehicle and automatically search for, detect, and recognize sparsely positioned targets, such as SCUDS, SS-21s, and their support vehicles.

(U) **Program Accomplishments and Plans**:

(U) FY 1994 Accomplishments:
- Completed Damocles hardware and software integration into test fixture. ($1.0M)
- Performed captive carry tests to collect data and test hardware and software integration. ($6.0M)
- Performed initial free flight experiments. ($1.5M)

(U) FY 1995 Program:
- Complete Damocles experiments, tests, and analysis. ($5.8M)

(U) **Program Change Summary**: (In Millions)

	FY 1994	FY 1995	FY 1996	FY 1997
President's Budget	8.3	5.8	0	0
Current Budget	8.5	5.8	0	0

(U) **Change Summary Explanation**:

FY 1994 Increase reflects minor repricing.

(U) **Other Program Funding Summary Cost**: N/A

(U) **Schedule Profile**: N/A

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1995
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 2 Exploratory Development	R-1 ITEM NOMENCLATURE Tactical Technology, PE 0602702E

COST *(In Thousands)*	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	Cost to Complete	Total Cost
Advanced Tactical Technology TT-06	27,293	36,157	39,393	42,763	49,028	45,292	51,127	52,527	Continuing	Continuing

(U) **Mission Description**: This project focuses on the technology and applications of compact lasers, microwave radiation sources, advanced displays and mathematical algorithms for signal processing to dramatically improve the performance of radars, sensors, and systems for electronic warfare, targets recognition, and military communications. Seven broad technology areas are being investigated: (a) compact, efficient, frequency-agile, diode-pumped, solid-state lasers for infrared countermeasure, laser radars and sensors; (b) compact high density data storage for high bandwidth image processing; (c) high performance, pulsed radio frequency (RF) radiation sources for smaller and better microwave tubes; (d) fast computational algorithms for signal processing, target recognition and tracking, electromagnetic and acoustic propagation in nonlinear medium; (e) passive infrared signature suppression to counter the predominate air-to-air missile threats; (f) precision optics components for critical DoD applications; and (g) "Hybrid Reality" optical displays which synthesize on- and off-board sensor information driven by fast computational algorithms with machine intelligence. Integrated combinations of technology products will also be evaluated to assess synergy and value for operational applications (e.g. Agile Warrior and Small Engine Application Program (SENGAP)).

(U) **Program Accomplishments and Plans**:

(U) FY 1994 Accomplishments:

- Compact Laser ($5.9M): Performed technology demonstration of power laser operation at one micron; semiconductor diodes for laser pumping; and active target acquisition for infrared countermeasure and laser radars.
  - Demonstrated one kilowatt average power one micrometer wavelength laser.
  - Demonstrated new semiconductor laser diodes operating at 808 nanometer wavelength.
  - Demonstrated wavefront aberration corrections for active pointing and tracking.
  - Demonstrated design concepts for high repetition rate infrared countermeasure laser.
- Holographic Data Storage ($2.5M): Demonstrated new hologram fixing and multiplexing techniques for holographic data storage system.
- Pulsed Radio Frequency (RF) ($10.2M): Designed and fabricated advanced RF radiation sources for radar and RF countermeasure.
  - Designed and fabricated electronic system to demonstrate cooperative angle jamming technique.

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- Designed and fabricated 44 gigahertz (GHz) solid state, high efficiency amplifiers for space applications.
- Designed microwave power tube using microcathode to operate at 10 GHz.
- Demonstrated high performance 94 GHz amplifier operation and began prototype design.
- Designed, fabricated and demonstrated ultra high resolution radar operation using electromagnetic shockline technology.

• Fast Computational Algorithms ($8.7M): Began to develop novel algorithms for automatic detection and recognition of difficult-to-find objects.
- Developed wavelet-based multi-resolution methods and design tools for new digital filters.
- Demonstrated wavelet methods for detection of transient signals in sonar systems and for multisensor fusion.
- Demonstrated robust methods for direction finding and interference reduction in airborne platforms.
- Developed code for fast computation of electromagnetic scattering.

(U) FY 1995 Program:

• Compact Lasers ($5.0M): Demonstrate breadboard systems of compact high power lasers at one micron, tunable mid-infrared lasers, aluminum free laser diodes and active tracking systems at mid infrared wavelengths.
- Demonstrate transportable brassboard one kilowatt average power one micrometer wavelength laser with output at 10 Joule/100 Hertz (Hz), 10 nanosecond pulse length.
- Demonstrate laser diode bar arrays at continuous wave and quasi-continuous wave output at 808 nanometers.
- Demonstrate laboratory breadboard tunable mid-infrared lasers for U.S. Army advanced technology infrared countermeasure program.
- Demonstrate and test a laboratory breadboard active tracking system for mid-infrared wavelengths.

• Holographic Data Storage ($6.5M): Technology demonstration of page-format, high density input and readout capability.
- Demonstrate prototypes of test charge coupled devices, spatial light modulators and experimental validation of concept for holographic recording through waveguides.

• Pulsed Radio Frequency (RF) ($6.6M): Continue fabrication and integration of advanced RF amplifiers and power combining techniques.
- Fabricate triode amplifier using microcathode operating at 10 gigahertz (GHz).
- Design and fabricate prototype high performance 94 GHz power amplifier.
- Demonstrate high efficiency power combining technique of solid state devices operating at 44 GHz.
- Design reconfigurable antenna using microtip and diode laser technology.

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- **Fast Computational Algorithms ($12.7M):** Continue development of novel algorithms for automatic target detection, materials and microelectronics processing.
  - Develop and test novel wavelet-based algorithms and tools for digital processor and filters.
  - Develop methods for multiresolution synthetic aperture radar and adaptive waveform design.
  - Apply wavelet design tools to tactical communications and target recognition.
  - Demonstrate fast multipole radar cross section code for an order-of-magnitude increase in capability.
  - Develop simulation tools, signal processing and modern control methods for in-situ sensing and real-time control of materials and microelectronics processing.
  - Develop optimal phase-shift mask design methods.
- Miniature Small Engine Application Program (SENGAP) turbine engine ($3.6M): Flight test miniature SENGAP engine to validate successful bench testing and integration with decoy air vehicle concept.
- Advanced Infrared Signature Suppression ($1.8M):
  - Phase 2:
    - -- Bench test cooling system concept, thermodynamics of the system and the absolute value of the skin temperature.
    - -- Document results in Phase 2 final report.
  - Phase 3:
    - -- Design cooling panel for NASA F-15 Pod.

(U) <u>FY 1996 Program</u>:

- Compact Lasers ($7.0M): Demonstrate compact lasers and active tracking systems at mid-infrared wavelengths for IR countermeasures.
  - Demonstrate mid-infrared lasers, packaged for slow motion, dynamic testing.
  - Demonstrate and test compact active tracking system brassboard for mid-infrared wavelengths.
- Holographic Data Storage ($6.0M): Technology demonstration to establish system trade-offs of various candidate materials for holographic data storage.
  - Demonstrate proof-of-principle digital holographic data storage devices to establish the capability of various multiplexing methods and error detection and correction schemes.
- Pulsed Radio Frequency (RF) ($3.3M): Continue fabrication and demonstration of advanced RF amplifiers and power combining techniques.
  - Demonstrate low voltage operation of microtriode amplifier operating at high frequency.
  - Demonstrate high efficiency power combining technique of solid state amplifiers.
- Fast Computational Algorithms ($7.6M): Complete development of novel algorithms for automatic target detection and recognition; validate and begin transition.

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APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 2 Exploratory Development	R-1 ITEM NOMENCLATURE Tactical Technology, PE 0602702E, Project TT-06

- Demonstrate wavelet-based methods for data compression and clutter/noise removal.
- Demonstrate wavelet-based methods for automatic target detection and recognition.
- Demonstrate multiresolution methods and adaptive waveforms for image formation and processing.

• Precision Optics Technology ($5.8M): Develop conformal and off-axis optical components for next generation tactical systems using computer-aided design and manufacturing.
- Establish deterministic microgrinding and surface finishing techniques for reflective and refractive optical elements.

• Advanced Infrared Signature Suppression ($4.8M): Integrate and demonstrate (flight test) long-wave Infrared (LWIR) suppression system. Initiate development of advanced infrared (IR) suppression technologies for advanced aircraft.

• Agile Warrior/"hybrid reality" displays ($4.9M): Develop fast, high resolution panoramic visual display medium; demonstrate high network throughput with multiple dynamic, visual entities while retaining resolution, realism and precision.

(U) FY 1997 Program:

• Compact Lasers ($7.2M): Demonstrate breadboard systems of compact high power tunable mid-infrared lasers, and laser diodes operating at mid-infrared wavelengths.
- Demonstrate laboratory breadboard tunable mid-infrared lasers at 20 watt output with 20 Kilohertz (KHz) pulse repetition rate for large aircraft infrared countermeasures.
- Demonstrate mid-infrared laser diodes.

• Holographic Data Storage ($5.0M): Technology demonstration to establish functional limits of holographic data storage.
- Demonstrate holographic data storage testbeds for functional evaluation of write once read many (WORM) storage systems.

• Fast Computational Algorithms ($6.1M): Transition novel algorithms for automatic target detection and recognition to selected applications.
- Complete final algorithm selection and validation for system insertion.

• Precision Optics Technology ($10.0M): Continue developement of comformal and off-axis optical components for tactical systems.
- Model ion exchange and synthesize materials with varying index of refraction in the visible and infrared ranges.

• Advanced Infrared Signature Suppression ($4.8M): Continue development of advanced IR suppression technologies for advanced aircraft.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1995
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 2 Exploratory Development	R-1 ITEM NOMENCLATURE Tactical Technology, PE 0602702E, Project TT-06

- Agile Warrior/"hybrid reality" displays ($9.7M): Integrate panoramic display with optical elements and data processor; develop and demonstrate real time sensor fusion algorithms and integrate with hybrid visual display; demonstrate capability to synthesize and prioritize realtime multi-sensor data and integrate with panoramic display.

(U) **Program Change Summary**: *(In Millions)*

	FY 1994	FY 1995	FY 1996	FY 1997
President's Budget	26.3	38.9	27.1	36.1
Appropriated	26.3	36.2	N/A	N/A
Current Budget	27.3	36.2	39.4	42.8

(U) **Change Summary Explanation**:

FY 1994 Adjustments reflect minor program repricing.
FY 1996 Adjustments reflect an investment in "Hybrid Reality" optical display technology and precision optics.
FY 1997 Increase reflects funding transferred from MPT-01 for precision optics efforts.

(U) **Other Program Funding Summary Cost**: N/A

(U) **Schedule Profile**: N/A

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RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: February 1995

APPROPRIATION/BUDGET ACTIVITY: RDT&E, Defensewide
BA 2 Exploratory Development

R-1 ITEM NOMENCLATURE: Integrated Command and Control Technology, PE 0602708E

COST (In Thousands)	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	Cost to Complete	Total Cost
High Definition Systems IC-03	84,490	81,554	48,000	67,603	68,000	68,000	68,000	68,000	Continuing	Continuing

(U) **Mission Description**: This program element is budgeted in the Exploratory Development Budget Activity because it develops the technology and manufacturing capability for high definition displays and is important for virtually all DoD applications that involve visual and graphic information. Major components of this program include: projection, head mounted and direct view displays based on multiple technologies; display architectures and processors; compression algorithms; and high speed data transmission. These efforts will establish a domestic technical capability and demonstrate the manufacturing capability of components necessary for military systems that capture, process, store, distribute and display high resolution images.

(U) **Program Accomplishments and Plans**:

(U) FY 1994 Accomplishments:

- Continued development of flat panel and projection displays for aircraft cockpit, shipboard and mobile computing and communications applications. ($19.6M)
- Continued development of enabling technology critical to high projection display performance. ($13.4M)
- Developed imaging systems and processes needed to realize high information throughput. ($6.5M)
- Completed active matrix liquid crystal display (AMLCD) Pilot Demonstration Facility. ($25.0M)
- Initiated second AMLCD manufacturing testbed facility. ($20.0M)

(U) FY 1995 Program:

- Continue development of flat panel and projection displays for aircraft cockpit applications, mobile computing displays, and shipboard and landbased command and control centers. ($30.5M)
- Continue enabling material and component technologies for performance and cost goals for liquid crystal materials, polymer electroluminescent materials, lightweight optics, polarizers, color filters, flat backlights, projection lamps, field emitter materials and structures, and phosphors. ($12.0M)
- Develop manufacturing equipment and processes for the affordable production of high definition displays. Flat panel display manufacturing equipment will be scaled up to handle larger substrates at higher throughputs with improved process capability. ($28.0M)

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1995
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 2 Exploratory Development	R-1 ITEM NOMENCLATURE Integrated Command and Control Technology, PE 0602708E, Project IC-03

- Develop displays with integrated computation and image processing and develop improved phosphor materials and deposition processes for emissive displays (electroluminescent, field emission and plasma displays). ($11.1M)

(U) FY 1996 Program:

- Continue development of flat panel and projection displays for aircraft cockpit applications, mobile computing displays, and shipboard and landbased command and control centers. ($19.5M)
- Continue development of enabling material and component technologies including liquid crystal materials, electroluminescent materials, phosphors, laser illumination sources, projection screens, projection lamps, thin film transistors and color filters to meet display cost and performance goals. ($7.0M)
- Continue development of manufacturing equipment and processes for the affordable production of high definition displays. Printing processes and equipment will be developed to deposit and pattern photoresist, metals, insulators and semiconductors over large areas in a single step. ($6.0M)
- Continue development of U.S. display manufacturing supplier infrastructure. ($11.5M)
- Continue developing imaging systems technology to realize high information throughput display systems. ($4.0M)

(U) FY 1997 Program:

- Continue development of flat panel and projection displays for aircraft cockpit applications, mobile computing displays, and shipboard and landbased command and control centers. ($23.6M)
- Continue development of enabling material and component technologies including liquid crystal materials, electroluminescent materials, phosphors, laser illumination sources, projection screens, projection lamps, thin film transistors and color filters to meet display cost and performance goals. ($6.0M)
- Continue development of manufacturing equipment and processes for the affordable productions of high definition displays. Printing processes and equipment will be developed to deposit and pattern photoresist, metals, insulators and semiconductors over large areas in a single step. ($9.0M)
- Continue development of U.S. display manufacturing supplier infrastructure. ($16.0M)
- Develop technologies that will increase display system functionality while constraining cost by integrating microprocessors, memory, sensors and new features into displays. ($6.0M)
- Continue developing imaging systems technology to realize high information throughput display systems. ($7.0M)

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1995
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 2 Exploratory Development	R-1 ITEM NOMENCLATURE Integrated Command and Control Technology, PE 0602708E, Project IC-03

(U) **Program Change Summary:** *(In Millions)*

	FY 1994	FY 1995	FY 1996	FY 1997
President's Budget	84.8	68.0	68.0	68.0
Appropriated	84.8	81.6	N/A	N/A
Current Budget	84.5	81.6	48.0	67.6

(U) **Change Summary Explanation:**

FY 1994 Reflects minor program repricing.
FY 1995 Reflects reprioritization of DoD resources.
FY 1997 Reflects minor program repricing.

(U) **Other Program Funding Summary Cost:** N/A

(U) **Schedule Profile:** N/A

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RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: February 1995

APPROPRIATION/BUDGET ACTIVITY: RDT&E, Defensewide
BA 2 Exploratory Development

R-1 ITEM NOMENCLATURE: Materials and Electronics Technology, PE 0602712E

COST (In Thousands)	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	Cost to Complete	Total Cost
Materials and Electronics Technology	**261.174**	**274.114**	**226.045**	**269.658**	**298.556**	**308.658**	**363.719**	**428.712**	**Continuing**	**Continuing**
Materials Processing Technology MPT-01	129,053	148,627	122,741	146,258	160,887	167,249	175,494	214,240	Continuing	Continuing
Microelectronic Device Technology MPT-02	94,333	92,942	62,221	81,942	92,291	98,214	136,179	155,972	Continuing	Continuing
Cryogenic Electronics MPT-06	37,788	17,672	11,996	12,193	13,240	5,183	7,546	10,000	Continuing	Continuing
Military Medical/Trauma Care Technology MPT-07	0	14,873	29,087	29,265	32,138	38,012	44,500	48,500	Continuing	Continuing

(U) **Mission Description**: This program element is budgeted in the Exploratory Development Budget Activity because its objective is to develop technology related to those materials, electronics, and medical devices that make possible a wide range of new military and commercial capabilities. Many of the programs contained in this Program Element reflect the Department's initiative to support military technologies with dual-use applications.

(U) The Materials Processing project (MPT-01) concentrates on the development of novel materials, processing techniques, and fabrication strategies for production of higher performance advanced structural and electronic materials manufactured at a lower cost. A major area of concentration is the application of process modeling, mathematical simulation, sensors, and advanced control to materials processing, thin film processing, large area multichip module processing, and flexible fabrication and assembly. It includes research on composite materials, synthesis of diamond films; insertion of ceramics into military system components; flexible solid freeform fabrication; toxic waste elimination; modeling and simulation of vapor phase processing of thin film materials; development of high power, high temperature semiconductors; and adaptive ("smart") materials and structures.

(U) The Electronics Processing project (MPT-02) develops advanced electronic and optoelectronic devices, semiconductor process tools and methodologies, and materials for infrared devices. Areas of emphasis include high-performance analog-to-digital converters, military optical processors, novel optoelectronic devices, artificial neural network technology, low power electronics and semiconductor process design and synthesis.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1995
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 2 Exploratory Development	R-1 ITEM NOMENCLATURE Materials and Electronics Technology, PE 0602712E

(U) In the Cryogenic Electronics project (MPT-06), high temperature superconducting materials have reached a stage of development where specific applications have been identified in thin-film electronic devices and circuitry for military avionics. A corollary objective of this project is to build on the broader class of electronics technologies whose performance improves at cryogenic temperatures by demonstrating modules with superior performance.

(U) Military Medical/Trauma Care Technology project (MPT-07) is an initiative to significantly improve battlefield trauma care. The Advanced Biomedical Technology portion focuses on the human factors of advanced technology concepts in a front-line battlefield environment through development of body-worn monitors, field-portable digital imaging equipment, and battlefield surgical simulators. The Health Care Information segment concentrates on development of physician, medic, and community information associates for utilization by both medics during combat care scenarios and physicians during patient visits.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: February 1995

APPROPRIATION/BUDGET ACTIVITY: RDT&E, Defensewide
BA 2 Exploratory Development

R-1 ITEM NOMENCLATURE: Materials and Electronics Technology, PE 0602712E

COST (In Thousands)	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	Cost to Complete	Total Cost
Materials Processing Technology MPT-01	129,053	148,627	122,741	146,258	160,887	167,249	175,494	214,240	Continuing	Continuing

(U) **Mission Description**: The major goals of this project are to develop novel affordable materials, processing techniques, and fabrication strategies for production of advanced structural, electronic and magnetic materials and components and devices for application in military platforms and systems for improved performance and at lower processing costs. This is accomplished by awards to individual companies, universities, and government laboratories, as well as by cost-shared Advanced Materials Partnerships. A major area of concentration is the application of process modeling, mathematical simulation, sensors, and advanced controls to materials processing, thin film processing, large area multichip module processing, and flexible fabrication and assembly. Other predominant areas include: biosensors for chemical and biological surveillance and digital imaging systems for battlefield trauma care; and research on composites (metal matrix, polymer matrix, ceramic matrix, carbon-carbon and microlaminate) for advanced aerospace structural materials to upgrade gas turbine engine and airframe components. Non-destructive evaluation (NDE) equipment and techniques will be developed for component evaluation and structural integrity monitoring.

(U) Additional areas of focus are: synthesis and production of designer heteropolymers for far-forward and combat casualty medical care and passive chemical and biological warfare (CBW) defense; smart materials and structures, synthesis of diamond films for thermal management in electronic packaging; high temperature semiconductors, such as silicon carbide for high power applications in aircraft and electric vehicles; insertion of state-of-the-art ceramics into military system components (bearings, gas turbine engine components); development of field oriented bioremediation tools for cost effective in situ hazardous waste destruction; precision machining of high strength alloys, composites and ceramics using laser and electron beam energy sources.

(U) Flexible solid freeform fabrication capabilities are being developed for high performance structural materials (especially ceramics), which will fabricate functional components directly from Computer Aided Design (CAD) files and not require part-specific tooling or operator intervention. Research on magnetostrictive materials will enable demonstration of a non-volatile magnetic random access memory (RAM) with high density, short access time, infinite cycles, and low power. Magnetostrictive materials will also provide benefits to smart materials actuator systems. Environmental research includes DoD-related toxic waste elimination and "green" manufacturing, which seeks to eliminate or minimize toxic waste produced by fabricating products relevant to the DoD.

(U) In addition, an effort will exploit recent advances in solid phase synthesis and computational chemistry to allow for the development of sequence-specific synthetic heteropolymers (SSSHP) with important new capabilities. A Special Materials Analysis program will investigate a new class of absorption materials developed from coated microballoons to determine their effectiveness and utility for a broad spectrum of applications.

(U) **Program Accomplishments and Plans**:

(U) FY 1994 Accomplishments:

- Biotechnology ($7.9M): Utilized biological technologies to develop pharmaceuticals, sensors and imaging systems for battlefield trauma care.
  - Verified duration/magnitude of immune response to ultrasonically altered infectious organisms.
  - Initiated development of portable digital x-ray imaging system for battlefield trauma care.
  - Optimized fluidics subsystem and optimized dynamic range for cell-based biosensor.
  - Completed toxicity and efficacy studies in animal model systems (lyme disease demonstration application); completed cloning of parasitic antigens and initiated development of recombinant vaccine studies (lyme disease and malaria demonstration application).
- Structural Materials ($46.0M): Developed and demonstrated structural materials in affordable components, (composites, ceramics, alloys) for jet engines, airframes, missiles and other DoD systems.
  - Identified preliminary on-line sensing concepts for composite density enhancement during direct conversion of liquid hydrocarbon to pyrolytic carbon composite matrix during manufacturing; developed reaction chemistry for incorporation into computational process model.
  - Demonstrated feasibility for an order of magnitude increase efficiency of materials utilization during vapor deposition of titanium in the manufacture of silicon carbide reinforced titanium matrix composites using metal matrix composite model factory.
  - Initiated a program for manufacturing of silicon carbide fiber reinforced titanium alloys for components in aircraft gas turbine engines.
- Material and Device Fabrication ($14.1M): Fabricated functional prototype military components directly from Computer Aided Design (CAD) files. Reduced cost of final machining and assembly of composites and other structures. Developed processing technologies for fabricating multi-chip electronic modules.
  - Demonstrated solid freeform fabrication machine capability for producing particulate reinforced metal matrix composites with mechanical properties comparable to those produced by conventional methods.
  - Developed concepts of flexible fabrication to actively correct machine error using adaptive materials.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1995
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 2 Exploratory Development	R-1 ITEM NOMENCLATURE Materials and Electronics Technology, PE 0602712E, Project MPT-01

- **Initiated a cross-disciplinary materials research program, which included research on electro-optics, catalysts for hazardous and toxic substance disposal, diamond film growth, and durable protective oxidation-resistant coatings for superalloys.**
- Developed concepts for flexible methods for laser shaping materials that undergo plastic flow.
- Identified large format processing of materials and critical unit processes and initiated materials and equipment development for multi-chip module (MCM) fabrication.

• Advanced Materials and Processing ($18.5M): Reduced processing cost of advanced composites, electronic/photonic materials, and smart materials/structures for application in military platforms and systems. Incorporated simulation, modeling and intelligent processing of materials concepts.
- Initiated program in high temperature, high power semiconductors for aircraft and electric vehicle engine control applications.
- Initiated program to model and simulate vapor processing of materials and plasma etching processes.
- Initiated program to develop theoretical models for predicting mechanical properties of compositionally modulated multilayer structural composites.
- Initiated program to develop intelligent processing production of materials for smart structures.
- Developed several multilayer electrostrictor actuators for smart materials.

• Batteries ($6.4M): Improved energy density of military batteries.
- Demonstrated prototype rechargable solid state military battery. Delivered 20 prototypes for evaluation.

• Vapor Phase Processing ($17.7M): Developed low-cost processing of diamond films and photovoltaics for applications in military electronics.
- Demonstrated on-line sensors and feedback control of chemical vapor deposition (CVD) reactors; implemented second-generation control systems on direct current (DC) arc reactor systems; increased CVD diamond processing throughput with increased deposition rate, area and yield.
- Demonstrated feasibility for low-cost, high-rate, high materials utilization efficiency processing of copper-indium-diselenide multilayer photovoltaics using cylindrical magnetron sputtering.

• Environmental Science ($13.5M):
- Initiated program to develop new casting technologies which reduce the emissions of foundries in anticipation of Clean Air Act standards for benzene, formaldehyde, and hydrocarbons. Focus is on emissions measurements, core and mold making technology, metal melting treatments and handling, sand reclamation, and emissions control.

• Coal Utilization ($5.0M):
- Continued research for further reductions in gaseous and particulate emissions when firing coal-based fuels in industrial-scale boilers.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1995
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 2 Exploratory Development	R-1 ITEM NOMENCLATURE Materials and Electronics Technology, PE 0602712E, Project MPT-01

- Developed coal-based fuel/waste co-firing technologies.
- Identified and tested coal-based technologies that are suitable for small-scale heat and/or power applications.

(U) FY 1995 Program:

- Biotechnology ($1.9M): The basic research portion of this effort is found under PE 0601101E, Project MS-01. Complete program and transition to Advanced Biomedical Technology Program. (PE 0601101E, project MS-01 and 0602712E, project MPT-07).
  - Demonstrate gain of a biosensor device by modulation of intrinsic cellular amplification system (second messenger system).
- Structural Materials ($68.4M): Develop affordable composites, ceramics, and alloys using intelligent processing of materials and automated manufacturing concepts. Emphasis is on insertion of components into military systems.
  - Demonstrate on-line sensing of critical product and process variables and multivariable feedback control of the rapid densification manufacturing process for carbon-carbon composites.
  - Develop advanced electron beam curing process suitable for production of polymer matrix composites.
  - Develop cost effective processing technology for silicon carbide fiber reinforced titanium for turbine engine components.
  - Demonstrate reduced mean-time-between-failure (MTBF) associated with the upgrade of glass optical domes used in the Angle Rate Bombing Set (ARBS) of the AV-8B Harrier aircraft to spinal domes.
  - Demonstrate the increased performance of the M1A2 tank dual-axis head mirror assembly by replacing nickel-coated beryllium metal with silicon carbide.
  - Initiate six cost-shared Advanced Materials Partnerships (consortia) in the areas of polymer composites, ceramic composites, superalloy processing and advanced non-destructive evaluation of structural materials.
  - The special Materials Analysis program will address the readiness of coated microballoon absorption materials for systems applications by demonstrating high performance, broad band absorbers using full-scale microballoon material forms that meet the objectives of low weight and low cost.
- Material and Device Fabrication ($30.1M): Extend program to address hard and soft tooling, laser cutting and processing capabilities and large format for multi-chip modules.
  - Develop prototype design for adaptively-controlled machine tools, including a control scheme to correct machine errors.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1995
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 2 Exploratory Development	R-1 ITEM NOMENCLATURE Materials and Electronics Technology, PE 0602712E, Project MPT-01

- Develop and apply sensor technologies for on-line process control of the large-format and roll-to-roll unit processing tools identified for development of multi-chip modules.
- Demonstrate performance of large format unique materials in the production of multichip modules.
- Utilize selected laser sintering and 3-D printing solid free-form fabrication to demonstrate structural ceramic and metal components with strengths comparable to what can be produced using mass production methods.
- Initiate low cost processing program on light-weight beryllium-aluminum alloys for aerospace applications.
- Develop and apply fiber optic sensors to powder burnout and consolidation processes.

• Advanced Materials and Processing ($24.1M): Continue processing developments for affordable materials.
- Improve defect density in semiconducting silicon carbide boules to optimize electrical properties and increase yield.
- Develop architecture for vapor phase simulation code along with process modeling and simulation kernels.
- Develop computer models for plasma spraying of metal matrix composites.
- Demonstrate processing and fabrication of smart materials.
- Demonstrate feasibility of large area RF plasma diamond deposition.
- Develop theoretical and computational methods to predict structural and electro-optic properties for semiconductor superlattices.

• Vapor Phase Processing ($15.3M): Develop intelligent processing technologies to scale-up cost-effective production of thin film photovoltaics, multilayer turbine engine coatings, and thin film high temperature superconductor devices.
- Demonstrate vapor deposition process models for physical and chemical vapor deposition.
- Demonstrate on-line sensing to measure critical process and product variables in the production of thin film functional multilayer structures.
- Initiate development of plasma modeling and simulation tools for vapor deposition technologies.
- Field demonstrate a high efficiency, foldable photovoltaic recharging panel and control electronics to power singars radio.

• Environmental Sciences ($8.8M): Destroy DoD toxic waste using supercritical water oxidation (SCWO). Reduce toxic waste production as by-products of DoD-related fabrication processes ("green" manufacturing).
- Initiate construction of transportable supercritical water oxidation (SCWO) system capable of processing 1,000 gallons per day.
- Develop alternative electronic manufacturing processes for minimization/elimination of toxic wastes.
- Conduct survey of casting emissions and install research foundry.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1995
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 2 Exploratory Development	R-1 ITEM NOMENCLATURE Materials and Electronics Technology, PE 0602712E, Project MPT-01

(U) FY 1996 Program:

- Structural Materials ($40.8M):
  - Demonstrate full-scale rapid densification of carbon-carbon composite components.
  - Demonstrate a five-fold improvement in the life of the roll reaction control (RRC) valve bearings on the AV-8B Harrier aircraft due to the upgrade of the metal bearings with ceramic hybrid bearings.
  - Demonstrate capability of joining polymer matrix composites in advanced materials partnership; initiate four new Advanced Materials Partnerships in structural materials processing, non-destructive evaluation, and diamond film synthesis for thermal management in electronic packaging.
  - Validate the Resonant Ultrasonic Inspection Nondestructive Evaluation (NDE) technique for ceramic rolling elements through beta site testing at a commercial ball bearing finisher.
  - Establish quantitative criteria for NDE imaging for flaw detection.
  - Complete detailed design of polymer composite integrated airframe concept.
  - Evaluate strength and stiffness of metal matrix composite (ceramic fiber reinforced titanium) hollow fan blade for jet engines.
- Material and Device Fabrication ($35.1M):
  - Demonstrate prototype multichip modules with laminate technology roll to roll processing.
  - Demonstrate the use of X-ray tomography and develop software to generate CAD files from solid objects compatible with requirements of solid freeform fabrication.
  - Develop the machine capability to produce silicon nitride components using the fused deposition method with silicon nitride powder loaded wax filaments.
  - Demonstrate the capability to fabricate molds for slip casting structural ceramics using the 3-D printing technology.
  - Demonstrate application of smart materials to reconfigurable machines and tooling hardware.
- Advanced Materials and processing ($24.6M):
  - Develop a Chemical Vapor Deposition (CVD) process for the fabrication of particulate and chopped fiber reinforced composites with 10X increase in composite growth rate over normal CVD processing; and demonstrate the utility of the fabricated composites for the die casting of copper alloys.
  - Design, fabricate and evaluate fiber reinforced ceramic matrix composites fins for the Army's Line of Sight Anti-Tank (LOSAT) missile with a 50% weight savings over the current materials (steel).
  - Develop magnetoresistive materials with improved electrical resistance properties.
  - Develop simulation codes for physics of vapor deposition and validate on industrial processes.
  - Develop feedback control methods for plasma sprayed metal matrix composites.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1995
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 2 Exploratory Development	R-1 ITEM NOMENCLATURE Materials and Electronics Technology, PE 0602712E, Project MPT-01

- Demonstrate greater than 50 fold increase in CVD diamond deposition rate (from 60 mg/hr to greater than 3000 mg/hr) with a large area and high rate deposition system.
- Develop stable contacts for high temperature, high power semiconductors.
- Demonstrate material sensor and activator components manufacturability utilizing piezoelectric ceramics and electrostrictors.

• Vapor Phase Processing ($10.6M):
- Demonstrate on line sensing and closed loop control of thin film photovoltaic processing.
- Demonstrate an order of magnitude improvement in jet engine compressor blade erosion resistance through the use of multilayer coatings.
- Demonstrate high yield large area processing of thin film high temperature superconducting devices.

• Environmental Sciences ($11.6M):
- Design a supercritical water oxidation system for shipboard waste disposal.
- Initiate risk assessment methodologies for bioremediation; develop baseline criteria and metrics for risk reduction.
- Demonstrate more environmentally sound production processes for printed wiring boards.
- Select sites for bioremediation prototype process design and demonstration.

(U) FY 1997 Program:

• Biotechnology ($1.1M):
- Initiate linkage chemistry to attach sequence specific heteropolymers to fibers and resins for development of systemic toxic "sponge".

• Structural Materials ($52.3M):
- Demonstrate low cost production of high performance carbon-carbon composites.
- Demonstrate a 2X increase in mean-time-between-failures (MTBF) associated with the replacement of carbon engine starter oil face seals on aircraft (C-5, A-10, KC135R, F-111, C-130 and C-141) with ceramic face seals.
- Design, build and test a solid-state ceramic oxygen membrane generating system (COGS) for aircraft use.
- Continue four advanced materials partnerships in structural materials, demonstrate low cost processing of ceramic composites for jet engines; demonstrate versitile process for lowering cost of hot isostatic pressing of superalloy powders.
- Design prototype electron beam facility for curing polymer matrix composites.
- Establish quantitative predictions of structural strength using NDE measurements.

- Materials and Device Manufacturing ($33.0M):
  - Demonstrate the capability to produce ceramic components with complex geometry and dimensional tolerances and mechanical properties comparable to mass manufactured advanced ceramics using the Jet Printer technology (3-D printing).
  - Develop a new solid freeform build method for ceramic components based on layer-by-layer photolithography utilizing either large area liquid crystal display, or a light emitting diode display technology for electronic/programmable photomasks.
  - Test reconfigurable machines and tools in shop floor beta test sites.
  - Demonstrate fabrication process for microintegrated smart materials.
  - Demonstrate roll-to-roll processing of laminate multichip modules.
- Advanced Materials and Processing ($29.7M):
  - Determine the economic viability of Templated Grain Growth (TGG), a process by which solid phase epitaxy of crystallographically oriented seeds on near net shaped pollycrystalline components is used for growth of single crystal-like oxides.
  - Determine the performance characteristics of low cost, damage tolerant fibrous monolith components in engine environments.
  - Demonstrate control of plasma sprayed metal-matrix processing and extend process control models to physical vapor deposition of metal coated fibers.
  - Complete development of a plasma/ion etch numerical simulation.
  - Demonstrate predictive capability of high-pressure, low-order, chemical vapor deposition models and demonstrate feedback control to a desired wafer state.
  - Develop manufacturable processes for large area deposition of giant magnetoresistive materials and bipolar spin resistors.
  - Demonstrate intelligent processing of large area chemical vapor deposition (CVD) diamond with a production cost of $1.00 per karat.
  - Grow single crystal boules for three inch diameter silicon carbide semiconductor wafers by scaling up the reactor and developing larger seed crystals.
  - Demonstrate vibration reduction by a factor of ten in machine tools via specially designed sensor/actuator elements to enhance machining tolerances.
- Vapor Phase Processing ($12.9M):
  - Demonstrate a 5X cost reduction in production of thin film photovoltaic modules.
  - Demonstrate high yield multilayer coating of complex shape turbine engine components.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1995
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 2 Exploratory Development	R-1 ITEM NOMENCLATURE Materials and Electronics Technology, PE 0602712E, Project MPT-01

- Environmental Sciences ($17.2M):
  - Demonstrate a supercritical water oxidation pilot plant for the destruction of shipboard hazardous materials.
  - Complete characterization of field sites and design and testing of risk assessment tools for bioremediation of DoD hazardous waste sites.
  - Demonstrate novel recycling/reclamation techniques for disposal of scrap polymer matrix composites.

(U) **Program Change Summary**: *(In Millions)*

	FY 1994	FY 1995	FY 1996	FY 1997
President's Budget	129.1	106.8	112.1	125.2
Appropriated	129.1	129.7	N/A	N/A
Current Budget	129.1	148.6	122.7	146.3

(U) **Change Summary Explanation**:

FY 1995-97 Increases due to transfer of Advanced Materials Partnerships to this project.

(U) **Other Program Funding Summary Cost**: N/A

(U) **Schedule Profile**: N/A

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1995
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 2 Exploratory Development	R-1 ITEM NOMENCLATURE Materials and Electronics Technology, PE 0602712E

COST *(In Millions)*	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	Cost to Complete	Total Cost
Microelectronic Device Technologies MPT-02	94,333	92,942	62,221	81,942	92,291	98,214	136,179	155,972	Continuing	Continuing

(U) **Mission Description**: This element develops advanced electronic and optoelectronic devices, semiconductor process tools and methodologies, materials for optoelectronics and infrared devices. Areas of emphasis include high performance analog-to-digital converters (ADCs), military optical processors, novel optoelectronic devices and modules, artificial neural network technology and low power electronics. This microelectronics development project creates the technology base for advanced electronic and optoelectronic components to meet DoD needs. In this project, the feasibility of promising research results are developed to the point where their military utility can be determined. Many of the tasks in this project culminate in a subsystem prototype insertion demonstration.

(U) **Program Accomplishments and Plans**:

(U) FY 1994 Accomplishments:

- Tested first iteration GaAs hetero-junction bipolar transistor (HBT)-based ADCs for sampling speed and dynamic range. ($7.0M)
- Completed design and demonstration of GaAs HBT-based ADCs support components, such as multi-plexers and demultiplexers. ($4.0M)
- Initiated effort to develop a design system for circuits operating above 10 GHz. ($2.4M)
- Initiated development of neural network-based systems for signal processing applications (including signal demodulation, noise removal, face recognition, character recognition, large-vocabulary speech recognizers and multi-modal command systems for computer interfaces). ($4.0M)
- Developed neural network automatic target recognizer for future insertion into the Comanche Helicopter. ($.8M)
- Demonstrated electronic neural network hardware boards with speeds of up to 10 billion operations per second, and developed component technologies for optoelectronic systems that promise up to 10 trillion operations per second. ($3.0M)
- Completed studies on requirements and candidate hardware/software designs for an Advanced Vision System (AVIS) that will accelerate image processing and recognition algorithms. ($2.9M)
- Demonstrated optically controlled phased arrays and fiber-optic-based bi-static radar. ($2.7M)
- Demonstrated optical pattern recognition modules. ($2.2M)

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- Demonstrated acousto-optic pulse compression signal processor and jammer nulling processor. ($2.5M)
- Demonstrated optical electronic warfare channelizer and precision direction finder. ($1.7M)
- Developed packaged optoelectronic-microwave modules for microwave transmission. ($1.0M)
- Developed integrated monolithic tunable laser arrays. ($2.7M)
- Initiated efforts to develop low-cost optoelectronic modules. ($16.5M)
- Developed optoelectronic packages that incorporate passive alignment techniques between fibers and component input/output (I/O). ($4.5M)
- Established consortia for rapid automated optical alignment packaging and for accelerated development of blue lasers for insertion into laser memory disk systems. ($8.0M)
- Improved ferroelectric memory cell performance, especially imprint characteristics. ($1.4M)
- Initiated optical and electrical characterization of III-V bulk materials for optoelectronic and infrared device applications. ($2.5M)
- Initiated fabrication and evaluation of wide band gap II-VI blue emitters produced on III-V substrates. ($4.0M)
- Completed design of crystal growth system for 1kg InGaAs boule for 50mm diameter substrates. ($3.0M)
- Initiated program to optimize computer architecture and supporting design systems that fully exploit area array interconnects and multi-chip-module packaging. ($8.5M)
- Initiated program to demonstrate speed optimization with cryo-cooling. ($7.0M)
- Initiated a program to demonstrate a large format plasma processing of chemical vapor deposition (CVD) diamond. ($2.0M)

(U) FY 1995 Program:

- Validate high speed heterojunction bipolar transistor (HBT) technology by manufacturing components on pilot production lines. ($17.5M)
- Demonstrate the high-speed HBT process via components in a system application. ($2.4M)
- Establish transitions for mature neural network signal processing systems (including signal demodulators and adaptive filters), and continue development of high-performance end-to-end systems (including multi- module computer interfaces and image and character recognition systems. ($4.0M)
- Comprehensively test neural network target recognizer in preparation for insertion into Comanche Helicopter. ($1.0M)
- Complete electronic neural network boards and demonstrate on realistic applications; demonstrate optoelectronic hardware at 1 trillion operations per second. ($4.7M)
- Establish the Advanced Vision Systems (AVIS) architecture framework and design custom chips. ($5.0M)

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- Establish Advanced Vision Systems (AVIS) software requirements and initiate software development (including custom compilers, languages, debuggers, case tools, libraries, and environments). ($2.5M)
- Develop key components for affordable optoelectronic modules. ($10.0M)
- Field demonstration of optical pattern recognition modules, optical real-time synthetic aperture radar processor and pulse compression signal processor. ($1.0M)
- Demonstrate advanced serial and parallel optoelectronic busses. ($6.0M)
- Initiate insertion of prototype optoelectronic modules into system applications. ($5.0M)
- Develop 3.3 volt silicon on insulator (SOI) technology. ($8.0M)
- Develop unit simulation CAD tools. ($2.8M)
- Initiate consortium in nanolithography, nanoelectronics, and high-speed supercomputer visualization. ($9.0M)
- Initiate seeded growth of cadmium zinc telluride boules to achieve large, single crystal substrate material with controlled orientation. ($6.5M)
- Demonstrate large format, staring infrared focal plane arrays using substrtae material from seeded crystal growth. ($7.5M)

(U) FY 1996 Program:

- Deliver fully tested analog to digital converters, digital to analog converters, and multiplexers and demultiplexers. ($4.3M)
- Initiate prototype projects using heterojunction bipolar transistor components. ($4.3M)
- Complete transition of neural network signal processing systems to DoD platforms including installation of target tracker in Space Warfare Center. ($4.0M)
- Develop neural network target recognition algorithms for synthetic aperature radar images. ($.8M)
- Establish transitions for electronic neural network hardware boards. ($4.0M)
- Fabricate and test custom hardware for the AVIS program; develop packaging and integration strategies. ($4.6M)
- Develop first generation AVIS software (including custom compilers languages, debuggers, case tools, libraries, and environments). ($4.9M)
- Develop critical subassemblies for digital optoelectronics processor. ($3.5M)
- Develop key components of an optical backplane. ($5.0M)
- Develop packaged affordable serial output (serial or parallel data in) optoelectronic modules. ($7.0M)
- Develop packaged cost effective parallel output (parallel in, parallel out) optoelectronic modules. ($8.0M)
- Initiate development of radio frequency photonic subsystems for microwave/millimeter transmission. ($2.0M)

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APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 2 Exploratory Development	R-1 ITEM NOMENCLATURE Materials and Electronics Technology, PE 0602712E, Project MPT-02

- Develop 1.5 volt silicon on insulator (SOI) technology. ($7.0M)
- Develop circuit synthesis CAD tools. ($1.4M)
- Demonstrate self-clocking circuits. ($1.4M)

(U) FY 1997 Program:

- Develop integrated CAD tool set for high speed (>IGHz) designs. ($7.6M)
- Initiate demonstration of high speed analog to digital prototype. ($11.0M)
- Complete Advanced Vision Systems (AVIS) hardware modules and integration into heterogeneous computing systems. ($3.0M)
- Refine and complete AVIS software based on user feedback. ($4.0M)
- Demonstrate AVIS on image recognition application. ($.9M)
- Demonstrate neural network data fusion techniques in systems concept. ($8.0M)
- Demonstrate key elements of optoelectronic processor breadboard. ($2.0M)
- Demonstrate blue/green lasers with 25 hour lifetime. ($3.0M)
- Demonstrate packaged serial optoelectronic modules and identify military applications. ($6.0M)
- Demonstrate packaged parallel output (parallel in, parallel out) optoelectronic modules. ($5.9M)
- Demonstrate critical optical backplane components compatible with electronic packaging approaches. ($6.0M)
- Continue development of radio frequency (RF) photonic subsystems for microwave/millimetric wave transmission and develop millimetric wave-optical RF distribution antenna network. ($7.7M)
- Develop 0.9 volt silicon on insulator (SOI) technology. ($12.0M)
- Complete development of multi-GHz simulation tools. ($2.0M)
- Field test low power subsystem. ($2.8M)

(U) **Program Change Summary**: *(In Millions)*

	FY 1994	FY 1995	FY 1996	FY 1997
President's Budget	94.3	88.5	92.0	97.9
Appropriated	94.3	87.1	N/A	N/A
Current Budget	94.3	92.9	62.2	81.9

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APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 2 Exploratory Development	R-1 ITEM NOMENCLATURE Materials and Electronics Technology, PE 0602712E, Project MPT-02

(U) **Change Summary Explanation**:

FY 1995 Increase funds a Congressional TRP earmark in nanoelectronics.
FY 1996-97 Decrease due to a reprioritization of DoD resources.

(U) **Other Program Funding Summary Cost**: N/A

(U) **Schedule Profile**: N/A

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DATE: February 1995

APPROPRIATION/BUDGET ACTIVITY: RDT&E, Defensewide
BA 2 Exploratory Development

R-1 ITEM NOMENCLATURE: Materials and Electronics Technology, PE 0602712E

COST (In Thousands)	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	Cost to Complete	Total Cost
Cryogenic Electronics MPT-06	37,788	17,672	11,996	12,193	13,240	5,183	7,546	10,000	Continuing	Continuing

(U) **Mission Description**: High temperature superconducting (HTS) materials have reached a stage of development where specific applications can be identified in thin-film electronic devices and circuitry for military avionics. This program is building device and subsystem insertions for radar and electronic warfare systems with extremely wide bandwidth and dynamic range, general avionics, and airframe guidance subsystems, while continuing with the development of the underlying fabrication technology for superconducting thin films, bulk wire and other forms. Particular demonstrations include a switched filter bank for the B-1B radar warning receiver, superconducting electronic packages for electronic intelligence (ELINT) and electronic warfare suites in reconnaissance aircraft, and safe and economical devices for riveting and clamping sheet metal sections for aircraft manufacturing.

(U) A corollary effort is to build on the broader class of electronics technologies whose performance improves at cryogenic temperatures by demonstrating modules with superior performance. Such modules will find application in (1) military wireless communications networks; (2) Cryocomputers, in particular mid-range computers such as workstations; and (3) medical instrumentation, such as a magnetic resonance imaging microscope. Previously demonstrated technologies to be integrated include low-power microelectronics, HTS, multi-chip modules (MCMs) and magnetoresistive random access memories (RAM).

(U) **Program Accomplishments and Plans**:

(U) FY 1994 Accomplishments:

- High Temperature Superconductors/Analog and Digital Applications ($23.8M): Pursued insertions of HTS materials in thin-film analog and digital electronic devices and circuitry. Applied the technology to applications such as computer-aided engineering (CAE) software tools for HTS circuit characterization and optimization, and integration of available cryogenic refrigerators with HTS devices.
  - Continued development of optically-switched 30-element HTS filter bank to enable signal discrimination in radar warning receivers (RWR) in a dense countermeasure environment.
  - Improved acoustical damping of stabilized oscillator (STALO) based upon high-Q high temperature superconducting (HTS)/sapphire resonant cavity, to achieve a factor of 100 improvement over current radar.

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- Characterized performance criteria for radar receiver to detect sea-skimming missiles at adequate ranges in sea clutter, based upon HTS reference source and preselective filter bank integrated with low-noise antenna driver and appropriate closed-cycle cryogenic cooling system.
- Initiated development of an HTS crossbar switch to provide very high connectivity and performance enhancement (X5) over current capability, for application to mainframe computers and military telecommunications.
- Demonstrated digital circuits such as an asynchronous transfer mode (ATM) switch for the DoD global grid network and/or the commercial information infrastructure.
- Incorporated HTS analog components in cellular telephone and personal communications networks, utilizing the high-power handling and discrimination capability of thin-film HTS tuned filterbanks, delay lines and other components to provide enhanced coverage with better unit isolation.
- Developed wide-bandwidth HTS antennas and high-efficiency HTS coupling networks for application as miniaturized radio frequency (RF) sensors and transmitters in electronic warfare scenarios.

• High Temperature Superconductors/Multi-Chip Modules (MCM) ($14.0M): Demonstrated a fully functional module utilizing approximately 50 complementary metal oxide semi-conductor (CMOS) chips which will operate with X 2 greater speed in a more compact form.

- Extended materials processing capabilities to develop ion etching as a planarization technique for insulating dielectric layers and develop photoresist and etching procedures to attain fully reproducible 2 micron interconnect linewidth.
- Developed technology infrastructure by extending commercial computer-aided engineering (CAE) tools for normal metal interconnects to accommodate HTS interconnects, transitioning such capability to HTS vendors and MCM manufacturers.
- Developed alternate HTS MCM architectures such as the dual-offset mesh plane process.
- Integrated closed-cycle cryorefrigerator with MCM module for a complete push-button system.

(U) <u>FY 1995 Program</u>:

• High Temperature Superconductors/Analog and Digital Applications ($13.4M): Identify the most promising HTS applications to achieve the planned culmination of the program: (1) filter banks for alleviating saturation of radio warning receivers (RWR), (2) high resolution radar receivers, (3) crossbar switches as computer components, and (4) analog components for communication networks.

- Extend the switched HTS filterbank to be fully compatible with the RWR requirements of several aircraft Electronic Warfare (EW) suites.
- Integrate an HTS stabilized oscillator (STALO) with a low-noise antenna driver and preselective filter bank to verify that the noise floor meets performance requirements to detect sea-skimmers.

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- Undertake Complimentary Metal Oxide Semiconductor (CMOS) optimization according to the design proven with gallium arsenide components in room temperature crossbar switch and characterize performance at low temperature with high temperature superconductor (HTS) interconnects.
- Demonstrate function of filter networks, delay lines and other components according to specifications in subscale versions of communication networks.

• High Temperature Superconductors/Cryoelectronic Modules ($4.3M): Continue the integration of HTS devices and interconnects with cold conventional electronics, to produce subsystem modules with integrated cryocooler which can be easily integrated into larger systems to provide enhanced performance benefits.
- Demonstrate processor module for work station application, exhibiting 50% higher clock speed at -50C; design extension to 80K, using HTS interconnects for optional performance.
- Initial demonstration of communications module, with HTS filters and amplifier integrated with cryocooler assembly.

(U) FY 1996 Program:

• High Temperature Superconductors/Analog and Digital Applications ($4.0M): In this final year of the HTS Program, the focus will be on five insertion opportunities.
- Provide fully-integrated 32-element filterbank with refrigerator to F-15 project office for aircraft demonstration. Provide 96 element filterbank to B-1B project office for utilization.
- Complete evaluation of cryo-radar with HTS STALO and preselective filter bank, and determine performance specifications for low target cross-section detection.
- Complete development of crossbar switch and cryo-workstation to insert cryo-optimized packaged semiconductor integrated circuits in computers.
- Complete funding for Consortium for Superconducting Electronics, with demonstration of prototype cellular base station and Superconducting Quantum Interference Device (SQUID) array for magnetocardiography.
- Demonstration of a high-performance 8x8 asynchronous transfer mode (ATM) cryogenic switch in a wide area network.

• Cryogenics Technologies. ($8.0M)
- Undertake development of small/inexpensive reliable cryocoolers for application to communications, computers and medical instrumentation.
- Develop electronic devices and components optimized for cooled operation, such as CMOS, integrated circuits (ICs) and multichip modules (MCMs).
- Initiate applications demonstrations, with integrated cryocoolers and temperature-optimized components.

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(U) **FY 1997 Program:**

- Cryogenics Technologies. ($12.2M)
  - Demonstrate integration of cryocooler with workstation module, consisting of advanced microprocessor, associated controller and cache memory, with enhanced performance.
  - Demonstrate assembled High Temperature Superconductor (HTS) filterbank and matching network components in simulated cellular base station.

(U) **Program Change Summary:** *(In Millions)*

	FY 1994	FY 1995	FY 1996	FY 1997
President's Budget	37.8	14.2	4.0	0
Appropriated	37.8	18.5	N/A	N/A
Current Budget	37.8	17.7	12.0	12.2

(U) **Change Summary Explanation:**

FY 1995 Reduction to finance TRP earmark.
FY 1996-97 Adjustments reflect enhancement of emphasis in Cryogenic Technologies.

(U) **Other Program Funding Summary Cost:** N/A

(U) **Schedule Profile:** N/A

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APPROPRIATION/BUDGET ACTIVITY: RDT&E, Defensewide
BA 2 Exploratory Development

R-1 ITEM NOMENCLATURE: Materials & Electronics Technology, PE 0602712E

COST (In Thousands)	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	Cost to Complete	Total Cost
Military Medical/Trauma Care Technology MPT-07	0	14,873	29,087	29,265	32,138	38,012	44,500	48,500	Continuing	Continuing

(U) **Mission Description**: This project is a continuation and consolidation of work previously cited under several projects. The objective is to revolutionize far-forward battlefield trauma care. The project recognizes that planned downsizing of U.S. forces creates new pressures to ensure force readiness, skill mix, and effective joint doctrine at a time when battlefield casualties carry both strategic importance and tactical relevance. A review of combat casualty care has shown: (1) that 90% of combat deaths occur in the zone of close combat prior to medical or surgical intervention; (2) that fratricide continues at casualty rates as high as 20%-30%; (3) that casualty location is a continuing battlefield problem; and (4) that less than 5% of U.S. Army active-duty physicians have treated combat casualties.

(U) The ARPA Defense Healthcare Technologies program has two major segments. The first segment exploits ARPA's unique leadership role in the electronics and information sciences areas to project advanced medical and surgical care into the far-forward battlefield area to effect early, successful, clinical intervention. In one thrust, this program will develop lightweight personnel status monitors (PSMs) permitting remote non-invasive clinical diagnosis, casualty localization, and friend-foe identification. The PSM, which would be worn by all soldiers as part of their combat uniforms, is further augmented with low power, secure, wireless communications and Global Positioning Satellite system (GPS). The PSM would monitor the soldiers' clinical vital signs continuously, but would remain otherwise passive unless either queried by an operational commander or the soldiers' vital signs departed from established clinical norms.

(U) In a second thrust, this program will develop the technology base for early far-forward medical/surgical intervention. The goal is to preserve critical organ system function, prevent exsanguination, reverse systemic shock, and prevent hypoxia by use of automatically controlled devices to provide immediate mechanical or pharmacologic therapy. Once pharmacologic or early surgical stabilization has been achieved, the patient will be evacuated in a critical care life support pod (LSTAT) which will function like an autonomous single-patient hospital intensive care unit.

(U) In a third thrust, workers will develop and exploit advanced simulation technology to improve the training of battlefield health care providers and to ensure skill currency. The objectives of this effort are to provide for the

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virtual representation of human structure and function; insure near-seamless transition from training to clinical practice; and to permit simulation of combat-casualty medical care within the framework of operational battlefield requirements. The broader impact of whole-body virtual simulation on undergraduate and continuing medical education programs will allow military medical students to integrate traditionally separate academic disciplines and dramatically reduce the need for human cadavers. Virtual prototyping is provided of medical environments such as mobile operating rooms, critical care life support pod (LSTAT) and instruments/equipment inserted by casualty care simulations. New technologies for presenting information and training scenerios will be developed using human interface technologies.

(U) A fourth thrust will develop high-fidelity diagnostic imaging, particularly in biomedical applications of Computed Tomography (CT), ultrasound, infrared (IR), and conventional X-rays. For example the particular problem that is encountered in ultrasound imaging is that the medium (i.e., human) tissue is inhomogeneous and scatters the signal, which blurs the image. The process for developing high-resolution imaging will build upon the emerging technology of adaptive acoustics, the displays of which are intuitive and easily interpreted by the combat medic and physician.

(U) In the other segment of the Defense Healthcare Technologies program, the development of an advanced health care information infrastructure supports the entire trauma care technology base. Medical information must flow seamlessly and transparently on all levels of patient care. For this to occur, a platform-independent medical record system, such as the battlefield electronic patient record (BEPR), will insure immediate continuity, distribution, and accessibility of medical information from the forward battlefield to the rear echelon support in U.S. based medical centers. This information will be archived in multimedia heterogeneous databases of laboratory studies, radiologic and pathologic images, inpatient medical records, and be available over a world wide telecommunication system for real-time interactive collaboration among physicians. In addition, the infrastructure will provide a clinical associate system which is an intelligent system that assists physicians, nurses, corpsmen and paramedics in assessing and treating patients.

(U) This work does not duplicate any efforts of the military services or the National Institutes of Health. A Memorandum of Agreement exists between the Army Medical Department and ARPA.

(U) **Program Accomplishments and Plans**:

(U) FY 1994 Accomplishments: Not applicable.

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(U) FY 1995 Program:

- Advanced Biomedical Technology. ($5.5M) The basic research portion of this effort is found under PE 0601101E, Project MS-01.
  - Continue development of the personnel status monitor (PSM) primary life state sensors; executive (controller) breadboard; PSM sensor algorithm, code and system integration; medic/command data management and decision support; miniaturized personal communications for Global Positioning Satellite system (GPS) module; interface and integrate communications to controller subsystem; involves in-house and field testing. The PSM, Combat Medic Unit, and Medical Command Post unit interface with the Health Care Information Infrastructure program area.
  - Develop battlefield surgical simulation for lower extremities with emphasis on kinematic realism, soft tissue deformation, muscle contractility and simple bleeding (virtual environment).
  - Initiate exploratory studies of telepresence surgery (on experimental model) by wireless link between contingency field hospital and remote field operating room; critical care pod with integrated vital signs monitoring and closed cycle environmental control.
  - Develop remote physiologic sensors to access performance readiness.
- Health Care Information Infrastructure. ($9.4M)
  - Develop software architecture for a user-oriented associate system that captures ambulatory care data directly from physicians during patient visits.
  - Develop associate system that provides trauma guidelines directly to medics during emergencies and combat care scenarios.
  - Demonstrate shared electronic, graphic based planning and collaboration tools for multiple users in a distributed health and human services associate system.

(U) FY 1996 Program:

- Advanced Biomedical Technology. ($15.4M)
  - Continue the development of the personnel status monitor (PSM). Development of enhanced diagnostic capabilities that survey behavioral state of the soldier. Continue evaluation of novel transcutaneous non-invasive biosensor monitoring. Integrate closed-loop control algorithms for fluid infusion and mechanical ventilation support. Design probable conformal versions of the soldier-worn units. Design dismounted combatant version of the PSM for use in dismounted soldier tactical simulation exercises.
  - Continue development of battlefield surgical simulation with the incorporation of trauma mimicry to the trauma extremity simulator simulating physiologic shock and vital organ hypoxia and compromise.

- Continue development of a working prototype of Remote Telepresence Surgery by the integration of haptic feedback, and orbital lag-time solutions. Develop the structure of the biosensors-based critical care pod into likely form of working prototype that is fully an autonomous critical care system for advanced medivac.
- Develop battlefield/trauma ultrasonic imaging enhancement to reduce spurious reflections for unambiguous 3D interpretation of body structures.
- Continued development of the portable Stat-Lab by additional blood chemistry parameter analytic modules. Development of integrated analytic modules involving optical absorption and absorption assay technology, and cell counting by scattered light.

• Health Care Information Infrastructure. ($10.2M)
- Integrate models of combat doctrine and knowledge-based decision support tools (combat casualty protocols & guidelines) in support of combat medics and physicians.
- Demonstrate hands-free capture of patient data under battlefield conditions.
- Provide one-stop shopping for health information to geographically dispersed medical personnel.
- Create reference architecture for generalized associate system.
- Continue development of combat casualty associate systems that allow seamless integration of database sources and user interface development.
- Demonstrate integration of battlefield electronic patient record with peacetime care systems.

• 2-D Ultrasound Technologies. ($3.5M)
- Undertake modeling effort to simulate the propagation, scattering and detection of ultrasound in tissue, utilizing 2-D arrays of detectors.
- Initiate basic features of adaptive acoustics, namely the fabrication of 2-D sensor arrays and appropriate transmit and receive electronics.
- Examine Synthetic Aperitive Radar processing techniques to determine those features which are pertinent to the ultrasonic imaging problem; begin testing algorithms which could mitigate the contribution of multiple scattering sites to image degradation.

(U) FY 1997 Program:

• Advanced Biomedical Technology. ($14.2M)
- Continue development of the personnel status monitor (PSM). Further miniaturization of the Global Positioning Satellite (GPS) module of the PSM in a superchip design which couples a radio data communication chip, for the transmission of vital sign and situational awareness data to battalion level command. Miniaturization of prototype design will continue in coordination with the soldier regalia

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parameters of the 21CLW program of Secretary of the Army, Research, Development & Acquisition (SARDA). Develop simulation interface of the dismounted soldier's behavioral parameters as measured through the PSM.

- Continue development of battlefield surgical simulation by the incorporation of trauma mimicry, and morphine of the axial trunk musculoskeletal and organ system simulator. Axial trunk simulation of physiological shock, exsanguination and vital organ hypoxia and focus on the development of an enhanced education and training prototype for the combat medic and the combat surgeon.
- Integrate axial trunk and extremity simulators to form entire human body surgical/trauma simulator. A packaging and functional integration between body regions which allows multiple injury response and physiologic mimicry.
- Continue development of a working prototype of Remote Telepresence Surgery. Develop surgical tools for remote telepresence, robotically controlled, and coupled in force-feedback loops for enhanced operational dexterity. Develop fluid and blood sensor-based administration devices for the critical care pod. Develop pharmacologic hibernant sensor-based administration device for drug cocktail injection for the individual combatant. Test of the pharmacologic hibernant under controlled trauma simulations to determine physiologic response with drug-induced reversibility.
- Continue development in medical imaging involving portable Magnetic Resonance Imaging microscope for tissue examination and assessment of pathology. Develop image enhanced chips for application to ultrasonic 3D interpretation. Extend the development of portable digital X-ray to 20x20 cm detector array, for field use.
- Continue development of the assembly of the analytic modules for biological waste, recycling of fluids and the executive controller modules.

• Health Care Information Infrastructure. ($8.9M)
  - Demonstrate protocol based care in all outpatient clinics.
  - Facilitate transition of combat care associate to emergency services.
  - Demonstrate improved life cycle systems management via SEP/DSSA.
  - Demonstrate performance gains of advanced software engineering collaborators.
• 2-D Ultrasound Technologies. ($6.2M)
  - Continue to develop and implement the techniques of adaptive acoustics to ultrasonic imaging, utilizing 2-D sensor arrays and image processing.

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RDT&E, Defensewide
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R-1 ITEM NOMENCLATURE
Materials & Electronics Technology,
PE 0602712E, Project MPT-07

(U) **Program Change Summary:** *(In Millions)*

	FY 1994	FY 1995	FY 1996	FY 1997
President's Budget	0	15.3	28.0	30.0
Appropriated	0	14.9	N/A	N/A
Current Budget	0	14.9	29.1	29.3

(U) **Change Summary Explanation:**

FY 1996–97 Increases reflect minor program repricing.

(U) **Other Program Funding Summary Cost:** N/A

(U) **Schedule Profile:** N/A

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)								DATE February 1995		
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 3 Advanced Development					R-1 ITEM NOMENCLATURE Experimental Evaluation of Major Innovative Technologies, PE 0603226E					
COST *(In Thousands)*	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	Cost to Complete	Total Cost
Experimental Evaluation of Major Innovative Technologies	**599.914**	**671.792**	**618.005**	**595.873**	**566.784**	**572.265**	**642.430**	**765.299**	**Continuing**	**Continuing**
Command & Control Information Systems EE-21	500	55,022	61,361	38,624	31,300	39,237	41,687	46,034	Continuing	Continuing
ASTOVL/CTOL EE-24	25,712	0	0	0	0	0	0	0	0	N/A
Advanced Space Technology Program EE-27	68,662	62,785	0	0	0	0	0	0	0	N/A
Guidance Technology EE-34	10,809	10,120	26,150	29,673	32,000	21,600	17,000	20,000	Continuing	Continuing
Advanced Ship-Sensor Systems EE-36	17,180	34,348	16,502	33,513	45,614	51,550	53,050	68,050	Continuing	Continuing
Advanced Simulation EE-37	58,001	82,656	79,065	44,329	34,367	40,853	67,653	75,353	Continuing	Continuing
Unmanned Undersea Vehicle Systems EE-39	23,850	37,430	16,836	17,469	17,395	18,115	21,115	26,115	Continuing	Continuing
Critical Mobile Targets EE-40	117,424	117,338	117,759	112,842	118,387	128,860	133,860	147,860	Continuing	Continuing
Air Defense Initiative EE-41	24,642	34,718	23,476	24,777	35,029	31,989	46,989	68,989	Continuing	Continuing
Global Grid Communications EE-45	19,209	43,979	45,188	44,584	43,592	23,916	22,935	29,549	Continuing	Continuing

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COST *(In Thousands)*	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	Cost to Complete	Total Cost
Defense Simulation Internet EE-46	31,617	16,622	27,514	37,175	0	0	0	0	0	N/A
Classified Programs EE-CLS	202,308	176,794	204,154	212,887	209,100	216,145	238,141	283,349	Continuing	Continuing

(U) **Mission Description**: This program element is budgeted in the Advanced Development Budget Activity because its purpose is to demonstrate and evaluate advanced research and development concepts. Funding for ten projects are requested in FY 1996 within this program element such as the Air Defense Initiative, Critical Mobile Targets, Advanced Simulation, and Global Grid Communications projects. A number of advanced concept technology demonstrations are funded within these activities and several projects have dual-use applications. Funding for ARPA's Advanced Short Takeoff Vertical Landing (ASTOVL)/Conventional Takeoff and Landing (CTOL) EE-24 was transferred to PE 0603800E in FY 1996 and out years. A discussion of the most significant projects follows.

(U) The Air Defense Initiative (ADI) is examining innovative technologies to counter the airborne threat posed by cruise missiles and manned aircraft. Technologies under evaluation include sensor upgrades, data integration and identification improvements, and radar-absorbent materials research. Advanced infrared measurement and high resolution digital imagery systems are also under development, and a simulation and modelling effort is included to test and demonstrate ADI concepts.

(U) Advanced Simulation efforts will provide a distributed, scalable seamless warfighting environment at the weapon level of detail that will ultimately provide a massive synthetic theater of war capable of supporting such requirements as readiness training, doctrine refinement, requirements analysis, battle management simulation, and contingency planning. Communications and data infrastructures, range instrumentation and computer image generation are just a few of the developmental activities funded in the Advanced Simulation program.

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(U) The Critical Mobile Targets (WAR BREAKER) project is developing a comprehensive system of sensors, communication suites, and information processing systems to detect, identify, and prosecute high value, time-critical fixed and mobile targets such as theater ballistic missiles, tanks, and artillery.

(U) The Global Grid Communication project will develop and demonstrate advanced communications technologies needed for defense and intelligence operations for the 21st century. The ultimate goal is deployment of a gigabit network that will be interoperable with commercial, optical and secure wireless networks.

(U) The Advanced Ship-Sensor Systems project develops and demonstrates advancements in a wide range of technologies used in ship sensor, signal processing mechanical systems and advanced maritime platforms to significantly enhance the capabilities of naval and maritime forces.

(U) The UUV/Mine Countermeasures project develops and demonstrates autonomous maritime technologies and systems to counter underwater mines and the proliferation of weapons of mass destruction.

(U) This program element also includes efforts in Command and Control Information Systems, advanced Guidance/Targeting technologies, and the Defense Simulation Internet.

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COST *(In Thousands)*	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	Cost to Complete	Total Cost
Command Control Information Systems EE-21	500 *(6,733) **(3,000)	55,002 *(0) **(9,925)	61,361	38,624	31,300	39,237	41,687	46,034	Continuing	Continuing

*Speakeasy was funded in PE 0602702E, (TT-07) in FY 1994.
**IMPACT was funded in PE 0603226E (EE-27) in FY 1994 and FY 1995.

(U) **Mission Description**: Recent military operations, e.g., Desert Storm and Haiti, demonstrated that current theater command, control, communications, intelligence/information systems, planning and rehearsal systems, and non-lethal weapons capabilities lack the ability to support effective operations in diverse new arenas and scenarios ranging from desert heavy battle to urban areas with large civilian populations. Current capabilities do not provide critical interoperable wide-area communications and fail to provide real-time situational awareness, decentralized battle planning, rehearsal and execution capability, and flexible interfaces. These infrastructure shortfalls are particularly acute during early entry operations, military operations in urban areas and operations other than war when the availability of situational awareness information, planning and rehearsal capability and military communications assets are most limited and when less than lethal weapons and security measures are most needed. The programs in this project will enhance information processing, dissemination and presentation capabilities by inclusion of information concerning enemy and friendly forces (joint situational awareness picture); providing multi-media information interfaces to on-the-move users; and providing other battlefield synchronization tools.

(U) This project comprises nine programs: Command and Control Information Systems (C^2IS) (formerly Battle Command Initiative), Commercial Communications Technology Testbed (C^2T^2), multi-band, multi-mode radio (Speakeasy), satellite ground terminals (IMPACT), Military Operations in Built-up Areas (MOBA), Urban Security, Operations Other Than War (OOTW), Advanced Joint Planning ACTD and Joint Casting.

(U) C^2IS will develop battlefield interoperability, synchronization, and expansion tools and technology to support maneuver, fire support and intelligence functions in Early Entry lethality and survivability missions. Core capabilities include: information force multipliers for fire support; pre-positioned, user-tailored information; intelligent event-to-response mapping; joint and combined database synchronization; and linked rehearsal. C^2IS will develop modular software which turns Early Entry data into information and generates information force multipliers to enhance battlefield synchronization and addresses varying requirements of different echelons, e.g., timeliness and

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resolution. Command and Control Information Systems (C^2IS) serves as the integrating concept and mechanism for the functional and communications capabilities being developed in Commercial Communication Technology Testbed (C^2T^2), Speakeasy and IMPACT. Examples of many interface and insertion points being explored include Army Battle Command System and Rapid Force Projection Initiative Advanced Concept Technical Demonstration (ACTD). This effort will be conducted in conjunction and Early Entry simulation and evaluation efforts performed in project EE-37, which will be incorporated in this Program Element (PE) in FY 1997 and will use the architecture analysis, data modeling and technology development results from PE 0602702E, project TT-04.

(U) C^2T^2 will extend the information processing and rehearsal capabilities developed in C^2IS, which are intended primarily for use by commanders, down to individual dismounted soldiers. C^2T^2 will focus on providing local coordination and targeting information as well as a system and a process for evaluating commercial communications products for dismounted applications through a "plug and play" interface. The system will provide dismounted soldiers with a wearable suit including heads-up and wrist-mounted displays and micro-processors to provide position/location and image transfer capabilities. Because the system will have both short and long-range communications, it will be used to evaluate multi-squad coordination, soldier interactions with remote sensors and weapons, and special situations such as air/ground data transfer for rapid-response coordinated attacks on snipers, mortars, and ambush teams. This is being performed in conjunction with the Army's Advanced Warfighting Exercise 96-02, and is expected to provide an evaluation of applicable products and improved definition of system requirements.

(U) Speakeasy is a program to develop the modules of a multi-band, multi-mode programmable digital demonstration radio capable of communicating with a wide variety of existing military and civilian radios. This will allow units to communicate across the Services and will increase rates of data transfer. This will improve data flow within and across Services and result in long-term cost savings by allowing a common tri-Service radio which is interoperable with existing systems in each of the Services. Speakeasy will interoperate with all elements of C^2IS as well as with existing legacy systems to provide enhanced connectivity, and will provide service in situations where commercial communications may be inadequate, for example, where special anti-jam or low-probability of intercept communications are needed. Relevant IMPACT technology is being inserted in Speakeasy and the programs merged in FY 1996.

(U) IMPACT, formerly in project EE-27, was a multi-disciplinary program to enhance Satellite Communication (SATCOM) support to Command and Control by leveraging advanced technology to reduce the life-cycle costs of all military satellite communications (MILSATCOM) terminals with associated reductions in size, weight, and power consumption and increased performance, reliability and capability. The program has been refocused to support Speakeasy, and

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incorporated into it. IMPACT thrusts continuing under Speakeasy include: affordability (personnel cost avoidance through semi-automatic operation); interoperability (programmable radio architectures to enable simultaneous multi-mode, multi-band operations); enhanced mobility (via miniaturization) and high performance capabilities (very high data rate communications). IMPACT will provide support across the spectrum (UHF, SHF, and EHF) expanding the capabilities of Speakeasy in addition to addressing MILSATCOM.

(U) Military Operations in a Built-up Area (MOBA) will develop an integrated set of advanced technologies designed to provide timely and accurate operational awareness to significantly enhance force effectiveness in an urban environment. MOBA will enhance and supplement existing modeling and simulation tools to create a synthetic environment to address the unique suite of functional capabilities required to support activities ranging from architecture assessment to individual training whose objective is improved military operations within the urban environment. The architecture for MOBA will be utilized to provide the focus for the assessment of the contributions of technology alternatives to the enhancement of military operations in this environment.

(U) Urban Security (SECURES) will develop and demonstrate a tool which will play a key role in the efforts to ensure a safe and secure urban environment. This program will develop and demonstrate a fieldable urban environment gunshot detection sensor grid.

(U) Dual application Operations Other Than War (OOTW) will focus on the development of prototype systems for dual use (military OOTW and civilian law enforcement (LE)) applications. Example military activities include peacekeeping, counterterrorism, crowd control, noncombatant evacuation and nation building. Military OOTW missions share many common needs and characteristics with law enforcement missions, and share a common vision: protecting the lives of friendly forces as they perform their mission, minimizing collateral damage to noncombatants, and operating in a multi-cultural/multi-lingual environment. These common areas form the basis for a natural partnership among the military and law enforcement research and development (R&D) communities. This partnership has been formalized in a Memorandum of Understanding (MOU) between the Department of Defense (DoD) and the Department of Justice (DOJ) for joint technology development. A Joint Program Steering Group (JPSG) has been established under the terms of the DoD/DOJ MOU to plan and execute the R&D projects, and is chaired by ARPA. Management of the dual application OOTW projects under EE-21 will be provided through the JPSG. The ARPA focus will be on solutions that will improve our ability to conduct OOTW and LE missions through affordable, advanced technologies. Technology developments are being planned in areas such as concealed weapons detection, through the wall surveillance, geolocation, interactive simulation and training, urban mapping and visualization, telemedicine, and electrical power sources.

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(U) Advanced Joint Planning (AJP) ACTD will provide for the enhancement of operational capabilities by appropriate technology insertion of interoperable emerging command and control planning technologies in concert with developing concepts of operations for Battle Staff command and control with operational sponsorship of USACOM.

(U) Joint Casting will develop new casting practices which are designed to reduce the emissions of foundries in anticipation of Clean Air Act standards for volatile organic compounds and other pollutants, including benzene, formaldehyde, and hydrocarbons. The program focuses on characterization of emissions in current casting processes, core and mold making technology, metal melting treatments and handling, sand reclamation, and emissions control. The program is joint with participants from McClellan AFB, the United States Council for Automotive Research (USCAR), and California Office of Research and Technology Application (CA ORTA). The program is being administered by McClellan AFB on behalf of CA ORTA.

(U) **Program Accomplishments and Plans**:

(U) FY 1994 Accomplishments:
- Investigated advanced fire detector systems and fire suppressants for metal fires. ($.25M)
- Investigated innovative methods and techniques for monitoring nuclear waste. ($.25M)

(U) FY 1995 Program:
- Command Control Information Systems (C2IS), in this PE, begins in FY 1996. ($0.0M)
- Commercial Communications Technology Testbed (C^2T^2): Conduct squad, platoon and company level demonstrations of leveraged advanced civilian personal communications and computation technology for dismounted soldiers and vehicles, in military operational training/test environment. Link situation awareness and intelligence to ground soldiers. ($9.0M)
- Speakeasy: Complete the development and integration of the advanced technology modules into the Speakeasy Advanced Development Model (ADM), Phase I; demonstrate a fully integrated ADM; award Speakeasy Phase II contract. ($7.0M)
- Military Operations in Built-up Areas (MOBA): Effort is funded in FY 1996.
- SECURES will develop and demonstrate a deployable urban environment gunshot detection sensor grid. ($2.0M)

- Operations Other Than War (OOTW): Thrust to date has been in the selection of specific projects to be implemented, and planning acquisition approaches for each project. Since there is no out year funding planned for this effort, all FY 1995 initiated projects are being planned to provide for a clear and useful deliverable at the conclusion of the FY 1995 funded project activity. ($20.0M)
- Advance Joint Planning (AJP) ACTD: Develop metrics for and integrate, demonstrate and install selected advanced technology planning tools in a distributed collaborative environment with the United States Atlantic Command (USACOM) operational sponsorship to support readiness, planning and crisis response. ($5.0M)
- Joint Casting: Focus to date has been on metals and processes used in the automotive industry and not the high-end alloys used primarily in aerospace (funding provided via other PEs). Beginning in mid-FY 1995 the program will begin to investigate aerospace alloy casting emissions and other DoD relevant foundry operations. ($12.0M)

(U) FY 1996 Program:

- Design and develop tailoring associates, trigger event processing and early entry automated fire support element; design projection and course of action analysis subsystems. In conjunction with Battle Labs and Rapid Force Projection Initiative Advanced Concept Technology Demonstration (RFPIACTD), evaluate component concept demonstrations with Early Entry scenarios at the operational level. Design and plan demonstration of integrated Command and Control Information Systems (C^2IS), Speakeasy and Commercial Communications Technology Testbed (C^2T^2). ($4.2M)
- Continue the development of advanced technologies for the Speakeasy multi-band, multi-mode modules and hold preliminary design review. Conduct operational concept demonstration with emphasis on full electronic reprogrammability to achieve interoperability with existing military radios. Complete integration of IMPACT technology. ($16.7M)
- Demonstrate C^2T^2 in the integrated demonstration provided by the Advanced Warfighting Experiment 96-02. Evaluate C^2T^2 impact on integrated execution of Special Operations Forces (SOF) and tactical operations for efficiency of concurrent operations and fratricide avoidance. Develop and demonstrate improved, reduced cost communication system based on emerging technologies. Link heliborne reconnaissance and mine detection to ground units for prosecution. ($7.5M)
- MOBA: Develop an integrated set of advanced technologies to provide operational awareness to enhance force effectiveness and synthetic environment to address the unique set of functionality required to support activities ranging from architecture assessment to individual training that support improved operations in

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an urban environment. Finalize the formulation of an architecture for Military Operations in a Built-up Area (MOBA) to provide the focus for the assessment of the contributions of technology alternatives to the enhancement of military operations in an urban environment. ($18.0M)

- Advanced Joint Planning ACTD: Evaluate metrics of installed planning tools. Based on the results from previous installed planning tools - integrate and demonstrate additional planning tools which will result in a completed integration of planning tools at United States Atlantic Command (USACOM). Expand the funtionality of systems to crisis response; and evaluate the installed planning tools and associated metrics under operational conditions for future design incorporation. ($15.0M)

(U) FY 1997 Program:

- Command and Control Information Systems (C^2IS): Continue development of maneuver, fire support and intelligence components C^2IS technology and conduct evaluations in Brigade 97 exercises. Demonstrate integration of C^2T^2 and Speakeasy. ($13.0M)
- Speakeasy: Continue development of hardware and software technology for the Speakeasy demonstration radio and conduct critical design review. Transition technology. ($13.1M)
- Commercial Communications Technology Testbed (C^2T^2): Complete integration of C^2T^2, demonstrate improved system in a warfighting exercise, and transfer stand-alone technology. ($2.4M)
- Advanced Joint Planning ACTD: Based on the evaluation, complete the design, accomplish modifications and installation of a "leave behind" operational system, which can then be replicated for other CINCs. ($10.1M)

(U) **Program Change Summary**: *(In Millions)*

	FY 1994	FY 1995	FY 1996	FY 1997
President's Budget	.5	24.7	33.8	44.0
Appropriated	.5	50.0	N/A	N/A
Current Budget	.5	55.0	61.4	38.6

(U) **Change Summary Explanation**:

FY 1995 Increase reflects reprogramming to initiate Advanced Joint Planning ACTD.

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FY 1996 Increases reflect transfer of IMPACT from EE-27 and its merger with Speakeasy, continuation of Advanced Joint Planning ACTD, and incorporation of C^2IS relevant portion of EE-37.

FY 1997 Decease due to program repricing.

(U) **Other Program Funding Summary Cost**: N/A

(U) **Schedule Profile**:

Plan	Milestones
Apr 95	Develop metrics for Advanced Joint Planning (AJP)-ACTD.
Aug 95	Complete fabrication of joint casting research foundry.
Sep 95	Integrate, demonstrate and install selected advanced technology planning tools in a distributed collaborative environment for the AJP-ACTD.
Oct-Dec 95	Soldier testing of commercial communications system for dismounted operations and assessment of alternative missions.
Feb 96	Complete the integration of AJP-ACTD planning tools at USACOM.
Mar 96	Preliminary design review of Phase II Speakeasy system.
Jul 96	Expand the AJP-ACTD functionality of systems to crisis response.
Sep 96	Proof-of-concept demonstration of Early Entry intelligence processing tailoring associates.
Sep 96	Evaluate the installed AJP-ACTD planning tools and associated metrics under operations conditions.
Feb 97	Demonstrate novel advanced warfighting concepts using the improved commercial communications testbed.
Mar 97	Critical design review demonstration of Phase II Speakeasy.
Apr 97	Demonstrate a protoytype simulation environment capable of: representing Urban Warfare; conducting analysis of MOBA technology approaches; and evaluation of the contributions of MOBA technologies to operational effectiveness.
Sep 97	Complete the design, accomplish modifications and installation of a "Leave behind" an AJP-ACTD operational systems.
Apr 98	Demonstration of Early Entry Brigade command entity.
Mar 99	Demonstration of Early Entry force package generator.

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COST *(In Thousands)*	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	Cost to Complete	Total Cost
Advanced Space Technology System EE-27	68,662	5,925	0*	0	0	0	0	0	0	N/A

*In FY 1996 and subsequent years the IMPACT Program is funded in PE 0603226E, project EE-21.

(U) **Mission Description**: The Advanced Space Technology Program (ASTP) is aimed at achieving an affordability breakthrough in the development, launch and operation of satellite systems. To date, the goals have been to demonstrate low cost access to space with small launch vehicles; reduce the size, weight, power and cost of satellite components; and demonstrate first-generation lightweight satellite capabilities. This phase has formed a prerequisite technology foundation and has produced two new launch vehicles (the Pegasus Air-Launched Vehicle and the Taurus Standard Small Launch Vehicle), 10 small satellites and numerous advanced, miniaturized components. This phase of the program will conclude with the launch of Taurus, on-orbit demonstration of DARPASAT and completion of the remaining technology projects.

(U) IMPACT is a multidisciplinary development program aimed at leveraging advanced technologies to reduce the life-cycle costs of all military satellite communications (MILSATCOM) terminals with associated reductions in size, weight and power consumption of MILSATCOM terminals and increased performance, reliability and capability. The program addresses broad technology efforts that span all MILSATCOM terminal programs with technology initiatives in support of next-generation terminals.

(U) The themes and objectives of the IMPACT program will benefit all MILSATCOM terminals, as well as many commercial products. These themes include affordability (personnel cost avoidance through autonomous operation), interoperability (programmable radio architectures to enable simultaneous multimode, multiband operations), enhanced mobility (via miniaturization) and high-performance capabilities (very high data rate communications). The program will provide support across the spectrum (UHF, SHF and EHF) and across all terminal classes (fixed-site, mobile, manpack, airborne, shipborne, etc.).

(U) The Congressionally directed Tactical Support Satellite (TSS) program will conduct a competitive system concept definition effort which will provide cost effective solutions to address the Joint Chief of Staff's highest requirement priorities for TSS. Tactical concepts of operation will be developed. Key concepts include direct satellite tasking and receipt of data by the Joint Force Commander.

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(U) The Congressionally directed Launch Vehicle Technologies program is oriented towards identification and demonstration of unique and innovative launch concepts (e.g. parafoils) and launch subsystems (e.g. hybrid propellants) which would not otherwise be explored within the launch community. The goal of this effort is to demonstrate technologies which would enable significant cost reduction in acquisition and O&M to enhance vehicle reliability responsiveness assuring rapid access to space.

(U) The Congressionally directed Single-Stage-to-Orbit program is aimed at establishing a competitive reusable space launch technology base for the United States through high risk technology demonstration activities proposed by U.S. industry. This effort has also been directed to complete the DC-X "Delta Clipper" flight test program. This effort will be directed at a range of diverse technology demonstrations oriented toward resolving fundamental reusable space launch technology issues.

(U) The Congressionally directed Large Millimeter Wave Telescope is a potential joint United States/Mexico program to build and operate an adaptive, high precision, wide bandwidth, 50-meter aperture millimeter wave radio telescope. The sites being considered in Mexico offer low humidity and ability to view both northern and southern skies. This telescope is being designed for a 1 arcsec pointing accuracy, which, if achieved, would better the current state-of-the-art for radio telescopes.

(U) **Program Accomplishments and Plans**:

(U) FY 1994 Accomplishments:
- Conducted the launch of Taurus; initiated demonstration program for DARPASAT. ($2.4M)
- Continued technology development for IMPACT. ($2.9M)
- Initiated TSS system concept definition. ($9.9M)
- Initiated development of launch vehicle technologies. ($9.8M)
- Initiated the Large Millimeter Wave Telescope design study. ($3.0M)
- Built and tested a miniature version of the current shortwave infrared sensor. ($0.7M)
- Concluded DC-X flight test program at WSMR on 6/27/94. ($5.1M)
- Planned and coordinated Reusable Space Launch Technology (ReSLT) Program. ($34.9M)

(U) FY 1995 Program:
- Continue technology developments for IMPACT; conduct technology design reviews. ($5.9M)

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(U) **Program Change Summary:** *(In Millions)*

	FY 1994	FY 1995	FY 1996	FY 1997
President's Budget	28.7	5.9	7.0	6.0
Current Budget	68.7	5.9	0	0

(U) **Change Summary Explanation:**

FY 1994 Increase reflects the Congressional disapproval of the proposed rescission of the Single-Stage-to-Orbit ($40.0 million) Program.

FY 1996-97 Adjustments reflect the transfer of the IMPACT program to EE-21, Command, Control Information Systems.

(U) **Other Program Funding Summary Cost:** N/A

(U) **Schedule Profile**

Plan	Milestones
Mar 95	Complete demonstration of DARPASAT.
Mar 95	Transition the DARPASAT to user.
Dec 95	Complete IMPACT Design Reviews.

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COST *(In Thousands)*	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	Cost to Complete	Total Cost
Guidance Technology EE-34	10,809	10,120	26,150	29,673	32,000	21,600	17,000	20,000	Continuing	Continuing

(U) **Mission Description**: Fire-and-forget stand-off weapons need precise targeting information if critical fixed and mobile targets are to be eliminated effectively and with minimal collateral damage and minimum cost-per-kill. This requires that: (1) military surveillance and targeting systems geo-locate targets accurately in the same coordinate system (i.e. WGS-84) in which the weapon system navigates; (2) the weapon system has a precision navigation and guidance system on-board, plus weapons with effective endgame seekers; and (3) navigation and target location systems cooperate day/night and in adverse weather. In addition, future systems designed to accomplish precision strike missions must be significantly more affordable. The achievement of these characteristics in an integrated system is the goal of this program. The advanced navigation and guidance technologies being developed in support of this goal are the Global Positioning System (GPS), Guidance Package (GGP) and Sharpshooter. Both GGP and Sharpshooter technologies are applicable for both new or retrofit guidance/navigation packages for aircraft and weapons.

(U) GGP is the core component of the guidance technology project. It tightly integrates a miniature GPS receiver (MGR) and an all solid state, low cost, navigation-grade, interferometric fiber optic gyroscope (IFOG) based miniature inertial measurement unit (MIMU) with an advanced navigation computer into a potentially low cost ($15,000), precision navigation system. GGP Phase I addresses the technology issues involved in: (1) miniaturizing inertial grade inertial measurement units (IMUs) into a compact, manufacturable configuration; and (2) developing a multi-channel-on-chip, high dynamics MGR. A Memorandum of Agreement (MOA) has been signed which outlines a demonstration of a Phase 1 unit with the Army Bradley Fire Support Team Vehicle (FIST-V). GGP Phase 2 requirements place more stressing demands on performance of MIMU components and call for further reductions in size, power, and weight. An MOA has been signed with the Naval Air Systems Command designating GGP Phase 2 as the Navy's Advanced Integrated Navigation and Control Package.

(U) Sharpshooter will demonstrate an integrated, advanced technology, precision strike capability. The importance of minimizing collateral damage and fratricide, as well as coping with the adverse effects of weather, was dramatically illustrated in Desert Storm and other more recent operations. The high cost of today's guided weapons

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is largely driven by the need for complex, expensive seekers to compensate for weapon navigation system inaccuracies, target location uncertainties and poor weather conditions. These seekers need to operate at long-ranges with wide search areas and large processing loads. Accurate navigation and guidance, using Global Positioning System (GPS) and solid state inertial navigation technologies, and precision, low power clocks with associated GPS receiver upgrades will enable more accurate target location and provide seeker operations at shorter ranges with smaller search areas and smaller processing loads. Sharpshooter will incorporate accurate navigation and guidance by integrating and demonstrating use of GPS Guidance Package (GGP) units on an air-to-surface weapon. GGP reduces the weapon's midcourse errors and the resultant target location errors for which weapon seekers must compensate. Sharpshooter will also integrate and demonstrate a capability to increase geolocation and timing accuracies aboard surveillance, targeting and strike platforms. This subthrust encompasses development of GPS receiver upgrades to incorporate higher accuracy, miniature, low power clocks and the higher precision location accuracies emerging from GPS enhancements. With insertion of these GPS receiver upgrades, airborne platforms can be coordinated in position (1 to 3 meters CEP relative) without the need for real-time, direct communications among them. Technologies uniquely integrated in this project include those of GGP; miniature, low power, highly accurate time standards; GPS receiver upgrades and affordable terminal seekers. Sharpshooter payoff will be the demonstration of range-invariant, 3-meter circular error probable guidance accuracy in integrated carrier platform, weapon and seeker configurations. Technologies will be integrated and exploited to demonstrate the simplest, most affordable terminal seekers to satisfy the 3-meter CEP demonstration goals.

(U) **Program Accomplishments and Plans**:

(U) FY 1994 Accomplishments:

- Completed GPS GGP Phase 1 brassboard fabrication and laboratory tests. ($5.0M)
- Initiated GGP Phase 2 source selection preparations to further reduce GGP in size, weight, power consumption and cost. ($.4M)
- Initiated development of Multifunction Self-Aligned Gate (MSAG) technology for an active aperature antenna for testing on a Medium Altitude Endurance Unmanned Air Vehicle (UAV). ($3.9M)
- Initiated preparation activities to test GGP on the Army Fire Support Team Vehicle (FIST-V). ($.8M)
- Investigated GGP applications. ($.7M)

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(U) FY 1995 Program:

- Deliver Phase 1 Guidance Package (GGP) brassboards. ($.4M)
- Complete preparation and test GGP on the Army FIST-V. ($.3M)
- Initiate and complete Government laboratory and field evaluations of GGP Phase 1 brassboards. ($.6M)
- Initiate GGP Phase 2 designs. ($2.8M)
- MSAG - design and develop a 100-tile test array which will demonstrate an active conformal array for full duplex operation in a satellite link for testing on a Medium Altitude UAV. ($6.0M)

(U) FY 1996 Program:

- Continue Global Positioning System (GPS) Guidance Package (GGP) Phase 2 designs. ($12.5M)
- Initiate Sharpshooter flyable, integrated seeker brassboard design. ($8.0M)
- Initiate Sharpshooter user GPS receiver upgrades to provide improved location accuracies and improved transfer alignment to precision weapons. ($2.7M)
- Refine and evaluate components for the accurate, low power clock. ($3.0M)

(U) FY 1997 Program:

- Complete GPS GGP Phase 2 design and begin fabrication. ($15.0M)
- Complete Sharpshooter integrated seeker design, integrate with GGP and begin brassboard demonstrations. ($12.0M)
- Continue Sharpshooter user GPS receiver upgrades to provide positional coordination among surveillance and strike platforms and to provide improved accuracies to precision weapons. ($1.7M)
- Evaluate completed, packaged, low power clock units. ($1.0M)

(U) **Program Change Summary**: *(In Millions)*

	FY 1994	FY 1995	FY 1996	FY 1997
President's Budget	10.1	10.9	18.9	18.0
Appropriated	10.1	10.1	N/A	N/A
Current Budget	10.1	10.1	26.2	29.7

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(U) **Change Summary Explanation**:

FY 1994	Increase of $.7 million to investigate GGP applications.
FY 1995	Congressional reduction of GGP and Common Grid (-$6.7M) offset by Congressional add for Multifunction Self-Aligned Gate (+$6.0M).
FY 1996-97	Initiate and continue developments leading to Sharpshooter demonstrations.

(U) **Other Program Funding Summary Cost**: N/A

(U) **Schedule Profile**:

Plan	Milestones
Mar 95	Global Positioning System (GPS) Guidance Package (GGP) Phase 1 brassboard delivery.
May 95	Complete demonstration of GGP Phase 1 unit on FIST-V.
Jun 95	GGP Phase 2 award.
Aug 95	Complete Government evaluation of Phase 1 units.
Mar 96	Initiate Sharpshooter flyable brassboard design.
Nov 96	GGP Phase 2 critical design review.
Jul 97	Complete Sharpshooter design and brassboard demonstration.
Nov 97	Initiate Sharpshooter flight article fabrication and system integration.
Oct 98	Complete GGP Phase 2 contractor testing.
Mar 99	Complete Sharpshooter weapon demonstrations.

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COST *(In Thousands)*	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	Cost to Complete	Total Cost
Advanced Ship-Sensor Systems EE-36	17,180	34,348	16,502	33,513	45,614	51,550	53,050	68,050	Continuing	Continuing

(U) **Mission Description**: Major changes in the worldwide defense environment, due to the spread of sophisticated military technology to third world countries and the need to support littoral warfare, require the enhancement of U.S. capabilities in shallow water anti-submarine warfare (ASW), littoral warfare scene management, advanced mechanical systems. This project develops and demonstrates advancements in acoustic signal processing, active shock and vibration control, advanced sensor and actuator materials, and a wide range of maritime platforms including advanced ships and offshore platforms. These advances will significantly enhance the capabilities of naval and maritime forces to support future U.S. missions and enable the U.S. to more effectively project and operate these forces in a broader range of tactical environments.

(U) The project focuses on four areas of development; Sonar Technology, ASW Scene Management, Advanced Ship Mechanical Systems, and Advanced Maritime Platforms. In the Sonar Technology area, applications of advanced object detection, classification, and localization technologies using High Performance Computing (HPC) are demonstrated. Active and passive sonar techniques are applied, using advanced sources and sonar systems built from distributed elements or concentrated arrays. These applications will result in enhanced ASW capability against diesel-electric submarines operating in shallow water. In the ASW Scene Management area, advanced signal processing techniques are utilized which integrate real-time information with background intelligence to provide a complete picture of the shallow water operational situation. In the Advanced Ship Mechanical Systems area, technologies such as precision active structural controls, actuator and sensor systems and high speed digital signal processing are developed. These technologies will result in reduced ship acoustic signatures, high performance/high reliability propulsion systems, and increase ship system affordability. Advanced Maritime Platforms focuses on the technologies for large offshore structures, innovative ships and ship systems to provide the multi-mission, sustained presence capability required for joint operations associated with future regional conflicts.

(U) **Program Accomplishments and Plans**:

(U) FY 1994 Accomplishments:

- Completed a test to determine the limits of shallow water multistatic sonar. Continued development of automatic multistatic active shallow water processors for tactical sonars. ($5.1M)

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- Planned and participated in conduct of the Navy's activated Fixed Distributed System (FDS) test to demonstrate future advanced multistatics signal processing techniques. Initiated planning efforts and fleet liaison for a fleet Anti-Submarine Warfare (ASW) demonstration of shallow water processing technologies. ($2.3M)
- Applied signal processing techniques to diesel electric submarine echoes and radiated noise measurements and began development of automatic classifiers for diesel electric submarines. ($.4M)
- Initiated shallow water ASW total scene management efforts. ($1.2M)
- Developed and initiated testing of a polymer-based transducer. ($2.7M)
- Completed development and testing of shallow water impulsive source technology. ($1.0M)
- Initiated development and demonstration of active combustion process control techniques for the aeroderivative gas turbine engine. ($4.5M)

(U) FY 1995 Program:

- Continue development and testing of autonomous multistatic active processors for shallow water environment tactical sonars. ($4.5M)
- Complete conduct of proof-of-concept tests and assess performance of multistatic active processing technologies. Complete planning of fleet ASW demonstration. Develop processor for demonstration and initiate conduct of demonstration. ($3.7M)
- Continue development of autonomous diesel electric submarine detection and classification technologies and conduct laboratory demonstration of candidate systems. ($.9M)
- Apply scene management technologies to the multistatic active system and test high frequency tactical active sonar processing and scene generation capability. ($3.4M)
- Continue development and testing of polymer transducer array. ($1.6M)
- Continue development of impulsive sources by extending to very shallow water and environmental adaptability. ($1.5M)
- Reconfigurable small craft development: Develop technology for a small craft that would be reconfigurable for different missions in support of operations in shallow, littoral waters. ($2.0M)
- Conduct preliminary design for a Mobile Offshore Base. Prepare preliminary and sub- and full-scale demonstrations of critical technologies where risk and uncertainty are the highest. ($15.0M)

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- Deep Ocean Relocation: Through technology, environmental and cost modeling and simulation, develop a capability to compare and assess waste placement systems. ($1.7M)

(U) FY 1996 Program:

- Complete development of multistatic active adaptive processing for shallow water tactical sonars. ($3.5M)
- Conduct fleet Anti-Submarine Warfare (ASW) demonstration of multistatic active tactical processor. ($1.5M)
- Initiate development of automated multi-array processing system. ($3.0M)
- Complete ASW scene management design and develop scene management system. ($6.2M)
- Initiate planning for ASW scene management demonstrations. ($1.1M)
- Conduct Advanced Ship Mechanical Technology Concept Feasibility Studies to determine technology roadblocks and technical approaches, define feasibility critical experiments, and identify payoffs. ($1.0M)
- Complete assessment of Maritime Platform Technology development strategies. ($.2M)

(U) FY 1997 Program:

- Conduct final at-sea ASW demonstration of environmentally adaptive shallow water active sonar technology. ($2.5M)
- Complete proof-of-concept system of automated multi-array processing system and plan for FY 1998 demonstrations. ($5.0M)
- Conduct ASW total scene management tests and demonstrations. ($5.0M)
- Conduct Mechanical Technology Initiative Critical Experiments to determine feasibility of selected technology concepts. ($3.0M)
- Develop Signal Processing and Classification algorithms based on marine mammals' ability to detect and classify buried objects. ($3.7M)
- Perform concept feasibility demonstration of active structural control techniques for special warfare helicopter weapon stabilization, stealth, and habitability. ($2.4M)
- Demonstrate active mount technology for shock and vibration isolation of Commercial Off-The-Shelf (COTS) electronics and mechanical components on large-scale military vehicles or platforms. ($2.0M)
- Initiate development and demonstration of enabling active structural control technology for dynamically stiffened maritime structures and large payload/long reach teleoperated manipulators suitable for military cargo handling on large floating offshore structures. ($5.3M)
- Initiate development and demonstration of actuator, sensor, and active control enabling technology for powered exoskeleton and deep ocean teleoperated manipulators. ($4.6M)

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(U) **Program Change Summary:** *(In Millions)*

	FY 1994	FY 1995	FY 1996	FY 1997
President's Budget	17.2	15.9	16.5	16.9
Appropriated	17.2	34.3	N/A	N/A
Current Budget	17.2	34.3	16.5	33.5

(U) **Change Summary Explanation:**

FY 1997 Increase reflects the transfer of funding for the Advanced Ship Mechanical Systems area from Advanced Submarine Technology, PE 0603569E, Project AS-01, to this project to facilitate wider application of Mechanical Systems technologies.

(U) **Other Program Funding Summary Cost:** N/A

(U) **Schedule Profile:**

Plan	Milestones
Jun 94	Complete laboratory scale testing of low frequency (LF) acoustic sources.
Aug 94	Conduct multistatic active/passive system testing demonstration in a shallow water environment.
Sep 95	Conduct at-sea testing of an active acoustic system for shallow water environment.
Sep 95	Conduct testing for polymer transducer array.
Sep 95	Continue development and testing of Anti-Submarine Warfare (ASW) scene management system.
Jun 96	Complete ASW scene management system development.
Jul 96	Conduct preliminary designs of the mobile offshore base (MOBS) and landing ship/quay causeway (LSQC) concepts.
Jul 96	Conduct demonstrations of MOBS and LSQC critical technology in high risk areas.
Jul 96	Complete Concept Feasibility Studies for Advanced Ship Mechanical Systems.
Jul 96	Complete development of multistatic active adaptive processing for shallow water tactical sonars.
Aug 96	Complete Large-Scale Demonstration of advanced Aeroderivative Engine active control technology.
Oct 96	Begin selected Critical Feasibility Demonstration Experiments for Mechanical Technology Initiative.
Nov 96	Conduct final at-sea demonstration of an active acoustic system for shallow water environment.

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Mar 97	Conduct testing of biologically-based transmitter and receiver concepts.
Jun 97	Conduct Anti-Submarine Warfare (ASW) scene management system at-sea demonstrations.
Jun 97	Complete proof-of-concept of automated multi-array processing system.
Jul 97	Complete development and demonstration of adaptive arrays.
Sep 97	Demonstrate bio-sonar signal processing and classification algorithms.
Sep 97	Complete Critical Feasibility Demonstration Experiments for Advanced Ship Mechanical Systems.
Jul 98	Conduct ASW scene management system at-sea transition demonstrations.

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COST *(In Thousands)*	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	Cost to Complete	Total Cost
Advanced Simulation EE-37	58,001	82,656	79,065	44,329	34,367	40,853	67,653	75,353	Continuing	Continuing

(U) **Mission Description**: The strategic environment in which the United States operates has changed. The new strategy places emphasis on joint crisis response and requires coordinated joint and service training programs to ensure readiness. At the same time, resources will continue to shrink, requiring the Department to search for the most cost effective ways to address the threat across the full spectrum of military activity. To support the new National Military Strategy, the Advanced Distributed Simulation program is developing, as its legacy, the advanced interoperable technologies to effectively and efficiently construct, on demand, a robust variety of synthetic environments that will enable fundamental changes in how mainline defense functions are accomplished in the year 2000 plus. The ultimate goal is to provide cost effective tools and standards necessary to create seamless warfighting simulation environments at the weapons system level of detail capable of representations of a theater of war supporting the following functions: Joint/Service readiness training; Joint/Service doctrine refinement and development; requirements analysis; design, prototyping and manufacturing; and contingency planning, operations, after action review, early entry command and control information system for battle management and historical analysis. Specific efforts being undertaken as part of this project include the Environmental Representation program, semi-automated Forces development, Scaleability Initiative, Information Technology Development, early entry Command and Control Information Systems Technology Development, Integrated Product & Process Development, and the Synthetic Theater of War. As technologies mature, they will be integrated, demonstrated and tested in joint theater of war exercises of increasing size, complexity and utility.

(U) The Environmental Representation program concentrates on the creation of synthetic environments for simulation including representation of both static and dynamic terrain, weather and environmental phenomena, diurnal variations and dynamic terrain. The semi-automated forces create a scaleable computer-generated military force that is representative and behaviorally accurate with resolution of battle outcome at the weapon system level of detail. Scaleability efforts investigate and develop technological solutions to create a robust network interconnection capable of accommodating a wide range of simulation goals and network demands. The information technology development concentrates research and development in areas contributing to providing the communications infrastructure capable of supporting 100,000 entities interoperating with each other in perceptible real time. The early entry command and control information systems technology development relates to development of a robust simulation environment capable of situational representations facilitating evaluations of a multi-level, joint battle

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management system. The integrated product and process development simulation provides a distributed toolbox of simulation tools linking concurrent engineering of land vehicles with the warfighting environment.

(U) The Synthetic Theater of War Program demonstration scheduled for calendar year 1997, an integral element of the Advanced Simulation Technology Program, has been designated an Advance Concept Technology Demonstration (ACTD) by the Deputy Under Secretary of Defense for Advanced Technology. It focuses technology developments on the conduct of joint training and mission rehearsal and includes virtual and constructive simulation on a seamless, synthetic battlefield.

(U) **Program Accomplishments and Plans**:

(U) FY 1994 Accomplishments:

- Demonstrated, produced, tested, and prototyped interim expanded network information flow technologies capable of supporting up to 3,500 interactive, dynamic entities on the synthetic battlefield. Demonstrated the simulation technologies enabling the interoperation of higher-level aggregated simulation (classical simulations) with company networks of individual platform level simulators and company/battalion-level semi-automated forces. Prototyped network analysis and scenario initialization tools. ($3.4M)
- Demonstrated prototype environmental phenomena (smoke) effecting behavior of semi-automated forces; created large-scale terrain data base using new efficient representation technology (TIN); created experimental high-fidelity 1 meter terrain data base with vertical accuracies of less than .15 meters; initiated environmental representation research. ($4.3M)
- Demonstrated working semi-automated forces for a limited range of combat specific entities that were behaviorally accurate at a primitive level; initiated development of a synthetic forces sub-architecture capable of supporting the creation of complex joint simulations. ($13.2M)
- Demonstrated interoperation of simulated warfighting environment with service C3I systems in large-scale simulated maneuver exercises. ($.8M)
- The STOW-E (Synthetic Theater of War - Europe) exercise demonstrated integration of virtual warfighting simulation, constructive and live instrumented ranges. Initiated development of future Advanced Distributed Simulation Architecture. ($19.3M)
- Initiated the development of a Distributed Interactive Simulation (DIS) based architectural framework in which to demonstrate critical simulation technologies enabling cost effective, large scale, distributed simulations capable of addressing a broad range of defense functions. The function of the architecture is

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to serve as an integrating framework for existing sub-architectures and new sub-architectures as required. ($2.4M)

- Demonstrated interactivity of high performance aviation in a virtual simulation. ($.4M)
- Initiated the Congressionally directed Virtual Brigade Program for the development of a training development program to determine the optimum mix of training aids, devices, simulations, simulators and field training to intensify conventional training methods for an armored brigade. ($14.2M)

(U) FY 1995 Program:

- Continue to design, analyze, test, and demonstrate solutions promoting the growth of robust networks accommodating the unique demands of 5,000 interactive, dynamic entities operating in a coherent manner distributed across local, metropolitan, and wide area networks. Provide technical solutions promoting dial-up networking of heterogeneous simulations, simulators, and operational equipment. ($5.3M)
- Continue development of an environmental sub-architecture consistent with advanced distributed simulation development; demonstrate prototype environmental representation integrated with the semi-automated forces; prototype high fidelity terrain database in an operational scenario; continue environmental representation research focused on dynamic environmental effects, dynamic terrain representation and weather effects; continue development of synthetic environment data bases to support the Synthetic Theater of War (STOW) 1997 exercise. ($8.7M)
- Continue development and demonstrate prototype synthetic forces architecture and creation of baseline software entities within that architecture capable of supporting a distributed virtual simulation of command entities. Develop and demonstrate increasingly more capable working Synthetic Forces representing a wider range of combat forces characterized by more accurate behavioral representation. ($21.6M)
- Continue development of a capability to support seamless land/sea/air warfighting simulation environment representing 15,000 entities operating with a high degree of realism, fully integrated and supporting service and joint operational concepts. ($10.0M)
- Initiate development of advanced simulation technologies to provide improved capability to the post STOW-97 synthetic environment. These include improved synthetic forces functionality; higher-level command entities; and improved theater level functionality (e.g. logistics, electronic warfare, etc.). ($11.9M)
- Continue to develop and integrate advanced distributed simulation technologies designed to support this optimum mix of training aids, devices, simulations, simulators and field training to intensify conventional training methods for an armored brigade. ($19.0M)

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- Design components of an early entry command and control information systems environment capable of situational representations facilitating evaluations of battle management concept. ($1.4M)
- Continue development of concurrent engineering work stations and plan demonstration to assess adequacy of land vehicle design concepts. This is a demonstration of technology developed in PE 0602702E, TT-04. ($4.8M)

(U) FY 1996 Program:

- Continue to develop and demonstrate expanded information technologies supporting interaction of as many as 10,000 entities on the synthetic battlefield in a coordinated exercise, networking individual platform level simulators with company/battalion level synthetic forces. ($5.0M)
- Continue to develop and demonstrate a prototype environmental battlefield representation to include increased fidelity of terrain and environmental effects (e.g. fog, smoke, haze, diurnal effects, etc.); continue development of environmental data bases to support STOW 1997. ($6.3M)
- Continue development of synthetic forces command entities; expand development of synthetic forces to include representations of combat support and combat service support elements; continue to improve functionality of other synthetic forces. Develop and test a set of standard interface specifications capable of accommodating a variety of technical architectures which represent service unique command and operational features. ($21.3M)
- Continue development of simulation operating systems, testing and integration of technologies, and development of the Advance Concept Technical Demonstration (ACTD) legacy systems to support the STOW-97 ACTD. ($13.2M)
- Continue development of advanced simulation technologies to include improved synthetic forces functionality, higher level command entities, improved theater level functionality. ($21.6M)
- Develop component of an early entry command and control information systems capable of situational representations facilitating evaluations of battle management concepts. ($6.9M)
- Demonstrate concurrent-engineering applications on land vehicle design, link to synthetic battlefield, and tie requirements to design. ($4.7M)

(U) FY 1997 Program:

- Integrate and test expanded information technologies supporting a wide range of LAN, MAN, WAN bandwidth demands created by the exercise of greater than 50,000 entities operating in a coherent, coordinated manner on the synthetic battlefield. ($1.5M)

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- Continue to develop and demonstrate an environmental sub-architecture capable of supporting coordinated advanced distributed simulation exercises; continue development of environmental technologies capable of supporting a robust environmental battlefield to include interactive, fog haze, battlefield obscurant, diurnal effects; complete and transition STOW-1997 synthetic environment. ($3.0M)
- Continue to develop and transition a broad range of Synthetic Forces representing most combat elements as entity and small unit commanders, integrate with a simulation architecture supporting a distributed command and control structure portraying in simulation the influence of one command level on the actions of the subordinate formations. Continue to develop and demonstrate increasingly more sophisticated behaviors representing an extended set of battlefield reactions such as situational awareness, reaction to the environment and planning. ($13.7M)
- Demonstrate and transition to the ACTD a prototype Joint Synthetic Theater of War system supporting a seamless land/sea/air warfighting simulation environment capable of representing greater than 50,000 entities with a high degree of realism, supporting service and joint operational concept while retaining the arbitration of battle outcomes at the entity level of detail. ($5.2M)
- Continue development of advanced simulation technologies. Demonstrate those technologies which are sufficiently mature in STOW-97. ($13.0M)
- Demonstrate a concurrent engineering applications on land vehicle design, link to synthetic battlefield, and tie requirements to design. Integrate engineering applications with hardware test and evaluation tools and with the manufacturing modeling environment. ($7.9M)

(U) **Program Change Summary:** *(In Millions)*

	FY 1994	FY 1995	FY 1996	FY 1997
President's Budget	59.2	79.3	76.9	40.7
Appropriated	59.2	86.0	N/A	N/A
Current Budget	58.0	82.6	79.0	44.3

(U) **Change Summary Explanation:**

FY 1994 Reduction reflects minor repricings.
FY 1995 Decrease to Finance Advanced Joint Planning ACTD in Project EE-21.
FY 1996-97 Reflects program repricings.

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(U) **Other Program Funding Summary Cost**: N/A

(U) **Schedule Profile**:

Plan	Milestones
Jul 94	Demonstrated second generation synthetic forces.
Nov 94	Demonstrated integration of live virtual and constructive forces in a joint warfighting simulation at the entity level of detail working up to 3,500 entities. (Synthetic Theater of War - Europe (STOW-E)).
Apr 95	Demonstrate prototype ADS Architecture.
Sep 95	Demonstrate command entity synthetic forces operating in a partially integrated environment with up to 10,000 entities in perceptible real time.
Sep 95	Demonstrate working concurrent engineering toolbox for vehicle design.
Sep 96	Demonstrate higher level command entity synthetic forces operating in a more robust dynamic environment.
Sep 96	Demonstrate the capability to support 50,000 entities in perceptible real time through dynamic multicasting.
Nov 97	Demonstrate the STOW-97 ACTD synthetic theater of war capable of representing a JTF through combination of live, virtual and constructive simulation with a high degree of realism and with outcomes arbitrated at the entity level of detail.

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COST *(In Thousands)*	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	Cost to Complete	Total Cost
Unmanned Undersea Vehicle Systems (UUV) EE-39	23,850	37,430	16,836	17,469	17,395	18,115	21,115	26,115	Continuing	Continuing

(U) **Mission Description**: The increasing stockpile of underwater mines and the proliferation of weapons of mass destruction throughout the world present a threat in both littoral warfare and strategic warfare situations. The objective of this project is to develop and demonstrate autonomous maritime systems and technologies to counter these threats. The Autonomous Minehunting and Mapping Technology (AMMT) Program is developing technologies to support Navy clandestine mine warfare requirements that will enable the autonomous location and classification of mines with sufficient precision for detailed minefield mapping and subsequent reacquisition by a neutralization system. The project is also developing Synthetic Aperture Sonar (SAS) to increase underwater search rates; small autonomous taskable machines for mine neutralization in, and near, the surf zone; advanced acoustic communications that will enable tether-free control of minehunting UUVs; electromagnetic communications for use in shallow water; atomic interferometers for precision navigation, and a high energy density power system to provide the range and endurance required for longer UUV missions. In addition, technologies will be developed to enable monitoring the location of ships carrying weapons of mass destruction and perform clandestine surveillance, including monitoring an underwater environment for by-products of the manufacture or testing of weapons of mass destruction. These efforts are coordinated and support the long-range goals of the Navy UUV Program Plan.

(U) **Program Accomplishments and Plans**:

(U) FY 1994 Accomplishments:

- Refurbished ARPA Unmanned Undersea Vehicle (UUV); conducted technical analyses. ($2.2M)
- Investigated technologies for maritime counterproliferation. ($.1M)
- Continued development of Autonomous Minehunting and Mapping Technology (AMMT) and small taskable machines. ($4.5M)
- Investigated Synthetic Aperture Sonar (SAS) minehunting technology. ($.1M)
- Conducted at-sea multi-sensor data collection and validated software design; developed multi-node acoustic communication network. ($1.8M)
- Conducted at-sea test with testbed magnetic communication system. ($.3M)
- Completed bench testing of Proton Exchange Membrane (PEM) fuel cell power plant; completed design and started construction of aluminum-oxygen fuel cell power plant. ($3.3M)

- Continued development of atomic interferometer inertial sensor. ($.2M)
- Developed molten carbonate fuel cells and 200kW phosphoric acid fuel cell system. Investigated technologies for logistic fuel, high performance Proton Exchange Membrane (PEM) and solid oxide fuel cells. ($11.4M)

(U) FY 1995 Program:

- Configure Unmanned Undersea Vehicle (UUV) for at-sea testing; conduct modeling/simulation analysis. ($2.4M)
- Continue Autonomous Minehunting and Mapping Technology (AMMT) development; prepare for at-sea demonstration of mine detection, classification, identification and mapping; test small taskable machines and modes of locomotion. ($6.1M)
- Develop Synthetic Aperture Sonar (SAS) algorithms and models to increase minehunting area search rates. Conduct proof-of-principle demonstration. ($2.3M)
- Construct and demonstrate a high energy density aluminum-oxygen semi-cell power plant on land. ($3.1M)
- Continue advanced acoustic communications development. Demonstrate increased range and data rate. Integrate with AMMT. Complete and demonstrate an underwater acoustic local area network. ($1.4M)
- Conduct at-sea test of prototype magnetic communication system. ($.2M)
- Continue development of atomic interferometer inertial sensor. ($.2M)
- Develop and demonstrate miniature tactical weather station. ($.7M)
- Examine concepts for maritime counterproliferation, including tagging of vessels carrying weapons of mass destruction and clandestine underwater chemical sampling systems. ($1.4M)
- Investigate extension of surf-zone mine neutralization system to other underwater environments. ($.6M)
- Continue phosphoric acid fuel cell transit bus research and development program. ($12.0M)
- Development and demonstration of a portable Thermo Photo Voltaics (TPV) power system. ($2.0M)
- Continue 2 MW molten carbonate fuel cell improvement program in conjunction with DoE. ($5.0M)

(U) FY 1996 Program:

- Complete at-sea testing of Autonomous Minehunting and Mapping Technology (AMMT). ($3.6M)
- Continue development of advanced acoustic communications, including low probability of intercept communications. ($.8M)
- Complete design and fabrication of Synthetic Aperature Sonar (SAS). ($6.0M)
- Commence full scale testing of an aluminum-oxygen fuel-cell system. ($1.4M)
- Test brassboard atomic interferometer inertial sensor. ($.4M)
- Begin development of stealthy special operations forces delivery vehicle technologies. ($.6M)

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- Begin design and development of short range maritime tag delivery and attachment systems and underwater surveillance and chemical sampling system. ($2.6M)
- Continue development of a system of small, inexpensive underwater taskable machines for mine neutralization in all underwater environments. ($1.4M)

(U) FY 1997 Program:

- Continue development of stealthy special operations forces delivery vehicle technologies. ($1.6M)
- Develop prototype small taskable machine for minehunting and mine neutralization in very shallow water and the surf zone and other applications. Continue development of small taskable machines for underwater mine neutralization in environments other than the surf zone. ($5.2M)
- Continue development of advanced acoustic communications. ($.2M)
- Conduct at sea testing of synthetic aperture sonar. ($2.7M)
- Demonstrate short range maritime tag delivery and attachment systems and begin development of longer range system. ($4.1M)
- Continue development of underwater surveillance and chemical sampling system. ($3.7M)

(U) **Program Change Summary**: *(In Millions)*

	FY 1994	FY 1995	FY 1996	FY 1997
President's Budget	23.9	17.8	17.9	17.5
Appropriated	23.9	36.4	N/A	N/A
Current Budget	23.9	37.4	16.8	17.5

(U) **Change Summary Explanation**:

FY 1995-96 Increase reflects minor program repricing.

(U) **Other Program Funding Summary Cost**: N/A

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(U) **Schedule Profile**:

Plan	Milestones
Aug 94	Completed Proton Exchange Membrane (PEM) fuel cell power plant test.
Mar 95	Complete Phase I of Magnetic Communications Program.
Aug 95	Demonstrate miniature, tactical weather station.
Sep 95	Demonstrate acoustic communications network.
Sep 95	Conduct proof of principle synthetic aperture sonar demonstration.
Nov 95	Begin full scale testing of aluminum-oxygen semi-cell power system.
Dec 95	Begin Autonomous Minehunting Mapping Technology (AMMT) at-sea testing.
May 96	Demonstrate small autonomous prototype legged taskable machine in surf environment.
Sep 96	Demonstrate prototype atomic interferometer inertial sensor.
Mar 97	Conduct at-sea testing of short range maritime tag delivery and attachment system.
Sep 97	Begin Synthetic Aperature Sonar (SAS) at-sea testing.
May 98	Conduct test of small autonomous taskable machine with mine neutralization package.
Jul 98	Demonstrate longer range tag delivery system.
Sep 98	Begin demonstration of underwater surveillance and chemical sampling system.

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DATE: February 1995

APPROPRIATION/BUDGET ACTIVITY
RDT&E, Defensewide
BA 3 Advanced Development

R-1 ITEM NOMENCLATURE
Experimental Evaluation of Major Innovative Technologies,
PE 0603226E

COST *(In Millions)*	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	Cost to Complete	Total Cost
Critical Mobile Targets (WAR BREAKER) EE-40	117,424	117,338	117,759	112,842	118,387	128,860	133,860	147,860	Continuing	Continuing

(U) **Mission Description**: Prosecution of time-critical fixed and mobile targets has long been a concern of the Services as evidenced by past efforts in the areas of Strategic Relocatable Targets and Smart Weapons. Our experience in Desert Storm has dramatically demonstrated our current inability to prosecute these targets, particularly Tactical Ballistic Missile (TBM) launchers. ARPA's WAR BREAKER program will develop advanced technology and systems to enable the detection, identification and prosecution of a wide range of high value, time-critical fixed and mobile targets including TBM launchers, mobile command posts, Mobile Air Defense Units, tanks and artillery. This project serves as the framework for maturing and integrating advanced technologies, as well as developing and demonstrating systems concepts supporting the prosecution of these targets. Key technology areas include advanced surveillance, target acquisition, advanced automatic target detection and recognition, automated intelligence correlation, battlefield management, information distribution, terrain data generation technologies, advanced high throughput sensor processing, multi-sensor fusion, data fusion, image understanding, text understanding and sensor component technologies. Of these, the Intelligence and Planning component of WAR BREAKER is comprised of: Intelligence Correlation (IC), Multiple Access Intelligence and Nomination System (MAINS), Local Attack Controller (LAC), Terrain and Feature Generation (TFG), Internetted Unattended Ground Sensors (IUGS), and TOPSIGHT.

(U) **Program Accomplishments and Plans**:

(U) FY 1994 Accomplishments:

- Continued development of the WAR BREAKER analysis tool set to support Systems Engineering and Evaluation of systems performance within the Theater of Battle. Completed development of prototype baseline tool known as SimCore and started development of encapsulated SimCore Release 1. ($20.9M)
- Continued development of the Intelligence Correlation (IC) components/systems which extract, correlate, fuse and display intelligence information to determine changes in force status, order of battle and operational doctrine of time critical targets. ($13.5M)

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- Initiated development of dynamic intelligence processor, tracking and battle management functions for the Local Attack Controller (LAC). Demonstrated initial capabilities in Army Deep Operations and Joint STARS (JSTARS) environments. ($7.5M)
- Demonstrated technology to rapidly access historical intelligence information from multiple heterogeneous databases (MAINS). Initiated development of mission nomination, distributed database and fusion technologies. Conducted User Test Assessments of Imagery Exploitation System enhancement of completeness, correctness and speed. ($8.4M)
- Initiated the design and development of the Terrain and Feature Generation (TFG) system. Developed algorithms for multi-spectral, IFSAR, optical and infrared sensor data processing for automatic feature extraction. Developed control and database structures for cartographic data fusion. ($1.6M)
- Applied advanced processing/processors to National Technical Means exploitation (TOPSIGHT). ($4.5M)
- Initiated Internetted Unattended Ground Sensors (IUGS) through awards of enabling technologies studies. ($6.0M)
- Conducted initial tests of three dimensional (3-D) Digital Terrain Elevation (DTE) Interferometric SAR (IFSAR) which includes provisions of mapping and terrain analysis data to the state of California. ($11.5M)
- Conducted Multi-Sensor Target Recognition System (MUSTRS) captive flight test on a helicopter to evaluate performace envelope limits. ($9.2M)
- Continued Automatic Target Detection/Recognition (ATD/R) technology development and assessment of potential target discriminants for prosecution of deep hide targets and initiated advanced Moving Target Indicator/Synthetic Aperture Radar (MTI/SAR) ATD/R algorithm tests. ($7.2M)
- Awarded contracts to evaluate enabling technologies to support Low Cost Synthetic Aperature Radar (SAR) production. ($10.6M)
- Analyzed and assessed the performance of algorithms in detecting manmade targets in foliage from imaging radar and Ultra-Wideband (UWB) SAR data. ($6.5M)
- Awarded contract for Gamma-Gamma resonance imaging development. ($4.9M)
- Completed current multispectral Electro-optical/Infrared (EO/IR) and low-cost focal plane array technologies efforts. ($5.1M)

(U) <u>FY 1995 Program</u>:

- Continue systems engineering analytical and distributed simulation exercises in support of the WAR BREAKER system concept. Initiate analysis and modeling plan of two nearly simultaneous Major Regional Contingencies (MRCs). Complete encapsulated SimCore Release 1 for incorporation into analytical tool set. ($16.9M)

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APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 3 Advanced Development	R-1 ITEM NOMENCLATURE Experimental Evaluation of Major Innovative Technologies, PE 0603226E, Project EE-40

- Continue development, test, integration and demonstration of Intelligence Correlation (IC) technologies, components and systems to include a natural language processor, force/target tracker, force status assessor, and integration of two single intelligence correlators and a multiple intelligence correlator. ($17.0M)
- Continue development, test and integration of Local Attack Controller (LAC) components. Demonstrate initial integration of dynamic intelligence processor and battle management decision aids in an Air Force (CTAPS) environment. ($13.0M)
- Continue development, test and begin integration of the Multiple Access Intelligence and Nomination System (MAINS) to include demonstration of integrated query/fusion technologies and a mission nominator. ($9.5M)
- Initiate development, test and integration of the Terrain and Feature Generation (TFG) system by competitive award. Integrate technologies into TFG testbed for end-to-end evaluation, database development and user assessment. ($5.3M)
- Continue to apply advanced fusion and vision algorithms on high performance processors for National Technical Means exploitation (TOPSIGHT). Integrate search, automatic target recognition and imagery exploitation system capabilities. Complete software development and integration of the Imagery Exploitation System (IES). Conduct demonstration, test, and evaluation of the automatic processing of multiple sensors and context to detect and classify units. ($11.1M)
- Continue development and evaluation of enabling technologies for the Internetted Unattended Ground Sensors (IUGS). Examine additional technologies for performing data fusion. ($4.0M)
- Continue evaluation of technologies to provide rapid three-dimensional (3-D) digital terrain elevation data using interferometric synthetic aperture radar (IFSAR) and initiate transition to users. ($3.2M)
- Initiate development of the congressionally directed GEOSAR program utilizing low frequency IFSAR to develop terrain and potential target profiles under foliage. ($7.0M)
- Complete test and evaluation of Multi-Sensor Target Recognition System (MUSTRS) Technology. ($4.0M)
- Continue development of ATD/R technology components needed for automatic target detection, recognition, and classification, in a Moving and Stationary Target Acquisition and Recognition (MSTAR) Program; the emphasis is on a model-based reasoning approach to image analysis focused on SAR with applications to Laser radar (LADAR) and multispectral sensors as well as obtain results on the impact of alternative affordable radar sensor technology on ATR performance. ($11.3M)
- Continue 'DRAGNET' application development (which was previously a component of the low cost radar program) of Moving Target Indicator (MTI) radar and inverse synthetic aperture radar (ISAR) for detecting, recognizing and tracking high-value moving targets while they are actively moving in traffic, thus avoiding the cost of many high revisit rate SAR-imaging platforms. ($5.1M)

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- Continue development of the 'Monitor' application demonstration for aggregating vast quantities of sensor imagery, via ATR, Interactive Target Recognition, change detection, medium/high resolution group reasoning and super-resolution in order to efficiently generate synoptic views of the battlefield, substantially reducing the cost of the human analytic infrastructure and effecting lower cost collection systems. ($5.0M)
- Continue development of the 'Clipping Service' capability to automatically screen synthetic aperature radar (SAR) imagery and crop high-information content portions of images for transmission to ground stations to reduce datalink throughput rates and avoid dramatic data communications system costs. ($1.3M)
- Continue data analysis and assessment of the performance of advanced algorithms for detecting targets in foliage from high-resolution high frequency/ultra-high frequency (HF/UHF) ultra-wideband foliage penetrating (FOPEN) Synthetic Aperture Radar (SAR) data. ($3.1M)
- Conduct a demonstration of the 'Expose' algorithm with integrated FOPEN components. ($.5M)

(U) FY 1996 Program:

- Conduct distributed simulation analysis and modeling of two nearly simultaneous Major Regional Contingencies (MRCs) incorporating current Services' capabilities along with Services' new developed systems, and ARPA's new development Surveillance & Targeting and Intelligence & Planning systems. ($15.2M)
- Continue development, test, integration and demonstration of Intelligence Correlation (IC) technologies, components, and systems. Initiate integration of the natural language processor with intelligence correlators, and the target tracker with the force status assessor. ($19.4M)
- Continue development, test and integration of Local Attack Controller (LAC) components. Demonstrate LAC prototypes in Army (Deep Operations), Air Force (CTAPS) and Airborne (JSTARS) environments. ($9.5M)
- Continue development, test and integration of the Multiple Access Intelligence and Nomination System (MAINS). Demonstrate query/fusion integration, "Cold Start" database build, distributed database and mission nomination capabilities. ($9.7M)
- Continue development, test and integration of the Terrain and Feature Generator (TFG) system for rapid processing of spatial data. Continue testbed technology insertion and evaluation. ($5.6M)
- Continue to apply advanced fusion and vision algorithms on high performance processors for National Technical Means exploitation (TOPSIGHT). Demonstrate initial integrated, cross-sensor search and automatic target recognition capabilities in a laboratory environment. ($9.8M)

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- Demonstrate Internetted Unattended Ground Sensors (IUGS) component technologies to determine the performance gains in target classification and identification and the potential for an internetted system. ($5.2M)
- Continue development of 'Moving and Stationary Target Acquisition and Recognition' (MSTAR) infrastructure and baseline algorithm suite for an increased number of targets modeled and hide states. ($17.7M)
- Complete algorithm development and hardware modifications for 'Dragnet' moving target classification application demonstration. ($6.6M)
- Continue developing 'Monitor' application baseline configuration, including developing a testbed in cooperation with the ARPA Intelligence and Planning program. ($7.0M)
- Continue development of 'Clipping Service' application in cooperation with the DARO and the High Altitude Endurance (HAE) Unmanned Aerial Vehicle (UAV) program. ($2.6M)
- Initiate detailed tradeoffs on ATR performance as a function of candidate common components for a low-cost radar product line under the Affordable Radar Program. ($2.0M)
- Continue assessment of 'Expose' capabilities consistent with Foliage Penetration (FOPEN) objective and complete characterization of FOPEN environment and predicted system performance. ($4.1M)
- Transition extant Laser Radar (LADAR) ATR and multi-spectral technology to augment shallow and deep hide target detection/recognition to serve as an auxilliary sensor. ($3.4M)

(U) FY 1997 Program:

- Continue to conduct distributed simulation analysis and modeling of two nearly simultanious Major Regional Contingencies with current Services' capabilities, Services' new developed systems, and ARPA's new development Surveillance & Targeting and Intelligence & Planning systems. ($13.3M)
- Continue to develop, test, integrate and demonstrate Intelligence Correlation (IC) technologies, components, and systems. Demonstrate an initial fully integrated and functional prototype in a laboratory environment. ($19.0M)
- Continue development, test and integration of Local Attack Controller (LAC) components and integrated prototypes. Integrate distributed database technologies from MAINS. Demonstrate initial integrated functional prototypes in multiple heterogeneous operational environments. ($8.1M)
- Continue development, test and integration of the Multiple Access Intelligence and Nomination System (MAINS). Demonstrate an initial integrated prototype in an operational environment. ($9.5M)

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- Continue development, test, and integration of the Terrain and Feature Generator (TFG) system. Demonstrate an integrated initial prototype in an operational environment. ($5.0M)
- Continue to apply advanced fusion and vision algorithms on high performance processors for National Technical Means exploitation (TOPSIGHT). Demonstrate advanced integrated, cross-sensor search and automatic target recognition capabilities in a laboratory environment. ($9.5M)
- Transition IUGs technology to Rapid Force Projection Initiative Advanced Concept Technology Demonstration (ACTD) and underground ACTD. ($1.0M)
- Demonstrate 'Moving and Stationary Target Acquisition and Recognition' (MSTAR) development infrastructure and baseline algorithm suite for a set of 20 targets and transition components. ($19.0M)
- Demonstrate 'Dragnet' application as part of broad cost avoidance strategy for wide-area radar surveillance systems. ($5.2M)
- Transition and assess the performance of a 'Monitor' prototype workstation in cooperation with the ARPA I&P program. ($8.9M)
- Demonstrate 'Clipping Service' system for real-time screening Synthetic Aperature Radar(SAR) imagery. ($4.0M)
- Assess and select designs for common components of an Affordable Radar. Initiate experimentation contracts. ($3.5M)
- Demonstrate the 'Expose' application for Foliage Penetration (FOPEN) in an integrated airborne system. ($2.1M)
- Transition MSTAR (ATD/R) results to initiate laboratory development of an 'Auxiliary Sensor' capability utilizing passive and/or active multispectral and Laser Radar (LADAR) sensors. ($4.7M)

(U) **Program Change Summary**: *(In Millions)*

	FY 1994	FY 1995	FY 1996	FY 1997
President's Budget	117.2	132.9	148.4	152.5
Appropriated	117.2	118.2	N/A	N/A
Current Budget	117.4	117.3	117.8	112.8

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(U) **Change Summary Explanation:**

FY 1994-95 Adjustments reflect minor programming pricing.
FY 1996-97 Adjustments reflect DoD reprioritization.

(U) **Other Program Funding Summary Cost:** N/A

(U) **Schedule Profile:**

Plan	Milestones
Jun 94	Completed first phase of Multi-sensor Target Recognition System (MUSTRS) flight experiment (Helicopter).
Sep 94	Installation of SIGINT correlator prototype at operational site. (Intelligence Correlation)
Feb 95	Demonstration of Tracker 2.0 with multiple targets, diverse observation types and variable terrain. (Intelligence Correlation)
May 95	Test and evaluation of Intelligence and Planning components at Roving Sands exercise.
Jun 95	Complete WAR BREAKER SIMCOR analysis/distributed simulation tool set.
Aug 95	Proof of concept demonstration of integration of Intelligence and Planning components.
Sep 95	Initial demonstration of automatic cue development from contextual analysis of Moving Target Indicator (MTI) radar data. (Local Attack Controller)
Nov 95	Demonstrate automapping capability using interferometric Synthetic Aperture Radar (IFSAR).
Aug 96	Realtime demonstration, using infrared, of Forces Wide Area Search Component of TOPSIGHT.
Sep 96	Integrated Tracker-Kinematic Intelligence Processor demonstration for Army-USMC Battle Management. (Local Attack Controller)
Mar 97	Demonstration of distributed, cooperative Battle Damage Assessment. (Multiple Access Intelligence and Nomination System)
Apr 97	Demonstrate technology to build and distribute over a wide area network, terrain, feature, intelligence, and object data for a 1 million square KM theater.
Nov 97	Demonstrate integrated intelligence correlation and battle management to perform local attack control.
Aug 98	Demonstration of all service, distributed, collaborative Local Attack Control.
Sep 98	Terrain and Feature Generation operational prototype.

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COST *(In Millions)*	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	Cost to Complete	Total Cost
Air Defense Initiative EE-41	24,642	34,718	23,476	24,777	35,029	31,989	46,989	68,989	Continuing	Continuing

(U) **Mission Description**: Air Defense Initiative (ADI) programs form a critical part of the Advanced Research Project Agency's (ARPA) program to ensure defense against cruise missiles and manned aircraft. The programs also complement systems being pursued by other program offices to counter theater ballistic missile threats. The rapid evolution and proliferation of cruise missile systems require new approaches and technologies to effectively and efficiently counter future airbreathing threats to troops in regional theaters.

(U) The Mountaintop Program's objective is to accelerate the deployment of adaptive processing technology into DoD systems through: 1) enhanced understanding of phenomenology; 2) effective development of concepts; 3) practical systems applications; and 4) synergism with the adaptive processing community. Adaptive processing enables: better detection, track, and engagement of faint targets despite harsh interference from natural and man-made sources; cost savings associated with increased sensor life; and wider missions applications for individual sensors.

(U) The Maui High Performance Computing Center (MHPCC), with its 400 node scalable parallel distributed memory computer (an IBM POWER parallel SP-2 computer), will provide a vast computational resource for multiple technologies, including advanced algorithm development, signal processing, and signature modeling. The MHPCC will complement and host the Mountaintop database and will provide for storage and retrieval access, via the Internet and other designated communication links, from remote locations. The objective is to provide open access for interested users in the defense establishment, academia, and industry.

(U) HAVE DUNGEON enhances the capability to provide data integration and identification techniques for aerospace defense. Advanced hardware and software is developed to exploit data provided by intelligence sensors and collateral surveillance systems to provide near-real-time warning, attack assessment, and track history for the engagement of hostile targets.

(U) The Simulation and Modeling Program investigates and demonstrates new air defense technologies and concepts, and their integration into theater force structure. It emphasizes and illustrates concepts to counter the cruise missile and other airbreathing threats; and allows warfighters to test and demonstrate technology concepts. The

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program interacts with the existing Air Force Theater Air Command and Control Simulator Facility and the Navy Weapons and Tactics Analyses Center for man-in-the-loop simulation exercises. Extension of the initial simulation environment will be with ARPA's WAR BREAKER Defense Distributed Simulation System.

(U) The Special Materials Analysis program is investigating a new class of absorption materials developed from coated microballoons to determine their effectiveness and utility for a broad spectrum of applications.

(U) The Airborne Infrared Measurement System (AIRMS) program will provide improved scientific understanding of the fundamental limits of infrared technologies and will develop analytical tools, models, design methodologies, and associated signal processing algorithms/architectures. The program employs the existing AIRMS testbed airborne infrared imaging sensor and aircraft to collect high resolution digital imagery of airborne vehicles, background clutter, clouds, and other phenomenology.

(U) **Program Accomplishments and Plans**:

(U) FY 1994 Accomplishments:

- The Mountaintop program collected and analyzed a multi-channel radar database that emulates data from an airborne surveillance radar. This database was and continues to be, distributed to the user community for the development and evaluation of advanced adaptive processing techniques. The program also characterized the radar cross sections of tactical ballistic missiles and their plumes. This information will be used to study the capability of airborne sensors to counter the theater ballistic missile threat. Studies and analyses were conducted for a joint surveillance Space-Time Adaptive Processing (STAP) processor meeting the needs of the Navy, Air Force, Army and advanced joint applications. ($14.6M)
- The Simulation and Modeling Program developed a prototype system supporting both analyses and man-in-the-loop exercises, including distributed exercises. ($5.1M)
- HAVE DUNGEON's Proof-of-Concept Aerospace Defense Location participated in an interactive Theater Missile Defense wargame with Air Force and Navy simulation facilities, and demonstrated the integration of overhead and undersea surveillance. ($3.0M)
- The Special Materials Analysis program continued investigation of microballoon absorbing materials, ensuring strict materials processing controls, and performing specific comparisons of these new materials with existing absorbers. ($1.9M)

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(U) FY 1995 Program:

- The Mountaintop Program will complete the move of its primary collection sensor to the Pacific Missile Range Facility (PMRF), Hawaii, and begin collecting multi-channel data of advanced, low-flying targets in over-water and littoral environments. Emphasis will be on studying the impact of jamming clutter and multipath on the detection of sea-skimming cruise missiles. The program will design an advanced adaptive processor using commercial off-the-shelf technology and having joint application with STAP algorithms. The Centralized Research Environment for STAP Technology (CREST) will be hosted at the MHPCC. Programs will be initiated to: develop joint surveillance applications with the Navy, Air Force and Ballistic Missile Defense Organization, conduct advanced systems trade-off studies and critical experiments, expand the user community to include industry and academia, and investigate advanced phenomenology visualization. ($12.6M)
- The Simulation and Modeling Program will complete incorporation of ADI models in the simulation system. Man-in-the-loop exercises will address the value of new air defense technology concepts. ($5.4M)
- The Airborne Infrared Measurement System will perform target data collection flights, and begin evaluation of operational algorithms for target detection and tracking. ($13.1M)
- HAVE DUNGEON will establish the utility of integrated intelligence and conventional data source integration in the tactical environment. ($2.0M)
- The Maui High Performance Computing Center (MHPCC) will provide open Mosaic and Advanced Development Tool servers for dedicated use by the Mountaintop team including the Common Research Environment for STAP Technologies (CREST) consortium of researchers. The MHPCC will commit up to 5% of the computing cycles on the 400-node IBM Model SP-2 massively parallel processor, and at least a terabyte of storage on a mass storage device. ($1.6M)

(U) FY 1996 Program:

- The Mountaintop program will integrate the advanced adaptive processor into the Mountaintop data collection sensor at PMRF for breadboard evaluation. The processor will be evaluated as an advanced joint processor. The CREST on-line database and analysis tools hosted at the HPCC will be upgraded for real time remote experimentation and follow-on joint trade-off testing with the PMRF collection sensor. Consideration will be given to the applicability of the adaptive processing techniques developed under the Mountaintop program to a wide variety of military applications. Pilot projects for fire control, engagement and innovative sensors will be initiated. ($12.5M)
- The Simulation and Modeling Program will hold distributed exercises and demonstrations to verify performance of advanced sensors and netting to support ACTD development concepts from the EE-CLS/ADI program element. ($6.7M)

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- The AIRMS will analyze target data collection flights, employ the data in the evaluation of algorithms, and perform near real time demonstrations with operational algorithms. Additionally, AIRMS will provide data to support various Service demonstrations (Navy LEAP, Air Force AWACS EAGLE), and will also support numerous special research activities (ship self defense, countermine detection, and non-acoustic ASW). ($4.3M)

(U) **FY 1997 Program:**

- The Mountaintop program will continue collecting and analyzing phenomenology and target data. The advanced, joint STAP processor will transition to the brassboard phase of development. The user database and analysis tools will be coupled with the Mountaintop hardware for user-in-the-loop investigations. Promising innovative sensors, fire control, engagement and dual-use applications will be pursued. ($13.3M)
- The Simulation and Modeling Program will provide ACTD concept models to distributed exercises to support man-in-the-loop demonstration and test activities. ($7.0M)
- The AIRMS will demonstrate ground-based, real time detection and tracking of airborne targets and continue optimization of the advanced algorithm stream. ($4.5M)

(U) **Program Change Summary:** *(In Millions)*

	FY 1994	FY 1995	FY 1996	FY 1997
President's Budget	24.6	38.6	25.6	25.0
Appropriated	24.6	36.6	N/A	N/A
Current Budget	24.6	34.7	23.5	24.8

(U) **Change Summary Explanation:**

FY 1995	Program decrease to fund the Advanced Joint Planning ACTD.
FY 1996-1997	Changes reflect minor program repricing.

(U) **Other Program Funding Summary Cost:** N/A

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(U) **Schedule Profile**:

Plan	Milestone
Mountaintop Program:	
Oct 94	RSTER deployment/check-out at Makaha Ridge, PMRF.
Jan 95	Testing and over-the-water data collection commencement.
Mar 95	Adaptive Sensor Array Processing Conference/Annual Findings.
Apr 95	Technology Insert testing commencement.
Jul 95	Sensor participates in Navy Wide Area Defense.
Jul 95	CREST Alpha Test
Sep 95	CREST Beta Test
Oct 95	RLSTAP KHOROS 2.0 compatible
Dec 95	STAP University Annual Report
Mar 96	CREST Capability on-line
Mar 96	Adaptive Sensor Array Processing Conference/Annual Findings.
Apr 96	Sensor participates in Mountaintop experiment.
Dec 96	STAP University Annual Report.
Mar 97	Adaptive Sensor Array Processing Conference/Annual Findings.
Simulation and Modeling Program:	
Sep 94	Completed two additional simulation baseline models and the prototype system.
Sep 96	Conduct distributed Air Defense Initiative exercises demonstrating new concepts from EE-CLS/ADI program element.
Jun 97	Apply prototype system to ACTD models to support concept planning and development.
Jul 98	CMD ACTD distributed simulations, through distributed exercise support to testing.
Mar 99	Perform exercises involving prototype evaluation.
Airborne Infrared Measurement System Program:	
Mar 95	Begin evaluation of operational algorithms for target detection, tracking, characterization and recognition.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1995
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 3 Advanced Development	R-1 ITEM NOMENCLATURE Experimental Evaluation of Major Innovative Technologies, PE 0603226E, Project EE-41

Jul 96 Analyze data from targets in heavy clutter, employ the data in the algorithms, and perform near real time demonstrations with operational algorithms.
Dec 96 Demonstrate real time, ground based detection and tracking of airborne targets.
Nov 97 Conduct operational algorithm experiments and design trade studies to support the development of other advanced sensor platforms.

HAVE DUNGEON Program:
Jun 95 Prototype the system in exercise or operational demonstration.

MHPCC Program:
Oct 94 Initiate user interface development.
Jan 95 Complete Mountaintop Summit database.
Mar 95 Limited Capability Demonstration at the annual MIT/Lincoln Lab Adaptive Sensor Array Processing conference.
Jun 95 Define interface between the Rome Labs-developed Algorithm Development Tool and the IBM Model SP-2 massively parallel processor.
Jul 95 Trusted Interface Access.
Sep 95 Expanded User Access complete.

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DATE: February 1995

APPROPRIATION/BUDGET ACTIVITY
RDT&E, Defensewide
BA 3 Advanced Development

R-1 ITEM NOMENCLATURE
Experimental Evaluation of Major Innovative Technologies,
PE 0603226E

COST *(In Thousands)*	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	Cost to Complete	Total Cost
Global Grid Communications EE-45	19,209	43,979	45,188	44,584	43,592	23,916	22,935	29,549	Continuing	Continuing

(U) **Mission Description**: This program develops and demonstrates advanced communications technologies needed for defense and intelligence operations for the 21st century. The program will develop advanced information processing concepts to support a geographically dispersed staff for crisis management. Services for an enhanced information infrastructure to support command and control will be developed and shown to be applicable to advanced, high performance (and commercially available) networks. This program will demonstrate that commercial communications resources and technologies can be integrated with advanced optical components developed in this program as well as DoD tactical and satellite technologies developed elsewhere. The key elements are:

(U) Applications such as intelligent decision aids, that enable a geographically distributed planning staff to develop and analyze a course of action.

(U) Advanced services such as scalable file systems, databases, and distributed computing support that are integrated with high performance computing, and free applications from the necessity to work down to the raw data transport level.

(U) Demonstration networks that validate the research and development and enable early application development and technology transition into DoD efforts such as Defense Information System Networks.

(U) Develop network controls pertaining to management, and security software technologies to enable sensor-to-shooter applications combining all network media.

(U) Develop advanced optoelectronic network component technology and network architecture for scalable and modular networks. The aggregate network bandwidth will be in the range of terabits per second and the network will handle multi media service for both digital and analog signals.

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APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 3 Advanced Development	R-1 ITEM NOMENCLATURE Experimental Evaluation of Major Innovative Technologies, PE 0603226E, Project EE-45

(U) **Program Accomplishments and Plans**:

(U) FY 1994 Accomplishments:

- Designed the software architecture and conducted initial tests for joint task force planning/execution including weather, intelligence, strike planning and logistics. ($10.7M)
- Initiated network management, control, signaling efforts and demonstrated interoperability between commercial and DoD network assets. ($4.9M)
- Initiated optoelectronic network component technology development: switch, multiplexer, filter, amplifier and synchronizer. ($3.6M)

(U) FY 1995 Program:

- Design and conduct initial assessments of information services for the defense internet; evaluate prototype software components in a software engineering testbed and during an operational exercise. ($18.9M)
- Utilizing planning and decision developed aids, support the rapid construction of multiple crisis action plans. ($2.9M)
- Integrate DoD and commercial networks and demonstrate services and network management in support of DoD experimental application with military attributes such as crypto surge capability. ($5.2M)
- Develop integrated optoelectronic components for optical network. ($7.0M)
- Model multi-wavelength reconfigurable network architecture and initiate cost analysis and tradeoff. ($5.0M)
- Develop optical network management software and control algorithms. ($5.0M)

(U) FY 1996 Program:

- Demonstrate evolving software development practices and the migration of software applications and information services to higher bandwidth networks in an operational exercise involving multiple JTFs. ($18.8M)
- Demonstrate integration on a CONUS/International scale of all networks and demonstrate end-to-end secure transmission and signaling at gigabit rates. ($5.0M)
- Demonstrate high bandwidth operation of critical multi-wavelength components. ($8.8M)
- Field test local area network application of multi-wavelength analog and digital signal transmission. ($7.6M)
- Continue to develop multi-wavelength network management software and control algorithms. ($5.0M)

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1995
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 3 Advanced Development	R-1 ITEM NOMENCLATURE Experimental Evaluation of Major Innovative Technologies, PE 0603226E, Project EE-45

(U) **FY 1997 Program:**

- Identify control and protocol issues for operation of multi-wavelength networks. ($3.9M)
- Demonstrate advance integrated optoelectronic network component operations. ($10.7M)
- Complete multi-wavelength network architecture and control planning; and initiate field-trial network deployment for long-distance and wide area applications. ($13.5M)
- Demonstrate integration with advanced optical testbeds; large scale planning demonstrations; and deployable JTF C3 (mobile C3, plan rehearsal and refinement during deployment, intelligent interfaces). ($16.5M)

(U) **Program Change Summary:** *(In Millions)*

	FY 1994	FY 1995	FY 1996	FY 1997
President's Budget	19.2	48.5	51.9	49.8
Appropriated	19.2	45.7	N/A	N/A
Current Budget	19.2	44.0	45.2	44.6

(U) **Change Summary Explanation:**

FY 1995 Decreased to fund reprogramming to Management Headquarters.
FY 1996-97 Decreases reflect program repricing.

(U) **Other Program Funding Summary Cost:** N/A

(U) **Schedule Profile:**

Planned	Milestones
Apr 95	Demonstrate optical component prototypes.
Jul 95	Multiple crisis scenario (integrated simulation and modeling tools, more powerful trade-off analysis).
Sep 95	Integrate defense high performance networks with cross-country backbone using SONET/ATM. Early planning support demonstrations.

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May 96	Demonstrate network combining crypto, commercial communications, and defense secure wireless, satellite.
May 97	Demonstrate integration with advanced optical testbeds. Conduct large scale planning demonstrations.
Jul 97	Deployable JTF C3 (mobile C3, plan rehearsal and refinement during deployment, intelligent interfaces).
May 98	Cross-country demonstration of optical and advanced network management.

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APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 3 Advanced Development	R-1 ITEM NOMENCLATURE Experimental Evaluation of Major Innovative Technologies, PE 0603226E

COST *(In Thousands)*	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	Cost to Complete	Total Cost
Defense Simulation Internet (DSI) EE-46	31,617	16,622	27,514	37,175	0	0	0	0	0	N/A

(U) **Mission Description**: The goal of the Defense Simulation Internet (DSI) program is to research, develop and test at scale (worldwide), a network infrastructure capable of enabling distributed, real-time, multi-media (video, voice, shared data and work spaces) simulation that will seamlessly integrate all simulation, modeling, command and control functions from early design to battle rehearsal enroute to the conflict. The DSI provides DoD security requirements by implementing multiple strategies. The communications needs of the distributed, real-time, multi-media modeling and simulation community cannot be met with any other available technology. Also, commercial vendors are pursuing some of the required technologies, but development is too slow and unfocused to accommodate the immediacy of the Department of Defense's simulation requirements. The DSI program is therefore accelerating the commercial development of the technologies needed by the simulation community for distributed work environments worldwide. Nearly 100 nodes currently extend the DSI to each of the Services, most of the Commanders-in-Chief (CINCs) to some of our allies and other Government affiliated sites. These locations constitute the network's user sites; they provide valuable feedback on the technologies and methodologies being pursued and critical capability for both ongoing and major modeling and simulation events. A key mission of the DSI is to provide real-time infrastructure for the Synthetic Theater of War (STOW) 97. A major program goal is to transition the DSI into the Defense Information Systems Agency (DISA) Defense Information Systems Network (DISN) by the end of FY 1997. The transition of the DSI into the DISN provides affordability through consolidation of the costs required to operate multiple networks while continuing to support modeling and simulation requirements.

(U) **Program Accomplishments and Plans**:

(U) FY 1994 Accomplishments:

- Implemented interim upgrade to the network backbone (from 1.5 megabits per second (Mbps) to 6 Mbps) within the continental United States (CONUS), increasing bandwidth, throughput capacity and user capacity. Replaced current proprietary backbone with commercial-off-the-shelf (COTS) routers. ($2.9M)
- Upgraded the transatlantic and transpacific circuit capability to a T1 circuit (from .512 Mbps to 1.544 Mbps). Continued to lease current outside-CONUS (O-CONUS) circuits. ($2.4M)

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- Continued to lease approximately 100 communications lines currently connecting the Defense Simulation Internet (DSI) sites to the network backbone and leased an additional 40 new lines for additional sites. (Collectively referred to as tail circuits.) ($5.3M)
- Continued to operate the Network Operations Center (NOC): and provided network engineering support, exercise engineering and onsite support worldwide, security management and oversight, user training and hotline support, network configuration management including inventory control, and network equipment maintenance. (Collectively referred to as Operations Support). Began design and implementation of the Consolidated NOC. Currently providing ongoing operations support to major activities, including the Korean Initiative, Synthetic Theatre of War-Europe (STOW-E), and ULCHI Focus Lens exercise. ($10.9M)
- Initiated efforts for development of economical, multi-use, high speed, high capacity (bandwidth) communications supporting classified/unclassified traffic and engineer an unconstrained distributed simulation on the DSI network. Related efforts include support of bandwidth reduction technology, Defense Research Engineering Network (DREN) interface, evaluating available desktop video teleconferencing (VTC) capabilities, and exploring simulation applications for the proposed National Information Infrastructure (NII). ($3.7M)
- Developed enhancements to Stream 2 (ST2) Protocol in support of real-time, distributed, multi-media simulation requirements such as multi-casting, resource and network management, and implemented them on commercial-off-the-shelf (COTS) devices. ($3.5M)
- Initiated efforts to design and engineer a higher speed backbone to support the transition of the DSI into a cost-effective, high-performance services network, targeting frame relay and Asynchronous Transfer Mode (ATM) interfaces as key technologies. Began preliminary phase of evaluating high-speed, end-to-end encryption (E^3) devices that are protocol independent. ($2.9M)

(U) FY 1995 Program:

- Provide network operations and user services: 140 user sites expected by the end of FY 1995. The operations objective is to maintain and operate the DSI consistent with the DSI user community requirements. Included are management of the Network Operations Center (NOC), network security, exercise/event planning and management, and a 24 hour/7 day help desk. ($8.0M)
- Procure telecommunication circuits; Phase I backbone (T1), International circuits (Europe/Pacific theater T1 dual backbone upgrade starting in June), CONUS Phase II Backbone (T3 upgrade starting in Aug), Tail Circuits to user sites. ($6.1M)

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- Upgrade network: Implement the Phase II upgrade which is the first step of transition into Defense Information Systems Network (DISN) of the Defense Simulation Internet (DSI) dual backbone to T3/ATM technology by end of FY. Provide automated scheduling services to user control and improve network management and commercial-off-the-shelf (COTS) interoperability. Initiate Defense Information Systems Agency (DISA) migration planning process and install a network management viewport. Deploy DSI Phase I backbone to European and Pacific theaters. ($2.5M)

(U) FY 1996 Program:

- Provide network operations and user services. It is expected that the DSI will become a subnet of DISN Leading Edge (LE) in 1996. This subnet will contain an estimated 180 user sites. The operations objective is to maintain and operate the DSI in a manner consistent with the DSI user community requirements. Operations include the Network Operations Center (NOC), network security, exercise/event planning and management, and a 24 hour/7 day help desk. ($9.0M)
- Procure telecommunication circuits; International circuits (T1 backbone), CONUS Phase II Backbone (T3) Tail Circuits (T1), upgrade high use Synthetic Theater of War-Europe (STOW-E) sites to T3 tail circuit Q4. ($13.0M)
- Upgrade network: Initiate, deployment of upgrade which porvides ATM switches and end-to-end encryption for the wide area network interface to the sites and the edge devices which provide the local area interface with the workstation for STOW 97 (30 Sites). Upgrade to commercial standard desktop VTC. Integrate systems management to provide control of end node workstations. ($5.5M)

(U) FY 1997 Program:

- Provide network operations and user services. As a subnet of DISN LE, it is expected that by the end of FY 1997 the subnet work will contain an estimated 220 user sites. The operations objective is to maintain and operate the DSI in a manner consistent with the DSI user community requirements. Operations include the Network Operations Center (NOC), network security, exercise/event planning, management and a 24 hour/7 day help desk. ($10.0M)
- Procure telecommunication circuits: International circuits (T3 backbone), CONUS Phase II Backbone (T3) Tail Circuits (T1), upgrade high use STOW E sites to high capacity tail circuit. ($17.0M)
- Upgrade network: Complete deployment of service upgrade which provides ATM switches, end-to-end encryption and the edge devices to sites which require this upgraded capability (70 Sites). Automate network management to provide real-time management of high speed high bandwidth requirements. Provide resource

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reservation at the application level. Complete migration of Defense Simulation Internet (DSI) network operations and maintenance to Defense Information Systems Network (DISN). ($10.2M)

(U) **Program Change Summary:** *(In Millions)*

	FY 1994	FY 1995	FY 1996	FY 1997
President's Budget	31.6	15.9	26.2	37.0
Appropriated	31.6	15.9	N/A	N/A
Current Budget	31.6	16.6	27.5	37.2

(U) **Change Summary Explanation:**

FY 1995-97 Increase reflects minor program repricing.

(U) **Other Program Funding Summary Cost:** N/A

(U) **Schedule Profile:**

Plan	Milestones
Feb 94	Doubled DSI Backbone capacity (3 Mbps).
May 94	Completed Interim Backbone upgrade (6 Mbps).
Sep 95	Complete ATM T3 Backbone upgrade (45 Mbps).
Sep 95	European and Pacific Theater Phase I backbone.
Sep 96	DISA Network operations center fully functional.
Sep 96	Fully intergrate an automated network and life cycle management.
Sep 96	Complete ATM switches to STOW 97 sites.
Jun 97	Complete ATM switches to sites and end to end encryption to sites.
Sep 97	Complete network transition to DISA.

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RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1995
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 3 Advanced Development	R-1 ITEM NOMENCLATURE Advanced Submarine Technology, PE 0603569E

COST *(In Thousands)*	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	Cost to Complete	Total Cost
Subtech AS-01	43,839	32,381	7,473	9,942	5,449	5,430	26,230	35,530	Continuing	Continuing

(U) **Mission Description**: The objectives of this project are to develop and demonstrate advanced concepts and to pursue critical enabling technologies for future ship classes. The evolving worldwide threat of quiet diesel submarines and the proliferation of sophisticated submarine and weapons capabilities available to third world countries necessitates that the U.S. continue to maintain a superior submarine force. U.S. submarine technologies must keep pace with changing threats and remain immune to technological surprises, but declining resource availability mandates that this be done affordably. Therefore, the main thrust of this project is to provide far-term solutions for both increasing ship affordability and enhancing our operating capabilities in the littorals.

(U) This project continues to develop and demonstrate innovative technologies initiated under hydrodynamic control, advanced materials/structures, and structural acoustics efforts to reduce ship observables. These technologies will significantly enhance submarine stealth and survivability. They form the basis for efforts addressing affordability through improvements in structural acoustic design capabilities, innovative machinery mounting systems and high reliability propulsion systems.

(U) **Program Accomplishments and Plans**:

(U) FY 1994 Accomplishments:

- Fabricated non-autoclave cure thermoplastic-stiffened composite cylinders, door and spheres; tested thermoplastic cylinder, thermoset door and thermoset sphere; continued development of material property characterization tools and Non-Destructive Evaluation (NDE) methods. ($7.8M)
- Continued fabrication of SUPRELITE components for fatigue test. ($5.1M)
- Continued development of design and fabrication methodology for fiber placement cylinder and resin transfer molding (RTM) articles with embedded sensors. ($2.5M)
- Implemented automatic 3-D mesh generator for the Stealth Designer's Workbench (SDW). ($.3M)
- Developed Active Structural Control (ASC) techniques for: a) shock attenuation and design of a concept demonstration system for Special Warfare Craft, b) suppression of blade resonance and resulting high cycle turbine fatigue failure, and c) active vibration isolation of electronics cabinets and initiated concept demonstration system design. ($8.0M)

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APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 3 Advanced Development	R-1 ITEM NOMENCLATURE Advanced Submarine Technology, PE 0603569E, Project AS-01

- Demonstrated feasibility of ASC chatter and vibration control for high speed, high precision machining operations. Formulated concepts for ASC of chatter in precision milling operations. ($2.0M)
- Demonstrated active sound isolation through magnetic levitation. ($3.4M)
- Completed 50:1 scale model tests and numerical simulations for hull response to lightweight structures and completed truss beam damping tests, design of truss attachment, and numerical simulations. ($6.0M)
- Fabricated and tested active smart skin and Electromagnetic Turbulence Control (EMTC) concepts. ($3.4M)
- Expanded on technology developed in thick composites program and initiated fabrication of one Dry Deck Shelter (DDS) and test vehicle. ($4.3M)
- Evaluated advanced stealth, signature control, communications, materials, and producibility technologies to enhance submarine performance in littoral warfare. ($1.0M)

(U) FY 1995 Program:

- Develop and test active shock attenuation techniques. Initiate design of a thermally-boosted acoustic source for stealth applications. ($2.5M)
- Conduct a full scale demonstration of ASC for turning and boring applications. This effort is funded by a Congressional addition to the FY 1995 President's Budget. ($3.75M)
- Demonstrate initial active structural control concepts for suppression of blade resonance and turbine external components. This effort is funded by a Congressional addition to the FY 1995 President's Budget. ($3.75M)
- Demonstrate active compliant structure control concepts at laboratory scales. ($2.0M)
- Complete magnetic levitation technology transfer to United States. ($2.0M)
- Complete design and fabrication of 1/4-scale model for lightweight structures and complete truss testing and numerical simulations. ($5.0M)
- Continue fabrication, assembly and test of thick composites components and a cylinder with embedded sensors, and refinement of sensor demodulation and non-destructive evaluation (NDE) methods. ($.4M)
- Develop large scale, curved surface application of Electromagnetic Turbulence Control (EMTC). ($4.0M)
- Conduct initial demonstrations of individual submarine stealth and littoral warfare operation enhancing technologies. ($4.3M)
- The following activities relating to Advanced Submarine Technology are funded by Congressional additions to the FY 1995 President's Budget.
- Demonstrate Automated Welding Techniques. ($.7M)
- Perform a concept demonstration of a subsurface topographical defense and navigation system integrating weapons sensing and own-ship maneuvering systems. ($1.0M)

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APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 3 Advanced Development	R-1 ITEM NOMENCLATURE Advanced Submarine Technology, PE 0603569E, Project AS-01

- Develop advanced manufacturing techniques for affordable acquisition of large quantities of EMTC material and evaluate the multiple commercial applications of this technology including non-marine applications. ($3.0M)

(U) FY 1996 Program:

- Demonstrate Active Structural Control (ASC) shock attenuation techniques on full-scale platform. Develop and test a demonstration system to validate the design of a thermally-boosted acoustic source for stealth applications. ($2.0M)
- Integrate truss and hull structure at 1/4-scale. Test with magnetic levitation technology in submerged 1/4-scale model. ($1.8M)
- Conduct a demonstration of drag reduction, acoustic quieting and control using EMTC on a large scale vehicle. ($2.0M)
- Demonstrate feasibility of integrating littoral warfare mission enhancements and stealth technologies into submarine shallow water operations. ($1.7M)

(U) FY 1997 Program:

- Perform large scale demonstration of integrated stealth technologies, mission enhancements, and communications capabilities in submarine littoral warfare. ($9.9M)

(U) **Program Change Summary**: *(In Millions)*

	FY 1994	FY 1995	FY 1996	FY 1997
President's Budget	44.2	25.3	19.5	24.3
Appropriated	44.2	32.4	N/A	N/A
Current Budget	43.8	32.4	7.5	9.9

(U) **Change Summary Explanation**:

FY 1994 Adjustment reflects minor program repricing.
FY 1996 DoD reduction due to revised DoD priorities.
FY 1997 Decrease reflects the transfer of funding for Advanced Ship Mechanical Technologies into Advanced Ship/Sensor Systems, PE 0603226E, Project EE-36, to facilitate wider application of the technologies.

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(U) **Other Program Funding Summary Cost**: N/A

(U) **Schedule Profile**:

Plan	Milestones
Oct 94	Concept feasibility demonstration of precision machining turning operations.
Nov 94	Concept feasibility demonstration of electronics cabinet vibration isolation system.
Dec 94	Concept feasibility demonstration of active shock attenuation system.
Dec 94	Demonstration of Electromagnetic Turbulence Control (EMTC) in a high speed water tunnel on a MK-48 torpedo for drag reduction and control authority.
Aug 95	Factory floor demonstration of precision machining tuning and boring operations.
Sep 95	Concept feasibility demonstration of active control of turbine blade resonance vibrations.
Sep 95	Completion of feasibility assessment of individual stealth technologies in submarine design concepts optimized for littoral operations.
Sep 95	Completion of testing of optimized EMTC tiles in a high speed seawater environment.
Feb 96	Full-scale demonstration of active shock attenuation system.
Mar 96	Demonstration of EMTC at-sea on a full scale marine vehicle for acoustic quieting, drag reduction, and control authority.
Jun 96	Testing of integrated 1/4-scale lightweight truss structures with magnetic levitation technologies in submerged model.
Jul 96	Concept feasibility demonstration of thermoacoustic source noise cancellation system.
Aug 96	Full-scale demonstration of active control of turbine blade resonance vibration.
Aug 96	Large-scale demonstration of selected mission enhancements and stealth technologies in submarine design concepts.
Jul 97	Demonstration of Integrated Stealth Technologies for submarine concepts.

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DATE: February 1995

APPROPRIATION/BUDGET ACTIVITY: RDT&E, Defensewide
BA 3 Advanced Development

R-1 ITEM NOMENCLATURE: Defense Reinvestment,
PE 0603570E

COST *(In Thousands)*	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	Cost to Complete	Total Cost
Defense Reinvestment	495,502	443,196	500,000	400,000	400,000	400,000	400,000	400,000	Continuing	Continuing

(U) **Mission Description**: The purpose of the Defense Reinvestment program is to enhance the technological superiority and affordability of U.S. military technology through dual-use projects designed to directly improve military capabilities while also having potential pay-offs in the commercial sector. Key to meeting the program objectives is the selection of particular technology areas which can serve both a military and a commercial market, thereby encouraging a partnership and cost sharing between commercial industry and the Department of Defense. Manufacturing and technology assistance to the manufacturing firms critical to Defense acquisition, and education and training programs designed to enhance U.S. manufacturing skills and target displaced defense industry workers have also been a part of this program; future emphasis will be mainly on technology development.

Defense Dual-Use Critical Technology Partnerships
Commercial-Military Integration Partnerships
Defense Advanced Manufacturing Technology Partnerships
Manufacturing Engineering Education Grant Program
Regional Technology Alliances
Small Business Innovation Research

(U) The initial competition held in FY 1993/1994 resulted in the selection of 212 proposed partnerships. Lessons learned from this competition were shared with potential future partners through nationwide multi-city outreach seminars. These lessons are analyzed and applied, as appropriate, to enhance the program each year.

(U) The FY 1995 program is soliciting proposals in a general competition with emphasis on developing dual-use technologies. Changes in authorization language will be implemented to provide additional assistance for small businesses. Manufacturing Education and Training and Regional Technology Alliances will remain a part of the program. No manufacturing extension program will be part of this competition.

(U) The FY 1996 and FY 1997 programs will continue to develop and deploy promising new technologies with competitions planned for each year. The majority of the initial partnerships will have concluded their first phase by this time and studies will be initiated to analyze the success/results of these first efforts. At a minimum, the studies will search for strengths/weaknesses of each partnership and an overall assessment on the progress of the program.

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(U) Funding for the Small Business Innovation Research (SBIR) Program is included within this Program Element to strengthen the role of small business in meeting dual-use research and development for both military and commercial applications.

(U) **Program Accomplishments and Plans**:

(U) FY 1994 Accomplishments:

- Funded highly successful proposals identified as part of the FY 1993 solicitation. ($140.0M)
- Funded on-going manufacturing efforts such as the Agile Manufacturing program and the SBIR program. ($99.0M)
- Completed the selection process and identified new partnerships for a focused technology competition concentrating on 7 technology areas and deployment components. ($150.0M)
- Announced an open, general solicitation to be conducted in early to mid FY 1995. This competition will use remaining FY 1994 funds ($85.0M) as well as those appropriated in FY 1995.

(U) FY 1995 Program:

- Sign agreements with partners selected under focused competition.
- Conduct out-reach seminars to assist potential partners in responding to general competition announced in FY 1994.
- Execute FY 1995 options on successful partnerships begun in FY 1993 and FY 1994.
- Select and establish new partnerships resulting from the general competition announced in late FY 1994.
- Sign agreements with partners selected under the general competition.

(U) FY 1996 Program:

- Initiate the FY 1996 competition.
- Execute FY 1996 options on partnerships begun in FY 1995 and prior.
- Conduct additional out-reach seminars to discuss lessons learned from previous competitions.
- Complete selection process and identify new partnerships.
- Conduct formal assessment of FY 1993 program results.
- Sign agreements with partners selected under the FY 1996 competition.

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(U) **FY 1997 Program:**

- Initiate the FY 1997 competition.
- Execute FY 1997 options on partnerships begun in FY 1996 and prior.
- Conduct out-reach seminars to discuss lessons learned from previous competitions.
- Complete selection process and identify new partnerships.
- Conduct formal assessment of FY 1994 program results.
- Sign agreements with partners selected under the FY 1997 competition.

(U) **Program Change Summary:** *(In Millions)*

	FY 1994	FY 1995	FY 1996	FY 1997
President's Budget	474.0	625.0	650.0	675.0
Appropriated	474.0	548.2	N/A	N/A
Current Budget	495.5	443.2	500.0	400.0

(U) **Change Summary Explanation:**

FY 1994 Increase due to prior approved reprogramming action.

FY 1995 Reduction due to reprogramming of the Advanced Materials Partnerships program ($25.0M) to PE 0602712E; Agile Manufacturing ($30.0M) and the U.S. – Japan Management Training program ($10.0M) to PE 0603739E; and the MARITECH program ($40.0M) to PE 0603746E.

FY 1996–97 Adustments made to satisfy internal DoD budget priorities and effect the transfer of the Advanced Materials Partnerships, Agile Manufacturing, U.S. - Japan Management Training, and MARITECH programs to more appropriate program elements.

(U) **Other Program Funding Summary Cost:** N/A

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(U) **Schedule Profile**:

Plan	Milestones
1st Qtr FY 95	Sign agreements with partners selected under focused competition.
3rd Qtr FY 95	Select and establish new partnerships identified during the general competition announced in late FY 1994.
1st Qtr FY 96	Initiate the FY 1996 competition.
1st Qtr FY 97	Initiate the FY 1997 competition.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1995
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 3 Advanced Development	R-1 ITEM NOMENCLATURE Advanced Electronics Technologies, PE 0603739E

COST *(In Thousands)*	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	Cost to Complete	Total Cost
Advanced Electronics Technologies	**377.801**	**409.763**	**419.863**	**443.458**	**446.910**	**435.469**	**470.081**	**527.446**	**Continuing**	**Continuing**
Microelectronics Fabrication MT-01	0	0	1,907	26,534	46,800	65,250	70,550	78,900	Continuing	Continuing
MIMIC MT-02	79,631	20,472	0	0	0	0	0	0	0	N/A
IR Focal Plane Array (IRFPA) MT-03	41,429	44,116	36,744	19,276	0	0	0	0	0	N/A
Electronic Module Technology MT-04	115,524	119,084	134,473	133,814	150,089	163,372	209,064	233,034	Continuing	Continuing
Tactical Information Systems MT-05	9,263	14,652	20,164	17,721	14,835	21,646	23,000	27,500	Continuing	Continuing
Microwave and Analog Front End Technology (MAFET) MT-06	0	22,253	50,741	52,921	54,981	55,201	62,467	68,012	Continuing	Continuing
Centers of Excellence MT-07	23,837	38,377	23,642	19,936	10,000	10,000	5,000	5,000	Continuing	Continuing
Manufacturing Technology Applications MT-08	7,186	54,738	78,942	91,248	89,905	70,000	55,000	70,000	Continuing	Continuing
Advanced Lithography MT-10	57,931	57,731	39,003	61,404	65,300	50,000	45,000	45,000	Continuing	Continuing
Computer-aided Acquisition and Logistics Support MT-11	43,000	38,340	34,247	20,604	15,000	0	0	0	0	N/A

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APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 3 Advanced Development	R-1 ITEM NOMENCLATURE Advanced Electronics Technologies, PE 0603739E

(U) **Mission Description**: Microelectronic Fabrication project will develop precesses and technologies to permit the routine fabrication of systems which will meet the demands of the future joint warfighter. This will require the development and the demonstration of advances in several key areas. Critical technology developments will be required in: (a) physical equipment (modular cluster tools with real-time model-based control capable of computer integrated fabrication of combinations of silicon and other semiconductors); (b) material deposition and removal for interconnections; and (c) the development of techniques to integrate these processes into one continuous-flow, computer integrated, volume independent, fabrication process.

(U) The objective of the Microwave/Millimeter Wave Monolithic Integrated Circuits (MIMIC) project is to accelerate the development, manufacturing and demonstration of affordable microwave and millimeter wave analog integrated circuits. This technology will be the basis for the efforts in the Microwave and Analog Front End Technology (MAFET) program (MT-06) beginning in FY 1995. The MAFET program will further enhance microwave and millimeter wave module performance at reduced costs.

(U) The IR Focal Plane Array project focuses on the establishment of a manufacturing base for advanced infrared sensor arrays for major weapons systems. This base will allow the systems to meet operating requirements at approximately 1% of the current cost.

(U) The goal of the Electronic Module Technology project is to allow for the timely insertion and rapid acquisition of state-of-the-art microsensors and actuators, conformal electronics and affordable, high performance application specific electronic module (ASEM), components into major military systems. These systems include automatic target recognition, electronic countermeasures and Signal Intelligence (SIGINT). This project includes Advanced Technology Demonstrations in ASEM and Rapid Prototyping of Application Specific Signal Processor.

(U) Tactical Information Systems projects develop and demonstrate high definition miniature displays to provide visual information to individual combatants and small groups who are remotely located from conventional visual information sources.

(U) The Centers of Excellence program finances demonstration, deployment of and training on advanced manufacturing technologies. The goal of this technology is to reduce unit and life-cycle costs while improving quality.

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(U) The goal of the Manufacturing Technology Applications program is to reduce the cost and acquisition leadtime of future military systems by integrating manufacturing process considerations during the product design phase, and by demonstrating high efficiency multi-product prototype factories. This program will also enable manufacturers to economically produce military variants of their commercial products in limited quantities through the introduction of flexible process technologies.

(U) Advanced Lithography technology has enabled the dramatic growth of integrated circuit capability. Advances have led directly to improvements in electronic and computing systems performance in terms of speed, power, weight and reliability.

(U) The mission of the Computer-aided Acquisition and Logistic Support program is the transfer of Electronic Commerce (EC) technologies to small- and medium-size enterprises through a network of regional deployment centers.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: February 1995

APPROPRIATION/BUDGET ACTIVITY: RDT&E, Defensewide
BA 3 Advanced Development

R-1 ITEM NOMENCLATURE: Advanced Electronics Technologies, PE 0603739E

COST (In Thousands)	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	Cost to Complete	Total Cost
Microelectronics Fabrication MT-01	0	0	1,907	26,534	46,800	65,250	70,550	78,900	Continuing	Continuing

(U) **Mission Description**: Microelectronics technology in the commercial mainstream is based on the silicon–silicon dioxide system which is the world's best integration technology for transistors, resistors and capacitors. Military systems demand functions such as light emitters and detectors, RF/Microwave sources and detectors as well as many analog functions which can not be delivered by the silicon digital integrated circuit. Over the past 40 years, the Department has supported many alternative semiconductor systems in which lasers, detectors, optical components, microwave and analog devices and even microwave or optical integrated circuits have been developed for military applications. Current military system requirements now make it imperative that we develop compact, portable, low power electronics for the warfighter in the field as well as for brilliant autonomic weapons and surveillance systems to support rapidly deployable responses to global situations at all conflict levels. The key to accomplishing this is the ability to do for an entire system what the digital integrated circuit did for computing–fabricate the complete system on a chip. This project will develop processes and technology which will permit the routine fabrication of systems–on–a–chip which will meet the demands of the future joint warfighter. This will require the development and the demonstration of advances in several key areas. Critical technology developments will be required in: (a) physical equipment (modular cluster tools with real–time model–based control capable of computer integrated fabrication of combinations of silicon and other semiconductors); (b) material deposition and removal for interconnections; and (c) the development of techniques to integrate these processes into one continuous–flow, computer integrated, volume independent, fabrication process.

(U) **Program Accomplishments and Plans**:

(U) FY 1994 Accomplishments: N/A

(U) FY 1995 Program: N/A

(U) FY 1996 Program:

- Initiate effort to develop techniques for multifunction chip level integration for cost effective DoD requirements. ($1.9M)

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APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 3 Advanced Development	R-1 ITEM NOMENCLATURE Advanced Electronics Technologies, PE 0603739E, Project MT-01

(U) **FY 1997 Program:**

- Continue development of techniques capable of achieving multifunction chip level integration. ($5.0M)
- Initiate the development of process and design tools for multifunction chip level integration. ($5.0M)
- Initiate development of high yield, low cost and robust processes and associated tools for multifunction of chip level integration of dissimilar materials. ($11.5M)
- Start assessment and development of system-on-a-chip targeted to military systems with high impact to information processing applications. Potential applications include smart sensor-processors, smart input/output for processor/memory, and smart display/processors. ($5.0M)

(U) **Program Change Summary:** *(In Millions)*

	FY 1994	FY 1995	FY 1996	FY 1997
President's Budget	0	0	3.0	11.5
Appropriated	0	0	N/A	N/A
Current Budget	0	0	1.9	26.5

(U) **Change Summary Explanation:**

FY 1996 Repriced to provide adequate funds for program initiation.
FY 1997 Revised to support the development of manufacturing tools for state-of-the-art and volume independent manufacturing of cost effective components for DoD specific applications.

(U) **Other Program Funding Summary Cost:** N/A

(U) **Schedule Profile:**

Plan Milestones

Jun 96 Issue BAA to solicit proposals on multifunctional integration strategies which would enable military systems-on-a-chip to be fabricated.
Dec 96 Issue BAA to initiate the development of process and design tools for multifunction chip level integration.
Mar 97 Assess and select the approaches best suited to achieve multifunctional integration capability as well as meeting future military requirements.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1995
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 3 Advanced Development	R-1 ITEM NOMENCLATURE Advanced Electronics Technologies, PE 0603739E, Project MT-01

Jun 97 Initiate assessment and development of systems-on-a-chip targeted to military systems with high impact to information processing applications for the warfighter.

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DATE: February 1995

APPROPRIATION/BUDGET ACTIVITY: RDT&E, Defensewide
BA 3 Advanced Development

R-1 ITEM NOMENCLATURE: Electronics Manufacturing Technology
PE 0603739E

COST (In Thousands)	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	Cost to Complete	Total Cost
MIMIC MT-02	79,631	20,472	0	0	0	0	0	0	0	N/A

(U) **Mission Description**: This project provides for the acceleration of development, manufacturing and demonstration of affordable microwave and millimeter wave analog integrated circuits (ICs). The Microwave/Millimeter Wave Monolithic Integrated Circuits (MIMIC) program is providing previously unavailable microwave and millimeter-wave integrated circuits to enable DoD systems to meet size, weight and power constraints at the lowest possible cost. Its primary thrust is to develop affordable circuits operating in the 1 to 100 GHz frequency range with required characteristics and sufficient quantity to satisfy military systems needs. The use of reliable and maintainable semiconductor devices and circuits for selected system demonstrations will be accelerated and, thus provide the United States with a technological lead in deploying MIMIC-based military systems.

(U) **Program Accomplishments and Plans**:

(U) FY 1994 Accomplishments:
- Continued work on MIMIC Phase 2 contracts including delivery of process demonstration wafers, completion of MIMIC Phase 2 chip fabrication and continue assembly of MIMIC modules and brassboards. ($79.6M)

(U) FY 1995 Program:
- Completion of program including delivery of MIMIC chips, modules and brassboards and demonstrations of advanced technology and hardware. ($20.5M)

(U) FY 1996 Program:
- Not applicable. No funds requested.

(U) FY 1997 Program:
- Not applicable. No funds requested.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: February 1995

APPROPRIATION/BUDGET ACTIVITY
RDT&E, Defensewide
BA 3 Advanced Development

R-1 ITEM NOMENCLATURE
Electronics Manufacturing Technology,
PE 0603739E, Project MT-02

(U) **Program change Summary:** *(In Millions)*

	FY 1994	FY 1995	FY 1996	FY 1997
President's Budget	79.9	25.2	0	0
Current Budget	79.6	20.5	0	0

(U) **Change Summary Explanation:**

FY 1994 Reduction represents minor below threshold reprogramming.
FY 1995 Reduction reflects below threshold reprogramming to fund congressional TRP earmarks.

(U) **Schedule Profile:**

Plan	Milestones
Jun 94	Complete fabrication of MIMIC chips.
Jan 95	Complete integrated design/fabrication/test capabilities at MIMIC Phase 2 contractors.
Jul 95	Deliver MIMIC Phase 2 chips, modules and brassboards.

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DATE: February 1995

APPROPRIATION/BUDGET ACTIVITY: RDT&E, Defensewide
BA 3 Advanced Development

R-1 ITEM NOMENCLATURE: Advanced Electronics Technologies, PE 0603739E

COST (In Thousands)	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	Cost to Complete	Total Cost
IR Focal Plane Array MT-03	41,429	44,116	36,744	19,276	0	0	0	0	0	N/A

(U) **Mission Description**: The Infrared Focal Plane Array (IRFPA) project demonstrates affordable advanced infrared (IR) sensor arrays required for major weapon systems. Improvements in infrared materials, detector array fabrication, readout electronics, cryogenic testing and module assembly are addressed in order to provide low cost infrared sensors to system developers. Systems requiring affordable tactical infrared focal plane arrays include missile seekers, airborne and ground-based target acquisition systems, and infrared search and track systems. Currently, the IRFPAs are produced at low rates and high cost with technology that is just emerging from the laboratory environment. The goal of this project is to produce IRFPAs that meet system requirements with a hundredfold cost reduction relative to the cost at the beginning of the project, and to demonstrate a capability to produce focal plane arrays at low cost in low volume.

(U) **Program Accomplishments and Plans**:

(U) FY 1994 Accomplishments:

- Demonstrated imaging of a 480x640 long wavelength staring array fabricated on a silicon wafer with improved structure and low defect density. ($4.0M)
- Established repeatability of system compatible 480x4 scanning arrays and 64x64 staring arrays meeting tactical system requirements. ($15.0M)
- Designed and fabricated high performance read-out integrated circuit with improved linearity meeting mid and long wavelength requirements. ($5.4M)
- Completed evaluation of high speed, long wavelength, 11.0 micron at 68 degrees kelvin for a 480x4 focal plane array for airborne applications. ($6.0M)
- Completed analytical model of defect formation energies in infrared materials. ($1.0M)
- Completed design of flexible fabrication capability including laboratory demonstration of processes. ($10.0M)

(U) FY 1995 Program:

- Demonstration of one-hundred times (x100) cost reduction for 480x4 infrared focal plane arrays useful for ground and airborne applications. ($9.1M)

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APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 3 Advanced Development	R-1 ITEM NOMENCLATURE Advanced Electronics Technologies, PE 0603739E, Project MT-03

- On-line demonstration of electrical functionality probing of detector arrays on wafers. ($3.0M)
- Demonstration of 128x128 infrared focal plane array with spatial uniformity required for missile seeker. ($5.0M)
- Integration of dry processing into the infrared detector fabrication. ($7.0M)
- Laboratory demonstration of cluster tool concept for flexible fabrication of IRFPAs. ($20.0M)

(U) FY 1996 Program:

- Demonstrate automated thin film deposition and etching work cell for multiple focal plane array configurations. ($4.0M)
- Complete development of standard electronic cells for rapid design and fabrication of infrared read-out integrated circuits. ($8.0M)
- Verify performance of cryogenic packing vacuum seal; and vacuum bake-out workstation. ($5.0M)
- Complete prototype of computer aided design tool for infrared sensors. ($5.0M)
- Demonstrate uncooled focal plane arrays hybridized to low noise analog readout circuits. ($4.7M)
- Demonstrate focal plane array fabrication using four inch diameter silicon wafers. ($10.0M)

(U) FY 1997 Program:

- Incorporate into the cryogenic factory the capability to rapidly design and build prototypes of new cryogenic packages. ($3.0M)
- Demonstrate capability to produce multiple cryogenic package designs on the same manufacturing line. ($5.3M)
- Achieve capability to monolithically integrate infrared material on silicon read-out circuits. ($3.0M)
- Fabricate infrared read-outs using a 0.8 micron CMOS process, establishing the capability to fabricate high density staring arrays. ($3.0M)
- Demonstrate flexible, modular IRFPA final assembly, integration and test with the capability to rapidly reconfigure from 3-5 to 8-12 micron arrays for tactical and space surveillance applications. ($5.0M)

(U) **Program Change Summary**: *(In Millions)*

	FY 1994	FY 1995	FY 1996	FY 1997
President's Budget	41.4	44.8	43.2	14.4
Appropriated	41.4	44.1	N/A	N/A
Current Budget	41.4	44.1	37.7	19.3

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APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 3 Advanced Development	R-1 ITEM NOMENCLATURE Advanced Electronics Technologies, PE 0603739E, Project MT-03

(U) **Change Summary Explanation**:

FY 1996-97 Shift of $5 million from FY 1996 to FY 1997 was necessary to accommodate a change to the factory demonstration schedule.

(U) **Other Program Funding Summary Cost**: N/A

(U) **Schedule Profile**:

Plan	Milestones
Aug 95	Demonstrate a 100 times cost reduction of two-dimensional, staring IRFPAs.
Sep 95	Assemble scalable focal plane array facility.
Jan 96	Demonstrate process module concept for multipurpose scanning arrays.
Jun 96	Demonstrate equipment with flexibility to produce various IRFPA configurations on the same line.
Sep 96	Demonstrate large-area staring and scanning array for search and track, target acquisition, and missile seeker systems.
Sep 97	Demonstrate high-yield IRFPA manufacturing facility capable of varying production rates from small lots to high throughput rates.
Dec 97	Completion of modular infrared focal plane array final assembly, integration and test capability, scalable from low volume (single wafer processing) to higher production volume (ten wafer lots @ over 10,000 wafers per year); with single wafer cycle time of ten days.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: February 1995

APPROPRIATION/BUDGET ACTIVITY: RDT&E, Defensewide
BA 3 Advanced Development

R-1 ITEM NOMENCLATURE: Advanced Electronics Technologies, PE 0603739E

COST (In Thousands)	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	Cost to Complete	Total Cost
Electronic Module Technology MT-04	115,524	119,084	134,473	133,814	150,089	163,372	209,064	233,034	Continuing	Continuing

(U) **Mission Description**: The Electronic Module Technology Project is a broad initiative to substantially decrease the cost and increase the performance of weapon systems through the timely insertion of state-of-the-art electronic modules. Electronic module technology addresses the interconnection and physical packaging of various types of digital and analog integrated circuits, as well as other electronic, electro-optical and micro-mechanical components. It includes traditional approaches such as printed circuit boards, emerging technologies such as high density multichip modules (MCMs), and revolutionary approaches such as microelectromechanical systems.

(U) The project has five major objectives: (1) shorten the overall design, manufacture, test, and insertion cycle for advanced electronic subsystems; (2) advance the state-of-the-art in electronic interconnection and physical packaging technology to allow circuits to operate close to their intrinsic maximum speed with less overhead in terms of volume, weight and cost; (3) provide a robust manufacturing infrastructure for electronic modules; (4) demonstrate the system level payoff of electronic module technology through advanced technology demonstrators (ATDs); and (5) drive down the cost of advanced batch fabricated thin profile, microwave frequency transmit/receive modules.

(U) The project has the following major elements: (1) High-Density Physical Packaging; (2) Application Specific Electronic Modules (ASEM); (3) Multichip Integration (MCI); (4) Rapid Prototyping of Application Specific Signal Processors (RASSP); (5) Microelectromechanical Systems (MEMS); (6) High Density Microwave Packaging (HDMP); and (7) Electronic System Manufacturing (ESM). High-density physical packaging will develop and exploit high-density packaging technology for digital and mixed analog/digital electronics with clock rates up to several GHz and manufacturing processes that will lead to the production of complex shape, lightweight, and high density microwave frequency multichip modules and sub arrays. ASEM will reduce the non-recurring engineering time and cost for designing and inserting complex electronic modules. MCI will produce order of magnitude reductions in manufacturing cost and accelerate the acceptance and insertion of multi-chip integration technologies. RASSP is a major ARPA/tri-Service initiative which seeks to dramatically reduce the development time and life cycle cost of advanced signal processing capability while ensuring state of the art performance when the processor is fielded, not just when it is first defined. MEMS enables information and control technology for mobile systems/active individuals by developing and using microdynamic devices and systems, wireless/low-power communications and conformal/embedded manufacturing.

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HDMP is developing microwave frequency, thin, lightweight multi-chip packages for use in applications such as active scanned arrays. It is expected to result in cost reductions of up to 75% compared to present approaches with excellent performance. The Electronic Systems Manufacturing (ESM) program will develop new technologies for the assembly of compact, high-performance, electronic and electro-mechanical systems. The programs leverages related efforts developing component technologies such as semiconductors, displays, MCMs, and MEMs, as well as physical CAD tools in order to achieve dramatic reduction in system assembly cost.

(U) **Program Accomplishments and Plans**:

(U) FY 1994 Accomplishments:

- Continued development and demonstration of 10-100X packaging density improvement for digital processors, memories, and analog circuits operating at clock rates up to 500 MHz. ($5.5M)
- Continued the ASEM program with additional support for the flexible-access foundry system focusing on the board level integration of MCMs. Demonstrated 2 month turn-around time for MCM designs. Fabricated MCMs for insertion into computer workstation. ($25.1M)
- Continued the MCI program with the establishment of large format equipment development programs and the initiation of selected MCM insertions. ($27.9M)
- Expanded RASSP evaluation and technology base development and demonstrated first versions of design environment. ($37.0M)
- Initiated environmentally conscious electronics systems manufacturing. ($20.0M)

(U) FY 1995 Program:

- Develop microwave frequency multichip module housings, internal packaging interconnections, array interconnect technology, module assembly and integration and CAD tools and databases. Perform tests on modules to assess performance; assess projected per unit cost savings. ($5.1M)
- Continue the ASEM program with heightened emphasis on mixed signal modules and application demonstrations. Deliver new software tools to streamline the error-free design of MCMs. ($28.8M)
- Continue the MCI program with further development of manufacturing equipment, with a focus on the delivery of production modules for military aircraft and other dual-use applications. Demonstrate pilot production line for roll-to-roll fabrication of high density laminate MCMs. ($24.4M)
- Demonstrate improved signal processor design environment incorporating advanced CAD technology, VHDL extensions, and new signal processing algorithms. Complete first RASSP system demonstration prototypes and deliver preliminary RASSP benchmark evaluations. Initiate technology transition activities. ($42.1M)

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1995
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- Develop high-yield, high-uniformity, integrated electrical/mechanical fabrication processes for microelectromechanical components and systems and demonstrate concepts initial sensing and navigation, fluidic systems, optomechanical devices and embedded sensing. ($18.7M)

(U) FY 1996 Program:

- Complete development of required microwave packaging approaches and interconnection circuitry; produce and demonstrate required multi-chip microwave assemblies. Reassess projected per unit cost savings. ($9.1M)
- Demonstrate complete end-to-end RASSP design framework with additional demonstration hardware and benchmark evaluations. Develop accelerated framework standards, improved CAD technology for system testing, and VHDL reuse libraries. Accelerate technology transfer activities. ($38.1M)
- Increase density of integrated, co-fabricated electrical/mechanical components to enable new MEMS applications in data storage, personal navigation, signal processing. Expand infrastructure development to include MEMS design, manufacture, test and characterization tools. Initiate systems demonstrations. ($31.0M)
- Continue ASEM program to reach one month turn-around time and $25K NRE cost for digital MCMs. Demonstrate high volume production technology for producing known-good die. ($28.2M)
- Continue multi-chip integration program with the delivery of high volume/low cost laminate MCM technology and develop optimized modules and mixed signal applications. ($25.1M)
- Initiate the Electronic Systems Manufacturing (ESM) program by identifying breakthrough technologies to lower precision assembly costs through reducing discrete component count, simplifying assembly processes, or reducing the number of degrees of freedom requiring precision. ($3.0M)

(U) FY 1997 Program:

- Demonstrate microwave packaging array performance of advanced multi-chip assemblies; establish robust manufacturing approach resulting in significant cost savings; deliver all required hardware and program documentation. ($11.3M)
- Demonstrate final end-to-end RASSP signal processor design environment. Complete technology insertion demonstrations, benchmarking analysis, and technology transition activities. ($7.0M)
- Demonstrate MEMS applications using massively parallel MEMS systems in new dual-use areas including analytical instruments, precision assembly, active structural enhancement, and air vehicle control. ($43.9M)
- Continue ASEM program and demonstrate new ASEM foundry capability for flexible production of modules with board-level integration. (27.3M)

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APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 3 Advanced Development	R-1 ITEM NOMENCLATURE Advanced Electronics Technologies, PE 0603739E, Project MT-04

- Continue multi-chip integration program to demonstrate order of magnitude reductions in MCM manufacturing costs and MCM technology insertions. Continue insertion of MCM technology into dual-use products such as workstations, engine control and wireless communications. ($28.3M)
- Continue ESM program by further identification of breakthrough assembly technologies. Select the most promising approaches for further development of manufacturing equipment and processes. ($16.0M)

(U) Program to Completion: This is an ongoing effort for the transitioning of software technology (utilizing state of the art software engineering techniques and methods) and promulgating software use throughout the defense industrial base.

(U) **Schedule Profile**: N/A

(U) **Program Change Summary**: *(In Millions)*

	FY 1994	FY 1995	FY 1996	FY 1997
President's Budget	117.6	130.9	146.5	85.8
Appropriated	117.6	123.1	N/A	N/A
Current Budget	115.5	119.1	134.5	133.8

(U) **Change Summary Explanation**:

FY 1994 Reduction due to program repricing.
FY 1995 Reduction due to below threshold reprogramming to finance TRP earmark.
FY 1996-97 Adjustments reflect reprioritization of DoD resources to fully fund approved programs.

(U) **Other Program Funding Summary Cost**: N/A

(U) **Schedule Profile**:

Plan	Milestones
Feb 95	Demonstrate ASEM $50,000 non-recurring engineering cost 60 day cycle time for 10 chip Multichip Modules.

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APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 3 Advanced Development	R-1 ITEM NOMENCLATURE Advanced Electronics Technologies, PE 0603739E, Project MT-04

Mar 95	Demonstrate MCM insertions in OH-58D Image Processor.
Mar 95	Establish quick-turnaround SEM-E board foundry.
Sep 95	Complete high density microwave packaging (HDMP) initial development of housings, inter-chip and inter-layer interconnections and testing.
Sep 95	Complete HDMP developments of initial versions of specialized microwave packaging CAD tools and databases.
Mar 96	Demonstrate improved versions of RASSP design environment.
Jun 96	Complete HDMP final development of housings, interconnect approaches and perform initial module testing.
Jul 96	Demonstrate ASEM Technology for assuring known-good die.
Aug 96	Begin assembly of HDMP brassboard array and perform initial testing.
Sep 96	Deliver MCI Manufacturing Technology to the dual-use market.
Sep 96	Demonstrate and insert MEMS devices with high-density mechanical/electrical integration.
Jun 97	Demonstrate final end-to-end RASSP signal processor design.
Jul 97	Demonstrate microwave packaging array performance.
Jul 97	Establish distributed access to design, fabrication and evaluation services for multiple MEMS processes.
Sep 97	Demonstrate new mixed signal ASEM foundry capability.
Apr 98	Demonstrate large-scale, distributed MEMS arrays achieving macroscale effects.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: February 1995

APPROPRIATION/BUDGET ACTIVITY: RDT&E, Defensewide
BA 3 Advanced Development

R-1 ITEM NOMENCLATURE: Advanced Electronics Technologies, PE 0603739E

COST (In Thousands)	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	Cost to Complete	Total Cost
Tactical Information Systems MT-05	9,263	14,652	20,164	17,721	14,835	21,646	23,000	27,500	Continuing	Continuing

(U) **Mission Description**: This project is a major DoD effort to develop the technology for displays and portable information systems for use in a variety of military systems. The program has two major projects: Head Mounted Displays and Tactical Information Assistants. The Head Mounted Display project is developing world-class miniature displays and integrating these displays into head and helmet mounted configurations for use by pilots, combat vehicle crews and individual warriors as well as for virtual environments and simulation. It is expected that by the year 2000, the military will use more miniature displays for head mounted applications than the cumulative total of all other types of flat panel displays. This is the only DoD program addressing this need. The Tactical Information Assistant program will develop portable information systems that combine communication, computation, and navigation for use by individual warriors. The systems will use state-of-the-art displays, multichip modules, microelectromechanical devices, global positioning chips, low power electronics, and efficient energy sources. Emphasis is on augmenting things already carried or worn by warriors (weapons, clothing, binoculars, rangefinders, radios, etc.) with high information content components. Resulting systems will promote enhanced vertical and horizontal battlefield information infrastructures.

(U) **Program Accomplishments and Plans**:

(U) FY 1994 Accomplishments:

- Completed development of 640 x 480 pixel monochrome liquid crystal display. ($3.2M)
- Integrated 640 x 480 pixel monochrome liquid crystal display into a Combat Vehicle Crew head mounted system and demonstrated at the U.S. Army Armor Conference. ($2.6M)
- Completed all designs and first process runs of 1280 x 1024 pixel liquid crystal and electroluminescent displays. ($3.5M)

(U) FY 1995 Program:

- Head Mounted Displays - Emphasis will be on demonstrating a Combat Vehicle Crew head mounted display system in an M1A2 tank and initiating a program to develop 2560 x 2048 liquid crystal and electroluminescent displays in a one-square inch format. ($8.8M)

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- **Tactical Information Assistants** - This effort will develop light, thin, portable information systems for active, mobile users that focus on rapid prototyping with end-users in the design loop. Emphasis will be on modifying a field qualified, hand-held laser rangefinder to provide improved surveillance information gathering and transmission. ($5.9M)

(U) FY 1996 Program:

- Head Mounted Displays - Emphasis will be on continuing the development of 2560 x 2048 liquid crystal and electroluminescent displays, significantly decreasing the voltage requirements for electroluminescent displays and demonstrating a high-resolution head mounted display for aircrew pilots, combat vehicle crews, individual soldier and simulation applications. ($9.2M)
- Tactical Information Assistants - Emphasis will be on demonstration of three systems for use by individuals remotely located from conventional information sources. ($11.0M)

(U) FY 1997 Program:

- Head Mounted Displays - Complete development of 2560 x 2408 pixel displays and demonstrate in a military head mounted application. ($6.5M)
- Tactical Information Assistants - Initiate development of TIAs emphasizing the combination of computation, communication and navigation in a single unit. Initiate an effort to significantly improve the assembly and manufacturing of previously defined TIAs. ($11.2M)

(U) **Program Change Summary**: *(In Millions)*

	FY 1994	FY 1995	FY 1996	FY 1997
President's Budget	9.4	16.2	21.2	22.2
Appropriated	9.4	16.1	N/A	N/A
Current Budget	9.3	14.7	20.2	17.7

(U) **Change Summary Explanation**:

FY 1994 Reduction due to minor program repricing.
FY 1995 Reduction to fund TRP earmarks.
FY 1996-97 Adjustments reflect minor program repricing.

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(U) **Other Program Funding Summary Cost**: N/A

(U) **Schedule Profile**:

Plan	Milestones
Sep 94	Completed development of 1280 x 1024 pixel 1-inch displays.
Dec 94	Completed development of head mounted mechanical configuration with optics and initiate modification of hand-held laser rangefinder.
Nov 94	Initiated super high-resolution display development.
Dec 94	Demonstrated CVC HMD.
Jun 95	Demonstrate "eyeglass-like" displays.
Nov 96	Demonstrate modification of hand-held laser rangefinder.

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APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 3 Advanced Development	R-1 ITEM NOMENCLATURE Advanced Electronics Technologies, PE 0603739E

COST *(In Thousands)*	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	Cost to Complete	Total Cost
MAFET MT-06	0	22,253	50,741	52,921	54,981	55,201	62,467	68,012	Continuing	Continuing

(U) **Mission Description**: Microwave and millimeter-wave frequency technology for DoD electronic weapon systems is at a critical crossroads. Great progress has been made under the MIMIC program: many integrated circuits are available, chip costs are going down, and DoD weapon systems are benefiting. However, in many cases, chip and module costs are still a major impediment to fielding cost effective DoD weapon systems. Technology and infrastructure advances must be undertaken to sustain an effective defense capability and to maintain U.S. dominance in this critical technology area. The Microwave and Analog Front End Technology (MAFET) program will ruthlessly drive down non-recurring costs through improved computer aided design capabilities. It will provide urgently needed improvements in the performance and affordability of microwave and millimeter wave integrated circuits and modules. It will complement industry investments in related commercial technology. However, commercial microwave solid state technology does not have the performance characteristics to meet DoD weapon system needs. The MAFET program is the essential foundation for all DoD systems and programs making use of microwave/millimeter-wave solid state technology.

(U) The program will accomplish the following urgently needed tasks: (1) it will reduce design time and cost for every microwave system being developed or upgraded through an improved microwave/millimeter wave design environment. It will break the very expensive and time consuming current practice of design-build-test--redesign-rebuild-retest; (2) It will develop affordable, high performance sensors that must be available in order to field an effective defense. It will develop affordable products that allow troop protection from "friendly fire", that make possible more accurate weapon systems, that enhance the ability to "see" under all weather conditions, and that provide low power consumption, very portable, effective communication systems.

(U) MAFET will help to sustain the microwave and millimeter-wave industrial base that must be in place to meet DoD requirements. If MAFET is not undertaken, this base will shrink below minimum acceptable levels, effective defense will be at risk, and U.S. dominance of microwave and millimeter-wave technology will end.

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(U) **Program Accomplishments and Plans**:

(U) FY 1995 Program:

- Begin implementation of microwave/millimeter wave computer aided design environment that will reduce non-recurring chip/module/system costs by providing improved design, simulation, synthesis and cost analysis capabilities. This task includes enhancement of CAD tools specifically needed for microwave and millimeter wave circuit use (not digital circuit design tools which are different), tool set integration, effective use of performance and cost databases, needed circuit and module model development, and work on the needed Microwave Hardware Description Language (MHDL). ($11.8M)
- Develop advanced sensor technology including needed integrated circuit improvements in performance and yield, needed advanced material development (i.e., indium phosphide), improvement of related passive microwave and millimeter-wave components, development of needed interconnection approaches, improved packing (particularly at millimeter-wave frequencies), and improvements of test and assembly methodologies. ($10.5M)

(U) FY 1996 Program:

- Continue microwave/millimeter-wave computer aided design environment development with quantitative demonstration of ability to reduce time and cost of producing microwave/millimeter-wave products; continue development and implementation of MHDL. ($18.6M)
- Continue development of advanced sensor technology with demonstrations of improved performance coupled with cost savings. ($24.1M)
- Select most appropriate system application areas and begin benchmarking demonstration tasks that will allow quantitative assessment of sub-system and system performance improvements and cost savings resulting from MAFET activities. ($8.0M)

(U) FY 1997 Program:

- Continue microwave/millimeter-wave computer aided design environment development with implementation of advanced microwave/millimeter-wave CAD tools and integrated tool sets and implementation of improved models and cost analysis tools; conduct assessment and demonstration of design environment effectiveness through quantitative assessment of benchmarking metrics; continue development and implementation of MHDL. ($15.3M)
- Continue development of advanced sensor technology with demonstrations of improved performance coupled with cost savings. ($23.5M)

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- Provide quantitative demonstrations of performance improvements and cost savings achieved through MAFET program activities for selected, critical system applications. ($14.1M)

(U) **Program Change Summary**: *(In Millions)*

	FY 1994	FY 1995	FY 1996	FY 1997
President's Budget	0	24.5	54.5	68.3
Appropriated	0	23.2	N/A	N/A
Current Budget	0	22.3	50.7	52.9

(U) **Change Summary Explanation**:

FY 1995-97 Reduction due to minor program repricing.

(U) **Other Program Funding Summary Cost**: N/A

(U) **Schedule Profile**:

Plan	Milestones
Nov 94	Initiated first RFP or BAA for MAFET development contracts.
May 95	Award first MAFET development contracts.
Nov 95	Initiate additional RFP or BAA for MAFET development contracts.
May 96	Award second MAFET development contracts.
Dec 96	Demonstrate enhanced mm-wave frequency integrated circuits. Demonstrate extensions of design, fabrication, testing and assembly capabilities.
Mar 97	Demonstrate efficient, low cost, manufacturing and assembly approaches for highly integrated microwave circuit and module assemblies.

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DATE: February 1995

APPROPRIATION/BUDGET ACTIVITY: RDT&E, Defensewide
BA 3 Advanced Development

R-1 ITEM NOMENCLATURE: Advanced Electronics Technologies, PE 0603739E

COST *(In Millions)*	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	Cost to Complete	Total Cost
Centers of Excellence MT-07	23,837	38,377	23,642	19,936	10,000	10,000	5,000	5,000	Continuing	Continuing

(U) **Mission Description**: This project provides funding for Centers of Excellence including the Robert C. Byrd Institute for Advanced Manufacturing at Marshall University and the Focus: Hope National Center for Advanced Technologies (NCAT). The purpose of these Centers is to demonstrate, deploy and provide advanced manufacturing technology to significantly reduce unit production and life cycle costs, improve product quality, and deploy manufacturing training systems.

(U) The Institute for Advanced Flexible Manufacturing provides both a teaching factory and initiatives to local area industries to utilize computer-integrated manufacturing technologies and managerial techniques to improve productivity and competitiveness. The National Center for Advanced Technology (NCAT) is a component of the Focus: Hope Project whose purpose is to train technicians/engineers in advanced manufacturing processes and methods, demonstrate state-of-the-art flexible manufacturing and serve as a testbed for emerging manufacturing research.

(U) This project also includes funding for the U.S.-Japan Management Training Program whose purpose is to build a growing infrastructure of American scientists and engineers with knowledge about the Japanese R&D enterprise and providing training in the Japanese language.

(U) **Program Accomplishments and Plans**:

(U) FY 1994 Accomplishments:

- Developed contracts, determined manufacturing requirements, purchased the install manufacturing equipment and entered production for the 4th through 7th of the eleven planned manufacturing neighborhoods at National Center for Advanced Technologies (NCAT) increasing overall defense production rates to 10,000 parts per month. ($19.8M)
- Institute for Advanced Flexible Manufacturing. Continued the ongoing technology development, technology evaluation and technology transfer to local business. Provided system integration, supported CALS commercialization, client assistance for federal contracts, technology training through seminars and workshops, and research into dual-use flexible manufacturing. ($4.0M)

(U) FY 1995 Program:

- Complete the installation of the planned manufacturing neighborhoods at NCAT. ($14.4M)
- Continue the on-going technology development at Institute for Advanced Flexible Manufacturing which includes technology evaluation, research into dual-use flexible manufacturing and technology transfer to local business. ($4.0M)
- Establish a Regional Consortium for Advanced Education and Training Technologies which will provide for the development of computer software education and training technologies required to further adult training in advanced technology jobs critical to the defense industry. It will also focus on the retraining of defense personnel for industry jobs. ($10.0M)
- Create eleven centers of excellence to support students, researchers, and executives to understand Japan's manufacturing infrastructure, culture and language. ($10.0M)

(U) FY 1996 Program:

- Develop, demonstrate and evaluate new technologies for insertion and transfer to manufacturing centers and industry, with a focus on small to medium manufacturing companies. ($7.0M)
- Develop software to integrate 3D computer model with numerically controlled machine tools, and demonstrate its production capability. ($4.0M)
- Demonstrate an electronic (digital) library in the context of education and training of machinists. ($3.0M)
- Continue to support the centers of excellence to train students and professionals to understand Japan's manufacturing infrastructure, culture and language. ($9.6M)

(U) FY 1997 Program:

- Continue the development, demonstration and evaluation of new technologies for insertion and transfer to manufacturing centers and industry, with a focus on small to medium manufacturing companies. ($5.0M)
- Integrate all the manufacturing stations to demonstrate the ability to accept an order, automatically generate machining plans, automatically create a schedule for the machines, and execute the plans on the machines to create the desired component. ($5.0M)
- Continue to support the centers of excellence to train students and professionals to understand Japan's manufacturing infrastructure, culture and language. ($9.9M)

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DATE: February 1995

APPROPRIATION/BUDGET ACTIVITY
RDT&E, Defensewide
BA 3 Advanced Development

R-1 ITEM NOMENCLATURE
Advanced Electronics Technologies,
PE 0603739E, Project MT-07

(U) **Program Change Summary:** *(In Millions)*

	FY 1994	FY 1995	FY 1996	FY 1997
President's Budget	23.8	15.0	15.0	10.0
Appropriated	23.8	19.0	N/A	N/A
Current Budget	23.8	38.4	23.6	19.9

(U) **Change Summary Explanation:**

FY 1995-97 Net increase due to transfer of U.S.-Japan management training and funding TRP earmark.

(U) **Other Program Funding Summary Cost:** N/A

(U) **Schedule Profile:**

Plan	Milestones
Sep 94	Completed installation of the 4th through 7th manufacturing neighborhoods.
Sep 95	Complete installation of the manufacturing neighborhoods.
	Complete Center for Computing Excellence at the Greater Philadelphia Consortium.
Sep 96	Develop, demonstrate and evaluate technology insertion and technology transferred to medium and small manufacturing companies.
Mar 97	Evaluate impact of program on small to medium manufacturing times.
Nov 97	Complete transition of manufacturing technology.

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COST *(In Thousands)*	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	Cost to Complete	Total Cost
Manufacturing Technology Applications MT-08	7,186	54,738	78,942	91,248	89,905	70,000	55,000	70,000	Continuing	Continuing

(U) **Mission Description**: Future military systems will be affordable only if the manufacturing process is considered as an integral part of product design, production takes place in flexible, multi-product factories, and if advanced manufacturing technology is combined effectively with advanced business practices. This program focuses on demonstrations of process technology combined with innovative industrial practices, and will measure the improvements in cost, schedule and quality achievable in key defense product areas. Three major initiatives are included in the FY 1995-1998 program: Affordable Multi-Missile Manufacturing (AM3); and Agile Manufacturing Pilot Programs; and Interferometric Fiber Optic Gyroscopes (IFOG).

(U) The Affordable Multi-Missile Manufacturing (AM3) program is an Advanced Technology Demonstration initiated in FY 1995. This program was formerly called Flexible Design and Assembly in the Missile Manufacturing Sector (FDAMMS). The AM3 objective is to demonstrate the feasibility of 25-50% reductions in the unit cost of tactical missiles, both in ongoing missile production programs and in new missiles and major modifications. This will be accomplished by teams of missile prime contractors, component suppliers and manufacturing equipment and software vendors who develop and demonstrate the combined effects of advanced manufacturing and assembly systems and processes, missile value engineering changes, and acquisition reform and business practice innovations. A major technical theme is to achieve economies across a mix of missiles to compensate for the decline in individual missile quantities. Demonstrations will be conducted in the design and manufacture of components and guidance and control/seeker assemblies for multiple missiles, including R&D and production programs. Phase 1 (FY95-96) is detailed design of the factories and enterprise processes and missile design concepts, in several parallel contracts. Phase 2 (FY96-97) is demonstration in component level manufacturing. Phase 3 is downselection to two pilot manufacturing enterprises, cost shared implementation of concepts, and missile-level demonstrations. DoD missile program managers will be involved throughout the AM3 program so that successful results can be rapidly inserted to reduce the cost of DoD's portfolio of tactical missiles.

(U) Agile Manufacturing is an industry-developed vision for 21st century manufacturing, which focuses on the ability to thrive in an environment of changing product technologies, customer demands, and development and production team members. This new paradigm is ideally suited to the needs of defense manufacturing in the future. Agile Manufacturing Pilot Programs are structured to evaluate the manufacturing enterprise concepts and enabling

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technology required for agility on and above the factory floor. Since over 50% of the cost of weapon systems is attributable to components from lower tier suppliers, the major emphasis is on tightly integrating the supplier chain and other elements of the manufacturing enterprise. Pilot programs include enabling technology demonstrations, which focus on networks, decision support and enterprise command and control; advanced business practice demonstrations, which focus on the ability to form instant partnerships, link core competencies, and respond rapidly to customer needs; and integrated pilots, which are cost-shared demonstrations which combine flexible shop floor and enterprise level technologies with advanced practices to demonstrate new benchmarks for cost, time and quality in key product areas of importance to DoD. Continued refinement of Agile Manufacturing concepts, integration of demonstration results, and dissemination to a broad industry community is accomplished through a cost-shared Agile Manufacturing Industry Forum.

(U) Interferometric Fiber Optic Gyroscopes (IFOG) are emerging as preferred technology for future commercial inertial navigation applications. The IFOG Manufacturability Program emphasis will be on achieving the design and manufacturing flexibility required to make low volume Defense access to high volume commercial production economically viable. This program will develop the large throughput robotic assembly, packaging and testing technologies necessary to fabricate miniature navigation-grade (1 nm/hr) IFOG inertial measurement units (IMUs) at less than $1,500 per axis as a goal. Miniature navigation-grade IMUs are essential to precision strike weapon systems required to accurately navigate through extended periods of Global Positioning System (GPS) outage due to enemy jamming. Example technology development areas include: (1) low loss, low reflectivity, polarization-preserving optical connectors between optical fiber subassemblies, and optical sources, detectors and miniature integrated optical circuits (MIOCs); (2) rapid, precision coil winding machines; (3) geometrically stable, environmentally robust (temperature and vibration) packaging of critical optical subassemblies; (4) large volume MIOC foundry processes; and (5) automatic testing machines. Phase 1 will identify IFOG manufacturing process requirements for components, subassemblies and complete IFOG units. Phase 2 will demonstrate advanced manufacturing methods and equipment for environmentally robust, optically stable IFOG component and subassembly packaging facilities; for rapid, precision coil winding machinery; for large batch processing Multifunction Integrated Optical Circuit foundry; and for automatic test equipment. Refined manufacturing processes and controls for complete brassboard IFOG units will be implemented. Phase 3 establishes and demonstrates a prototype automated, flexible IFOG manufacturing facility, transitioning the manufacturing processes and control from Phase 2. This flexible production line will produce navigation grade (0.01 degree/hr) and tactical grade (0.1 - 1 degree/hr) IFOGs for military uses, as well as lower performing (> degree/hr), lower cost IFOGs for commercial use.

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(U) **Program Accomplishments and Plans**:

(U) FY 1994 Accomplishments:

- Demonstrated a networked infrastructure linking computer-aided design, engineering, and analysis with manufacturing systems. ($7.2M)
- Completed source selection for an industry forum activity to continue development and refinement of the Agile Manufacturing vision (joint program with National Science Foundation).

(U) FY 1995 Program:

- Competitive awards for Phase 1 of AM3. Begin detailed functional design of the multi-missile enterprise, including definition of enabling tools and technology to be demonstrated in Phase 2, layout of the factories, definition of key organization interfaces and business practice improvements, and definition of proposed changes in missile design. ($10.0M)
- Initiate AM3 cost analysis and benefits measurement process, including predicted metrics for the enterprise, comparison to relevant benchmarks from military and commercial firms, assessment of impact on the target missile mix, and development of the validation plan for Phases 2 and 3. ($4.2M)
- Competitive awards for Agile Manufacturing Enabling Technology Demonstrations of decision support, enterprise command and control, and flexible shop floor control. ($7.0M)
- Competitive awards for Agile Manufacturing Advanced Business Process Demonstrations of activity based cost systems, agile workforce management systems, supplier chain management integration, and contracting approaches for instant partnerships. ($7.0M)
- Competitive awards for Agile Manufacturing Pilot Programs and enterprise level demonstrations of technology and business practices in space launch vehicle manufacturing and in supplier chains for large metal castings. ($10.0M)
- Continue Agile Manufacturing industry forum activities to develop technical underpinnings and supporting data for agility concepts, education and tech transfer, and integration of demonstration results into an agility tool kit. ($6.0M)
- Define advanced manufacturing processes for Interferometric Fiber Optic Gyroscopes (IFOG) components and subassemblies. ($5.2M)
- Define advanced architectures and manufacturing processes for IFOG units. ($5.3M)

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(U) FY 1996 Program:

- Complete AM3 Phase 1, approve validation plans, and initiate Phase 2 demonstrations to assess and mitigate risks, including simulation and modeling, design and component-level manufacturing demonstrations, and qualification testing. ($15.1M)
- Competitive awards to research labs, universities and manufacturing system vendors for development of technology to fill gaps identified in AM3 Phase 1. ($15.0M)
- Complete Agile Manufacturing business practice demonstrations and documentation, insert results in Pilot Program testbeds, and disseminate results for DoD and industry implementation. ($5.0M)
- Complete Agile Manufacturing enabling technology demonstrations, initiate beta test in Pilot Programs, and transfer technology through the Industry Forum and through vendor products. ($5.0M)
- Continue Agile Manufacturing pilots in space launch vehicles and castings, and competitively award additional pilot in electronics manufacturing. ($13.0M)
- Continue Agile Manufacturing industry forum activities, including delivery of first version of agility toolkit. ($5.0M)
- Develop and implement manufacturing processes for coil winding and optical components/subassemblies. ($8.3M)
- Complete Interferometric Fiber Optic Gyroscopes (IFOG) architectures and begin to develop and implement manufacturing processes. ($12.5M)

(U) FY 1997 Program:

- Complete AM3 Phase 2 component-level validation demonstrations. ($19.9M)
- Downselect to two pilot enterprises for AM3 Phase 3, and initiate cost-shared implementation and demonstration of concepts and technology across the target missile mix. ($19.0M)
- Complete Agile Manufacturing pilots in space launch vehicles and metal castings, transfer results through the Industry Forum and through vendor products and network services. ($10.0M)
- Continue Agile Manufacturing pilot program in electronics and initiate a pilot in aircraft or engine manufacturing. ($15.0M)
- Complete Agile Manufacturing industry forum activities, transition to self-sustainment that does not require DoD funding. ($5.0M)
- Evaluate wind coils and packaged subassemblies. ($5.4M)
- Continue to implement brassboard IFOG unit manufacturing processes. ($12.4M)
- Initiate Phase 3 (e.g., procure long-lead items). ($4.5M)

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Advanced Electronics Technologies,
PE 0603739E, Project MT-08

(U) **Program Change Summary:** *(In Millions)*

	FY 1994	FY 1995	FY 1996	FY 1997
President's Budget	6.7	39.5	72.5	78.9
Appropriated	6.7	24.5	N/A	N/A
Current Budget	7.2	54.7	78.9	91.2

(U) **Change Summary Explanation:**

FY 1994 Increase reflects minor repricing.
FY 1995-97 Increase due to transfer of Agile Manufacturing into this program element.

(U) **Other Program Funding Summary Cost:** N/A

(U) **Schedule Profile:**

Plan	Milestones
Apr 95	Initiate Agile Manufacturing technology, business practice, and integrated pilot contracts.
May 95	Award Interferometric Fiber Optic Gyroscope (IFOG) manufacturability contracts.
Jun 95	Initiate AM3 Phase 1 contracts.
Jan 96	Define processes for assembling IFOG optical components (e.g. sources, detectors).
Feb 96	Establish IFOG unit architectures and baseline configurations.
Mar 96	Complete IFOG investigations of designs and methods for coil winding.
Apr 96	Approve validation plans and initiate AM3 Phase 2 contracts.
Sep 96	Complete Agile Manufacturing enabling technology and business practice demos.
Apr 97	Complete IFOG advanced coil winding machinery.
Jul 97	Demonstrate winding of coils with advanced coil winding machinery.
Jul 97	Complete AM3 Phase 2 demos, downselect to two contractors for Phase 3.
Aug 97	Demonstrate packaging of IFOG optical subassemblies.
Sep 97	Complete initial integrated pilots and transition Industry Forum to self-sustainment.
Nov 97	Demonstrate assembly of brassboard IFOG units.
Dec 99	Complete AM3 Phase 3 multi-missile manufacturing demos.

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COST (In Thousands)	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	Cost to Complete	Total Cost
Advanced Lithography MT-10	57,931	57,731	39,003	61,404	65,300	50,000	45,000	45,000	Continuing	Continuing

(U) **Mission Description**: Lithography technology has enabled the dramatic growth of integrated circuit (IC) capability over the past two decades. Advances in lithography are required to increase the speed and reliability of electronic and computing systems while decreasing their cost, power consumption and weight. Advanced microelectronics technology is essential for computing, data and signal processing, and communications in military systems, such as smart weapons, radar, electronic warfare, sensing, communications, command and control, and surveillance. Further improvements in areas such as target recognition, autonomous guided missiles and beam forming for sonar and radar require microcircuits with smaller features in order to meet the operational speed, power, weight and volume constraints of these systems.

(U) Current microelectronics fabrication utilizes 0.35 micron minimum feature sizes. This effort develops subsystems and systems to establish lithographic capability below 0.2 microns for late 1990s military systems. Because different lithography approaches will be used in future generations of semiconductor technology, this effort balances investment in competing approaches with a strong emphasis on the common cross-cutting techniques that will be required. Key developments include mask technology (electron-beam tools for pattern writing, mask fabrication demonstration, mask repair tools, and membranes), improved alignment and overlay techniques, metrology, systems development and integration utilizing various radiation sources (x-ray, electron-beam, ion-beam, and optics), and device demonstrations to establish viability of the developed systems.

(U) **Program Accomplishments and Plans**:

(U) FY 1994 Accomplishments:

- Improved cross-cutting technologies (mask, alignment) leading to 0.18 micron design rules, including demonstration of a 50KV e-beam mask writer. ($24.0M)
- Initiated efforts to migrate the 0.25 micron aligners to 0.18 micron capability. ($6.0M)
- Continued efforts in ion-beam, electron-beam, and advanced optical lithography, including characterization of the 193-nanometer exposure system. ($7.0M)
- Demonstrated 0.25 micron logic device fabrication with proximity x-ray and demonstrated pattern definition with improved projection x-ray system. ($15.9M)

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- Extended x-ray technology into other applications such as coronary applications. ($5.0M)

(U) FY 1995 Program:

- Develop mask technology including masks with feature sizes at 0.25 and 0.18 micron for proximity x-ray systems. ($20.0M)
- Develop exposure systems and processes for proximity x-ray systems. ($23.0M)
- Initiate program to develop mechanical alignment systems for deep ultra-violet exposure systems. ($7.7M)
- Demonstrate subsystems for 0.18 micron tools in ion-beam and electron-beam exposure systems. ($7.0M)

(U) FY 1996 Program:

- Deliver 0.18 micron feature size x-ray and 0.25 micron phase shift optical masks from mask shop. ($15.0M)
- Demonstrate prototype projection electron-beam and ion-beam lithography lenses. ($8.0M)
- Demonstrate processing using x-ray lithography for 0.25 and 0.18 micron. ($5.0M)
- Develop alignment sub-assemblies and sources for 0.12 micron lithography system. ($8.0M)
- Improve output of x-ray point sources. ($3.0M)

(U) FY 1997 Program:

- Demonstrate stage control for lithography tools with 0.12 micron capability. ($4.0M)
- Fabricate devices using soft x-ray reduction techniques. ($3.0M)
- Demonstrate breadboard (alpha) versions of an electron-beam or ion-beam projection lithography system. ($16.0M)
- Fabricate masks and devices with .18 micron design rules. ($14.0M)
- Initiate design and build of 0.12 stepper. ($10.0M)
- Improve e-beam writing, inspect, repair, and processing for 0.12 mask capability. ($14.4M)

(U) Program Change Summary: *(In Millions)*

	FY 1994	FY 1995	FY 1996	FY 1997
President's Budget	58.4	10.0	25.0	25.0
Appropriated	58.4	57.7	N/A	N/A
Current Budget	57.9	57.7	39.0	61.4

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APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 3 Advanced Development	R-1 ITEM NOMENCLATURE Advanced Electronics Technologies, PE 0603739E, Project MT-10

(U) **Change Summary Explanation**:

FY 1994 Reduction due to minor program repricing.
FY 1996-97 Increase due to reprioritization of DoD resources.

(U) **Other Program Funding Summary Cost**: N/A

(U) **Schedule Profile**:

Plan	Milestones
Dec 95	Demonstrate a "nanowriter" electron-beam tool for writing features at 50 nanometers.
Mar 96	Deliver prototype x-ray masks with 0.18 µm features.
Jun 96	Demonstrate mask repair tool for masks with 0.15 micron features.
Jul 96	Demonstrate source for Extreme Ultra Violet (EUV) (13.5 nm) lithography.
Sep 96	Fabricate devices with 0.18 micron features.
Dec 96	Demonstrate x-ray source suitable for x-ray prototype tool for 0.18 µm features.
Jan 97	Deliver mask writer for writing 0.18 µm features.
Mar 97	Demonstrate stage control to 10 nm, suitable for 0.12 micron lithography tools.
Apr 97	Demonstrate breadboard (alpha) version of electron-beam lithography system.
Sep 97	Fabricate devices using EUV lithography.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: February 1995

APPROPRIATION/BUDGET ACTIVITY	R-1 ITEM NOMENCLATURE
RDT&E, Defensewide BA 3 Advanced Development	Advanced Electronics Technologies, PE 0603739E

COST (In Thousands)	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	Cost to Complete	Total Cost
CALS / Electronic Commerce Resource Centers MT-11	43,000	38,340	34,247	20,604	15,000	0	0	0	0	151,191

(U) **Mission Description**: The mission of this program is the transfer of electronic commerce (EC) technologies to small- and medium-size enterprises (SMEs) through a network of regional deployment centers. This mission is a subset of the overall DoD plans for Continuous Acquisition and Life-cycle Support (CALS) and for electronic commerce as part of Acquisition Reform. To reflect the focus on that subset, the program name was changed in CY 1994 from CALS Shared Resource Centers to Electronic Commerce Resource Centers (ECRCs). In transferring EC technologies to SME's, the ECRC technical vision is that manufacturing companies will move down a path of increasing EC capability that ranges from linking suppliers with customers, via electronic data interchange, to the establishment of virtual enterprises. An ECRC technology hub has been established to keep abreast of EC technologies and to ensure that technical consultants in the regional ECRCs are equipped with the latest information and training on EC technologies.

(U) **Program Accomplishments and Plans**:

(U) FY 1994 Accomplishments:
- Cognizance for the CALS Shared Resource Centers (CSRC) program transferred from Air Force to ARPA. ($1.0M)
- Established agreements for continuation of existing centers. ($24.0M)
- Established three new Regional Satellites. ($9.0M)
- Established technology development hub. ($9.0M)

(U) FY 1995 Program:
- Reestablish Orange, TX ECRC under management of non-profit or educational institution (Congressional direction). ($2.0M)
- Continue Regional ECRC activities; expand the depth of specialized ECRC expertise through technology demonstration projects; establish and execute a plan for support of the DoD Electronic Commerce in Contracting initiative; convene a series of DoD Prime/supplier chain forums and follow up with small- and medium-size suppliers to implement electronic commerce transaction capabilities. ($23.3M)

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1995
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 2 Exploratory Development	R-1 ITEM NOMENCLATURE Advanced Electronics Technologies, PE 0603739E, Project MT-11

- Conduct technology hub operations with initiatives for Electronic Commerce Testbed and for advances in tools needed for development of Standard for Exchange of Product Data (STEP) application protocols. ($7.0M)
- Competitive awards to Electronics Commerence Resource Centers (ECRC)/university/business teams for near-term innovations in electronics commerce practices. ($6.0M)

(U) FY 1996 Program:

- Demonstrate value to small- and medsize enterprizes (SMEs) and DoD activities through continued operation of ECRCs and their education, training, and technical support services. ($22.2M)
- Continue Technology Hub operations with initiatives for Electronic Commerce Testbed, and for advances in tools needed for development of STEP applications. ($6.0M)
- Competitive awards to ECRC/university/business teams for near-term innovations in electronics commerce practices. ($6.0M)

(U) FY 1997 Program:

- Continue Technology Hub functions under contractor winning full and open competition. ($3.0M)
- Operate network of ECRCs under management of team winning competition; provide education, training, and technical support to SMEs in the supplier chains of DoD and DoD primes. ($17.6M)

(U) Program Change Summary: *(In Millions)*

	FY 1994	FY 1995	FY 1996	FY 1997
President's Budget	43.0	40.0	20.0	15.0
Appropriated	43.0	38.3	N/A	N/A
Current Budget	43.0	38.3	34.2	20.6

(U) Change Summary Explanation:

FY 1996-97 Adjustments reflect increase due to repricing and continuation at prior year level of effort.

(U) Other Program Funding Summary Cost: N/A

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1995
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 2 Exploratory Development	R-1 ITEM NOMENCLATURE Advanced Electronics Technologies, PE 0603739E, Project MT-11

(U) **Schedule Profile**:

Plan	Milestones
Feb 94	Transferred CALS Shared Resource Centers (CSRC) program from Air Force to ARPA.
Jun 94	Established agreements for continuation of existing centers.
Sep 94	Established three new CSRC Regional Satellites.
Sep 95	Complete initial demonstrations, show feasibility of non-Federal cost share.
Sep 96	Demonstrate value of networked access to ECRC services; implement mechanisms for non-Federal cost sharing.
Sep 97	Transition Electronic commerence Resources Centers (ECRC) retail deployment activities to manufacturing extension program beyond RDT&E.
Sep 98	Transition ECRC activities to manufacturing extension program beyond RDT&E.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: February 1995

APPROPRIATION/BUDGET ACTIVITY
RDT&E, Defensewide
BA 3 Advanced Development

R-1 ITEM NOMENCLATURE
Advanced Simulation, National Guard
PE 0603744E

COST (In Thousands)	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	Cost to Complete	Total Cost
Advanced Simulation (National Guard) SM-01	27,107	29,537	5,799	14,614	20,000	15,000	15,000	18,000	Continuing	Continuing

(U) **Mission Description**: In FY 1992, Congress appropriated funds to initiate a program to apply advanced technology to the training of National Guard Roundout Brigades. This program was initiated to respond to issues that developed in the 1991 Desert Shield/Desert Storm mobilization and is now a part of the Synthetic Theater of War Advanced Concept Technology Demonstration.

(U) The program goal is to achieve a significant improvement in training effectiveness required for reserve component maneuver force mobilization through the use of advanced distributed information technologies and innovative training strategies at a lower cost than current active component methods for conducting the same training. The intent is to develop and integrate technologies that enable National Guard soldiers to conduct sophisticated training either at the local community armory, or at the soldier's home. The program will capitalize on existing commercial technologies where feasible, and develop technologies where needed with dual-use potential.

(U) **Program Accomplishments and Plans**:

(U) FY 1994 Accomplishments:
- Connected two test brigades to the Defense Simulation Internet (DSI). ($1.2M)
- Continued development of reconfigurable ground simulator. ($4.0M)
- Conducted field trials of brassboard location instrumentation and intervehicular communications technology. Executed partial Phase II effort to develop and test prototypes in unit testbeds. ($4.3M)
- Continued development of desktop equipment simulators and advanced technology distributed training capabilities. Priorities are on the maneuver battalion staff, forward support battalion staff, critical vocational skills of support personnel, brigade staff and small unit leaders. ($4.6M)
- Initiated connection of armories in the State of Iowa to the statewide fiberoptic network. ($10.0M)
- Intensified development of measures of performance and program evaluation research. ($3.0M)

(U) FY 1995 Program:
- Establish two test brigades on the Defense Simulation Internet (DSI). ($1.5M)
- Complete final functionality test of reconfigurable ground simulator. ($8.0M)

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1995
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 3 Advanced Development	R-1 ITEM NOMENCLATURE Advanced Simulation, National Guard PE 0603744E, Project SM-01

- Complete development and assessment of location instrumentation and intervehicular communications technology. ($5.5M)
- Continue development of desktop simulators and advanced technology distributed training capabilities and delivery technologies. ($11.1M)
- Continue development of measures of performance and conduct program evaluation research. ($3.4M)

(U) FY 1996 Program:

- Evaluate the operation of one test brigade on the Defense Simulation Internet (DSI). ($.5M)
- Continue modification and development of training programs and assessment prototypes. ($.8M)
- Continue development of desktop simulators and advanced technology research in distance learning and distributed training technologies. ($1.7M)
- Continue development of innovative program evaluation research technologies and methods. ($2.8M)

(U) FY 1997 Program:

- Evaluate the interaction of two test brigades on the Defense Simulation Internet (DSI). ($1.5M)
- Complete development of innovative training programs and delivery assessment technologies. ($4.1M)
- Complete development of reconfigurable desktop simulators. ($1.9M)
- Complete development of high performance distributed training systems. ($3.5M)
- Complete development of measures of performance and conduct program evaluation research. ($3.6M)

(U) **Program Change Summary**: *(In Millions)*

	FY 1994	FY 1995	FY 1996	FY 1997
President's Budget	27.1	20.9	20.9	14.7
Appropriated	27.1	29.5	N/A	N/A
Current Budget	27.1	29.5	5.8	14.6

(U) **Change Summary Explanation**:

FY 1996 Funding reduced to reflect realignment of priorities.
FY 1997 Reduction reflects minor program repricing.

(U) **Other Program Funding Summary Cost**: N/A

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1995
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 3 Advanced Development	R-1 ITEM NOMENCLATURE Advanced Simulation, National Guard PE 0603744E, Project SM-01

(U) **Schedule Profile**:

Plan	Milestones
May 94	Installed JANUS Brigade/Battalion Local Area networks.
Jul 94	Initiated Iowa armory connections to Iowa Fiberoptic Network.
Dec 94	Demonstrated proof-of-concept reconfigurable simulator.
Feb 95	Begin field trials of assessment tools.
Mar 95	Deliver enhanced virtual reality equipment simulators.
Mar 95	Verification and validation of initial reconfigurable full-crew simulators.
Apr 95	Establish and test DSI nodes for the two experimental brigades.
May 95	Evaluate ARPA-JANUS Wide Area Network Brigade Simulation technology.
May 95	Test Pen-operated Command and Control systems at experimental Brigades.
Jun 95	Test multi-media learning technologies for Staff Officer Training Systems.
Jul 95	Field initial Deployable Force-on-Force Instrumentation System.
Jul 95	Deliver draft assessment measures and plan.
Aug 95	Beta-test Brigade simulation scenarios.
Sep 95	Deliver prototype digital library.
Oct 95	Test MOS-specific distance learning technology.
Feb 96	Field Phase II Desktop Gunnery Systems.
Mar 96	Field final Deployable Instrumented Range System.
Aug 96	Evaluate performance of first experimental brigade at the National Training Center (NTC).
Sep 96	Demonstrate initial links to the Synthetic Theater of War (STOW).
Aug 97	Evaluate performance of second experimental brigade at the NTC.
Dec 97	Deliver completed program assessment and final report.

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RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1995
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 3 Advanced Development	R-1 ITEM NOMENCLATURE Semiconductor Manufacturing Technology, PE 0603745E

COST *(In Thousands)*	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	Cost to Complete	Total Cost
SEMATECH EM-01	89,000	89,227	89,554	0	0	0	0	0	0	N/A

(U) **Mission Description**: This project supports SEMATECH, a pre-competitive industrial consortium that addresses the long-term semiconductor manufacturing requirements for military applications. The goal of SEMATECH is to continue reducing costs while maintaining the state-of-the-art in complexity and performance for silicon technologies. It concentrates on future factory design and process definition and control efforts for flexible manufacturing of both low- and high-volume devices in the same factory. Environmentally conscious manufacturing, and safety and health of manufacturing personnel are also part of this effort. This project will combine advances in physical equipment with software advances, i.e., fully computer-integrated manufacturing (CIM) systems, and modeling and simulation tools for designing processes, tools, and factories. SEMATECH comprises the companies that supply the majority of the integrated circuits used in defense systems, and it has a proven track record of working with equipment suppliers effectively. FY 1996 is the final year of direct government funding.

(U) **Program Accomplishments and Plans**:

(U) FY 1994 Accomplishments:
- Completed 0.25 micron semiconductor manufacturing technology process definition. ($62.5M)
- Initiated projects for 0.18 micron semiconductor manufacturing technology process definition. ($3.5M)
- Established integrated environmental, safety, and health (ESH) objectives in all technical programs. ($19.0M)
- Executed a critical materials program investigating next generation substrate technologies. ($2.0M)
- Developed a productivity goal methodology, completing the analysis of three process flows from silicon-start through final packaging, ensuring continued improvement in overall capital productivity. ($0.5M)
- Initiated projects to place greater emphasis on back-end processes, such as packaging and test. ($1.5M)

(U) FY 1995 Program:
- Demonstrate full flow 0.25 micron pilot line-capable manufacturing technology. ($15.0M)
- Complete development of key equipments and unit processes to enable 0.25 micron semiconductor manufacturing. ($49.2M)

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1995
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 3 Advanced Development	R-1 ITEM NOMENCLATURE Semiconductor Manufacturing Technology, PE 0603745E, Project EM-01

- Develop software tools and models that assist in the design of processes and equipment based on first-principles of physics. ($8.0M)
- Plan and begin technology development projects for 0.18 micron feature size generations. ($5.0M)
- Optimize materials, processes, and equipment for low contaminant, robust manufacturing. ($1.0M)
- Initiate projects to reduce the sensitivity of manufacturing cost to production volume. ($1.0M)
- Initiate projects in generic design tools that support advanced capabilities. ($1.0M)
- Demonstrate improved manufacturing tools and methods with enhanced Environmentally Safety Health (ESH) performance. ($9.0M)

(U) FY 1996 Program:

- Investigate mainstream process flows for 0.18 micron technology. ($27.0M)
- Initiate a subset of key improvement projects for critical manufacturing tools needed for 0.18 micron capabilities. ($42.6M)
- Complete integration of a software tool suite that supports rapid prototyping of advanced designs. ($5.0M)
- Optimize micro- and mini-environments for contamination-free manufacturing. ($6.0M)
- Demonstrate improved manufacturing tools and methods with enhanced ESH performance. ($9.0M)

(U) **Program Change Summary**: *(In Millions)*

	FY 1994	FY 1995	FY 1996	FY 1997
President's Budget	89.5	90.0	90.0	90.0
Appropriated	89.5	89.2	N/A	N/A
Current Budget	89.0	89.2	89.6	0

(U) **Change Summary Explanation**:

FY 1994-96 Reduction due to minor program repricing.
FY 1997 SEMATECH announced that the semiconductor industries' accomplishments of the last few years, now permit the member companies to plan for assuming full responsibility for SEMATECH's operational funding beginning in FY 1997.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1995
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 3 Advanced Development	R-1 ITEM NOMENCLATURE Semiconductor Manufacturing Technology, PE 0603745E, Project EM-01

(U) **Other Program Funding Summary Cost**: N/A

(U) **Schedule Profile**:

Plan	Milestones
Dec 94	Transfer key unit processes and generic manufacturing methods for integration into production facilities for 0.35 micron manufacturing.
Nov 95	Demonstrate generic design tools that support first-pass success and reduced design cycle times.
Dec 95	Complete full-flow 0.25 micron process technology development projects and transfer technology to member companies.
Mar 96	Transfer software tool suites that support reduced development cycle times.
Jun 96	Demonstrate operation of key elements of a fully integrated advanced manufacturing system enabling maximum flexibility and rapid response to process modifications.

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RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1995
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 3 Advanced Development	R-1 ITEM NOMENCLATURE Maritime Technology, PE 0603746E

COST (In Thousands)	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	Cost to Complete	Total Cost
Shipbuilding Technology MR-01	38,750	52,000	49,657	49,708	50,000	0	0	0	0	240,115

(U) **Mission Description**: The shipbuilding technology program is designed to preserve the shipbuilding segment of the defense industrial infrastructure by improving competitiveness of the U.S. Shipbuilding industry through advanced technology applications. For the Defense Department, a competitive shipbuilding industry will optimize Navy ship acquisition reform and facilitate the Department's objective for affordable Navy ships. The goal of the DoD Acquisition Reform program is to take advantage of the best commercial practices of industry and thereby achieve cost reductions of the ships and systems it purchases. The government's attempt at acquisition reform as it applies to ship acquisition could fall short, however, if U.S. shipyards are not commercially competitive. Having operated exclusively in a protected domestic market, the U.S. shipbuilding industry has not implemented the best commercial processes necessary to compete in the international arena or to build affordable Navy ships. The key for acquisition reform to be fully successful for the U.S. shipbuilding industry is for industry to attain global commercial competitiveness, the goal of this program.

(U) The shipbuilding technology program is a two phased effort that will provide products and infrastructure for both the near and long term. The near term effort will enhance the international competitiveness of the shipbuilding industry through identification and development of competitive build strategies that could be implemented in U.S. shipyards in the next 2-3 years, and the development of a portfolio of U.S. ship designs for the international marketplace. This effort will be enhanced by developing an infrastructure that can help the industry to achieve international competitiveness. Infrastructure enhancements include the implementation of electronic communications and commerce throughout the industry, and by participating in an industry-wide forum for interaction and problem solving on a technical level.

(U) The long term effort will include the infusion of innovative product technologies and process improvements that will bring the capabilities of the U.S. shipbuilding industry above those of foreign shipyards. This will allow us to capture a larger share of the international market and will result in a self-sustaining highly efficient U.S. shipbuilding industry.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1995
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 3 Advanced Development	R-1 ITEM NOMENCLATURE Maritime Technology, PE 0603746E, Project MR-01

(U) **Program Accomplishments and Plans:**

(U) FY 1994 Accomplishments:

- Commenced development and implementation of globally competitive ship building strategies among 15 shipyards and the development of 20 affordable U.S. ship designs. ($26.4M)
- Initiated cooperative shipbuilding process projects addressing welding, surface preparation and coating, environmental compliance, design/production integration, industrial engineering, human resource innovation and education and training. ($3.2M)
- Initiated Phase I of a DoD National Shipbuilding Communication Network (NSnet). ($.2M)
- Commenced a National Maritime Technology Needs Study by the National Research Council's Marine board. ($.2M)
- The following activities were funded by Congressional additions to the FY 1994 President's Budget.
- Developed requirements and technology needed to demonstrate an advanced integrated hybrid propulsion system. ($3.7M)
- Developed Distributed Simulation of Ship Self-Defense. ($1.7M)
- Specified Hypervelocity Interceptor Technology. ($2.0M)
- Modeled Over-the-Horizon (OTH)/Early Detection Technology. ($.8M)
- Investigated Human Computer Interactions for Scene Understanding. ($.5M)

(U) FY 1995 Program:

- Complete development of advanced shipbuilding strategies and affordable designs commenced in FY 1994. ($13.3M)
- Initiate additional shipbuilding process/build strategy development initiative. ($12.2M)
- Initiate advanced technology development initiatives to improve ship production processes and/or ship/shipboard systems operations. ($13.2M)
- Initiate Phase II of NSnet's infrastructure development. ($.5M)
- Complete National Maritime Technology Needs study. ($.1M)
- Initiate study to determine how best to integrate competitive commercial practices for affordable Naval ship construction. ($.2M)
- Advanced shipbuilding capabilities demonstration. ($.5M)
- Demonstrate distributed simulation of ship self defense. ($3.0M)
- Develop Hypervelocity Interceptor Technology. ($6.8M)

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1995
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 3 Advanced Development	R-1 ITEM NOMENCLATURE Maritime Technology, PE 0603746E, Project MR-01

- Develop Over-the-Horizon (OTH)/Early Detection Technology. ($1.2M)
- Demonstrate Initial Human Computer Interaction Suite for Scene Understanding. ($1.0M)

(U) FY 1996 Program:

- Complete all shipbuilding strategy development initiatives and new ship designs started in FY 1994 and FY 1995. ($18.4M)
- Complete advanced technology development initiatives. ($11.0M)
- Initiate additional advanced technology developments for improving ship production processes and products. ($18.0M)
- Establish a National Shipbuilding Consortium. ($1.2M)
- Support international awareness of U.S. shipbuilding programs and capabilities. ($.5M)
- Continue to improve and expand NSnet. ($.6M)

(U) FY 1997 Program:

- Initiate additional advanced technology developments for improving ship production processes and products. ($19.0M)
- Complete advanced ship production technology developments and initiate new starts. ($15.0M)
- Complete advanced technology developments for competitive ship operations and initiate new starts. ($14.0M)
- Continue to improve and provide support for NSnet. ($.7M)
- Support National Shipbuilding Consortium. ($1.0M)

(U) **Program Change Summary**: *(In Millions)*

	FY 1994	FY 1995	FY 1996	FY 1997
President's Budget	38.8	40.0*	50.0	50.0
Appropriated	38.8	52.0	N/A	N/A
Current Budget	38.8	52.0	49.7	49.7

*Requested in PE 0603570E.

(U) **Change Summary Explanation**:

FY 1996-97 Minor program repricing.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1995
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 3 Advanced Development	R-1 ITEM NOMENCLATURE Maritime Technology, PE 0603746E, Project MR-01

(U) **Other Program Funding Summary Cost**: N/A

(U) **Schedule Profile**:

Plan	Milestones
Sep 94	Solicit via BAA, Shipbuilding Process & Product Improvement Technologies.
Sep 94	Solicit via BAA, competitive build strategies and new ship design concepts.
Jan 95	Establish NSnet presence on the Internet.
Mar 95	Select projects to be awarded from above listed BAA's.
May 95	Complete Awards of Projects selected for above BAA's.
Sep 95	Complete Live Fire Exercises with existing hypervelocity ship self-defense interceptors.
Sep 95	More than one U.S. shipyard successful in selling ships on international market.
Sep 95	Detect, track and intercept synthetic theatre ballistic missile and high altitude anti-ship cruise missile.
Jul 96	Complete program on environmentally friendly surface preparation and coating of ship surfaces.
Jul 96	Complete program on advanced ship welding technologies.
Sep 96	Form National Shipbuilding Consortium.
Jan 97	Complete program on robotic applications for shipbuilding programs.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1995
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 3 Advanced Development	R-1 ITEM NOMENCLATURE Joint Advanced Strike Technology, PE 0603800E

COST *(In Thousands)*	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	Cost to Complete	Total Cost
Joint Advanced Strike Technology JA-01	*(25,712)	**(35,428)	30,675	80,925	83,922	19,000	16,000	10,000	Continuing	Continuing

*Funded in EE-24, PE 0603226E in FY 1994.
**Funds transferred by Navy to continue FY 1994 program.

(U) **Mission Description**: The Joint Advanced Strike Technology (JAST) Program has been chartered to facilitate the evolution of fully validated affordable operational requirements and proven operational concepts, and to transition the key technologies to enable the successful development and production of affordable next generation strike aircraft weapon systems for the Navy, Marine Corps, Air Force, and our allies. The JAST Program is a joint program with no executive service. The Navy and Air Force each provide approximately equal shares of annual funding for the program beginning in FY 1995. The ARPA Advanced Short Take Off Vertical Landing (ASTOVL)/Conventional Take Off and Landing (CTOL) Common Affordable Lightweight Fighter (CALF) project (previously known as ASTOVL) was integrated with the JAST program by FY 1995 legislation. ARPA contributes funding for the JAST concept flight demonstration effort commencing in FY 1996 under this new program element. The US/UK international collaborative CALF Program conceived by ARPA was investigating a revolutionary approach for melding advanced technology, multi-service commonality, and improved business practices directed toward demonstrating an affordable, capable replacement for the F-16, F/A-18, and AV-8B. ARPA is bringing this insight and experience to bear in integrating the structure and philosophy of the CALF program within the JAST framework. The ARPA CALF program manager now is serving as the Director for STOVL issues and technologies within the JAST organization. This ensures that ARPA's expertise in ASTOVL technologies, streamlined acquisition, and rapid prototyping are brought to bear in the JAST technology demonstration program.

(U) **Program Accomplishments and Plans**:

(U) FY 1994 Accomplishments:

- Conducted small scale wind tunnel model testing and large scale propulsion model fabrication for the Shaft Coupled Lift Fan Concept. ($9.9M)
- Conducted small scale wind tunnel model testing and large scale propulsion model fabrication for the Gas Coupled Lift Fan Concept. ($9.8M)
- Performed direct lift concept design analysis and small scale component testing. ($6.0M)

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1995
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 3 Advanced Development	R-1 ITEM NOMENCLATURE Joint Advanced Strike Technology, PE 0603800E, Project JA-01

(U) FY 1995 Program:

- Initiate large scale wind tunnel testing and large scale propulsion system tests for the Shaft Coupled Lift Fan Concept. ($14.5M)
- Initiate large scale wind tunnel tests and large scale propulsion system tests for the Gas Coupled Lift Fan Concept. ($9.6M)
- Initiate large scale wind tunnel tests and large scale propulsion system tests for the Direct Lift Concept. ($8.3M)
- NASA Test Support. ($3.0M)

(U) FY 1996 Program:

- Complete critical technology validation program for the Direct Lift, Shaft and Gas Coupled Lift Fan Concepts. ($6.9M)
- Initiate Concept Flight Demonstration efforts. ($23.8M)

(U) FY 1997 Program:

- Continue Concept Flight Demonstration efforts. ($80.9M)

(U) **Program Change Summary**: *(In Millions)*

	FY 1994	FY 1995	FY 1996	FY 1997
President's Budget	25.7	20.0	1.9	0
Appropriated	25.7*	35.5**	N/A	N/A
Current Budget	25.7*	35.5**	30.7	80.9

*FY 1994 Funds in PE 0603226E.
**Funds appropriated to JAST on PE 0603800N.

(U) **Change Summary Explanation**:

FY 1995 Funding includes the Navy contribution to this joint effort.
FY 1996-97 Funds increase to finance flight demonstration.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1995
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 3 Advanced Development	R-1 ITEM NOMENCLATURE Joint Advanced Strike Technology, PE 0603800E, Project JA-01

(U) **Other Program Funding Summary Cost**: *(In Millions)*

	FY 1994	FY 1995	FY 1996	FY 1997
United Kingdom	12.0	0.00	0.00	0.00

	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001
PE 0603800F	0.06	83.8	151.2	199.8	304.3	413.6	197.0	73.5
PE 0603800N	29.6	98.3	149.3	199.3	292.4	409.3	196.9	73.6
PE 0603217N	11.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0

(U) **Related RDT&E**: PEs 0604800N & 0604800F: Milestone II for a joint follow-on engineering & manufacturing development (E&MD) program for the next generation strike fighter weapon systems(s) is planned in FY 2000. The follow-on aircraft weapon system(s) program will develop a family of aircraft from concepts proven under the JAST Program, incorporating affordable technologies transitioned from the JAST Program.

(U) **Schedule Profile**:

Planned	Milestones
May 95	Jet Induced Effects Model Testing Complete.
Jun 95	Propulsion System Component Testing Complete.
Jul 95	Commence Large Scale Propulsion Model Testing.
Jan 96	Large Scale Propulsion Model Testing Complete.
Mar 96	Critical Technology Validation Complete.
May 96	Begin Demonstrator Aircraft Design, Fabrication, and Flight Test.
Oct 97	Begin Demonstrator Engine Testing.

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RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1995
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defensewide BA 6 RDT&E Management Support	R-1 ITEM NOMENCLATURE Management Headquarters (R&D), PE 0605898E

COST *(In Thousands)*	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	Cost to Complete	Total Cost
Management Headquarters MH-01	27,580	30,218	32,643	33,881	34,814	35,808	36,308	36,987	Continuing	Continuing

(U) **Mission Description**: This program element is budgeted in the Management Support Budget Activity because it provides funding for the administrative support costs of the Advanced Research Projects Agency. This funding provides for the personnel compensation and benefits for civilians as well as costs for building rent, physical and information security, travel, supplies and equipment, communications, printing and reproduction. In addition, funds are included for reimbursing the Military Services for administrative support costs associated with contracts undertaken on the Agency's behalf.

(U) **Program Accomplishments And Plans**:

(U) FY 1994 Accomplishments:

- Funding under this program element in FY 1994 supported management and administration for the RDT&E program assigned to ARPA. The majority of the funds were required for the pay of personnel who operate the Agency. The funding level reflects the rental costs associated with the expansion of office space, additional personnel provided by the FY 1994 Appropriation Act, and the related support requirements necessary to adequately execute the increased responsibilities assigned to the Agency. It also finances the ramp up to the additional work years provided in FY 1995.

(U) FY 1995 Program:

- ARPA will continue the management and administrative support efforts for headquarters at an increased level over FY 1994. An additional 28 billets have been added to ARPA in FY 1995.

(U) FY 1996 Program:

- ARPA will continue the management and administrative support efforts for headquarters at approximately the same level as FY 1995.

(U) FY 1997 Program:

- ARPA will continue the management and administrative support efforts for headquarters at approximately the same level as FY 1996.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: February 1995

APPROPRIATION/BUDGET ACTIVITY
RDT&E, Defensewide
BA 6 RDT&E Management Support

R-1 ITEM NOMENCLATURE
Management Headquarters (R&D),
PE 0605898E, Project MH-01

(U) **Program Change Summary:** *(In Millions)*

	FY 1994	FY 1995	FY 1996	FY 1997
President's Budget	24.0	28.7	29.6	30.3
Appropriated	25.5	28.7	N/A	N/A
Current Budget	27.6	30.2	32.6	33.9

(U) **Change Summary Explanation:**

FY 1994 Increase reflects increased costs associated with the lease, buildout and furniture for an additional floor of the Arlington, VA Headquarters building.

FY 1995-97 Increases reflect annualization of prior year billet increases, pay raise, related travel requirements, and building lease costs.

(U) **Other Program Funding Summary Cost:** N/A

(U) **Schedule Profile:** N/A

Ballistic Missile Defense Organization (BMDO)

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Ballistic Missile Defense Organization
FY 1996/1997 R D T & E Program

Exhibit R-1

Appropriation: 0400 D Research Development Test & Eval Defwide

Date: FEB 1995

Line No	Program Element Number	Item	Act	FY 1994	FY 1995	FY 1996	FY 1997	Sec
				Thousands of Dollars				
7	0602173C	Support Technologies/Follow-on Technologies Exploratory Development	2		81,406	93,308	105,313	U
	Exploratory Development				81,406	93,308	105,313	
23	0603173C	Support Technologies/Follow-on Technologies - Advanced Technology Devel	3		134,628	79,387	87,823	U
24	0603215C	Limited Defense System	3	562,331				U
25	0603216C	Theater Missile Defense Advanced Development	3	1,476,307				U
26	0603218C	Research and Support Activities	3	524,354				U
	Advanced Development			2,562,992	134,628	79,387	87,823	
64	0603861C	Theater High-Altitude Area Defense System - TMD - Dem/Val	4		452,321	576,327	72,188	U
65	0603862C	Theater Missile Defense Ground Based Radar (GBR-T) - Dem/Val	4		171,828			U
66	0603863C	HAWK Upgrades Theater Missile Defense Acquisition - Dem/Val	4		25,984	23,188		U
67	0603864C	Battle Management and C4I for TMD Acquisition - Dem/Val	4		19,989	24,231	24,425	U
68	0603867C	Navy Lower Tier TMD Acquisition - Dem/Val	4		139,676			U
69	0603868C	Navy Upper Tier TMD - Dem/Val	4		68,450	30,442	33,400	U
70	0603869C	CORPS Surface-to-Air Missile - TMD - Dem/Val	4		14,971	30,442	33,400	U
71	0603870C	Boost Phase Intercept Theater Missile Defense Acquisition - Dem/Val	4		40,000	49,061	44,300	U
72	0603871C	National Missile Defense - Dem/Val	4		389,988	370,621	399,038	U
73	0603872C	Other Theater Missile Defense/Follow-on TMD Activities Acquisition - De	4		380,139	460,470	449,908	U
75	0604225C	Theater Missile Defense Acquisition EMD Programs	4	42,097				U
	Demonstration and Validation			42,097	1,703,346	1,564,782	1,056,659	

Ballistic Missile Defense Organization
FY 1996/1997 R D T & E Program

Exhibit R-1

Appropriation: 0400 D Research Development Test & Eval Defwide

Date: FEB 1995

Line No	Program Element Number	Item	Act	FY 1994	FY 1995	FY 1996	FY 1997	Sec
				Thousands of Dollars				
81	0604861C	Theater High-Altitude Area Defense System - TMD - EMD	5				664,000	U
82	0604864C	Battle Management and C4I for TMD Acquisition - EMD	5		534	14,301	17,976	U
83	0604865C	Patriot PAC-3 Theater Missile Defense Acquisition - EMD	5		275,683	247,921	160,070	U
84	0604866C	ERINT/Patriot PAC-3 Risk Reduction - TMD - EMD	5		74,000	19,485	9,760	U
85	0604867C	Navy Lower Tier TMD Acquisition - EMD	5			237,473	193,600	U
		Engineering and Manufacturing Development			350,217	519,180	1,045,406	
95	0605218C	Ballistic Missile Defense RDT&E Program Management and Support	6		197,996	185,542	188,418	U
		RDT&E Management Support			197,996	185,542	188,418	
Total		Ballistic Missile Defense Organization		2,605,089	2,467,593	2,442,199	2,483,619	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

Feb 1995

RDT&E Defensewide / BA 02 (Exploratory Development)
RDT&E Defensewide / BA 03 (Advanced Development)

Program Element Number: 0602173C/0603173C
PE Title: Support Technologies (U)

Project Number and Title:	FY1994 Actual	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	FY2000 Estimate	FY2001 Estimate	Total Program
PE NUMBER 0602173C									
1651 Innovative Science and Technology	38,267	45,509	50,739	52,614	50,384	51,143	48,828	47,868	Continuing
1660 Statutory and Mandated Programs	31,893	38,496	42,569	52,699	54,619	49,254	46,740	45,801	Continuing
PE TOTAL	70,160	84,005	93,308	105,313	105,003	100,397	95,568	93,669	
PE NUMBER 0603173C									
1155 Phenomenology Program	0	6,566	0	0	0	0	0	0	Continuing
1161 Advanced Sensor Technology	103,681	10,162	23,500	27,840	27,300	28,500	32,000	30,200	Continuing
1270 Advanced Interceptors	13,150	15,415	21,731	25,660	26,200	25,000	30,000	31,800	Continuing
1299 Discontinued Projects	19,928	0	0	0	0	0	0	0	Completed
1360 Directed Energy Programs	75,031	41,808	29,854	30,000	0	0	0	0	Completed
1660 Statutory and Mandated Programs	4,323	4,323	4,302	4,323	4,323	4,323	4,323	4,323	Continuing
2259 ACES / ADP	0	3,000	0	0	0	0	0	0	Continuing
3153 Arch, Analysis / BMC3 Initiatives	0	7,392	0	0	0	0	0	0	Continuing
3157 Environmental, Siting, & Facilities	5,506	5,606	0	0	0	0	0	0	Continuing
3270 Threat and Countermeasures Program	31,243	30,167	0	0	0	0	0	0	Continuing
3352 Modeling & Simulations	0	3,000	0	0	0	0	0	0	Continuing
3360 Test Resources	0	6,963	0	0	0	0	0	0	Continuing
PE TOTAL	252,862	134,402	79,387	87,823	57,823	57,823	66,323	66,323	

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION:

(U) The BMD supporting technology program develops concepts and components for next generation and product improved ballistic missile defense systems.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E Defensewide / BA 02 (Exploratory Development)
RDT&E Defensewide / BA 03 (Advanced Development)

Program Element: 0602173C/0603173C
PE Title: Support Technologies (U)

This responsibility for BMD unique technology development rests solely with BMDO within the Department of Defense. In order to meet long range defense guidance priorities, a focused, robust component and advanced concept technology development program must be maintained to position the Department to be able to respond to a changing environment and an uncertain future. The program advances the state-of-the-art in those critical functions, components, and subsystems necessary to increase system performance, reliability, maintainability and survivability while reducing acquisition and life cycle cost. This program directly supports those critical related technologies for next generation BMD Systems.

(U) The BMD technology program is designed to provide answers to many key R&D issues for developmental and future Theater and National Missile Defense systems. BMDO crafts the program as a component of the overall Department technology area plan. The efforts include:

- Development of all-weather, day/night detection, tracking and discrimination of TMD targets from air borne fused sensors, discrimination and target object map generation on-board interceptors, the detection and tracking of low observable targets, and other high leverage sensor technologies all under Advanced Sensor Technology (Project 1161).
- Advanced component and system technology development for missile defense interceptors (Project 1270). These programs address the technical issues associated with nuclear hardened seekers critical for hit to kill vehicles, low drift inertial guidance, divert/attitude control systems with more desirable field handling characteristics, advanced signal processing and limited field of view optical systems, and other needed technical advances unique or vital to missile defense systems.
- The culmination of advanced chemical laser systems technologies (Project 1360) to demonstrate integration of high power laser beam with large optics per Program Decision Memorandum guidance.
- While not part of this program element, the continued development of hit-to-kill interceptors which operate at high speed within the atmosphere (Project 1265) is integrally related to this program of supporting technology.
- This program also includes important mandated outreach efforts to transition BMD technology to commercial and industrial sectors and to affirmatively incorporate historically minority and black colleges and universities in development of BMD technology. (Project 1660).
- Includes manpower authorizations and the associated costs specifically identified and measured to the performance of these programs.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1994 Accomplishments: See individual R-2 project summaries.
(U) FY 1995 Plans: See individual R-2 project summaries.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

Feb 1995

RDT&E Defensewide / BA 02 (Exploratory Development)
RDT&E Defensewide / BA 03 (Advanced Development)

Program Element: 0602173C/0603173C
PE Title: Support Technologies (U)

(U) FY 1996 Plans: See individual R-2 project summaries.
(U) FY 1997 Plans: See individual R-2 project summaries.

Acquisition Strategy: See individual R-2 project summaries.

B. (U) Program Change Summary:

PE NUMBER 0602173C	FY1994	FY1995	FY1996	FY1997	TOTAL COST
Previous President's Budget	73,053	106,460	106,774	113,820	400,107
Appropriated Value		81,406			81,406
Adjustments to Appropriated Value		2,599			2,599
Current Budget Submit	70,160	84,005	93,308	105,313	352,786

PE NUMBER 0603173C	FY1994	FY1995	FY1996	FY1997	TOTAL COST
Previous President's Budget	247,703	241,831	239,163	230,145	958,842
Appropriated Value		143,631			143,631
Adjustments to Appropriated Value		-9,229			(9,229)
Current Budget Submit	252,862	134,402	79,387	87,823	554,474

Change Summary Explanation:
Funding: Over the past few years, in compliance with congressional direction and in consonance with the recent Bottom-Up Review findings, the Department has significantly restructured the follow-on supporting technology program for ballistic missile defense. Today, only those programs that either directly support future TMD and NMD system developments, or hold significant promise for advanced BMD systems remain under the management responsibility of BMDO. In instances where those programs have significant collateral application to other military missions, technical information is shared with the interested military department. The ongoing advanced technology program supports DoD's long-term commitment to continue, at a stable level, critical research on technologies that build on work to date in order to prepare for more capable and affordable active ballistic missile defense systems. The funding that is now available to the development of technologies does not allow for the exploitation of breakthroughs developed by thc far-term efforts or to speed up development of mid-term systems should the need or opportunity arise.
Schedule: None.
Technical: None.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E Defensewide / BA 02 (Exploratory Development)
RDT&E Defensewide / BA 03 (Advanced Development)

Program Element: 0602173C/0603173C
PE Title: Support Technologies (U)

C. (U) Other Program Funding Summary

Related RDT&E:	FY1994 Actual	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	FY2000 Estimate	FY2001 Estimate
0603861C THAAD SYSTEM DEM/VAL	710,093	651,901	576,327	72,188	0	0	0	0
0603863C HAWK DEM/VAL	29,629	26,800	23,188	0	0	0	0	0
0603864C TMD-BMC3 DEM/VAL	12,617	20,009	24,231	24,425	25,237	20,751	22,193	22,278
0603865C PAC3 DEM/VAL	77,584	0	0	0	0	0	0	0
0603867C NAVY L/T DEM/VAL	150,446	139,676	0	0	0	0	0	0
0603868C NAVY U/T DEM/VAL	81,000	68,450	30,442	33,400	0	0	0	0
0603869C CORPS SAM DEM/VAL	16,270	14,971	30,442	33,400	0	0	0	0
0603870C BPI DEM/VAL	37,022	40,000	49,061	44,300	66,300	72,300	0	0
0603871C NMD DEM/VAL	549,973	386,988	370,621	399,038	399,341	399,318	399,472	399,472
0603872C OTHER TMD DEM/VAL	272,388	386,368	460,470	449,908	613,099	551,654	951,981	1,116,700
0604861C THAAD SYSTEM EMD	0	0	0	664,000	838,000	619,100	212,000	86,000
0604864C TMD-BMC3 EMD	0	534	14,301	17,976	25,977	20,861	29,201	29,314
0604865C PAC3 EMD	42,097	276,283	247,921	160,070	65,005	775	487	98
0604866C PAC3 RISK EMD	97,000	74,000	19,485	9,760	0	0	0	0
0604867C NAVY L/T EMD	0	0	237,473	193,600	142,680	151,428	115,482	50,323
0605218C MGMT	205,948	163,206	185,542	188,418	224,742	219,543	230,014	223,971

D. (U) Schedule Profile
See individual R-2 project summaries.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 02 (Expl. Dev.)

PE: 0602173C (Proj: 1651)
PE Title: Support Tech (U)

Project Number / Title: 1651 Innovative Science and Technology (IS&T)

Program Name:	FY1994 Actual	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	FY2000 Estimate	FY2001 Estimate	Total Program
0602173C RDT&E	38,267	45,509	50,739	52,614	50,384	51,143	48,828	47,868	Continuing

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION:

(U) To prepare to meet critical future active defense needs, advanced technology programs will invest in a balanced program of high leverage technologies that yield improved capabilities across a selected range of boost phase and terminal defense interceptors, advanced target sensors, and innovative science. The objectives of these investments are to provide (1) component technologies that offer improved performance or reduced costs for our acquisition programs, (2) a better understanding of the physical processes to support the acquisition programs, and (3) technical solution options to mitigate unpredicted threats. This project explores innovative technologies of interest to BMDO. Unlike other BMDO projects that fund near term technology and testing efforts, this project invests seed money in high-risk technologies that could dramatically change how BMD develops future systems. Cause and exploit breakthroughs in science that will keep BMD at the foremost edge of what is possible. Conduct proof-of-concept demonstrations that transition technology to development programs.

(U) Many of today's baseline technologies on BMDO systems like THAAD, ERINT, and GBR are available only because of wise investment in innovative technology 10 years ago. Examples include: Indium Antimonide and Mercury Cadmium Telluride ultra-sensitive detectors, 32-bit RISC processors for image analysis, composite materials for lightweight satellite structures, interferometric fiber optic gyroscopes for sophisticated guidance and control, and solid-state Gallium Arsenide transmitter/receivers for BMDO radars. The IST program is the only R&D program in the Defense Department focussed on future BMDO technical requirements.

(U) These programs will focus, to the maximum extent feasible, on innovative technologies in support of future BMD sensor and interceptor systems. These systems will require processing, sensor,power, optics, propulsion, and communications capabilities beyond those currently being developed. An important goal of the programs is to identify, develop, and demonstrate innovative technologies which will dramatically improve BMD system performance.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Brief Description of Element section of each Program Element Summary.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) Since the IST program began, it has fathered several new technologies important to BMDO and other military and commercial systems including: thin-film diamond, wide-bandgap electronics, digital superconducting electronics, and terahertz communications. It has transitioned several new technologies into advanced development including: multi-chip module fabrication, diode-pumped solid state lasers, novel sensor focal plane arrays, and fiber-optic gyroscopes for guidance systems. Several other technologies have moved into BMDO systems including: back-lighted thyratron switch for ground-based radar, advanced tracking algorithms for interceptors, and fault-tolerant electronic circuits for space-based sensors. In addition, IST defense technologies have already given birth to over 90 new products available today in the commercial market making it one of the most productive dual-use programs in government.

(U) In addition, the IST office managed the highly successful CLEMENTINE satellite program which demonstrated 23 novel technologies in space, flight qualifying them. Innovative management and procurement practices accomplished this highly acclaimed mission for only $80M in under 23 months. The lean management of IST has already produced a satellite laser communications transceiver that recently demonstrated 1.2 gigabit per second data transfer (a new record for free space) in a mountaintop-to-

mountaintop demonstration. The cost of producing artificial diamond films has been reduced by a factor of 300 by IST since 1986, opening up a wide array of applications for BMDO to exploit, including: high-power electronics for radars, high-temperature seeker window for endo interceptors, ultra-sensitive ultraviolet detectors for rocket plumes, and low-friction hard coatings for gimbals, tracker mounts, and rocket nozzles. There are numerous other examples of major technology demonstrations sponsored by IST R&D which will make BMDO platforms more capable, affordable, and manufacturable.

(U) There are more than 300 research contracts sponsored by IST in these areas. For brevity, the projects are listed by the six broad areas below. Note that these program areas continue each year, unchanged, except by redirection of BMDO priorities. The technical contracts, of course, may change annually. The dollar amounts are only targets, since new ideas and innovations are often proposal driven and are difficult to anticipate.

(U) FY 1994 ACCOMPLISHMENTS:

- ($8.467M) Advanced Processing - Wafer integration of 3-dimensional neural network computer for a fast-frame seeker, and first integration of superconducting analog to digital converters, correlators, phase shifters, etc., for 60 Ghz spread spectrum communications. When completed, the fast-frame seeker will be able to process 1000 frames per second, allowing BMDO interceptors to perform passive discrimination of many targets. The superconducting communications modem will permit an increase of 100,000 in the data rate that was available during the Desert Storm conflict, as well as many simultaneously users, without fear of interception or jamming.
- ($12M) Sensor and Detection - Complete critical design review of Skipper satellite to obtain aerothermochemistry data necessary for high-speed re-entry vehicle target detection. SKIPPER is the first joint American/Russian satellite and will cost the US less than $8M when completed for a complete orbital mission. A Gallium Arsenide quantum well detector was demonstrated that has far better yield, is 70 times cheaper, more radiation-hard, much more manufacturable than the incumbent

HgCdTe sensors was demonstrated in the lab for long-wave infrared (LWIR) detection on BMDO interceptors and sensors...this is a major breakthrough in sensor technology!

- o ($3.9M) Power and Propulsion - Demonstrated 95% efficient power conditioning unit for Hall Electric Thruster which IST purchased from Russia last year. This electric propulsion unit will be ready for flight testing in FY95. Novel solar cell arrays using dual-band Gallium Arsenide/Indium Gallium Arsenide were integrated with an innovative inexpensive cylindrical-lens solar concentrator. The lab tests confirmed over 30% efficiency from an affordable array which will be ready for flight testing in FY95.
- o ($6.1M) Materials - Major improvements in the growth of wide-bandgap semiconductor materials for high-power electronics were achieved. These materials, silicon carbide, Gallium Nitride, and Aluminum Nitride, will revolutionize the microelectronics field with their tremendous thermal dissipation, blinding switching speeds, and high electric breakdown strengths when manufactured into devices. Diamond films and sheets where manufactured at affordable prices 300 times less than when IST began its program in 1986. A major accomplishment resulted when a square foot of diamond 2 millimeters thick was grown by the new technique of planar plasma processing.
- o ($1.3M) Propellants - IST is exploiting years of Russian expertise and investment in ammonium dinitrimide propellants, where the Russians are a decade ahead of the US. BMDO researchers are learning the manufacturing technology of this next-generation propellant which promises a spectacular doubling of payloads with similar mass of propellant.
- o ($6.5M) Communications - IST developed a 2 x 200 mW diode laser for high-data-rate satellite laser communications system that will reduce the weight of the transmitter substantially. This transmitter demonstrated the ability to transfer over 1,000,000,000 bits of information through free space in a field demonstration. A flight test of this revolutionary technology is now possible.

(U) FY 1995 Plans:

- ($9M) Complete integration of the neural network fast frame seeker and demonstrate the performance in a lab demonstration. Complete integration of the wafer-scale associative string processor for computing the imaging data from large-format sensors planned for BMDO space sensors in real time, impossible with today's image processors. Continue programs in wavelength division multiplexed networks for distributed simulation and communications. Continue programs in target tracking algorithms, photonic devices for data fusion from multiple sensors, and missile signature measurements.
- ($9.5M) Integrate the gallium arsenide quantum well focal plane array with a monolithic readout technology and optics into a completed camera system and demonstrate it in the field against BMDO targets. Demonstrate the efficacy of sparse-array coherent laser radar against real missile targets in the field, using the advanced diode-pumped solid-state glass laser system delivered to the IST experimental range last year. Continue programs in advanced sensors and detectors using novel materials, sensor fusion experiments employing both radar and optoelectronic detectors, and neural network processors for BMDO target recognition in cluttered environments.
- ($8M) Exploit IST advances in wide band-gap materials for high-power electronic devices to reduce the weight and volume of ground-based radar power supplies. Prepare the high-efficiency solar array concentrators for flight testing in FY96 if funding is made available.
- ($5.5M) Continue the development of wide band-gap semiconductors for non-volatile memory and ultraviolet sensors. Improve the quality and the area of diamond films produced by plasma processing and extend the technique to other semiconductor materials to produce large sheets of microelectronic wafers greater than a square foot.
- ($4.509M) Exploit the Russian ammonium dinitrimide propellant technology for BMDO interceptors, by jointly producing test quantities in US laboratories. Prepare the Hall Stationary Plasma Thruster for flight testing and fly it if funding is made available in FY96. Continue the R&D program on advanced thermoplastic elastomers for solid rocket propellant.
- ($6M) Flight test the high data rate laser satellite communication system on an airplane and prepare for a space flight in FY96 if funding is available. Continue to develop the superconducting terahertz modem for spread-spectrum, code division multiple access communications for BMDO battle management.

- ($3M) Launch the SKIPPER aerothermochemistry and missile signature experiment onboard a Russian Molniya rocket. Continue the R&D projects on dual-band solar blind detectors and plume spectroscopy measurements.

(U) FY 1996 Plans:

The IST program is a focussed, mission research project which relies on breakthroughs and new opportunities in missile defense technology as well as on its structured core R&D efforts. Thus, out-year planning is purposely left general in many respects to allow the program to exploit new proposals in the key technical areas listed below. Where specific projects are planned to come to fruition, they are noted directly.

- ($8M) Neural networks for image recognition; optical image processing; multi-sensor tracking; distributed simulation battle management; BM/C^3 networking. A field demonstration of the associative string processor, linked to a large-format focal plane array is planned.
- ($18M) Advanced focal plane arrays; LIDAR; sensor fusion testbed for target handover and multi-sensor fusion; missile signatures. The fast framing seeker is slated for testing in a real interceptor scenario to test its ability to do passive discrimination,
- ($8M) Advanced switching for radar; high-efficiency solar cells and concentrators; miniature interceptor guidance technology. Flight test the high-efficiency solar concentrator arrays in space to qualify the new technology and demonstrate folding.
- ($8M) Wide band-gap semiconductors; polymer-based electronics; digital superconducting electronics; non-volatile random access memory; diamond windows and coatings. Fabricate a 10 square centimeter diamond window and test it at high velocity.
- ($4M) High-impulse solid propellants; electric propulsion thrusters; propellant manufacturability. Flight test the stationary plasma thrusters in space for satellite orbital transfer and orbit plane adjustment.

- ($4.734M) Laser diodes for communication; laser satellite communication systems; terahertz communication sources; spread-spectrum CDMA communications modem. Flight test the laser satellite communication system using a satellite-to-ground link to demonstrate free-space communications at data rates greater than 1 gigabit per second.

(U) FY 1997 Plans:

The R&D efforts supported in FY97 and beyond will generally be in the areas listed below. However, specific activities such as major demonstrations, flight tests, and discoveries of novel technologies will emerge from the core IST research programs in the future and are unknown at this time. Thus, dollar amounts are estimates. Recall that IST research is opportunity-driven and must remain flexible and adaptive.

- ($8M) Neural networks for image recognition; optical image processing; multi-sensor tracking; distributed simulation battle management; BM/C^3 networking.
- ($18M) Advanced focal plane arrays; LIDAR; sensor fusion testbed for target handover and multi-sensor fusion; missile signatures; fast framing seeker.
- ($8M) Advanced switching for radar; high-efficiency solar cells and concentrators; miniature interceptor guidance technology.
- ($9M) Wide band-gap semiconductors; polymer-based electronics; digital superconducting electronics; non-volatile random access memory; diamond windows and coatings.
- ($4.5M) High-impulse solid propellants; electric propulsion thrusters; propellant manufacturability.
- ($5.114M) Laser diodes for communication; laser satellite communication systems; terahertz communication sources; spread-spectrum CDMA communications modem

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 02 (Expl. Dev.)

PE: 0602173C (Proj: 1651)
PE Title: Support Tech (U)

Acquisition Strategy: This R&D program receives proposals in response to an annual Broad Agency Announcement of research opportunities. Proposals received are competitively judged according to BMD relevance, cost, and capabilities of the offeror. Strong emphasis is placed on the dual-use nature of the proposed effort.

B. (U) PROGRAM CHANGE SUMMARY:

	FY1994	FY1995	FY1996	FY1997	TOTAL COST
Previous President's Budget	41,510	60,000	60,000	60,000	221,510
Appropriated Value		41,510			41,510
Adjustments to Appropriated Value		3,999			3,999
Current Budget Submit	38,267	45,509	50,739	52,614	187,129

Change Summary Explanation:
Funding: FY94 reduction was an internal BMDO reduction. FY95 reduction was Congressional. The FY95 adjustment was management funds transferred to the R&D account. Reduction in FY96 and 97 are OSD reductions to scale down technology investment. Reductions will slow future technology discovery and development, and delay demonstrations across the spectrum of IST technical activities.

Schedule: NONE

Technical: NONE

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 02 (Expl. Dev.)

PE: 0602173C (Proj: 1651)
PE Title: Support Tech (U)

C. (U) OTHER PROGRAM FUNDING SUMMARY

Related RDT&E:
(U) The IST program acts as a creator of new technology for BMD. It feeds into all to other BMDO technology programs and it acts as a catalyst to transition devices and components whose efficacy has been demonstrated under IST sponsorship into these other advanced development programs for next-stage engineering demonstration.

D. (U) Schedule Profile
(U) With the exception of the SKIPPER satellite launch, scheduled for July 1995, future demonstrations of maturing IST technology are not specified more accurately than by year (and these are stated in the Program Plans sections above). The uncertainty associated with payoffs from innovative research makes it difficult to predict actual progress to a particular quarter of the year.

	FY1994				FY1995				FY1996				FY1997			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Annual Broad Area Announcement			X				X				X					X

Planned Milestones Beyond FY1997: Contingent on new discoveries and innovations.

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RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 02/03 (Expl. Dev. / Advanced Development)

PE: 0602173C/0603173C (Proj: 1660)
PE Title: Support Tech (U)

Project Number / Title: 1660 Statutory and Mandated Programs

Program Name:	FY1994 Actual	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	FY2000 Estimate	FY2001 Estimate	Total Program
0602173C RDT&E	31,893	38,496	42,569	52,699	54,619	49,254	46,740	45,801	Continuing
0603173C RDT&E	4,323	4,323	4,302	4,323	4,323	4,323	4,323	4,323	Continuing

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION:

(U) There are three programs managed under this project:

1. Small Business Innovation Research
2. Technology Applications
3. Historically Black Colleges and Universities/Minority Institutions

(U) The Small Business Innovation Research (SBIR) program explores innovative concepts pursuant to PL102-564 which mandates a two phase competition for small businesses with innovative technologies.

(U) The Technology Applications Program, established in 1986, makes BMD technology available to federal agencies, State and local governments, and U.S. business and research interests. The program objective is to develop and support the transfer of BMD derived technology to other Department of Defense applications as well as other federal, state and local government agencies, federal laboratories, universities, and the domestic, commercial, and private sector.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 02/03 (Expl. Dev. / Advanced Development)

PE: 0602173C/0603173C (Proj: 1660)
PE Title: Support Tech (U)

(U) The Historically Black Colleges and Universities/Minority Institutions (HBCU/MI) Program increases and improves the participation of these colleges and institutions in the BMDO program. It also responds to Section 832 of PL 101-510 which establishes a specific goal within the overall five percent goal for HBCU and MIs and introduces them to BMDO technologies and the particulars of the BMDO procurement process.

(U) Each program will focus, to the maximum extent feasible, on innovative technologies in support of future BMD sensor and interceptor systems. These systems will require processing, sensor, power, optics, propulsion, and communications capabilities beyond those currently being developed. An important goal of each program is to identify, develop, and demonstrate innovative technologies which will dramatically improve BMD system performance.

(U) These projects are assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Brief Description of Element section of each Program Element Summary.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) The BMDO SBIR program has been a model for all government. It has nurtured infant technologies that have a future BMD can use and into which the commercial markets can invest. Nine firms have had a sufficient level of assistance from SBIR to enable them to go to the capital markets and raise over $100M in Initial Public Offerings. The market value, which fluctuates widely as expected for unprofitable but promising firms, is nearly twice the total amount the BMDO has spent in its entire SBIR program that has invested in about 180 firms. BMDO plans to continue its emphasis on new technology with both anti-missile and commercial market appeal. The ratio of private sector funding to BMDO dollar increase as more and more firms realize that BMDO takes seriously the commercialization mandate of PL102-564 and makes commercialization an active factor in choosing technologies and

firms to support with this small seed capital fund. Historicaliy, this program has obtained a remarkable 65 cents of private investment for every BMDO dollar invested. The STTR program is just starting.

(U) FY 1994 Accomplishments:
- o ($31.903M) Began developing many forward looking advanced technologies toward which the private sector has invested $20M to continue development for future military and commercial applications.

(U) FY 1995 Plans:
- o ($12M) 200 Phase I SBIR and STTR awards to 140 firms.
- o ($27.896M) 60 Phase II SBIR and STTR awards to 50 firms.

(U) FY 1996 Plans:
- o ($10.694M) 200 Phase I SBIR and STTR awards to 140 firms.
- o ($32.083M) 60 Phase II SBIR and STTR awards to 50 firms.

(U) FY 1997 Plans:
- o ($13.175M) 200 Phase I SBIR and STTR awards to 140 firms.
- o ($39.524M) 60 Phase II SBIR and STTR awards to 50 firms.

(U) The BMDO Technology Applications program has been a technology transfer model for all government. This multifaceted program has successfully moved technology from a defense environment to the commercial sector -- an effort that has contributed to roughly 168 BMDO-related commercial products. It has also assisted the 28 companies that spun out from Federal laboratories, universities, and industries to manufacture products using BMDO-funded R&D. Encouraging face-to-face interaction between people

in government, industry, and universities, the program is effective using various approaches. In FY 1994 the program accomplished the following:

(U) FY 1994 Accomplishments:

- o ($1.200K) Database - Completed review of new operating concept to move database to more modern, accessible, and usable format. Integrated on-line database with general outreach program to provide users with expanded, more detailed information.
- o ($450K) Panel Reviews - Conducted joint reviews with NASA, Army, and Air Force on BMD-supported technology. Expanded availability and level of support in commercialization assistance to BMD researches at panel reviews.
- o ($350K) Outreach - Revised and expanded publications to better provide information and technology transfer services. Conducted survey of primary outreach tool to target most significant readership and provide desired level of information. Conducted series of presentations on BMD technology transfer program to national technology transfer professionals.
- o ($862K) Networking - Working with other federal technology transfer and dual-use programs such as Technology Reinvestment Project (TRP), Advanced Technology Project (ATP), the OSD Director, Defense Research and Engineering (DDR&E) Office of Technology Transition, and expand results of technology transfer.

(U) FY 1995 PLANS:

- o Program will continue as mandated by law with minor changes to preceding FY94 effort.
- o ($1.200K) Database - Design, program, and install improved national database on BMD programs. Expand technical information to improve chances for technology transfer. Open database access to wider segment of U.S. technical and business community.
- o ($450K) Panel Reviews - Expand unique and innovative business and commercialization assistance for BMD-supported large, medium and small business researchers by covering application areas such as transportation, communications, environment, and others. Conduct joint service and laboratory Panel Reviews to teach technique to other DoD organizations.

- o ($350K) Outreach - Publications, brochures, target articles for journals and newspapers, quarterly newsletters, conference exhibits, ads and reports on BMDO technology. Publish in-depth synopses on BMD-supported research such as accelerators, power sources, materials, and other breakthrough technical innovations coming from BMD research.
- o ($862K) Networking - Working with other federal technology transfer and dual-use programs such as Technology Reinvestment Project (TRP), Advanced Technology Project (ATP), the OSD Director, Defense Research and Engineering (DDR&E) Office of Technology Transition, and expand results of technology transfer.

(U) FY 1996 PLANS:

- o Program will continue as mandated by law with minor changes to preceding FY95 effort.
- o ($1.200K) Database - Complete installation of improved database and investigate international access to the technology database.
- o ($459K) Panel Reviews - Provide assistance to large, medium and small businesses wishing to bring BMD supported technology to the commercial market.
- o ($350K) Outreach - Publications, brochures, target articles for journals and newspapers, quarterly newsletters, conference exhibits, ads and reports on BMDO technology, etc.
- o ($862K) Networking - Working with other federal technology transfer and dual-use programs such as Technology Reinvestment Project (TRP), Advanced Technology Project (ATP), the OSD Director, Defense Research and Engineering (DDR&E) Office of Technology Transition, and expand results of technology transfer.

(U) FY 1997 PLANS:

- o Program will continue as mandated by law with minor changes to preceding FY96 effort.
- o ($1.200K) Database - Maintain up-to-date information on potential BMD programs that have commercial applications. Implement graphics and interactive modes into national database on BMD-sponsored technologies.

- o ($450K) Panel Reviews - Provide assistance to large, medium and small businesses wishing to bring BMD supported technology to the commercial market.
- o ($350K) Outreach - Publications, brochures, target articles for journals and newspapers, quarterly newsletters, conference exhibits, ads and reports on BMDO technology, etc.
- o ($862K) Networking - Working with other federal technology transfer and dual-use programs such as Technology Reinvestment Project (TRP), Advanced Technology Project (ATP), the OSD Director, Defense Research and Engineering (DDR&E) Office of Technology Transition, and expand results of technology transfer.

(U) The Historically Black Colleges and Universities/Minority Institutions (HBCU/Mis) pilot was well received and encouraged more HBCU/Mis to participate in BMDO related research.

(U) FY 1994 Accomplishments:
- o ($1.461K) HBCU/MI's set-aside resulted in 10 contract awards to conduct Innovative Science and Technology basic research.

(U) FY 1995 PLANS:
- o ($1.461K) HBCU/MI program will award 10 contracts as a target.

(U) FY 1996 PLANS:
- o ($1.461K) HBCU/MI program will award 10 contracts as a target.

(U) FY 1997 PLANS:
- o ($1.461K) HBCU/MI program will award 10 contracts as a target.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 02/03 (Expl. Dev. / Advanced Development)

PE: 0602173C/0603173C (Proj: 1660)
PE Title: Support Tech (U)

Acquisition Strategy: These competitively awarded programs are in response to an annual announcement of research opportunities. Proposals received are judged according to BMD relevance, cost, and capabilities of the offeror.

B. (U) PROGRAM CHANGE SUMMARY:

SPT Tech Exp Dev:	FY1994	FY1995	FY1996	FY1997	TOTAL COST
Previous President's Budget	31,543	46,460	46,774	53,820	178,597
Appropriated Value		39,896			39,896
Adjustments to Appropriated Value		-1,400			(1,400)
Current Budget Submit	31,893	38,496	42,569	52,699	165,657

Spt Tech ATD:	FY1994	FY1995	FY1996	FY1997	TOTAL COST
Previous President's Budget	4,323	4,323	4,323	4,323	17,292
Appropriated Value		4,323			4,323
Adjustments to Appropriated Value		0			0
Current Budget Submit	4,323	4,323	4,302	4,323	17,271

Change Summary Explanation:
Funding: None.
Schedule: None.
Technical: None.

C. (U) OTHER PROGRAM FUNDING SUMMARY

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 02/03 (Expl. Dev. / Advanced Development)

PE: 0602173C/0603173C (Proj: 1660)
PE Title: Support Tech (U)

Related RDT&E:
The SBIR and HBCU programs feed novel technologies into all other BMDO programs.

D. (U) Schedule Profile

	FY1994				FY1995				FY1996				FY1997			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Acquisition Milestone																
SBIR Solicitation	X				X				X				X			

Planned Milestones Beyond FY1997: Milestones beyond FY97 dependent on new discoveries and innovations.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 03 (Advanced Development)

PE:0603173C (Proj: 1155)
PE Title: Support Tech (U)

Project Number / Title: 1155 Phenomenology Program

Program Name:	FY1994 Actual	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	FY2000 Estimate	FY2001 Estimate	Total Program
0603173C RDT&E	0	6,566	0	0	0	0	0	0	Continuing

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION:

(U) International technical exchange programs are implemented in the areas of optical and radar discrimination, reentry, background, and plume phenomenology. The basic approach involves identifying areas where mutual benefits can be realized through joint activities such as joint participation in ground and flight tests, phenomenology code/algorithm comparisons, data exchanges, and joint data analyses. Technically, the U.S. stands to gain from insight into foreign phenomenology code capabilities (identifying areas not handled well by U.S. phenomenology codes), access to a broader range of data sets and test opportunities, and access to areas of unique foreign expertise (e.g., U.K. penaid design). From a technology and funding perspective, there is potential U.S. gain from foreign contributions to flight tests, experimental hardware, and data collections.

(U) A team of U.S. experts in the areas of discrimination, reentry signatures, backgrounds, and plumes is necessary to assess proposals for joint efforts and ensure that interchanges result in benefits to U.S. programs. This team proposes, plans, and executes joint data collections, data analyses, and phenomenology code and algorithm comparisons. Current U.S. background, target signature, and plume technology bases include a wealth of data and a number of phenomenology codes and models which have been systematically built up over the past few years. These international efforts provide the means to advance the backgrounds and plume technology bases and leverage foreign cooperative programs. Current programs include: U.S./U.K. Scientific Cooperative Research Exchange (SCORE)

Program - Target Signatures & Backgrounds (TSB) Panel, NATO Extended Air Defense (EAD)/Theater Missile Defense (TMD) Ad Hoc Working Group (AHWG) - Plume Phenomenology Expert Group (U.S., U.K., France, Canada), U.S./French Bilateral Group - Plumes, Backgrounds, and Reentry Signatures, U.S./Israeli TBM Signature and Phenomenology Research, U.S./German Phenomenology Research.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Brief Description of Element section of each Program Element Summary.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) The mission of this project is to provide for joint activities such as ground and flight tests, phenomenology code/algorithm comparisons, data exchanges, and joint data analyses that support TMD and NMD systems development. These international efforts will continue under Project 1155 beyond FY95, although costs will be shared between NMD and TMD PE's.

(U) FY 1994 Accomplishments:
- o (0.000M) None.

(U) FY 1995 Plans:
- o ($1.200M) Discrimination. Continue joint U.S./U.K. analysis of data sets to compare and validate codes for discrimination techniques, optical and radar signatures, data fusion, aerothermal heating, and hardbody modelling through the SCORE TSB Panel. Provide for the exchange of data sets from past and future joint experimental flight tests (specifically Zodiac Beauchamp, Red Tigress, and TMD Critical Measurements Program (TCMP)) to drive these analyses. Complete a Data Exchange

Agreement (DEA) between the U.S. and France on exchange of TBM reentry signature data through the U.S./French Bilateral Group. Provide a threat representative target test case to French for joint analysis in the area of TBM reentry signatures. Exchange reentry, intercept, and kill assessment data through the U.S./Israeli TBM Signature and Phenomenology Research program.

- o ($1.000M) Backgrounds. Joint background data collection involving U.S. Miniature Sensor Technology Integration (MSTI) satellite and French sensor aircraft. Provide funding for U.S. expert team to evaluate proposals for comparison of state-of-the-art phenomenology codes through the U.S./French Bilateral Group. Exchange Earth background and environmental data through the U.S./Israeli program. Establish U.S./German Phenomenology Research program for cooperation in the backgrounds phenomenology area.
- o ($1.666M) Plumes. Complete analysis of shared plume data from previous U.S./French missions. Continue the investigation of joint test cases, through the SCORE TSB Panel, comparing U.S. and U.K. plume flow field and radiation models. Complete the exchange/sanitizing/disclosure process for release of the Composite High Altitude Radiation Model (CHARM) to the U.K. Provide a data set from observations of an Atlas plume for joint analysis and code comparisons by the French Bilateral Group. (Complete U.S. proposal for joint data collection on a French submarine launched missile.) Identify parameters for a threat representative target to begin code/algorithm comparisons and begin analysis. Complete proposal to collect data on the static firing of a French rocket motor, where France, the U.S., the U.K., and Canada will provide optical sensors for data collection.
- o ($2.700M) Technical Analysis. Provide BMDO the specialized support required to resolve development and deployment issues. Includes trades studies of the cost, schedule, and technical risks of alternative deployment readiness options. Provide special studies and reviews involving long-range program planning, technical and programmatic issues such as methods to maximize NMD deployment by leveraging development efforts of the TMD program.

(U) <u>FY 1996/1997 Plans:</u>
None. Efforts will continue in parts of Project 1155, cost shared between TMD (PE 0603872C) and NMD (PE 0603871C).

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 03 (Advanced Development)

PE:0603173C (Proj: 1155)
PE Title: Support Tech (U)

Acquisition Strategy: This project funds its efforts through executing agents in the Air Force, Army, Navy and BMDO via existing contracts.

B. (U) PROGRAM CHANGE SUMMARY:

	FY1994	FY1995	FY1996	FY1997	TOTAL COST
Previous President's Budget	0	450	450	450	1,350
Appropriated Value		3,450			3,450
Adjustments to Appropriated Value		3,116			3,116
Current Budget Submit	0	6,566	0	0	6,566

Change Summary Explanation:
Funding: This project evolved from projects 1101,1105, and 3300 in the FY95 President' Budget. The increase in funding from FY94 to FY95 is due to: 1) Project roll up described in the paragraph above, 2) NMD, TMD, and Technology cost sharing of the project, and 3) Creation of new U.S./international working groups, with the exception of U.S./U.K. SCORE, which is a continuing effort. The reduction in funding from FY95 to FY96 shows that Technology PE 0603173C will no longer participate in the cost sharing arrangement for Project 1155 and international efforts will be supported by TMD and NMD PE's.

Schedule: None

Technical: None

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 03 (Advanced Development)

PE:0603173C (Proj: 1155)
PE Title: Support Tech (U)

C. (U) OTHER PROGRAM FUNDING SUMMARY

Related RDT&E:	Funding Dependency? (Yes[1]/No)
1155 Phenomenology PE: 0603871C	Yes
1155 Phenomenology PE: 0603872C	Yes

[1]Funding data for related RDT&E efforts that have a funding dependency can be found in the respective project summary/program element.

D. (U) Schedule Profile

U.S./U.K. Scientific Cooperative Research Exchange (SCORE) Program - Target Signatures & Backgrounds (TSB) Panel Meetings: December 1994, April 1995, and September 1995.

NATO Extended Air Defense (EAD)/TMD Ad Hoc Working Group (AHWG) - Plume Phenomenology Expert Group (U.S., U.K., France, Canada) Meeting: December 1994, March 1995, and August 1995.

U.S./French Bilateral Group - Plumes, Backgrounds, and Reentry Signatures Meetings: November 1994 and May 1995.

U.S./Israeli TBM Signature and Phenomenology Research Meetings: November 1994 and July 1995.

U.S./German Phenomenology Research Meeting: March 1995

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 03 (Advanced Development)

PE: 0603173C (Proj: 1161)
PE Title: Support Tech (U)

Project Number / Title: 1161 Advanced Sensor Technology

Program Name:	FY1994 Actual	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	FY2000 Estimate	FY2001 Estimate	Total Program
0603173C RDT&E	103,681	10,162	23,500	27,840	27,300	28,500	32,000	30,200	Continuing

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION:

(U) To prepare for critical future active defense needs, advanced technology programs will invest in a balanced program of high leverage technologies that yield improved capabilities across a selected range of boost phase and terminal missile defense interceptors, advanced target sensors, and innovative science. The objectives of these investments are component technologies with improved performance or reduced costs for acquisition programs, and technical solution options to mitigate advanced and unpredicted threats.

(U) The Advanced Sensor Technology Program (ASTP) is a shift in emphasis from demonstration of existing sensors to advanced sensor development. ASTP will develop and demonstrate enhanced performance sensor subsystems that are needed for post-2000 missile defense. Previous advanced development efforts (like those formerly in Project 1201, Interceptor Component Technology) were focused only on component development and were managed separately. In FY94 plans were made to consolidate these advanced sensor technology efforts into a single program to leverage funding and more efficiently develop sensor subsystems applicable to a variety of missions, including atmospheric surveillance and interceptor seekers, beginning in FY95. For the surveillance application, emphasis is placed on timely detection of missile launches from long ranges, precise tracking for launch site location and impact/intercept point prediction, target designation, and kill assessment. Development of LWIR passive sensors, miniaturized ladars, and radar components necessary to achieve long range threat detection, accurate homing guidance, and aimpoint selection for autonomous hit-to-kill interceptors will be performed in the Advanced Interceptor and Systems Technology (AIST) program in Project

1270, Applied Interceptor Materials and Systems Technology. The AIST program will build upon achievements made in sensors and sensor data fusion as a part of the ASTP program. Specifically, these demonstrated subsystems support upgrades to the exo-kill vehicle and surveillance and tracking sensor elements of NMD (Projects 1151 and 1267), and future TMD system generation.

(U) In contrast, Project 1155 (Phenomenology) uses state-of-the-art sensors for collecting phenomenology data that can be used by ASTP. Project 1151 (Sensors) concentrates on more mature technology to reduce the immediate NMD risks. Exploratory and basic research technologies (6.1 and 6.2) are addressed by the Innovative Science and Technology (IS&T) program, while technologies selected for ASTP are at the Engineering Development (6.3) stage.

(U) Advancements made in interceptor component and sensor technology (Projects 1101 & 1201) during the late 1980's and early 1990's allowed BMDO in FY94 to identify components offering the most potential for system improvement. BMDO consolidated these programs and resources to effectively focus on advanced sensor subsystem development and demonstration to provide improvements for upgrades to NMD and TMD systems, as described above. Due to the Congressional reduction in FY95, the program was stretched out one year, and emphasis was placed only on extremely critical and promising technologies.

(U) Advanced Sensor Technology Program (ASTP)

(U) Advanced sensor subsystems for NMD and TMD surveillance systems under development in FY95 have been selected based on their capabilities to address future ballistic missile threats with increased sophistication. Specifically, ASTP will develop passive and active sensors for long range threat detection and for target tracking and identification. Passive infrared, radar, and ladar components will be developed and improved to deliver increased performance while decreasing sensor size, mass, and power consumption. Active and passive sensors will be integrated into a compact assembly to enable surveillance from distributed platforms, either in space or in the atmosphere (via aircraft) Real time sensor data fusion techniques and processing hardware will be developed and combined with

the integrated sensor package. This will provide a fused sensor system capable of precise threat identification with a more rapid response by exploiting multiple phenomena, thereby increasing the probability of detection and correct target identification, extending the defended area, improving probability of kill, and reducing the probability of leakage.

(U) Russian American Observation Satellites (RAMOS)

(U) The RAMOS program is an cooperative effort with Russian scientists and engineers to exchange infrared data acquired through remote sensing systems and to develop plans for future cooperative space experiments. This program investigates options to leverage off existing funded experiments to foster a closer working relationship at the technology level between both nations.

(U) This project is assigned to the Budget Activity and Program Element Codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Mission Description and Budget Item Justification section of each Program Element Summary.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) In FY93 and FY94 the Clementine and Miniaturized Sensor Technology Integration (MSTI) programs successfully demonstrated the operational capability of existing sensor technology in space. In FY95 the MSTI program was transferred to the Air Force and the Clementine program was transferred to the Navy. In FY94, a review of on-going and planned sensor advanced development efforts was conducted by BMDO with participation from the Army, Navy, and Air Force. ASTP represents a shift in FY95 from demonstration of existing sensors to development of advanced sensor subsystems. Studies and analyses were conducted to provide insight to the most promising technologies for ASTP applications. Specific technologies that were consolidated into the ASTP

program include: multi-color focal plane arrays such as mercury cadmium telluride (HgCdTe) and aluminum gallium arsenide (AlGaAs) multiple quantum well (MQW), on focal plane array processors, solid state (including eyesafe) and CO_2 laser radars for atmospheric surveillance, miniature gigaflop processors, advanced radar techniques, and multi-target and data fusion algorithms. This program will integrate these components into complete sensors, develop appropriate algorithms to fuse multi-sensor information, and will perform field tests and demonstrations. Passive and active sensors will be integrated in ground demonstrations starting in FY96, leading to further development and integration for flight demonstration in FY00 and FY02. Multiple approaches will be pursued for various sensor subsystems when more than one technology appears feasible and selection cannot be made without additional development and testing. Technology downselects will occur in FY98 for the atmospheric surveillance flight demonstration in FY00.

(U) In previous years, work was also performed for Launch Services in Project 1701 and in Special Test Activities in Project 1702. These efforts have been terminated in FY95. The cost of launch services and special test activities will now be assumed by the appropriate users on an as needed basis. This cost will be included in the total cost for each program.

(U) FY 1994 Accomplishments:

- o ($36.53M) Interceptor Integration Technology
  - Completed MSTI satellite flight tests utilizing existing sensor technology
  - Began mission planning and flight hardware procurement activities for MSTI-3
- o ($27.91M) Sensor Integration
  - Completed Clementine I Space Experiment
- o ($27.86M) Launch Services
  - Completed ground-based preflight verification for MSTI, Clementine, and Single Stage Rocket Technology (SSRT)
  - Supported payload processing, payload integration, mission operations and planning, range operations and integration, mission analysis, and test operations for MSTI, Clementine, and SSRT

- o ($4.8M) Special Test Activities (Completed BMDO SSRT Program)
  - Completed two flight tests
  - Began repair of DC-X flight test vehicle in preparation of possible completion of flight tests
  - Transferred system to NASA

(U) FY 1995 Plans:

- o ($1.30M) Program planning and analyses
  - Program scheduling and critical path identification
  - Test planning
  - System simulation
- o ($2.16M) Sensor design and analysis of Clementine multi-spectral boresighted imagery and fused sensor data for application to ASTP
- o ($1.80M) Design passive IR multi-color HgCdTe and multiple quantum well (MQW) focal plane arrays, and on-focal plane array processors
- o ($2.90M) Design solid state and gas laser transmitters, direct and heterodyne detectors, and eyesafe ladar components
- o ($0.50M) Integrate radar technology development objectives with existing programs
- o ($0.50M) Develop data fusion processing hardware algorithms
- o ($1.00M) Define terms of RAMOS agreement
  - Review and organize remote sensing data
  - Perform data exchange

(U) FY 1996 Plans:

- o ($7.80M) Perform sensor integration, demo planning, and simulation for ground demonstrations; refine requirements for

components typical of NMD & TMD missions
- o ($8.35M) Fabricate and deliver 256x256 2-color HgCdTe Array, perform simultaneous 2-color 256x256 MQW imagery demo, perform on-FPA processing demo
- o ($1.25M) Demonstrate eyesafe laser pump
- o ($4.35M) Begin bi-static radar testing, component integration
- o ($2.75M) Complete planning and begin testing of data fusion algorithms with system simulations, begin design of data fusion processor brassboard

(U) FY 1997 Plans:
- o ($9.84M) Begin laboratory, ground, and chamber demonstrations of integrated components, begin planning for flight demonstrations, continue sensor performance simulations
- o ($8.10M) Continue development, integration, and testing of passive IR subsystems that are candidates for multi-sensor flight demo: demonstrate 256x256 2-color array at Army Missile Optical Range (AMOR), test 10x10 multi-color strained layer superlattice array; deliver on-focal plane array electronics
- o ($1.75M) Fabricate and deliver hardened eyesafe aluminum gallium antimonide detector for eyesafe ladar
- o ($4.45M) Continue integration and testing of radar sensors that are candidates for multi-sensor flight demo
- o ($3.65M) Complete data fusion processor brassboard and begin testing algorithms, some with data from sensor demos

(U) Acquisition Strategy:

(U) ASTP is a Tri-Service/BMDO program. The executing agents will utilize existing contracts, planned new contracts, and in-house resources to perform this program. The Air Force is developing passive infrared technology (multi-color focal plane arrays and on-focal plane processing) and is responsible for passive sensor integration and testing. The Army is responsible for ladar integration and

testing. The Navy is developing radar technology (bi-static) and is leveraging off of existing airborne radar programs. BMDO is developing fusion processor technology and algorithms and is responsible for performing platform integration and conducting major flight demos. BMDO will initiate contracts to perform these efforts. Cooperation with on-going programs will be maximized to leverage funding.

(U) This project assures timely infusion of the needed ASTP technologies into BMDO core programs. Since ASTP is a continuation of BMDO sensor technology, many of the contracts are now in place. Extensive planning and preparation during FY94 and FY95 will also facilitate the FY96 program expansion. A coordinated team of management and technical personnel is now in place in the Army, Navy, and Air Force, managed by BMDO. Essential documentation has been prepared, and mission requirements have been analyzed and flowed-down to ASTP component designs. Broad Agency Announcements have been published to ensure potential attractive technologies and innovative approaches have not been overlooked during the tri-service planning efforts. BMDO contracting efforts are in progress to initiate platform integration and sensor fusion.

B. (U) PROGRAM CHANGE SUMMARY:

	FY1994	FY1995	FY1996	FY1997	TOTAL COST
Previous President's Budget	104,829	48,000	48,000	48,000	248,829
Appropriated Value		15,162			15,162
Adjustments to Appropriated Value		-5,000			(5,000)
Current Budget Submit	103,681	10,162	23,500	27,840	165,183

Change Summary Explanation:
Funding: The advancements made in interceptor component technology (Project 1201) and sensor technology (Project 1101) during the late

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RDT&E, Defensewide / BA 03 (Advanced Development)

PE: 0603173C (Proj: 1161)
PE Title: Support Tech (U)

1980's and the early 1990's allowed BMDO in FY94 to identify components offering the most potential for system improvement. BMDO consolidated these programs and resources to effectively focus on advanced sensor subsystem development to provide improvements for upgrades to NMD and TMD systems. Through this extensive FY94 preparation, BMDO was poised to pursue ASTP at a $48M level in FY95 mostly utilizing existing contracts and some planned new contracts. The 79% reduction in FY95 funding has caused the demonstrations that were originally planned for FY99 and FY01 to both slip one year. The significantly reduced FY95 funding has been partially accommodated by deferring the planning and design of service-built sensors and BMDO's integration efforts until FY96. This accounts for $18.4M of the budget reduction. Cuts and deferrals in technology development constitute the remainder of the $38M reduction. Radar technology development was all but eliminated in FY95; only studies of alternative approaches and platforms will be performed. Contract new starts will be delayed by six to twelve months. A $10M reduction in FY96 funding will limit the amount and fidelity of ground testing that can be accomplished. Any further reductions in funding will jeopardize insertion of technology into NMD and TMD systems in the timeframe required. The remaining $13.27M deficit in FY96 and the $20.16M deficit in FY97 account for the funds transferred to Project 1270 to perform AIST.

Schedule: No Change

Technical: The FY95 program represents a shift in philosophy from demonstration of existing technology (e.g. Clementine and MSTI, formerly Projects 1110 and 1202, transferred to the Navy and the Air Force, respectively), to development of advanced technologies to counter the advanced or unpredicted threat.

C. (U) OTHER PROGRAM FUNDING SUMMARY:

Related RDT&E:	Funding Dependency? (Yes[1]/No)

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PE Title: Support Tech (U)

1270 Advanced Interceptor, PE: 0603173C	Yes
3360 Rapid Optical Beam Steering (ROBS) PE:0603871C	Yes
XXXX AirForce Maui Optical Site (AMOS)	Yes

[1]Funding data for related RDT&E efforts that have a funding dependency can be found in the respective project summary/program element.

D. (U) Schedule Profile

	FY1994				FY1995				FY1996				FY1997			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Acquisition Milestone																
Engineering Milestone								Xh				Xj				
Xm,Xo T&E Milestone			Xa*	Xb*,Xc*		Xd*			Xf	Xg		Xi,Xn			Xk	
Xg Contract Milestone																
Other Program Events				Xe*		Xp										

Xa - Completed ground based pre-flight verification for MSTI, Clementine, and SSRT
Xb - Completed Clementine I space experiment
Xc - Completed MSTI satellite flight tests
Xd - Completed DC-X flight tests and transferred system to NASA
Xe - Completed planning for ASTP consolidation
Xf - Sequential 2-color 256x256 MQW Imagery Demo
Xg - 64x64 2-color HgCdTe Demo at AMOR

Xh - On-FPA Processing Electronics Design Complete
Xi - Simultaneous 2-color 256x256 MQW Imagery Demo
Xj - On-FPA Electronics Demo
Xk - 10x10 Multi-color Strained Layer Superlattice Array Demo
Xl - 256x256 2-color HgCdTe Demo at AMOR
Xm - On-FPA Electronics Delivery
Xn - Eyesafe Ladar Pump Demo
Xo - Hardened Eyesafe Solid State Ladar AlGaSb Detector Delivery
Xp - Define Terms of RAMOS Agreement

Planned Milestones Beyond FY1997:

- First technology downselect planned for FY98
- Fused sensor suite for atmospheric surveillance demo planned for FY00
- Second technology downselect planned for FY00

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PE Title: Support Tech (U)

Program Name:	FY1994 Actual	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	FY2000 Estimate	FY2001 Estimate	Total Program
0603173C RDT&E	13,150	15,415	21,731	25,660	26,200	25,000	30,000	31,800	Continuing

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION:

(U) The Advanced Interceptor and Systems Technology (AIST) program develops and demonstrates: advanced interceptor sensor processing power components; multifunctional material and structures; low cost interceptor composite manufacturing processes; gel propellants and low cost flight test demonstrations. These technologies are critical to the deployment of effective, affordable TMD and NMD systems.

The AIST projects are planned and executed through direct interchange with System Program Offices (SPOs) and prime contractors responsible for fielding current NMD Technology Readiness and TMD systems hardware.

The AIST program consists of five major task programs:

(U) Advanced Interceptor Components Program

(U) The focus of the Advanced Interceptor Component program is the development of interceptor components necessary to achieve long range threat detection, accurate homing guidance, discrimination, and aim point selection for autonomous hit-to-kill interceptors. components.

(U) The Materials and Structures (M&S) Program

(U) The M&S program develops advanced low cost manufacturable multifunctional composite structural components, sensor jitter adaptive and passive vibration isolation and suppression systems, optical materials and baffle specialty components and low temperature superconductor LWIR sensor electronics.

(U) Advanced Propellant Interceptor Motors Program

(U) This program (funding currently being reassessed for FY95-96) develops and demonstrates a high-performance, low cost, throttleable divert and attitude control system (DACS) for gel and solid propellant engines.

(U) Power Technology Program

(U) The power program provides test data from Russian TOPAZ II space nuclear reactors and develops power components for interceptors. The TOPAZ project will be transferred to the Defense Nuclear Agency for FY96. The remaining funding will be used to develop power component technology providing weight and performance improvements.

(U) Endo Atmospheric Flight Experiment (EFEX) Program

(U) This multiflight test program (funding currently being reassessed FY95-96) will use existing sounding rockets to provide the hypersonic flight environment to validate advanced interceptor technologies.

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RDT&E, Defensewide / BA 03 (Advanced Development)

PE: 0603173C (Proj: 1270)
PE Title: Support Tech (U)

(U) This project is assigned to the Budget Activity and Program Element Codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Mission Description and Budget Item Justification section of each Program Element Summary.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) Use of active/passive systems for target/decoy discrimination has been demonstrated in ground tests performed at the Army Missile Optical Range (AMOR). The multi-folded-carbon dioxide ladar with a 1-m cavity length was tested with an integrated receiver/processor. Results were correlated with passive measurements to demonstrate discrimination.

The M&S program has successfully developed a one step, near net shape mold fabrication process for lightweight, ultrastiff composite interceptor structures, which makes composite manufacturing cost competitive with aluminum machining processes.
Use of adaptive "smart" structures for vibration suppression has been successfully demonstrated in space. Component and system ground tests of a brassboard gel DACS have been completed.

(U) FY 1994 Accomplishments:

- ($10.65M) Space Surveillance System Support
- Delivered Space Active Modular Materials Experiments (SAMMES), Satellite Attack Warning Assessment Experiment (SAWAFE), and Active Control Experiment 2 (ACTEX II) for 2QFY95 launch.
- Conducted STRV-1b space radiation and cryocooler flight experiment.
- Continued design and development of the US/UK experiment module (STRV2) for space non-contaminating composites, radiation measurement, jitter control, MWIR and lasercomm validation in support of Midcourse Sensor Programs.
- Continued TOPAZ ($7.06M) Space Nuclear Reactor Non-Nuclear Ground Test.

- o ($2.500M) Interceptor System Support
- o Demonstrated manufacturable weight reducing structural composite, optical and thermal components for ERINT/PAC-3 and THAAD.
- o Static pressure tested carbon-carbon flexseal nozzle.
- o Initiated low temperature superconductor LWIR sensor multi-agency (NASA/BMDO) testbed.
- o Continued Endo atmospheric flight experiment (EFEX) program conceptual design for interceptor composite structures, optical materials and window cooling concepts.

(U) FY1995 Plans:

- o ($11.30M) Space Surveillance System Support
- o Continue TOPAZ ($8.5M) testing (Note: TOPAZ is to be transferred to DNA in FY1996 per Congressional direction).
- o Continue data reduction of existing space flight experiments (ACTEX-1, STRV-1b and STEP 3).
- o Develop design data for vibration isolation and suppression experiment to be flown on the STRV-2 experiment module.
- o Complete and space flight demonstrate SCARLET (satellite solar concentrator array).
- o ($4.115M) Interceptor System Support
- o Initiate advanced structural composite collaborative manufacturing technology programs for geometric complex shapes with Japan.
- o Complete initial phase of low temperature superconducting interceptor LWIR sensor signal processing demonstration. The results will demonstrate the high speed, wide bandwidth, low power capability of LTS microelectronics for LWIR signal processing. Initiate LTS collaborative program with Japan.

(U) FY1996 Plans:

- o ($4.0M) Space Surveillance System Support

- o Complete FY94-FY95 space flight experiments (ACTEX 1, STRV-1b and STEP 3) data reduction and final reports. Complete development of sensor isolation system for STRV-2 flight experiment.
- o ($21.731M) Interceptor System Support
- o Develop flight test articles of advanced optical baffles and weight reducing structural/thermal composite components for Navy lower tier, THAAD and TMD-GBR systems.
- o Fabricate first EFEX flight test assembly to evaluate advanced cooled and uncooled sapphire windows and high temperature interceptor composite structures.
- o Initiate gel propellant motor testing. Baseline solid propellant designs.
- o Initiate advanced ground interceptor battery and power transfer components.
- o Demonstrate solid state laser amplifier and verify coherent ladar waveforms.
- o Demonstrate 3 meter folded CO2 ladar receiver and transmitter.
- o Continue LTS interceptor LWIR sensor testbed and composite component manufacturing programs with Japan.

(U) <u>FY 1997 Plans:</u>

- o ($2.0M) Space Surveillance System Support
- o Complete correlation of space environmental effects ground test data with space flight experiments. Complete integration of sensor isolation system and launch STRV-2 flight experiment.
- o ($23.66M) Interceptor System Support
- o Continue development of weight reducing structural, thermal and optical components for Corps Sam, TMD-GBR, and Navy lower-tier.
- o Conduct EFEX 1 flight experiments; continue development of EFEX 2 flight experiment; initiate EFEX 3 design.
- o Test interceptor power component prototype units (THAAD); provide test data to interceptor system designers and program offices.

- o Continue development, integration and testing of ladar subsystems for multi-sensor flight demo.
- o Perform solid state 2-D imaging demo and test 6 meter folded CO2 ladar amplifier.
- o Demonstrate hardened, low drift rate IMU and light weight, small volume communications package.
- o Initiate radome development for enhanced performance MMW radar.
- o Complete joint LTS and composites program with Japan.

Acquisition Strategy: The AIST Project utilizes U.S. Army Space Defense Command, DoD and DoE laboratories to fund contractors supported by relevant in-house expertise to meet the AIST milestones. Weapons systems prime contractors acquire license agreements to use advanced manufacturing/producibility processes (e.g., composite materials, baffles and nozzles) developed by the AIST Project. International funding (e.g., UK and Japan) and joint agency coalitions (e.g., NASA, DoE and ARPA) are assembled to obtain critical level of effort (e.g., US/UK STRV-2, BMDO/AF/ARPA Smart Structures, US/Japan Composites and superconducting materials programs).

B. (U) PROGRAM CHANGE SUMMARY:

	FY1994	FY1995	FY1996	FY1997	TOTAL COST
Previous President's Budget	11,630	12,000	12,000	12,000	47,630
Appropriated Value		13,300			13,300
Adjustments to Appropriated Value		2,115			2,115
Current Budget Submit	13,150	15,415	21,731	25,660	75,956

Change Summary Explanation:

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RDT&E, Defensewide / BA 03 (Advanced Development)

PE: 0603173C (Proj: 1270)
PE Title: Support Tech (U)

Funding: None
Schedule: None
Technical: None

C. (U) OTHER PROGRAM FUNDING SUMMARY

Related RDT&E:	Funding Dependency? (Yes[1]/No)
1161, Advanced Sensor Technology; PE# 0603872C,0603173C	NO
1265, Boost Phase Interceptor; PE# 0603870C	NO
1267, Ground-based Interceptor; PE# 0603871C	Yes
1151, Sensors (Active and Passive) PE# 0603871C	Yes
2257, PATRIOT; PE# 0604865C	NO
2260, THAAD; PE# 0603861C	NO
3180, NMD System Integration; PE# 0603871C	NO
3251, Systems Engineering and Technical Support; PE# 0603871C	NO
2262, Corps SAM; PE# 0603869C	NO
2263, Sea Based Area; PE# 0603867C	NO

[1]Funding data for related RDT&E efforts that have a funding dependency can be found in the respective project summary/program element.

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PE: 0603173C (Proj: 1270)
PE Title: Support Tech (U)

D. (U) Schedule Profile

	FY1994				FY1995				FY1996				FY1997			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Grnd/Producibility Tests				X[b]				X[e]		X[f,g,h,v]	X[i,t,w,x,y,z]	X[e,m,n]	X[p,q,aa]	X[r]		
Flight Tests			X[c]			X[d]		X[bb]						X[k]		X[y]
Other Program Events									X[o]	X[j]			X[l]			
Engineering Milestone							X[u]									

[a]-Test flexseal nozzle
[b]-TOPAZ ground test
[c]-Launch STRV-1
[d]-Launch STEP3
[e]-Test PAC3 gimbal post
[f]-Demo superconductor processor
[g]-KV ground plane EMI shield demo
[h]-Deliver THAAD composite bulkhead
[i]-Test interceptor power components
[j]-Deliver MWIR Interceptor baffle
[k]-Launch EFEX-I
[l]-Adv. battery demo
[m]-KV active damping demo
[n]-Interceptor composite structures demo
[o]-Transfer TOPAZ to DNA
[p]-Complete LTS sensor processor demo
[q]-Test interceptor power module
[r]-Gel propellant life characterization
[s]-US/UK flt. exp. data reduction
[t]-Gel DACS hardware and test
[u]-3-m CO2 ladar transmitter design
[v]-3-m CO2 ladar transmitter demo
[w]-Solid state ladar amplifier demo
[x]-Coherent ladar waveform verification
[y]-3-m CO2 ladar receiver demo
[z]-6-m CO2 ladar amplifier test
[aa]-Solid state ladar 2-D imaging demo
[bb]-Lauch SCARLET flight demo

Planned Milestones Beyond FY1997:

o Continue EFEX Program Flights 2 through 5	FY98-01
o Continue development of weight reducing structural/thermal components for TMD	FY97-99
o Initiate Materials and Structures support efforts for Corps-SAM and BPI	FY98
o Continue battery technology for interceptors	FY98-01
o Flight test gel DACS	FY99
o On-orbit data reduction for STRV-2	FY97-98
o First technology downselect for Advanced Interceptor Components	FY98
o Second technology downselect for Advanced Interceptor Components	FY00
o Fused sensor suite for autonomous interceptor for Advanced Components	FY02

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RDT&E, Defensewide / BA 03 (Advanced Development)

PE: 0603173C (Proj: 1299)
PE Title: Support Tech (U)

Project Number / Title: 1299 Discontinued Projects

Program Name:	FY1994 Actual	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	FY2000 Estimate	FY2001 Estimate	Total Program
0603173C RDT&E	19,928	0	0	0	0	0	0	0	Completed

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION:

(U) Prior to its termination in FY94, Brilliant Pebbles (BP) was the space-based interceptor element of the National Missile Defense (NMD) major defense acquisition program. As a result of the Bottom-Up Review, NMD was restructured to a technology readiness program and BP was cancelled in the FY95 PB, and is represented in this project.

(U) Project 1204 funded technical and engineering resources required by Government Program Managers to plan and conduct technology investigation programs within the Interceptor Technology Directorate, and is represented in this project. Resources were used to perform analyses, develop innovative concepts in the particular technologies, plan and implement major experiments, perform data reductions and analysis of experiment results, and perform system engineering studies on interceptor technology concepts. Technical and engineering support was provided to all phases of interceptor technology program design, development, and test, including systems requirements/concepts definition, systems engineering and design, flight test planning and conduct, and range and on-orbit operations.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Mission Description and Budget Item Justification section of each Program Element Summary.

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RDT&E, Defensewide / BA 03 (Advanced Development)

PE: 0603173C (Proj: 1299)
PE Title: Support Tech (U)

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) In FY94, the two competing BP contractor efforts were terminated.

(U) FY 1994 Accomplishments:

- ($15.0M) Terminated TRW and Martin Marietta BP contracts.
- ($0.247M) Continued systems engineering and technical assistance efforts in support of identification, analysis, development, and testing of advanced kinetic energy interceptor components and subsystems, including D2 and Communications Technology efforts.
- ($1.535M) Provided in-depth technical comparisons and research of emerging technologies; analyzed architectural changes and determined interceptor technology development requirements; continued support of technical feasibility decisions and interceptor technology advanced program planning.
- ($3.146M) Planned in detail, and provided technical support to all phases of ground and flight experiments for the Navy LEAP, SRAM/LEAP, MSTI, AIT, and ADI programs.

(U) FY 1995 Plans: None

(U) FY 1996 Plans: None

(U) FY 1997 Plans: None

Acquisition Strategy: N/A

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RDT&E, Defensewide / BA 03 (Advanced Development)

PE: 0603173C (Proj: 1299)
PE Title: Support Tech (U)

B. (U) PROGRAM CHANGE SUMMARY:

	FY1994	FY1995	FY1996	FY1997	TOTAL COST
Previous President's Budget	19,928	0	0	0	19,928
Appropriated Value		0			0
Adjustments to Appropriated Value		0			0
Current Budget Submit	19,928	0	0	0	19,928

Change Summary Explanation:

Funding: None
Schedule: None
Technical:None

C. (U) OTHER PROGRAM FUNDING SUMMARY None

D. (U) Schedule Profile None

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RDT&E, Defensewide / BA 03 (Advanced Development)

PE: 0603173C (Proj: 1360)
PE Title: Support Tech (U)

Project Number / Title: 1360 Directed Energy Programs

Program Name:	FY1994 Actual	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	FY2000 Estimate	FY2001 Estimate	Total Program
0603173C RDT&E	75,031	41,808	29,854	30,000	0	0	0	0	Completed

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION:

(U) BMDO's charter is to provide for defense against current and future missile threats. A robust missile defense against a wide variety of threats requires terminal phase, mid-course phase, and boost phase intercept capabilities. The Space Based Laser (SBL) program was created to provide the nation with a space-based boost phase intercept capability option. This program element, project number 1360 contains DOD's only space-based ballistic missile defense program.

(U) The Space-Based Laser program was created in 1979 (well before SDI) to explore the possibility of performing ballistic missile defense and other counterspace missions. New technologies offered the possibility of intercepting missiles in the boost phase on a global, 24-hour basis—with the ability to destroy missiles before they release tens to hundreds of submunitions and to prevent debris from landing on defended assets. Such basing provides a robust first tier for ground-based systems, greatly enhancing defense-in-depth. Upon transfer to the Strategic Defense Initiative Organization (SDIO), the program was diverted from its focus of producing a weapon. Hence the program ceased trying to achieve such goals as high laser power, functioning optics, and systems integration on a time-urgent basis. Extensive concept definition studies were carried out, as well as technology development. The results were extremely positive.

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RDT&E, Defensewide / BA 03 (Advanced Development)

PE: 0603173C (Proj: 1360)
PE Title: Support Tech (U)

(U) The program addressed the key critical technical issues: (1) Can a chemical laser be built powerful enough to destroy a missile at militarily useful ranges? (Alpha program); (2) Can mirrors and optics be built large enough and easily enough? (Large Aperture Mirror Program (LAMP) and Large Optical Segment (LOS)); (3) Can the high power beam be controlled and directed adequately? (Large Optics Demonstration Experiment,LODE); (4) Can missile targets be acquired and tracked from space and can a laser be pointed and fired accurately enough? (Acquisition, Tracking, and Pointing/Fire Control (ATP/FC)); (5) Can these key components be integrated into a functional unit suitable for space flight and operation? (Star LITE program); (6) Can the fully integrated system operate adequately on-orbit? (Star LITE flight option).

(U) Progress To Date. The program has proved that the answer to all these questions is "yes," and has built devices that perform all the above material functions. These devices can be integrated into a functioning defensive weapon. (1) The Alpha program's high energy chemical laser achieved weapons-class power for the first time in 1991. (2) LAMP and LOS demonstrated the ability to build optics of the required size with the successful fabrication of a 4 meter segmented mirror in 1989 and a key segment of an 11 meter mirror in 1993. (3) Large Optics Demonstration Experiment (LODE) demonstrated the ability to control the projected (or outgoing) beam in low power laser experiments in 1987. (4) The basic feasibility of acquiring and tracking missiles from ground and space has been demonstrated by a number of programs. The ATP/FC technologies required (sensors, optics, processors, etc.) have been demonstrated at or near performance levels required for the Space Based Laser program. Stable low power laser beam pointing from space to ground was demonstrated at the same precision level required for an operational SBL in 1991 in the Relay Mirror Experiment (RME).

(U) Current Status. The major building blocks have been developed (issues 1-3, partially 4). Key system integrations and tests lie ahead (issues 4-6). Remaining tasks are: to integrate the high power laser with the large optics beam director and test (Alpha-LAMP Integration, ALI); to integrate ATP technologies and test ATP/FC technologies; to integrate ALI hardware with ATP/FC hardware and test; to integrate ALI/ATP/FC system with spacecraft interfaces; and to build a prototype SBL spacecraft for first flight testing.

(U) Unique features of a space-based laser missile defense include global, 24-hour boost phase intercept capability and defense against surprise first strikes. SBLs can destroy missiles of greater than 80 km range, providing a robust first layer for both theater and national missile defenses-in-depth. SBL does not require prior knowledge of enemy launch site locations. The footprint of one SBL can cover 10% of the earth. Twelve to eighteen could provide overlapping, full-time coverage of missile threats from theaters anywhere. Each SBL would be capable of destroying up to 100 missiles. SBL can defend against missiles without putting the lives of US military personnel at risk. With its long range and speed of light defense, it accomplishes boost phase intercept at the earliest possible moment, offering the highest probability that intercepted missile fragments (possibly containing active chemical/biological or nuclear materials) will fall back on the attackers, not on defended assets.

(U) The 103rd Congress directed that the SBL be phased out. Accordingly only the ALI tests and initial HABE ground tests will be accomplished. The high power Alpha laser has been placed in "maintenance only" status until required by ALI in 1996. After completion of the ALI tests in 1997, the SBL program would be terminated, the nation's only space based laser missile defense option.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Brief Description of Element section of each Program Element Summary.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) Three of the four major subsystems for an operational space-based laser (SBL) (laser device, beam control system, and the beam director or telescope) have been demonstrated by the chemical laser project with hardware scalable and traceable to operational system requirements. These three systems, along with the attendant ATP, comprise the major subsystems of an operational SBL. The current focus of the Chemical Laser project is the integration of these subsystems in a program named the Alpha/LAMP Integration

(ALI) experiment. In 1994, virtually all ALI hardware as well as the ALI test facility will be completed. The schedule calls for experiment integration in FY95 and FY96, with high power testing complete in FY97.

The following is a list of accomplishments for FY 1994.

(U) FY 1994 Accomplishments:

- ($32.579M) ALI. Continued fabrication and delivery of ALI experiment hardware (application of Holographic Optical Elements (HOEs) to all primary mirror segments, uncooled secondary mirror assembly, PtSi focal plane arrays, optical bench assembly, and several diagnostic and support assemblies), and brought ALI facility to beneficial occupancy status.
- ($10.280M) Alpha. Began modification of Alpha for interface with ALI and demonstrated high power operation of modified Alpha. Validated performance of uncooled, single-crystal-silicon beam-sampling mirrors. Completed modification of test facility coolant system to correct major source of beam jitter.
- ($11.275M) Chemical Laser Advanced Technology Programs. Performed fluid dynamic testing of the Stimulated Brillouin Scattering (SBS) cell in the Advanced Phase Conjugation Experiment (APEX). Continued fabrication of first advanced hydrogen fluoride-overtone laser nozzle module to increase efficiency and brightness of hydrogen fluoride lasers. Continued numerous small advanced technology research/demonstration efforts including beam expander repointing/stabilization technology, small scale autonomous alignment risk reduction, hydrogen fluoride laser master oscillator/power amplifier (MOPA) measurements, hydrogen fluoride laser line-selection measurements, and application of neural net technology to precise pointing and disturbance rejection. Continued fabrication of second Large Optical Segment (LOS) 4-meter mirror facesheet (center facesheet of space compatible 11 meter diameter mirror). Continued development of advanced optical coatings for uncooled optics; demonstrated all fabrication technologies for full scale annular resonator optic substrate, including diamond turning across fused single crystal silicon bond joints. Began modification of the Advanced Beam Control System brassboard for autonomous beam control system alignment experiments.

- o ($2.400M) HABE ATP Field Experiment. Continued HABE ATP system integration and restructured program to delay flight operations and address ground tests. Conducted initial ground experiments against subscale threats. Accepted delivery of Inertial Pseudo-Stellar Reference Unit (IPSRU) for system integration.
- o ($4.209M) ATP Technology Development. Completed structural disturbance damping tests, evaluated system identification algorithms, and documented system configuration on Space Pointing and Integrated Controls Experiment (SPICE) program. Completed hard body hand over algorithm development and delivered to HABE test group. Tested and delivered 3 axis inertial pseudo-stellar reference unit for integration into the HABE experiment. Developed initial simulation and data archival software for ATP-FC components and test experiments. Finalized advanced ATP technology reference concepts and developed experiment and test concepts to validate advanced system design.
- o ($12.407M) Close-Out of Neutral Particle Beam Program. Discontinued all ground testing at Los Alamos Labs including the Ground Test Accelerator. Argonne National Lab projects in abeyance pending FY95 decommissioning (~$3M) if no other funding source acquired. Canceled all flight preparation activity. Terminated contract with Grumman.
- o ($1.881M) Close-Out of Directed Energy Demonstration Program. Evaluated feasibility of applying Russian technology to scale Diode-Pumped Solid State Lasers to weapon levels (joint program was considered). Performed atmospheric propagation analyses to support Aircraft Based Laser (ABL) program and evaluate its operational capabilities. Contributed to joint USN/UK Royal Navy tests using Mid-Infrared Advanced Chemical Laser and Sea Lite Beam Director at White Sands Missile Range.

(U) In 1994 the Chemical Laser project continued to develop additional promising advanced technologies with the potential for significant cost, weight, and/or brightness improvement. Advancements in very-low-absorptance optical coatings and mirror substrates eliminated the need for liquid-cooled optics. Experience in the Chemical Laser project shows that uncooled ultra-lightweight optical components can be produced in half the time for one third the cost of cooled optics. Other efforts included (1)

operating a hydrogen fluoride laser on its overtone, thereby doubling its brightness, (2) phase-conjugation beam/jitter control and (3) improved optical manufacturing techniques. These efforts are not funded in FY95 or beyond.

(U) The ATP-FC program completed the space Relay Mirror Experiment and the ground-based Rapid Retargeting Precision Pointing testbed demonstration which achieved operational level stabilization and pointing accuracies. Completed solid rocket plume ultra-violet (UV) signature measurements from space. Completed a closed loop demonstration of active control of structural disturbances on the Space Pointing and Integrated Controls Experiment (SPICE) test bed. Completed development of an Inertial Pseudo-Stellar Reference Unit (IPSRU) capable of pointing a low-power laser alignment beam with extreme precision in inertial space. FY95 plans focus on integration of ATP component technologies in an end-to-end field test as part of the High Altitude Balloon Experiment (HABE). The ATP program is not funded in FY96 or beyond.

(U) FY 1995 Plans:

- ($27.150M) ALI. Complete fabrication and delivery of all critical optical hardware (high-bandwidth deformable mirror and high-bandwidth fast-steering mirror, calibration and alignment assembly, spare PtSi focal planes) and remaining facility hardware (support pallets, power management equipment, plumbing and integration and test chamber handling and support assembly).
- ($2.850M) Alpha. Place Alpha in a "maintenance-only" mode. Periodic operation of critical systems will be exercised to preserve the laser device for return to high power operation in FY97. These periodic operations include flowing all water systems, operating the pressure recovery system and large gate valves, operating all pumps, compressors and valves, inspecting optics and probe laser and performing alignment checks.
- ($8.100M) HABE ATP Field Experiment. Continue ATP ground integrated system checkout. Integrate IPSRU with HABE payload. Perform IR tracking tests from the ground against boosting scaled rockets. Perform balloon system checkout flight.

- ($3.708M) ATP Technology Programs. Develop the aimpoint selection and target identification algorithms for integration into HABE tests. Integrate auto-alignment capability for two-mirror system onto existing ABCS brassboard and demonstrate automated boresight and alignment. Continue ATP-FC integration efforts and perform preliminary analysis on concepts for future precision ATP-FC systems for surveillance and laser defensive system concepts. Perform BMC^3/Directed Energy information architectures.

(U) FY 1996 Plans:

- ($27.150M) ALI. Complete fabrication of the remaining ALI hardware. Conduct subsystem tests and carry out the ALI experiment configuration system level tests.
- ($2.850M) Alpha. Continue to preserve the Alpha through the third quarter in a low maintenance mode.

(U) FY 1997 Plans:

- ($20.500M) ALI. Complete subsystem tests and the Alpha buildup to include full system diagnostics. Carry out a single ALI high power experiment. Reduce the data, deliver final report and conduct an orderly closeout.
- ($9.500M) Alpha. Conduct one high power lasing test to verify proper laser operation before the ALI experiments and verify ALI diagnostics operations. Conduct orderly closeout.

(U) Acquisition Strategy: BMDO's contract to build a space-based laser ("Zenith Star") was competed in 1988 and awarded to Martin Marietta. The Alpha/Lamp Integration (ALI) effort is performed under this contract. The Alpha laser is maintained and operated under a BMDO contract to TRW. Existing contract vehicles are viable for closing out the program in FY97 or to launch the first prototype in December 1998. The contracts remain open and can receive new funds in FY96 if options are exercised.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 03 (Advanced Development)

PE: 0603173C (Proj: 1360)
PE Title: Support Tech (U)

B. (U) PROGRAM CHANGE SUMMARY:

	FY1994	FY1995	FY1996	FY1997	TOTAL COST
Previous President's Budget	70,144	90,000	90,000	90,000	340,144
Appropriated Value		42,500			42,500
Adjustments to Appropriated Value		-0,692			(692)
Current Budget Submit	75,031	41,808	29,854	30,000	176,693

Change Summary Explanation:
Last year's project numbers of 1302 and 1305 have been consolidated this year as 1360. Last year's project numbers 1303 (Neutral Particle Beam) and 1307 (Directed Energy Weapon Demonstrations) have been terminated.

Funding:
Schedule:
Alternative:

C. (U) OTHER PROGRAM FUNDING SUMMARY

Related RDT&E:		Funding Dependency? (Yes[1]/No)
Demonstration and Validation	P.E. 0603319F	No
1161 Advanced Sensor Technology	P.E. 0603173C	No
1155 Phenomenology Program	P.E. 0603173C	No
3360 Test Resources	P.E. 0603871C	No

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 03 (Advanced Development)

PE: 0603173C (Proj: 1360)
PE Title: Support Tech (U)

[1]Funding data for related RDT&E efforts that have a funding dependency can be found in the respective project summary/program element.

D. (U) Schedule Profile

	FY1994				FY1995				FY1996				FY1997			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Engineering Milestones				x^a				x^b		x^c						x^d
T&E Milestones						x^e		x^f					x^g	x^{h-i}		
Other Program Events								x^{j-k}								x^l

x^a - Holographic gratings applied to 4-m LAMP mirror
x^b - ALI optical bench assembly fully populated and rolled in to vacuum chamber
x^c - Began low-power ALI experiments; integrate and align system
x^d - ALI final report
x^e - Acceptance test of ALI deformable mirror and fast steering mirror
x^f - High Altitude Balloon Exp. (HABE) Balloon Sys Checkout
x^g - High-power Alpha lasing test to reverify operational status
x^h - First high-power ALI lasing exp. (open-loop)
x^i - ALI high-power test (closed-loop)
x^j - HABE IR passive tracking exp
x^k - ATP-FC program close-out
x^l - Chemical Laser program close-out

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 03 (Advanced Development)

PE: 0603173C (Proj: 2259)
PE Title: Support Tech (U)

Project Number / Title: 2259 Israeli Co-Operative Projects

Program Name:	FY1994 Actual	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	FY2000 Estimate	FY2001 Estimate	Total Program
0603173C RDT&E	0	3,000	0	0	0	0	0	0	

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION:

(U) The Boost Phase Intercept (BPI) Study showed the feasibility and utility of using high-altitude, long-endurance UAVs to perform very stressing missile defense mission to protect the state of Israel. A preliminary cost and operational effectiveness assessment concluded that such a system could be very complementary to Arrow and developed quickly with indigenous Israeli technology.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Mission Description and Budget Item Justification section of each Program Element Summary.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1995 Plans:
- o ($3.000M) Joint U.S./Israeli BPI Assessment
- o Explore joint BPI missile defense against Theater Missiles in the Middle East using simulations, wargaming and personal interchanges, here and abroad, among appropriate government and military counterparts. Defines what the U.S. gets out of a U.S./Israel joint/BPI development program.

- o Analyze common technology requirements between U.S. Air Force and Israeli BPI concepts.
- o Explore selected improvements for Israeli BPI missile, aircraft, and BM/C^3.
- o Prepare report.

(U) FY 1996 Plans: None

(U) FY 1997 Plans: None

Acquisition Strategy: This is a study program. No acquisition is contemplated at this time.

B. (U) PROGRAM CHANGE SUMMARY:

	FY1994	FY1995	FY1996	FY1997	TOTAL COST
Previous President's Budget	0	0	0	0	0
Appropriated Value		3,000			3,000
Adjustments to Appropriated Value		0			0
Current Budget Submit	0	3,000	0	0	3,000

Change Summary Explanation:
(U) The Israeli Boost Phase Intercept (BPI) study has been integrated into one budget item consisting of all Israeli Cooperative Projects. In previous budget submissions, the ITB was part of the Test and Evaluation Support (Project 3300) and the Israeli Systems Engineering and Integration (ISE&I) and Israeli Boost Phase Intercept (BPI) Study were part of the Architecture and Studies (Project 3201).

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 03 (Advanced Development)

PE: 0603173C (Proj: 2259)
PE Title: Support Tech (U)

C. (U) OTHER PROGRAM FUNDING SUMMARY

Related RDT&E:	Funding Dependency (Yes[1]/No)
3359 - System Test & Evaluation - 0603872C	Yes
3251 - Sys. Eng. & Tech Spt - 0603872C	Yes
3352 - Modeling & Simulations - 0603872C	Yes
2259 - Israeli Coop. Projs - 0603872C	Yes
1265 - Boost Phase Intercept- 0603878C	Yes

[1]Funding data for related RDT&E efforts that have a funding dependency can be found in the respective project summary/program element.

D. (U) Schedule Profile

	FY1994				FY1995				FY1996				FY1997			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Engineering Milestone - Complete BPI Studies				X				X								

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 03 (Advanced Development)

PE:0603173C (Proj: 3153)
PE Title: Support Tech (U)

Project Number / Title: 3153 Architecture Analysis and BMC3 Initiatives

Program Name:	FY1994 Actual	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	FY2000 Estimate	FY2001 Estimate	Total Program
0603173C RDT&E	0	7,392	0	0	0	0	0	0	Continuing

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION:

(U) This project supports the creation for FY95 of two new offices within BMDO to ensure that appropriate issues relating to system architecture and BMC3 are addressed in a coordinated and synergistic manner across all BMDO NMD and TMD efforts. The new offices, Architecture Integrator (DA) and the BMC3 Office (DB), report directly and independently to the BMDO Director (BMDO/D) to provide the necessary mission-area oversight to address and resolve BMC3 technical issues. Neither FY95 DA or DB efforts will be continued via this Program Element in FY96, but will be continued via TMD and NMD Program Element funding as appropriate. During FY95, this Program Element provides for the performance and transition of DA and DB system-level oversight activities to be continued via the NMD and TMD Program Elements, as appropriate, in FY96 and beyond.

(U) This project includes systems analyses of alternative ballistic missile defense architectures and concepts. These analyses are independent studies of element designs, architecture performance, alternative architectures and their performance, architecture costs, and insertion of emerging technologies into the system elements to reduce costs and increase effectiveness. Efforts also include mission analyses and simulations which focus on defining ballistic missile defense concepts; the impact of these concepts on international stability, deterrence, and arms control; and strategic and tactical effectiveness of proposed architectures. During FY95, DA activities performed under this Program Element comprise the continuation of architecture analysis and integration activities

beginning prior to FY95. In FY96, appropriate activities will be continued under the appropriate TMD and/or NMD Program Element(s).

(U) FY95 DB efforts will provide for the mission-area oversight and coordination of all BMDO BMC3 development and acquisition activities in the role of senior advisor to the Director, BMDO. This effort will provide for the synergistic evaluation of relevant BMC3 technical issues; the formulation of appropriate plans, programs, and policies to facilitate the coordination of all BMD Advanced Development BMC3 research, development, and acquisition activities across TMD and NMD program activities; promote appropriate reuse strategies to maximize BMD reuse capabilities; and minimize the duplication of BMC3 research and development efforts across all NMD and TMD development efforts. FY95 DB activities, not directly traceable to projects performed prior to FY95, will transition various activities funded via both TMD and NMD Program Elements, as appropriate, beginning in FY96.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Mission Description and Budget Item Justification section of each Program Element Summary.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1994 Accomplishments:
Architecture Analysis (DA):
- o This effort was not funded via this P.E. during FY94.

BMC3 Initiatives (DB):
- o This effort was not funded via this P.E. during FY94.

(U) FY 1995 Plans:

Architecture Analysis (DA):

- ($ 2.500M) Compare the government baseline and specific contractor element designs in order to update architecture performance previously determined; continue investigations of special topics and unique system concepts; evaluate advanced technology concepts.

BMC3 Initiatives (DB):

- ($ 0.883M) Information Architecture--identify, evaluate and promote the implementation of emerging evolutionary development processes across the BMD Community; support BMDO efforts in external DoD initiatives as they relate to IA-based evolutionary development processes; develop the programs, processes, and policies to support the implementation of such process throughout the BMD BMC3 development efforts; and support the development and implementation of BMD BMC3 Domain Information Architecture (IA) capabilities. Provide a core team of experts to support the mission-area analysis, evolution, and implementation of capabilities to provide a seamless development environment for BMD BMC3 software development from requirements through design and production of BMC3 executable code.
- ($ 0.425M) TMD/NMD Reuse--define and develop the process by which BMDO may find reuse opportunities through activities such as the Feature-Oriented Design Process developed by the Software Engineering Institute (SEI). Specifically, determine reuse opportunities in the near term as related to using TMD products in NMD and vice-versa, i.e., establish links between instantiated TMD and NMD information/software/physical architectures. Coordinate with and leverage from various DoD reuse efforts in the identification of candidate reuse opportunities for BMDO implementation.
- ($ 0.322M) Reuse Library--analysis of various object libraries under development, analysis of overall BMDO reuse requirements, and definition of appropriate BMD Reuse Library construct and process requirements for the cost-effective implementation of reuse throughout the BMD community. Pursue the establishment of a BMC3 library consortium with the JSIMS SPO, CTAPS SPO, NTF BCCE effort, NRAD, ARC, BMDO, and other appropriate DoD BMC3 development

organizations. Address the BMD BMC3 reuse capability in the context of the broader spectrum of acquisition reform within the DoD community.

- o ($ 0.200M) DoD Initiatives/Policy--address various DoD initiatives such as the Software Reuse Initiative, Software Management Initiative, software standards, etc., and their implications for BMDO BMC3 development efforts. As a leading innovator in software engineering techniques and methodologies, BMDO will work to shape the outcome of these initiatives based upon BMDO Options Assessment (OA) contractor finding, results of BMC3 Support Center (BSC) (located at the NTF) activities, and related experiences. Inferences and related policy implications will be drafted as they pertain to larger acquisition reform issues. Impacts upon BMDO efforts will be assessed, decisions made on how to implement, and feedback provided to the DoD community when implementation discrepancies arise.
- o ($ 0.200M) Allied Initiatives--support activities such as SCORE, CNAD etc., in order to formulate BMC3 cooperative development opportunities beyond present generalized BMDO community objectives. Anticipated activities include demonstrations, WALEX-type exercises, etc., primarily focused on NATO and other multi-national concerns and activities.
- o ($ 0.470M) Demonstrations--provide support for demonstrations that address those BMD-wide implementation needs which are not addressed by focused TMD and/or NMD-related demonstrations. Support the development on integrated planning tools to ensure BMDO-wide activities are properly harmonized. These will include such demos as JWID95, Joint Interoperability efforts, etc., which will continue to help in the definition of operation and implementation requirements for BMC3 CONOPS, Domain Architecture, etc.
- o ($ 0.114M) Software Engineering--define and sustain the BMDO Software Improvement Process which will include as a minimum the inclusion of the Software Engineering Institute Software Capability Evaluation process across the BMDO community in source selections and in encouraging continuous process improvement across all BMDO software development activities. Develop the process by which the BMDO will address its internal capabilities/skills as a PM office, including implementation of the new SEI PM Process evaluation guidelines.

- o ($ 0.502M) Direct Support--provide DB with the overall direct support required to coordinate all of the above efforts, establish and provide oversight to the engineering processes used to translate operational BMC3 requirements into Joint and Combined interoperable systems; provide independent technical analyses in support of options being explored by the Architecture Integrator; establish liaison with and foster synergism with National Technical Means C3I planning elements; plus additional support for unanticipated requirements as they evolve. Provide for non-Government expert support to the above efforts.
- o ($ 0.926M) Hardware/Software--hardware and software purchases in support of the objectives listed above. Anticipated purchases include CASE tools to support IA development and maintenance efforts, hardware and software to support reuse library analysis and development, products to support BMC3 demonstrations, etc.
- o ($ 0.850M) Service Support--Army, Air Force, Navy, and National Test Bed (NTB) support in the performance and execution of above tasking to meet emerging DB goals and objectives to support evolving BMDO mission requirements.

(U) FY 1996 Plans:
- o Continuation of DA and DB FY95 program efforts under both TMD and NMD Program Elements.

(U) FY 1997 Plans:
- o Continuation of DA and DB FY95 program efforts under both TMD and NMD Program Elements.

Acquisition Strategy: The RFP for the architecture analysis follow-on contract was released in May 1994. Contract award is anticipated in the first quarter of FY 1995. Expertise of Government, FFRDC, SEIC, and SETA personnel will be leveraged in the execution of project activities, utilizing existing contracts to the maximum extent possible. Specifically, USASSDC and USAF/ESC Government and contractor personnel are expected to lead Information Architecture and development efforts; existing and follow-on SETA and SEIC contracts will provide the core of technical expertise for a variety of BMC3 activities; and existing contract vehicles

for IDA and other contractors will provide state-of-the-art technical expertise in Software Engineering and related technical areas. Additional contractor services will be procured as needed to meet emerging program requirements.

B. (U) PROGRAM CHANGE SUMMARY:

	FY1994	FY1995	FY1996	FY1997	TOTAL COST
Previous President's Budget	0	8,000	8,000	8,000	24,000
Appropriated Value		8,000			8,000
Adjustments to Appropriated Value		-608			(608)
Current Budget Submit	0	7,392	0	0	7,392

Change Summary Explanation: Architecture analysis and integration efforts performed as part of this project were previously performed via CDS Project 3207 prior to FY95. Beginning in FY96, all activities comprising FY95 CDS Project 3153 will be funded and performed via a combination of both TMD and NMD Program Elements, as appropriate.

Funding: Reflects reductions in funding directed by Congress.
Schedule: None. This project is not an acquisition program, but supports BMD long-term planning.
Technical: Reductions in funding result in a reduced level of effort.

C. (U) OTHER PROGRAM FUNDING SUMMARY

Related RDT&E: Funding Dependency (Yes[1]/No)

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 03 (Advanced Development)

PE:0603173C (Proj: 3153)
PE Title: Support Tech (U)

3153 Arch. Anal.& BMC3 Initiatives P.E. 0603871C No

[1]Funding data for related RDT&E efforts that have a funding dependency can be found in the respective project summary/program element.

D. (U) Schedule Profile

	FY1994				FY1995				FY1996				FY1997			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Acquisition Milestone																
Engineering Milestone																
- Software Policy Update																
- BMD IA (CONOPS)					x											
- Software Engineering Documentation Updates								x								
T&E Milestone																
Contract Milestone																
- Award Arch. Analysis Support Contract					x											
Other Program Events																
- Annual Contract Program Review								x								
- Tech. Analyses, Reports, & Briefings As Req'd.					x	x	x	x								

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 03 (Advanced Development)

PE:0603173C (Proj: 3157)
PE Title: Support Tech (U)

Project Number / Title: 3157 Environment, Siting and Facilities

Program Name:	FY1994 Actual	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	FY2000 Estimate	FY2001 Estimate	Total Program
0603173C RDT&E	5,506	5,606	0	0	0	0	0	0	Continuing

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION:

(U) This project provides environmental program guidance, environmental impact analyses and documentation, real property facility siting, and facility management and acquisition support for the BMDO National Missile Defense (NMD) system and Theater Missile Defense (TMD) system. Plans, programs, budgets, and oversees the NMD and TMD facility acquisition through Military Construction (MILCON) and RDT&E construction projects. Provides guidance and leads BMDO NMD and TMD environmental compliance, pollution prevention, other environmental efforts, and the Environmental Assessment and Environmental Impact Statement process for NMD and TMD activities. Develops guidance for Executing Agents on facility siting, facility acquisition, and environmental matters to support NMD and TMD activities. Provides MILCON design funds to support design of BMDO's NMD and TMD major and minor MILCON projects. Provides MILCON Minor Construction funds to support TMD's out-of-cycle unforeseen MILCON projects under $1.5M.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Mission Description and Budget Item Justification section of each Program Element Summary.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1994 Accomplishments:

- ($ 3.856M) Continued facility siting development, environmental compliance programs, and environmental analysis and documentation for critical test and evaluation programs for TMD: (Completed the TMD Programmatic EIS, THAAD EA, Hera EA, and Wake Island Reuse EA and Baseline Study; continued to work the TMD Extended Test Range EIS. Initiated siting analysis for extended test range testing for TMD. Completed siting analysis for THAAD User Operational Evaluation System [UOES] and THAAD First Objective Battalion fielding.) The Facilities, Siting and Environmental project delivered documentation, analysis and facilities to support the BMDO contingency NMD capability based on a 1997 deployment decision. These supported the test and evaluation for the NMD program. An Environmental Impact Analysis was developed as required by the National Environmental Policy Act (BMD Programmatic EIS). A siting study was conducted for the deployment of the NMD system. Continued facility siting development, environmental compliance programs, and environmental analysis and documentation for critical test and evaluation programs and NMD (Completed the BMD Programmatic Environmental Impact Statement [EIS] and the USAKA Supplemental EIS. Initiated siting analysis for System Test Sites.)

- ($ 0.512M) Continued real estate facility planning in support of TMD and NMD with emphasis on future TMDI test facilities and NMD fielding sites.

- ($ 1.138M) Executed and managed TMD's and NMD's FY 94-96 Military Construction, Minor Military Construction, and RDT&E facility design and construction projects and activities to progress with the TMD initiative's and NMD's facility requirements: (TMD GBR maintenance facility and UOES site work, THAAD training/maintenance storage, and target launch

complexes. Also did facility constructibility, construction methods, and materials planning for a return to the SAFEGUARD site.)

- o ($2.977) MILCON Design Activities

(U) FY 1995 Plans:

- o ($ 4.588M) Develop siting, basing deployment plans, environmental compliance, environmental analysis, and documentation for TMD and NMD: (Facilitate and expedite a contingency deployment of an NMD capability. Site specific issues for TMDI garrisoning and fielding. TMD Flight Test EA, Supplement to TMD Extended Test Range EIS, integration of environmental documents). Complete current SETA contract. Award new SETA contract.
- o ($ 0.268M) Complete facility planning in support of test and evaluation activities, acquisition programs, and NMD contingency deployment planning, with emphasis on TMDI garrison facilities and launch complex issues.
- o ($0.750M) Execute and manage the TMD and NMD FY 95-97 Military Construction, Minor Military Construction, and RDT&E facility design and construction projects and activities with emphasis on completing the TMD initiative's facility requirements. (Complete design of THAAD First Objective Battalion facilities at Fort Bliss, Texas, design for THAAD test facilities at USAKA, and completion of facilities on Wake Island.)
- o (0.530M) MILCON Design Activities.

Acquisition Strategy: BMDO contractor support (Currently under a small business Cost Plus Fixed Fee contract; this contract will be recompeted for similar contract-type award in FY 95) will be utilized for technical and overview assistance of Facilities, Siting, and Environmental activities. Other similar small business contracts, as well as full and open competition Cost Plus Fixed Fee and Fixed Price contracts, by U.S. Army Space and Strategic Defense Command and the U.S. Army Program Executive Office-Missile Defense will be utilized for additional technical assistance for the development of Facilities, Siting, and Environmental documentation

requirements. BMDO tasks the Services through Program Management Agreements to perform the required tasks in support of the BMDO program. BMDO performs quarterly on-site reviews to verify and validate completed tasks.

B. (U) PROGRAM CHANGE SUMMARY:

	FY1994	FY1995	FY1996	FY1997	TOTAL COST
Previous President's Budget	5,606	5,606	5,606	5,606	22,424
Appropriated Value		5,606			5,606
Adjustments to Appropriated Value		0			0
Current Budget Submit	5,506	5,606	0	0	11,112

Change Summary Explanation:
Funding: None
Schedule: None
Technical: None

C. (U) OTHER PROGRAM FUNDING SUMMARY:

Related RDT&E:	Funding Dependency? (Yes[1]/No)	
3160 Readiness Planning	0603871C	No
2154 Ground Based Radar	0603862C	No
1267 Kinetic Kill Vehicle	0603871C	No

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 03 (Advanced Development)

PE:0603173C (Proj: 3157)
PE Title: Support Tech (U)

1460 Battle Management C3 0603871C No

[1]Funding data for related RDT&E efforts that have a funding dependency can be found in the respective project summary/program element.

D. (U) Schedule Profile

	FY1994				FY1995				FY1996				FY1997			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Contract Milestone							Xa/Xb									

Xa Complete current SETA contract.
Xb Award new SETA contract.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 03 (Advanced Development)

PE: 0603173C (Proj: 3270)
PE Title: Support Tech (U)

Project Number / Title: 3270 Threat and Countermeasures Program

Program Name:	FY1994 Actual	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	FY2000 Estimate	FY2001 Estimate	Total Program
0603173C RDT&E	31,243	30,167	0	0	0	0	0	0	Continuing

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION:

(U) Threat and Countermeasures Program. This Project, PE 0603173C is transitioning to PE 0603871C (NMD Technology) and PE0603872C (other TMD) for all future work. It was previously funded under Projects 3202, 3203, and 3206 in the FY95 President's Budget. The BMDO National Missile Defense (NMD) and Theater Missile Defense (TMD) Threat Programs define potential adversary military forces principally theater and strategic missiles, which the Ballistic Missile Defense (BMD) system could confront. To accomplish this mission, BMDO has a threat development program which is based on Intelligence Community projections and is traceable to quantifiable analysis. The Program comprises three component tasks: Intelligence Threat, Countermeasures Integration, and System Threat Scenario Generation.

(U) Intelligence Threat Task. The purpose of the BMD Intelligence Threat task is to provide Intelligence Community-validated NMD and TMD threat descriptions. The Intelligence Threat task divides the threat into four major categories: Operational Threat Environment, Targets, System Specific Threats (SST), and Reactive Threats. The Operational Threat Environment includes assessments of the NMD and TMD operational and technological environments and projects the effects of developments and trends on mission capability. The Targets category includes a projection of foreign theater and strategic missile systems and the countermeasures that enhance their performance. This includes force structure, performance characteristics, and sample signatures.

System Specific Threat includes reconnaissance, surveillance, and target acquisition; lethal and non-lethal threats; and regional integrated SST assessments. Reactive Threats are those that an adversary may develop as a result of deployment of U.S. NMD and TMD systems.

(U) System Threat Scenario Generation Task. The accurate specification and characterization of ballistic missiles and the appropriate development and integration of scenarios using these characterizations are critical to the analysis of alternative ballistic missile architectures, the performance assessments of potential technology applications, and the operational performance evaluations of candidate designs. This task provides baseline and excursion scenario descriptions in documentary and electronic form for use in BMDO TMD COEA evaluations and NMD system and architecture analyses. These descriptions are the only approved threat employment portrayals authorized for acceptable BMDO analysis. This task:

(1) Identifies user needs for threat scenario descriptions.
(2) Identifies analyses needed to fully specify and characterize the threat missile systems, penetration aids, tactics, etc., and ensures the analyses is accomplished.
(3) Provides the analysis results to all interested agencies for review and comment.
(4) Addresses critical threat issues which arise during the analysis process.
(5) Ensures all supporting agencies' views on threat issues are fully aired.
(6) Reviews, approves, produces, and distributes all System Threat Scenario Descriptions.
(7) Produces threat computer tapes and supporting documentation for use by the development and acquisition communities.

(U) Countermeasures Integration Task. The BMDO Countermeasure Integration (CMI) Program assists BMD acquisition program offices in developing ballistic missile defense systems that are robust to potential countermeasures which are practical and within the means of anticipated adversaries. Included in this mission is CMI Program support to the BMD threat development process and advance warning to BMDO system designers. The CMI program determines the effectiveness of potential countermeausers through

analysis, high fidelity simulations, and ground and flight tests. The BMDO CMI Program reviews BMD systems for susceptibilities and identifies potential countermeasure concepts. CMI then analyses the potential effectiveness of each countermeasure concept and characterizes credible countermeasures by providing designs and performance parameters. CMI informs intelligence and system threat developers of potential countermeasures, informs BMD system designers with advance warning of potential countermeasures, and assists BMD system designers in developing counter-countermeasures. Providing vulnerability and susceptibility information to the system designers early enables them to build robustness into their designs during the early stages of the system development process, a cost-effective means for providing a flexible high-performance design.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Mission Description and Budget Item Justification section of each Program Element Summary.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) Intelligence Threat. The key project accomplishments have been the production of BMDO Capstone System Threat Assessment Reports (STARs), Intelligence Production Requirements, and system level descriptions of most adversarial ballistic missiles and penaids. In addition, the Intelligence Threat task detailed lethality-oriented and test target designs, extensively assessed System Specific Threats, and began country-by-country evaluations of military doctrine for missile employment. An unclassified ballistic missile proliferation report was widely distributed.

(U) System Threat Scenario Generation. This task was designed to provide threat data in a form that could be used by system designers to evaluate the effectiveness of missile defenses. From the creation of the FY 88-89 Design-to-Threat documentation to the FY 91 Global Protection Against Limited Strikes (GPALS) 91 series of scenarios to the current production of Theater Campaign

Scenarios, the System Threat Scenario Generation task sought to provide a more detailed description of the total threat environment U.S. missile defense systems will face in the future. The scenarios created since the inception of the program expanded the threat description from single ballistic missile flights to descriptions of environments that include missiles, aircraft, UAVs, cruise missiles, rockets, electronic warfare, and red defensive systems such as SAMs. All threat data contained in the scenarios are drawn from Intelligence Community estimates and modeled by the National Test Facility. The scenarios developed in FY94 are the result of joint BMDO and U.S. Army Air Defense Artillery School efforts with support from U.S. Navy and U.S. Air Force elements.

(U) Countermeasures Integration. The Countermeasures Integration program completed susceptibility analyses of the THAAD, GBR, and PAC-3 (ERINT) systems to potential enemy countermeasures and communicated the results to the BMD acquisition community. A countermeasures "skunkworks" was established to conceive, design, assemble, and test simple inexpensive TMD countermeasures in a "Rest of World" (ROW) environment. The skunkworks completed one highly successful countermeasures flight test and commenced work on three other potentially effective countermeasures. Additionally, the Countermeasures Integration program established a data base on the countermeasures technologies available to potential ROW adversaries. This data base will assist the BMD developers in designing systems that are robust to potential countermeasures. Counter-countermeasures parametric studies (CCMPS) were initiated to assist BMD program offices in assessing the design, cost, and schedule impact of implementing counters to potential countermeasures. The Countermeasures program completed a comprehensive analysis (technical/non-technical) of the effect of countermeasures upon TMD systems in the low endoatmospheric region (the Low Endo Red/Blue Exchange) and planned a similar exchange directed at countermeasures to the entire TMD architecture in all regions

(U) FY 1994 Accomplishments:

- ($8.053M) Intelligence Threat task: STAR and STAR Annexes, Specialty Threats, Targets Analyses, System-Specific Threat (SST) Studies, Operational Threat Environment (OTE) Intelligence Assessments.

- o ($6.890M) System Threat Scenario Generation task: Developed threat system characterizations and scenario descriptions in response to the analysis needs of the system/element developers, Continued to upgrade the threat modeling capability and produce threat tapes and supporting documentation through the NTF, Developed scenarios depicting threat systems employed in theater environments.
- o ($16.300M) Countermeasures Integration task: TMD CM Red/Blue activities and Counter-countermeasure Parametric Studies, TMD CM technical experiments and evaluations, CM Skunkworks (3 countermeasures missions), Analysis, oversight, and database management.

(U) FY 1995 Plans:

- o ($7.550M) Intelligence Threat task: Capstone STAR, National Missile Defense Threat Assessment Report, Targets Analyses, Operational Threat Environment Intelligence Assessments, Threat Reference Guide, Management Planning and Support.
- o ($5.617M) System Threat Scenario Generation task: Developed threat system characterizations and scenario descriptions in response to the analysis needs of the system/element developers, Continue to upgrade the threat modeling capability and produce electronic media and supporting documentation through the NTF, Develop scenarios depicting employed threat systems
- o ($17.000M) Countermeasures Integration task: TMD CM Red/Blue activities and Counter-countermeasure Parametric Studies, TMD CM technical experiments and evaluations, CM Skunkworks teams conduct CM concept, design, fabrication, and flight tests (3 countermeasures missions), Non-technical analysis, oversight, and database management.

(U) FY 1996 Plans: None

(U) FY 1997 Plans: None

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 03 (Advanced Development)

PE: 0603173C (Proj: 3270)
PE Title: Support Tech (U)

Acquisition Strategy: The acquisition strategy for the Threat Program is to ensure continuity in the threat development and scenario generation process. Funding is provided to Executing Agents who accomplish tasks under existing contracts (via MIPRS, SETAs, and FFRDCs).

B. (U) PROGRAM CHANGE SUMMARY:

	FY1994	FY1995	FY1996	FY1997	TOTAL COST
Previous President's Budget	31,243	33,243	33,243	33,243	130,972
Appropriated Value		33,243			33,243
Adjustments to Appropriated Value		-3,076			(3,076)
Current Budget Submit	31,243	30,167	0	0	61,410

Change Summary Explanation:
Funding: There was a reduction in the FY95 CMI Program by $1.303M.
Schedule: None.
Technical: None.

C. (U) OTHER PROGRAM FUNDING SUMMARY

Related RDT&E:	Funding Dependency? (Yes[1]/NO)
1266 Sea-based Theater-wide Defense (Upper Tier) 0603868C	No
2154 TMD-GBR 0603861C	No
2257 PATRIOT 0208865C	No

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 03 (Advanced Development)

PE: 0603173C (Proj: 3270)
PE Title: Support Tech (U)

2260 THAAD 0603861C/0604861C	No
2263 Navy Area TBMD 0603867C/0604867C	No
3352 Modeling and Simulations 0603871C/0603872C	No
3270 Threat and Countermeasures 0603872C/0603173C	Yes

[1]Funding data for related RDT&E efforts that have a funding dependency can be found in the respective project summary/program element.

D. (U) Schedule Profile

	FY1994				FY1995				FY1996				FY1997			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
STAR Published					X											
CM Skunkworks (Flight tests)			X													
Threat Scenario Generation (as required)																

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 03 (Advanced Development)

PE:0603173C (Proj: 3352)
PE Title: Support Tech (U)

Project Number / Title: 3352 Modeling and Simulations

Program Name:	FY1994 Actual	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	FY2000 Estimate	FY2001 Estimate	Total Program
0603173C RDT&E	0	3,000	0	0	0	0	0	0	Continuing

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION:

(U) This project provides for the development of validated models and simulation techniques and tools that are critical in assessing the performance capabilities of BMD systems. This is a highly complex problem requiring high-performance vector and parallel processing super-computers as well as scalar processors and advanced graphic work stations. This cost effective approach will reduce high cost missile test programs and will establish requirements for future technology. A portion of this capability is housed at the National Test Facility (NTF). This facility is capable of operating in a distributed integrated simulation environment and hosts modeling and simulation wargames that provide the analysis, integration, demonstration, and performance verification capability for BMD systems. This facility is provided to all Services and procedures have been established that ensure efficient utilization and sound verification, validation, and accreditation.

(U) The funding for this facility is distributed across three Program Elements (PEs) in FY95 (NMD,TMD, and Support Technology). This cost sharing approach maximizes synergy and minimizes duplication of modeling and simulation resources. These Pes cover the total costs for operations and maintenance of this facility which includes: computer hardware and software, communications networks, security, and other essential capabilities necessary to develop and operate reconfigurable, multiple experiment test bed environments. This document describes the Support Technology portion of funding for these activities.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 03 (Advanced Development)

PE:0603173C (Proj: 3352)
PE Title: Support Tech (U)

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Mission Description and Budget Item Justification section of each Program Element Summary.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) This project's effort provides super-computing resources at the NTF and integration support including operations and maintenance of the facility, computer hardware and software, communication networks, security, and other essential capabilities that support Ballistic Missile Defense.

(U) FY 1994 Accomplishments:
Not Applicable

(U) FY 1995 Plans:
- ($3.000M) Provide super-computing resources at the NTF and integration support including operations and maintenance of the facility, computer hardware and software, communication networks, security, and other essential capabilities that support Ballistic Missile Defense.

(U) FY 1996-1997 Plans:
Not Applicable

(U) Acquisition Strategy: The tasks in this project have been met through full and open contractual competition to support Technology Follow-on M&S requirements. Overall BMDO M&S oversight is provided by BMDO/AQM.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 03 (Advanced Development)

PE:0603173C (Proj: 3352)
PE Title: Support Tech (U)

B. (U) PROGRAM CHANGE SUMMARY:

	FY1994	FY1995	FY1996	FY1997	TOTAL COST
Previous President's Budget	0	3,000	3,000	3,000	9,000
Appropriated Value		3,000			3,000
Adjustments to Appropriated Value		0			0
Current Budget Submit	0	3,000	0	0	3,000

Change Summary Explanation:
Funding: This project evolved from project 3300 funding in the FY1995 President's Budget. Provides a one year infusion of Support Technology funding and compliments NMD and TMD funding for development and operations at the NTF.
Schedule: None
Technical: None

C. (U) OTHER PROGRAM FUNDING SUMMARY

Related RDT&E:	Funding Dependency? (Yes[1]/No)
3352, Modeling and Simulation, PE 0603871C	Yes
3352, Modeling and Simulation, PE 0603872C	Yes

[1]Funding data for related RDT&E efforts that have a funding dependency can be found in the respective project summary/program element.

D. (U) Schedule Profile

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 03 (Advanced Development)

PE:0603173C (Proj: 3352)
PE Title: Support Tech (U)

	FY1994				FY1995				FY1996				FY1997			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Acquisition Milestone																
Engineering Milestone																
T&E Milestone																
Contract Milestone																
Other Program Events																

Planned Milestones Beyond FY97:
None

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 03 (Advanced Development)

PE: 0603173C (Proj: 3360)
PE Title: Support Tech (U)

Project Number / Title: 3360 Test Resources

Program Name:	FY1994 Actual	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	FY2000 Estimate	FY2001 Estimate	Total Program
0603173C RDT&E	0	6,963	0	0	0	0	0	0	Continuing

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION:

(U) The goal of the Technology Development program is to develop and demonstrate technologies to insure that ballistic missile defense elements can perform their missions in all expected environments against all deployed and expected threats. The technologies can be used to enhance the performance of ongoing acquisition and technology readiness programs and to enable new capabilities against existing threats. Project 3360 provides for BMDO planning oversight and coordination of integrated Test and Evaluation activities and inter-element, as well as inter-service Test and Evaluation efforts and provides for test infrastructure for common ground test facilities and range instrumentation. The common ground test facilities include: the Kinetic Kill Vehicle Hardware-in-the-Loop Simulator (KHILS) at Eglin AFB, Fort Walton Beach, FL; the Hypervelocity Wind Tunnel Number 9 (Tunnel 9) at the Naval Surface Warfare Center, White Oak, MD; the Aero-optical Evaluation Center (AOEC) located at Calspan Corp., Buffalo, NY; the Army Missile Optical Range (AMOR) at the U.S. Army Missile Command, Huntsville, AL; the Portable Optical Sensor Tester (POST) and the Characterization of Low Background Mosaics (CALM) at Rockwell International, Anaheim, CA; the Naval Research and Development (Nrad) faciiity located at the Naval Command, Control and Ocean Surveillance Center, San Diego, CA; and the infra-red and blackbody standards at the National Institute of Standards and Technology (NIST) in Gaithersburg, MD. The range instrumentation includes special test equipment, data collection assets, and range instrumentation upgrades including the Kwajalein Missile Range Safety System (KMRSS) located at the Kwajalein Missile Range (KMR) in the Marshall Islands. These ground test and instrumentation assets provide valuable program risk reduction and test implementation capability in support of the Technology

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 03 (Advanced Development)

PE: 0603173C (Proj: 3360)
PE Title: Support Tech (U)

Development test and evaluation program. The ground test facilities provide a cost effective method of testing and evaluating applicable component and sub-system level technologies. The range instrumentation provides a cost effective capability to collect test vehicle characteristics and performance data on flight tests. These facilities and capabilities support component design, verification and validation of target realism, and the evaluation of test results. Project 3360 has combined all of the projects which have previously been designated 3310, 3311, and 3313. The FY95 RDT&E Descriptive Summary of these previous projects was combined in CDS 3300 with other test and evaluation support projects. This program element no longer exists after FY95. Please refer to Project 3360 Other TMD and 3360 NMD Technology for further descriptions.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Mission Description and Budget Item Justification section of each Program Element Summary.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY1994 Accomplishments: None

(U) FY 1995 Plans:

- ($ 6.143M) Provide ground test facility infrastructure and upgrades for BMDO testing including: hardware-in-the-loop testing at KHILS, wind tunnel testing at Tunnel 9, shock-tunnel testing at AOEC, sensor testing at POST, CALM and Nrad, and phenomenology characterization at AMOR and KHILS. IOC of the WISP at KHILS and IOC of AOEC.
- ($ 0.820M) Provide range instrumentation, upgrades, data collection, and analyses for BMDO testing including the KMRSS at KMR.

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RDT&E, Defensewide / BA 03 (Advanced Development)

PE: 0603173C (Proj: 3360)
PE Title: Support Tech (U)

(U) FY 1996 Plans: None

(U) FY 1997 Plans: None

Acquisition Strategy: The 3360 (test resources) project for the Technology Development program provides support to Technology in the form of ground test facilities and test range instrumentation. In the selection and acquisition of test facilities and range instrumentation, the BMDO implements a Reliance process which a) maintains perspective of national technical test capabilities; b) is responsive to program requirements; c) uses existing test resources where possible; d) requires coordination prior to development of new resources; and e) consolidates management of existing resources where possible and practicable. This policy results in a variety of acquisition methods. Executing Agent Project Managers for the elements and tasks under this project include the three services and the BMDO, to take best advantage of existing strengths and capabilities. Service Project Manager organizations specifically include : the U.S. Army Space and Strategic Defense Command (USASSDC), the U.S. Navy Office of Naval Research, Navy Ballistic Missile Defense Technology and the U.S. Air Force Phillips Laboratory. The majority of the ground test facilities are government owned and operated, many with some degree of contractor support, which support multiple BMDO users.

B. (U) PROGRAM CHANGE SUMMARY:

	FY1994	FY1995	FY1996	FY1997	TOTAL COST
Previous President's Budget	0	5,950	4,250	4,250	14,450
Appropriated Value		7,950			7,950
Adjustments to Appropriated Value		-0,987			(987)
Current Budget Submit	0	6,963	0	0	6,963

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 03 (Advanced Development)

PE: 0603173C (Proj: 3360)
PE Title: Support Tech (U)

Change Summary Explanation:

Funding: Project 3360 has combined all of the projects which have previously been designated 3310, 3311, and 3313. The FY95 RDT&E Descriptive Summary of these previous projects were combined in CDS 3300 with other test and evaluation support projects.

Schedule: None

Technical: None

C. (U) OTHER PROGRAM FUNDING SUMMARY

Related RDT&E:	Funding Dependency? (Yes[1]/No)
1151, Sensors, 0603871C	No
1155, Phenomenology Program, 0603871C	No
1161, Advanced Sensor Technology, 0603173C	No
1265, Boost Phase Interceptor, 0603870C	No
1267, Ground Base Interceptor, 0603871C	No
1270, Advanced Interceptors, 0603173C	No
1651, Innovative Science and Technology, 0602173C	No
2358, HAWK System BMC3, 0603863C	No
3157, Environmental, Siting and Fac, 0603173C	No
3354, Targets, 0603871C	No
3359, System Test and Evaluation, 0603871C	No
3360, Test Resources, 0603871C,72C	Yes

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 03 (Advanced Development)

PE: 0603173C (Proj: 3360)
PE Title: Support Tech (U)

[1]Funding data for related RDT&E efforts that have a funding dependency can be found in the respective project summary/program element.

D. (U) Schedule Profile

Milestones	FY1994				FY1995				FY1996				FY1997			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
KHILS WISP IOC								X								
Tunnel 9 Full Flight Dup IOC						X										
Tunnel 9 Phenomenology Support							X									
AOEC IOC							X									
AOEC AIT Support						X	---	---	---	---	---	---	---	---	---	---
AMOR KHILS Support								X	---	---	---	---	---	---	---	---
AMOR EKV Support								X								
POST Sensor Tech Support						X	---	---	---	---	---	---	---	---	---	---
CALM Sensor Tech Support					X	---	---	---	---	---	---	---	---	---	---	---
Nrad Sensor Tech Support					X	---	---	---	---	---	---	---	---	---	---	---
NIST IR Primary Standard						X	---	---	---	---	---	---	---	---	---	---

Planned Milestones Beyond FY1997: NONE

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04/05 (Dem/Val / EMD)

PE: 0603861C/0604861C (Proj: 2154)
PE Title: THAAD SYSTEM (U)

Project Number / Title: 2154 Theater Missile Defense Ground-Based Radar

Program Name:	FY1994 Actual	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	FY2000 Estimate	FY2001 Estimate	Total Program
0208861C PROC	0	0	0	0	11,941	156,234	289,580	433,872	2,396M
0603861C RDT&E	235,705	171,828	162,558	8,188	0	0	0	0	732M
0604861C RDT&E	0	0	0	204,000	173,000	134,000	79,000	33,000	760M

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION:

(U) The Theater Missile Defense Ground-Based Radar (TMD-GBR) is the acquisition and fire control radar of the Theater High Altitude Area Defense (THAAD) weapon system. TMD-GBR is designed to provide threat early warning, threat type classification, interceptor fire control, external sensor cueing, launch and impact point estimates for the THAAD weapon system (project 2260). Also, the TMD-GBR is required to provide cueing support to other TMD systems such as PATRIOT. TMD-GBR is based on state-of-the-art solid-state X-band radar technologies. The TMD-GBR program will purchase one demonstration/validation (Dem/Val) radar and two User Operational Evaluation System (UOES) radars. The TMD-GBR Dem/Val radar will be used to support the initial radar integration and interceptor tests at White Sands Missile Range in FY1995, continuing radar characterization tests at U.S. Army Kwajalein Atoll in FY1996. At the end of the TMD-GBR Dem/Val program the Dem/Val radar and its associated equipment will be transferred to the National Missile Defense Radar Technology Demonstrator program. The UOES radars will continue integrated THAAD weapon system testing in FY1996 and be available for Limited User Tests and contingency deployments in FY1997. The engineering and manufacturing development program will expand the UOES performance characteristics to meet the ORD objective system requirements. Included in the TMD-GBR program is a solid state demonstration array (SSDA) program, concentrating on increased transmit/receive (T/R) module performance and producibility and maintaining the ability for competitive award of the EMD effort.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04/05 (Dem/Val / EMD)

PE: 0603861C/0604861C (Proj: 2154)
PE Title: THAAD SYSTEM (U)

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) The TMD-GBR UOES completed its CDR in Dec 1993. T/R module production began in January 1994, and the TMD-GBR Block 1 software successfully entered DT&E in April 1994. The design entered factory system testing in July 1994, and is scheduled to begin delivery to White Sands Missile Range in March 1995.

(U) FY 1994 Accomplishments:
- o ($ 87.700M) Complete TMD-GBR Dem/Val radar fabrication and begin factory string/system test.
- o ($ 10.100M) Complete Build 1 and Build 2 of system software.
- o ($ 6.000M) Complete TMD-GBR UOES CDR.
- o ($128.400M) Begin TMD-GBR UOES fabrication.
- o ($ 3.505M) Continue systems engineering analysis of radar performance, countermeasures, and integration into THAAD weapon systems.

(U) FY 1995 Plans:
- o ($ 73.506M) Complete manufacturing of Dem/Val radar and continue fabrication and production of UOES Number 1 and 2 radars.
- o ($ 61.045M) Continue development of advanced prime power units (PPU), SSDA, and other supporting technologies (fiber optic cable (FOCPAT), nuclear environment (OPINE), electronic countermeasures, and anti-radiation missiles (ARM)); provide for government and contractor program and logistics management support.

- o ($ 31.450M) Conduct factory integration testing; conduct radar testing at Ft. Devens; deliver TMD-GBR Dem/Val radar to WSMR; complete integration of Dem/Val radar at WSMR; begin flight testing with THAAD.
- o ($ 5.827M) Complete engineering design for TMD-GBR Dem/Val and UOES radars.

(U) FY 1996 Plans:

- o ($ 77.864M) Complete technology developments (SSDA, Advanced PPU, FOCPAT, OPINE, ARM) and transfer to EMD requirements; provide government and contractor program and logistics management; develop EMD requirements, request for proposal, prepare for source selection and support preparation for Milestone II in FY97
- o ($ 45.490M) Complete fabrication of UOES No. 1 and 2 radars.
- o ($ 35.432M) Complete factory string tests on UOES No. 1 and 2; deliver UOES No. 1 and 2 radars to WSMR; complete integration and support THAAD flight testing; conduct radar characterization tests at WSMR (RST-1) and USAKA (in conjunction with the Theater Critical Measurements Program (TCMP)).
- o ($ 3.772M) Provide system engineering support to THAAD flight tests and compare test results to predicted performance simulations.

(U) FY 1997 Plans:

- o ($ 63.122M) Begin piece part purchases and fabrication of EMD radars.
- o ($ 49.362M) Award EMD contract and begin objective system design engineering; conduct requirements and design reviews on objective GBR.
- o ($ 27.514M) Provide government and contractor program and logistics support of EMD program.
- o ($ 17.800M) Release EMD RFP, conduct source selection and support Milestone II Defense Acquisition Board; provide program management support on conclusion of Dem/Val.
- o ($ 23.606M) Complete Dem/Val flight test support; support THAAD limited user tests and UOFS characterization tests.

- o ($ 12.290M) Begin planning for Development, test & evaluation test program; purchase dedicated target for FY99 radar test.
- o ($ 8.188M) Monolithic Microwave Integrated Circuit producibility and yield improvements for EMD.
- o ($ 10.306M) Complete manufacturing of radar component spares and provide CLS for UOES radars.

Acquisition Strategy: A full and open competition resulted in the award of the GBR Family of Strategic and Theater Dem/Val radars contract to Raytheon Company on 17 September 1992. The Dem/Val phase includes the development and test of the TMD-GBR Dem/Val radar and two TMD-GBR UOES radars. A contract for the development and test of the TMD-GBR EMD radar and fourteen Production radars will be competitively awarded following a Milestone II decision in 1QFY97.

B. (U) PROGRAM CHANGE SUMMARY:

DEM/VAL:	FY1994	FY1995	FY1996	FY1997	TOTAL COST
Previous President's Budget	234,000	173,200	157,450	49,220	613,870
Appropriated Value		173,200			173,200
Adjustments to Appropriated Value		-1,372			(1,372)
Current Budget Submit	235,705	171,828	162,558	8,188	578,279

EMD:	FY1994	FY1995	FY1996	FY1997	TOTAL COST
Previous President's Budget	0	0	9,790	145,130	154,920
Appropriated Value		0			0
Adjustments to Appropriated Value		0			0
Current Budget Submit	0	0	0	204,000	204,000

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04/05 (Dem/Val / EMD)

PE: 0603861C/0604861C (Proj: 2154)
PE Title: THAAD SYSTEM (U)

Change Summary Explanation:
Funding: This project was funded under Project 2104 in the FY95 President's Budget. For FY94 additional funds were transferred to TMD-GBR due to the contract overrun experienced by Raytheon. These funds were needed to maintain the contract schedule for the Dem/Val radar. In FY95, while Congress appropriated the full President's Budget request, they also made an undistributed reduction to the RDT&E appropriations. The $6.357M reduction was the TMD-GBR share of this amount. For FY97, an accounting error was made between the Dem/Val and EMD RDT&E program elements. An additional $42.100M will be reprogrammed in the FY97 President's Budget from EMD to Dem/Val for completion of the Dem/Val program.

Schedule: The Milestone II decision date slipped from 4QFY96 to 1QFY97 due to the THAAD program delay resulting from funding reductions in the FY95 Congressional appropriations for THAAD. The UOES #1 and #2 radars and the RST-1 and RST-2 radar tests have moved due to funding shortfalls in FY95. These shortfalls are the combined result of the FY95 Congressional reduction in RDT&E funds for DoD and contract overruns at Raytheon.

Technical: None

C. (U) OTHER PROGRAM FUNDING SUMMARY

MILCON/Procurement: As listed on Page 1.

Related RDT&E:	Funding Dependency? (Yes[1]/No)
*1155, Phenemonology Program, 0603872C	Yes
*1161, Radar Survivability 0603872C	Yes
*1170, TMD Risk Reduction, 0603872C	Yes

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04/05 (Dem/Val / EMD)

PE: 0603861C/0604861C (Proj: 2154)
PE Title: THAAD SYSTEM (U)

*3251, Sys Eng and Tech Support, 0603872C	Yes
*3261, BM/C3I, 0603872C	Yes
*3265, User Experiments, 0603864C/0604864C	Yes
*3354, Targets, 0603872C	Yes
*3359, System Test and Evaluation, 0603872C	Yes
*3157, Envir Siting & Facilities, 0603872C	Yes
*3260, Test Resources, 0603872C	Yes
*3352, Modeling and Simulation,	Yes
*2259, Israeli Cooperative Projects, 0603872C	Yes

* These projects provide essential technical, engineering, and/or infrastructure support to MDAP programs.

[1]Funding data for related RDT&E efforts that have a funding dependency can be found in the respective project summary/program element.

D. (U) Schedule Profile

	FY1994				FY1995				FY1996				FY1997			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Acquisition Milestone													Xm			
Engineering Milestone	Xuc	Xtr	Xsw				Xdv			Xu1		Xu2				
T&E Milestone								Xi			Xr1	Xr2				
Contract Milestone													Xe			
Other Program Events						Xt										

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04/05 (Dem/Val / EMD)

PE: 0603861C/0604861C (Proj: 2154)
PE Title: THAAD SYSTEM (U)

Xuc = UOES CDR Complete
Xdv = Dem/Val Radar Delivery
Xu1 = UOES Radar 1 Delivery
Xu2 = UOES Radar 2 Delivery
Xm = Milestone II
Xtr = Begin T/R Module Production
Xi = Integration System Tests Start (with THAAD)
Xt = Testbed Radar Integration and Testing Complete
Xr1 = Radar System Test 1
Xr2 = Radar System Test 2
Xsw = Begin Software DT&E
Xe = Engineering Manufacturing and Development Contract Award

Planned Milestones Beyond FY1997:

Milestone III	1QFY02
Production & Deployment	FY02

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)

Budget Activity 04 - Dem/Val

February 1995

Project and Title - 2154 TMD-GBR

P.E. Number: 0603861C
P.E. Title: THAAD System (U)

A. Project Cost Breakdown (In Thousands)

Project Cost Categories	1994	1995	1996	1997
a. Prime Contract Development	194,764	97,976	92,016	2,817
b. Supporting Contracts Effort	23,555	41,444	33,024	4,408
c. Other Government Agencies	9,605	21,988	26,577	0
d. Program Management Support	7,781	10,420	10,941	963
Totals	235,705	171,828	162,558	8,188

B. Budget Acquisition History and Planning Information

Performing Organizations

Contractor or Government Performing Activity	Contract Method/Type or Funding Vehicle	Award Obligation Date	Performing EAC	Project Office EAC	Total Prior to 1994	Budget 1994	Budget 1995	Budget 1996	Budget 1997	Budget to Complete	Total Program
Raytheon	C CPIF/AF	SEP 92	428,013	451,902	94,431	194,764	92,991	92,016	2,817	0	477,019
Dynetics	C CPFF	FEB 93	21,195	21,195	1,121	2,650	5,000	5,000	0	0	13,771
TBE	C CPAF	APR 92	41,463	41,463	5,460	8,253	9,822	9,250	3,108	0	35,893
GTRI	SS COST	NOV 94	0	0	0	0	1,000	1,000	1,300	647	3,947
Colsa, Inc.	SS CPFF	JUN 89	16,530	16,530	2,192	3,976	5,362	5,000	0	0	16,530
Undetermined	C CPFF	NOV 95	0	0	0	0	4,985	1,000	0	0	5,985
WEC	CPIF	SEP 92	27,472	27,472	(7,245)	(14,550)	5,477	200	0	0	5,677
Undetermined	C CPFF	JUN 95	0	0	0	0	650	8,000	0	0	8,650
ESD/MIT-LL	SS COST	OCT 92	25,368	25,368	3,500	3,868	6,000	6,000	0	0	19,368
Belvoir	C CPFF	SEP 94	0	0	0	430	3,863	3,459	0	0	7,752
CECOM/MITRE	SS CPFF	OCT 92	7,561	7,561	1,111	1,450	2,100	2,500	0	0	7,161
Misc	C COST	DEC 93	0	0	1,570	10,648	19,474	12,492	0	0	44,184
T&E WSMR	C CPFF	OCT 93	7,270	7,270	0	870	3,000	3,200	0	0	7,070
STRICOM	C CPFF	MAR 95	0	0	0	0	1,684	2,500	0	0	4,184
M&S			0	0	0	7,781	10,420	10,941	963	0	30,105

Government Furnished Property

Item Description	Contract Method/Type or Funding Vehicle	Award Obligation Date	Performing EAC	Project Office EAC	Total Prior to 1994	Budget 1994	Budget 1995	Budget 1996	Budget 1997	Budget to Complete	Total Program
Product Dev. Property HEMTT, M983 TRUCK	FFP	JUL 94			0	1,015	0	0	0	0	1,015
Support & Mgmt. Property											
Test & Eval. Property											

Subtotal Product Dev.					109,385	235,705	171,828	162,558	8,188	647	688,311
Subtotal Support & Mgmt.											
Subtotal Test & Evaluation											
Total Project					109,385	235,705	171,828	162,558	8,188	647	688,311

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)

Budget Activity 05 - EMD

February 1995

Project and Title - 2154 TMD-GBR

P.E. Number: 0604861C
P.E. Title: THAAD System (U)

A. Project Cost Breakdown (In Thousands)

Project Cost Categories	1994	1995	1996	1997
a. Prime Contract Development	0	0	0	148,068
b. Supporting Contracts Effort	0	0	0	32,547
c. Other Government Agencies	0	0	0	15,078
d. Program Management Support	0	0	0	8,307
Totals	0	0	0	204,000

B. Budget Acquisition History and Planning Information

Performing Organizations

Contractor or Government Performing Activity	Contract Method/Type or Funding Vehicle	Award Obligation Date	Performing EAC	Project Office EAC	Total Prior to 1994	Budget 1994	Budget 1995	Budget 1996	Budget 1997	Budget to Complete	Total Program
Undetermined	C CPIF/AF	SEP 96			0	0	0	0	148,068	201,511	349,579
Undetermined	C CPIF/AF	MAR 97			0	0	0	0	7,000		7,000
CECOM	C CPFF	OCT 92	3,000	3,000	0	0	0	0	3,000		3,000
Belvior	C CPFF	SEP 94			0	0	0	0	2,078		2,078
ESD/MIT-LL	SS Cost	MAR 97			0	0	0	0	6,000		6,000
Misc	C Cost	MAR 97			0	0	0	0	13,405		13,405
T&E WSMR	C CPFF	OCT 96			0	0	0	0	4,000		4,000
Management					0	0	0	0	8,307		8,307
Support					0	0	0	0			
Dynetics	C CPFF	FEB 93			0	0	0	0	5,000	2,424	7,424
TBE	C CPAF	APR 92			0	0	0	0	6,142	0	6,142
Undetermined	C CPFF	NOV 95			0	0	0	0	1,000	3,000	4,000

Government Furnished Property

Item Description	Contract Method/Type or Funding Vehicle	Award Obligation Date	Performing EAC	Project Office EAC	Total Prior to 1994	Budget 1994	Budget 1995	Budget 1996	Budget 1997	Budget to Complete	Total Program
Product Dev. Property											
Support & Mgmt. Property											
Test & Eval. Property											

Subtotal Product Dev.								0	204,000	206,935	410,935
Subtotal Support & Mgmt.											
Subtotal Test & Evaluation											
Total Project					0	0	0	0	204,000	206,935	410,935

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04/05 (Dem/Val / EMD)

PE: 0603861C / 0604861C (Proj: 2260)
PE Title: THAAD SYSTEM (U)

Project Number / Title: 2260 THAAD

Program Name:	FY1994 Actual	FY1995* Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	FY2000 Estimate	FY2001 Estimate	Total Program
0208861C PROC	0	0	0	0	0	489,599	426,906	342,321	5,143M
0603861C RDT&E	474,388	480,073	413,769	64,000	0	0	0	0	1,793M
0604861C RDT&E	0	0	0	460,000	665,000	485,100	133,000	53,000	1,974M
0604861C MILCON	0	0	13,600	4,700	18,000	4,900	0	0	43M

*See OTHER PROGRAM FUNDING SUMMARY section

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION:

(U) The THAAD system is being designed to negate theater ballistic missiles (TBM) at long ranges and high altitudes. Its long-range intercept capability will make possible the protection of broad areas, dispersed assets, and population centers against TBM attacks. THAAD combined with the Theater Missile Defense Ground-Based Radar (TMD-GBR), forms the THAAD system. The TMD-GBR (Project 2154) provides fire control and surveillance for the THAAD system. THAAD will be interoperable with both existing and future air defense systems. This netted and distributed Battle Management/Command, Control, Communications, Integration (BM/C3I) architecture will provide robust protection against the TBM threat spectrum. The THAAD element includes missiles, launchers, BM/C^{3}I units, and support equipment. THAAD is pursing integration of THAAD BM/C3I with the project, manager, Air Defense Command and Control System to take advantage of perivious Army devlopments that can be incorporated into the THAAD program.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04/05 (Dem/Val / EMD)

PE: 0603861C / 0604861C (Proj: 2260)
PE Title: THAAD SYSTEM (U)

(U) The Dem/Val program will develop a design for the objective THAAD system and demonstrate the capabilities of the system in a series of 14 flight tests. The residual hardware resulting from the THAAD demonstration/validation (Dem/Val) program will be used for a prototype "battalion" called the User Operational Evaluation System (UOES). The UOES will be used for early operational assessment, and for soldiers to influence the final desgin will also be available for limited use as a contingency capability during a national emergency. It is projected to consist of 40 missiles with 4 launchers, 2 BM/C3I units, 2 TMD-GBRs and support equipment. The objective system design will be developed and tested in the Engineering, Manufacturing, and Development (EMD) phase. This phase will lead to low rate initial production and subsequent fielding in 2002.

(U) During FY95 and FY96 the Dem/Val flight test program will be conducted at White Sands Missile Range (WSMR), New Mexico. The flight test schedule consists of 14 flights and system tests in 2QFY95. The targets for the flight test program will be developed under the Tactical Missile Defense (TMD) Targets contract (Project 3354). Integration and coordination with WSMR to facilitate initiation of flight tests are a high priority within the THAAD program.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) The THAAD program has continued the Dem/Val hardware and software design development and delivery in support of integration and acceptance testing for the first flight at WSMR. The first Ground Test Unit (GTU-01) was delivered to WSMR to support range integration/training activities. Four successful simulated hot launch tests have verified the canister launch environment. The BM/C3I hardware and initial software were delivered to Lockheed Missiles and Space Company's (LMSC)

Systems Integration Laboratory (SIL) for integration testing. The first flight kill vehicle is at WSMR undergoing final assembly and testing in preparation for the first flight in 2QFY95.

(U) FY 1994 Accomplishments

- ($ 474.388M)
- Successfully completed booster static firings and shroud separation testing.
- Began TMD-GBR testbed integration testing and installed two processors into the SIL for Hardware-In-The-Loop testing.
- Completed delivery of the Dem/Val interim launcher to WSMR.
- Completed delivery of the initial palletized loading system truck and BM/C3I shelters to LMSC.
- Completed FDR and FDRU
- Conducted guidence & control testing
- Conducted launcher & BM/C3I Brassboard Testing
- Sensor handover requirements program underway
- Evaluated Insb seeker design & completed prototype
- Software code approval and release continuing

(U) FY 1995 Plans:

- ($ 358.014M) Major Contract: Conduct missile flight test program. Begin THAAD system tests with TMD-GBR and launcher. Complete system requirements review. Complete system design review.
- ($ 41.373M) Support Contracts: Continue software independent verification and validation. Continue nuclear environment survivability design analysis. Continue hit assessment, discrimination, and guidance, navigation and control algorithm development. Continue hit to kill test range lethality analysis. Continue environmental assessment of WSMR and potential EMD test ranges.

- o ($ 40.503M) GFE/Other: Complete infrastructure devlopment and begin flight test at WSMR. Begin Divert and Attitude Control System (DACS) propellant loading. Continue integration and testing of joint tactical information data systems, launch support, BM/C3I, weapon system deck model, and simulation efforts. Continue system threat vulnerability assessment. Maintain integrated logistics and product assurance efforts.
- o ($ 13.161M) In-house Support: Maintain government salaries, benefits, travel, and training.
- o ($ 18.322M) THAAD Dem/Val Targets: Continue development and delivery of targets to support THAAD and TMD-GBR flight tests. Maintain infrastructure to support TMD targets.
- o ($ 7.200M) THAAD Lethality Analysis: Continue sled testing for hit-to-kill analysis. Continue lethality simulation code validation.
- o ($ 1.500M) Operational Test and Evaluation

(U) FY 1996 Plans:

- o ($ 282.00M) Major Contract: Conduct system flight test program. Conduct system specification review. Exercise UOES missile option.
- o ($ 34.800M) Support Contracts: Continue nuclear environment survivability analysis. Continue software independent verification and validation. Continue environmental assessments. Continue lethality analysis. Continue algorithm development.
- o ($ 44.868M) GFE/Other: Continue range facility and flight test support and evlauation at WSMR. Continue DACS propellant loading. Continue integration and testing of joint tactical information data systems, launch support, BM/C3I, weapon system deck model, and simulation efforts. Continue system threat vulnerability assessment. Maintain integrated logistics and product assurance efforts.
- o ($ 14.285M) In-house Support: Maintain government salaries and benefits, travel, training.
- o ($ 3.981M) Essential Technologies: Continue lethality simulation code validation.

- o ($ 28.859M) THAAD Dem/Val Targets: Complete delivery of targets to support THAAD and TMD-GBR Dem/Val flight tests. Maintain infrastructure to support TMD targets.
- o ($ 4.976M) Continue GEL Propellant DACS risk reduction support.
- o ($ 13.600M) Military Construction

(U) FY 1997 Plans:

- o ($ 44.200M) Dem/Val: Conduct Milestone II DAB review. Complete analysis of system flight test data. Deliver UOES missiles.
- o ($ 460.000M) EMD: Begin developmental test and operation. Begin software maintenance. Award EMD contract.
- o ($ 3.500M) Essential Technologies: Complete lethality simulation code validation.
- o ($ 16.300M) THAAD EMD Targets: Begin development and delivery of targets to support THAAD and TMD-GBR EMD flight tests. Maintain infrastructure to support TMD targets.
- o ($ 4.677M) Military Construction

Acquisition Strategy: The Concept Definition phase, completed in 1992, involved three contractor teams and defined concepts and preliminary designs for the THAAD system. The THAAD Dem/Val contract was competitively awarded to Lockheed Missiles and Space Corporation in September 1992. The Dem/Val program will develop a design for the objective THAAD system and the contract contains an option for production of the UOES missiles which will be based on the design demonstrated in the Dem/Val flight test program. The EMD phase contract is expected to be a sole-source award to the Dem/Val contractor.

B. (U) PROGRAM CHANGE SUMMARY:

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04/05 (Dem/Val / EMD)

PE: 0603861C / 0604861C (Proj: 2260)
PE Title: THAAD SYSTEM (U)

THAAD DEM/VAL:	FY1994	FY1995	FY1996	FY1997	TOTAL COST
Previous President's Budget	481,910	535,540	499,800	24,870	1,542,120
Appropriated Value		470,000			470,000
Adjustments to Appropriated Value		10,073			10,073
Current Budget Submit	474,388	480,073	413,769	64,000	1,432,230

THAAD EMD:	FY1994	FY1995	FY1996	FY1997	TOTAL COST
Previous President's Budget	0	0	0	403,300	403,300
Appropriated Value		0			0
Adjustments to Appropriated Value		0			0
Current Budget Submit	0	0	0	460,000	460,000

Change Summary Explanation:
Funding: This project was funded under Project 2210 in the FY95 Presidents Budget. Due to a loss of $18M in FY96 and $41.167M in FY97 resulting from the reduction in appropriations and undistributed budget cuts, the program cannot assure UOES deployability in FY97. The FY97 President's Budget will be realigned, to be consistent with current program execution plans for EMD and Dem/Val.

Schedule: The FY95 reduction in funding to $480.073 delays exercising the UOES missile option by one quarter to 1QFY96, reduces the number of test flights in FY95 from 5 to 4, and delays the completion of the Dem/Val contract and all subsequent milestones by one month.

Technical: Technical risk is increased by elimination/reduction of alternate/enhancing support technology programs due to funding constraints in supporting technology (PE 0603173C)

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04/05 (Dem/Val / EMD)

PE: 0603861C / 0604861C (Proj: 2260)
PE Title: THAAD SYSTEM (U)

C. (U) OTHER PROGRAM FUNDING SUMMARY

MILCON/Procurement: As listed on Page 1.

Related RDT&E:	Funding Dependency? (Yes[1]/No)
*1155, Phenemonology Program, 0603872C	Yes
*1161, Radar Survivability, 0603872C	Yes
*1170, TMD Risk Reduction, 0603872C	Yes
2154, Theater Missile Defense Ground-Based Radar, 0603862C	Yes
*3251, Systems Engineering and Technical Support, 0603872C	Yes
*3261, BM/C3I, 0603872C	Yes
*3265, CINC TMD Assessment Program/TMD/NMD User Interface 0603864C/0604864C	Yes
*3354, Targets, 0603872C	Yes
*3359, System Test and Evaluation, 0603872C	Yes
*3157, Environmental Siting & Facilities, 0603872C	Yes
*3260, Test Resources, 0603872C	Yes
*3352, Modeling and Simulation, 0603872C	Yes
*2259, Israeli Cooperative Projects, 0603872C	Yes

* These projects provide essential technical, engineering, and/or infrastructure support to MDAP programs.

These Programs Provide(d) Alternate/Enhancing Support Technologies to THAAD:
1270 Window Mechanical Properties

1270	GEL Divert Engine
1170	Advanced Electro-Optics
1151	ALIRT
1155	Optical Signature Code
1161	Electro-magnetic Environmental Effects
1651	Miniature Interceptor Technology
3160	Sapphire Window Production
1270	Advanced Composite Materials

Due to a reduction in technology support funding, all of these programs will be terminated in FY95.

(U) FY 1995 efforts totalling $27.022M that are funded in the Other TMD Activities Program Element (PE 0603872C) are included in the program element totals shown on this R-2 Exhibit.

Funding data for related RDT&E efforts that have a funding dependency can be found in the respective project summary/program element.

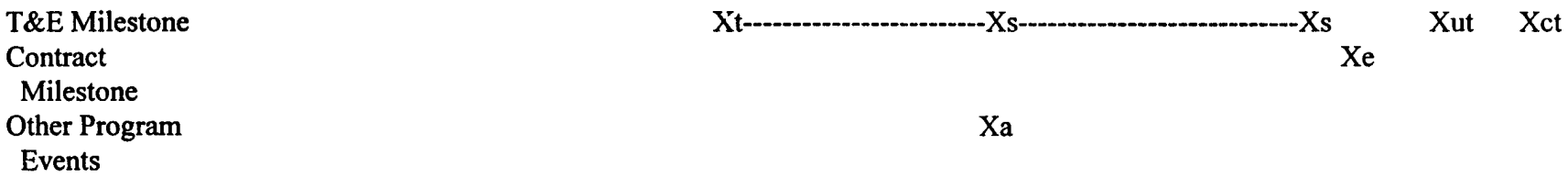
D. (U) Schedule Profile

	FY1994				FY1995				FY1996				FY1997			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Acquisition Milestone													Xm		Xd	Xp
Engineering Milestone	Xf		Xu			Xrr		Xdr/Xi			Xsr					

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04/05 (Dem/Val / EMD)

PE: 0603861C / 0604861C (Proj: 2260)
PE Title: THAAD SYSTEM (U)



Xm = Milestone II
Xd = UOES Delivery
Xf = Final Design Review
Xu = Final Design Review Update
Xt = Flight Testing Begins
Xs = System Testing
Xe = EMD Contract Award
Xrr = System Requirements Review
Xdr = System Design Review
Xsr = System Specifications Review
Xp = Preliminary Design Review
Xut = Limited User Testing
Xct = User Characterization Testing
Xa = UOES Option Award
Xi = Integrated System Tests (with TMD-GBR)

Planned Milestones Beyond FY1997:
1QFY02 = Milestone III
1QFY02 = First Unit Equipped
1Q FY99= CDR
3QFY99 = LRIP
2QFY01 = IOT&E

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)

Budget Activity 04 - Dem/Val

February 1995

Project and Title - 2260 THAAD

P.E. 0603861C
P.E. Title: THAAD System (U)

A. Project Cost Breakdown (In Thousands)

Project Cost Categories	1994	1995	1996	1997
a. Prime Contract	349,559	358,014	282,000	61,000
b. OGAs	45,700	40,503	44,868	0
c. Support Contracts	33,670	41,373	34,800	0
d. Program Management	9,431	13,161	14,285	0
e. Targets	36,028	18,322	28,859	0
f. Lethality	0	7,200	0	0
g. OT&E	0	1,500	0	0
h. Essential Technologies	0	0	3,981	3,000
i. GEL Propellant DACS	0	0	4,976	0
TOTAL	474,388	480,073	413,769	64,000

B. Budget Acquisition History and Planning Information

Performing Organizations

Contractor or Government Performing Activity	Contract Method/Type or Funding Vehicle	Award Obligation Date	Performing EAC	Project Office EAC	Total Prior to 1994	Budget 1994	Budget 1995	Budget 1996	Budget 1997	Budget to Complete	Total Program
Product Development Organization											
LMSC	C/CPFF	SEP 92			337.0	349.6	358.0	282.0	61.0	0	1387.6
TEC MASTERS	C/CPFF	JUN 92			4.4	14.5	11.9	8.2	0	0	39.0
TACOM	MIPR	DEC 93			0	1.3	0	0	0	0	1.3
ESC	MIPR	NOV 93			0	13.3	0	1.0	0	0	14.3
Support & Management Organizations											
WSMR		DEC92			4.7	6.0	19.0	30.0	0	0	59.7
CRC	MIPR	Dec 92			7.4	14.2	21.3	13.0	0	0	55.9
OTHER	C/CPAF				13.4	28.473	36.273	37.361	3.0	0	118.51
Test & Evaluation Organizations											
MICOM	MIPR	FEB 92			0	0	4.3	8.2	0	0	12.5
ASGI	C/CPAF	JAN 94			0	1.9	0	0	0	0	1.9
OTHER OT&E					0	.1	3.0	3.0	0	0	6.1

Government Furnished Property

Item Description	Contract Method/Type or Funding Vehicle	Award Obligation Date	Performing EAC	Project Office EAC	Total Prior to 1994	Budget 1994	Budget 1995	Budget 1996	Budget 1997	Budget to Complete	Total Program
Product Dev. Property											
Support & Mgmt. Property											
Test & Eval. Property											

Subtotal Product Dev.					341.4	378.7	369.9	291.2	61.0	0	1442.2
Subtotal Support & Mgmt.					25.5	48.673	76.573	80.361	3.0	0	234.107
Subtotal Test & Evaluation					0	2.0	7.3	11.2	0	0	20.5
Total Project					366.9	429.373	453.773	382.761	64.0	0	1696.807
Targets					0	36.028	17.6	29.0	0	0	82.628
Lethality					0	8.987	7.2	2.008	0	0	18.195
MILCON					0	0	0	(13.6)	0	0	(13.6)
OT&E					0	0	1.5	0	0	0	1.5
GRAND TOTAL					366,900	474,388	480,073	413,769	64,000	0	1799.130

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)

Budget Activity 05 - EMD

February 1995

Project and Title - 2260 THAAD

P.E. 0604861C
P.E. Title: THAAD System (U)

A. Project Cost Breakdown (In Thousands)

Project Cost Categories	1994	1995	1996	1997
a. Prime Contract	0	0	0	357,600
b. OGAs	0	0	0	51,100
c. Support Contracts	0	0	0	36,200
d. Program Management	0	0	0	15,100
Totals	0	0	0	460,000

B. Budget Acquisition History and Planning Information

Performing Organizations

Contractor or Government Performing Activity	Contract Method/Type or Funding Vehicle	Award Obligation Date	Performing EAC	Project Office EAC	Total Prior to 1994	Budget 1994	Budget 1995	Budget 1996	Budget 1997	Budget to Complete	Total Program
Product Development Organization										TBD	TBD
TACOM	C/CPEF	OCT 96							1.0		
LMSC		SEP 96							357.6		
TEC-MASTERS		JUN 92							5.4		
ESC		OCT 96							15.5		
Support & Management Organizations											
WSMR	MIPR	DEC 92							10.0		
Other									33.5		
CRC									13.0		
USAKA		DEC 92							10.0		
Test & Evaluation Organizations											
MICOM		FEB 92							4.0		
Other									10.0		

Government Furnished Property

Item Description	Contract Method/Type or Funding Vehicle	Award Obligation Date	Performing EAC	Project Office EAC	Total Prior to 1994	Budget 1994	Budget 1995	Budget 1996	Budget 1997	Budget to Complete	Total Program
Product Dev. Property											
Support & Mgmt. Property MILCON											
Test & Eval. Property											

Subtotal Product Dev.					0	0	0	0	379,500		
Subtotal Support & Mgmt.					0	0	0	0	66,500		
Subtotal Test & Evaluation					0	0	0	0	14,000		
Total Project					0	0	0	0	460,000	891,325	1351,325
MILCON									(4,700)		(22.9)
OT&E									0	5,039	5.039
GRAND TOTAL									460,000	896,364	1356,364

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE: 0603863C (Proj: 2358)
PE Title: HAWK (U)

Project Number / Title: 2358 Hawk System BM/C3

Program Name:	FY1994 Actual	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	FY2000 Estimate	FY2001 Estimate	Total Program
0208863C PROC	0	3,804	5,106	20,430	0	0	0	0	Completed
0603863C RDT&E	29,629	26,800	23,188	0	0	0	0	0	Completed

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION:

(U) This project will provide a Theater Missile Defense (TMD) capability for U.S. Marine Corps operations. This Marine Corps' TMD initiative is jointly funded with BMDO and will yield a low-risk, near-term capability for expeditionary forces against short-range ballistic missiles. The program consists of modifying the TPS-59 long-range air surveillance radar and the HAWK weapon system to allow detection, tracking, and engagement of short-range TBMs. The program will also provide a communications interface by developing an Air Defense Communications Platform.

(U) Modifications to the TMD mode of the TPS-59 radar will result in TBM target detection at ranges out to 400 nautical miles and 500,000 feet in altitude. Technical, developmental, and operational testing is scheduled for FY 1996 with first units equipped in early FY 1997.

(U) The HAWK weapon system modifications include upgrades to the battery command post and improvements to the Hawk missile that will result in a missile configuration called the "improved lethality missile". The modified HAWK battery command post

will process cueing data to control the high power illuminator radar. The improved lethality missile will incorporate fuse and warhead improvements to 370 improved lethality missiles that have been transferred from the Army to the Marine Corps. Another 600 improved lethality missile modification kits will be procurred and installed by the end of FY 1996. Production of the battery command post modification kits will begin in FY 1995. The installation of all battery command post modifications will be completed by the end of FY 1996.

(U) The Air Defense Communications Platform (ADCP) will convert TPS-59 data messages and Tactical Data Information Link-J (TADIL-J) formatted messages into the intra-battery data link formats required by the Hawk weapon system. The Air Defense Communications Platform (ADCP) will also transmit TADIL-J formatted messages to other theater sensors. This communications interface is currently in development and initial production will begin in FY 1996.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) A major accomplishment in FY 1994 was the integrated test of the HAWK tactical missile defense capability which verified the operation of the TPS-59, data link, battery command post, and improved lethality missile. Two Lance missiles were successfully intercepted and destroyed by the improved lethality missile during this test. Additional FY 1994 accomplishments included approving the TPS-59's baseline design, beginning TPS-59 system integration, and approving the Air Defense Communications Platform's baseline design.

(U) FY 1994 Accomplishments:
PE: 0603863C
- o ($ 2.500M) Conduct AN/TPS-59 design reviews.
- o ($22.129M) Begin AN/TPS-59 system integration effort.
- o ($ 2.500M) Conduct ADCP design reviews.
- o ($ 2.500M) Conduct HAWK engineering change proposal (ECP) test readiness review.

(U) FY 1995 Plans:
PE: 0603863C
- o ($15.000M) Complete AN/TPS-59 system integration effort.
- o ($ 8.000M) Initiate AN/TPS-59 contractor's developmental tests.
- o ($ 3.800M) Initiate ADCP integration and testing.

PE: 0208863C
- o ($3.804M) Initiate HAWK Battery Command Post modification procurement.

(U) FY 1996 Plans:
PE: 0603863C
- o ($20.352M) Complete AN/TPS-59 integration and testing.
- o ($ 1.716M) Complete ADCP integration and testing.
- o ($ .820M) Complete HAWK integration and testing.
- o ($ .300M) Provide targets for live flight testing.

PE: 0208863C

- o ($1.345M) Complete Battery Command Post modification procurement.
- o ($1.837M) Complete improved lethality missile procurement.
- o ($0.533M) Complete HAWK additional fuse modification procurement.
- o ($1.391M) Complete ADCP long lead item procurement.

(U) FY 1997 Plans

PE: 0603863C:

- o No funding/tasks. System development efforts completed in FY 1996.

PE: 0208863C

- o ($14.833M) Initiate AN/TPS-59 procurement.
- o ($1.197M) Complete HAWK North Finding Module procurement.
- o ($4.400M) Initiate ADCP procurement.

Acquisition Strategy: The TPS-59 modification is designated an acquisition category IV (ACAT IV) program being developed by Martin Marietta on a cost plus incentive fee contract. The ADCP is an ACAT IV development program with the software being developed by Advanced Programming Concepts on a cost plus incentive fee contract. The ADCP hardware and software integration is being accomplished by the Naval Systems Warfare Center, Crane, IN. The HAWK modifications are included in an ACAT IV program being developed by Raytheon on a cost plus incentive fee contract.

B. (U) PROGRAM CHANGE SUMMARY:

Hawk DEM/VAL:	FY1994	FY1995	FY1996	FY1997	TOTAL COST

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE: 0603863C (Proj: 2358)
PE Title: HAWK (U)

Previous President's Budget	29,629	26,800	23,000	0	79,429
Appropriated Value		26,800			26,800
Adjustments to Appropriated Value		0			0
Current Budget Submit	29,629	26,800	23,188	0	79,617

Change Summary Explanation:

Funding: This project was funded in PE 0604216C, project 2308 in the FY1995 President's Budget. The FY96 funding increase is for target costs in the FY96 testing. This was included in PE 0604216C, project 3300, during FY94 and is not an increase to total program cost.

Schedule: None.

Technical: None.

C. (U) OTHER PROGRAM FUNDING SUMMARY

MILCON/Procurement: As listed on Page 1.

Related RDT&E:	Funding Dependency? (Yes[1]/No)
2160, TMD Existing Systems, 0603872C	Yes
3153, Architecture Analysis/BMC3 Initiatives, 0603872C	Yes
3251, Systems Engineering and Technical Support, 0603872C	Yes
3354, Targets, 0603872C	Yes
3359, System Test and Evaluation, 0603872C	Yes

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RDT&E, Defensewide / BA 04 (Dem/Val)

PE: 0603863C (Proj: 2358)
PE Title: HAWK (U)

	FY1994 Actual	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	FY2000 Estimate	FY2001 Estimate	Total Program
C1067, Aviation Radar Product Improvement Program, 0606226M	9,067	60	489	0	0	0	0	0	9,616
C1120, Air Defense Missile System, 0606223M	636	233	2,011	0	0	0	0	0	2,880
Related Procurement:									
Procurement, BMDO, HAWK/BMC3, 0208863C	0	3,804	5,106	20,430	0	0	0	0	29,492
Procurement, Marine Corps, TPS-59 Mods	0	0	0	12,453	16,478	0	0	0	28,931
Procurement, Marine Corps, ADCP	0	0	0	0	8,902	596	614	8,260	18,372

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RDT&E, Defensewide / BA 04 (Dem/Val)

PE: 0603863C (Proj: 2358)
PE Title: HAWK (U)

[1]Funding data for related RDT&E efforts that have a funding dependency can be found in the respective project summary/program element.

D. (U) Schedule Profile

	FY1994				FY1995				FY1996				FY1997			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Acquisition Milestone																
TPS-59 Milestone III											X					
ADCP Milestone II						X										
ADCP Milestone III												X				
HAWK ECP Approval				X*												
Engineering Milestone																
TPS-59 PDR		X*														
TPS-59 CDR			X*													
ADCP PDR		X*														
ADCP CDR			X*													
T&E Milestone																
TPS-59 Development Tests										X	X					
TPS-59 Operational Tests										X	X					
ADCP Development Tests										X	X					
ADCP Operational Tests										X	X					
HAWK ECP Operational Eval				X*												

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RDT&E, Defensewide / BA 04 (Dem/Val)

PE: 0603863C (Proj: 2358)
PE Title: HAWK (U)

Contract Milestone				
TPS-59 Contractor Tests	X	X	X	
ADCP Contractor Tests	X	X	X	
Other Program Events				
TPS-59 Mod Fielding				X
ADCP Fielding				X

Planned Milestones Beyond FY1997: None.

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RDT&E, Defensewide / BA 04/05 (Dem/Val / EMD)

PE: 0603864C/0604863C (Proj: 3261)
PE Title: TMD BM/C^{3}I (U)

Project Number / Title: 3261 BM/C^{3}I Concepts

Program Name:	FY1994 Actual	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	FY2000 Estimate	FY2001 Estimate	Total Program
0208864C PROC	0	0	32,242	20,300	60,931	0	0	0	Continuing
0603864C RDT&E	12,617	20,009	24,231	24,425	25,237	20,751	22,193	22,278	Continuing
0604864C RDT&E	0	534	14,301	17,976	25,977	20,861	29,201	29,314	Continuing

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION:

(U) The primary mission of this project is to provide the warfighter with an integrated and interoperable TMD Battle Management/Command, Control, Communications, and Intelligence (BM/C3I) capability having the flexibility to meet a wide range of threats and expected needs. The BM/C3I architecture for TMD is built upon the existing command and control (C2) structure for Theater Air Defense (TAD) and adds the communications linking TMD C2 nodes, weapons, and sensors, and the TMD interfaces to intelligence systems and other supporting capabilities. The BMDO, from its joint perspective, uses this project to oversee independent weapon systems development and to provide guidance, standards, equipment, integration, and analysis to maximize the performance of a multitude of sensors, interceptors, and C2 nodes and to synergize their individual contributions to an integrated Joint theater-wide TMD system. BMDO has three major thrusts to the TMD BM/C3I program.

(U) The first thrust establishes the links and means for receipt and in-theater dissemination of launch warning information from space-based and intelligence systems external to TMD. This project supports the system engineering of their capability and prototype development of items such as gateways between National Technical Means and the Joint Data Network Some elements of this thrust

are funded separately under different programs such as the Joint Tactical Ground Station (JTAGS). This project focuses on the efforts to link these separate systems into the theater.

(U) The second thrust of the BM/C3I program focuses on the communication of information via the Joint Data Net and interoperability among systems. Interoperability includes both the communications equipment, links, and protocols and the common command and control procedures between different weapons systems to ensure a truly integrated theater-wide ballistic missile defense system. The cornerstone of TMD interoperability and the Joint Data Net is the Joint Tactical Information Distribution System (JTIDS) and the Tactical Data Information Link-JTIDS (TADIL-J) message format. This project builds upon existing TAD C2 networks to develop and implement new messages and links necessary for ballistic missile engagements. It includes the integration of JTIDS terminals into TBMD C2 platforms and the software upgrades necessary to utilize new TBMD information within the C2 systems. The significant increase in requested funding for FY96 reflects the increased activity associated with the initial procurement of JTIDS terminals for the Joint Data Net, the start of integrating terminals into multi-service platforms, and UOES implementation, this funding is critical for timely inter-Service interoperabiltiy.

(U) The third thrust of the BM/C3I program directs attention to the Service upgrades of C2 centers. Various command center upgrades are included in this project to reduce decision making time necessary to effectively engage ballistic missiles. Again, BMDO leverages off several existing Service funded theater air defense command center upgrades and this project funds only the specific TMD related aspects of these upgrades. BMDO's central direction and support of hardware and software developments will produce an integrated C2 capability for TMD.

(U) The effects of early warning, improved interoperability, integration, and command center upgrades on current and emerging TBMD doctrine are operationally analyzed through war games, simulation, and modeling to optimize the integrated Joint Theater Ballistic Missile Defense System in support of the Joint Forces Commander.

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RDT&E, Defensewide / BA 04/05 (Dem/Val / EMD)

PE: 0603864C/0604863C (Proj: 3261)
PE Title: TMD BM/C^{3}I (U)

(U) All of the efforts in this project are designed to provide a seamless interoperable architecture to provide timely warning and information necessary to reduce decision times and allow more opportunities to efficiently and effectively engage hostile missiles. The desired end result is to kill more missiles and reduce casualties to U.S. and friendly forces.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy.

PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) This project accomplished the following: The approval of the TADIL-J Interface Change Proposal (ICP) by the DoD Configuration Control Group; the formal introduction of the U.S. approved ICP to the NATO Allied Data System Interoperability Agency; initial analysis of correlation algorithm for the satellite broadcast systems disseminating TBMD messages; conducted the first joint Theater Missile Defense Wargame distributed simulation; demonstrated benefits of an Air Defense Command Post during joint exercises and completed the first phase of the TAD/TMD information exchange requirements needed for interoperability among the Services.

(U) FY 1994 Accomplishments:

- ($5.321M) BM/C3I Integration - Army: Began prototyping of Air Defense Command Post; demonstrated C2 connectivity to national assets; defined Information Exchange Requirements (IER) C4 systems.
- ($5.746M) BM/C3I Integration - Air Force: Demonstrated Operations Concept Demonstration (OCD) II and BM/C3I connectivity in Roving Sands 94 exercise; developed gateway concepts and conducted trade-offs; developed decision support aids for JFACC battle management.

- o ($0.425M) BM/C3I Integration - Navy: Software Modifications to Simulation models for TMD Wargame Support; initiated the modeling of Navy Command and Control interfaces; defined IERs for C4 systems.
- o ($1.125M) BM/C3I Integration - Joint/Combined: Conducted surveillance data fusion study; obtained Configuration Control Board approval of TMD message standard; initiated Tactical Information Broadcast Service (TIBS) correlation algorithm; applied open architecture approaches to TMD System Exerciser interfaces; initiated development of NATO TMD message standard; developed operational interfaces among TRAP/TIBS/CTPP message sets; conducted TMD wargame; initiated IERs for Theater Air Defense (TAD)/TMD Information Architecture (IA).

(U) FY 1995 Plans:

- o ($6.767M) BM/C3I Integration - Army: Integrate prototype capabilities into Air Defense TOC weapon systems; automate existing TOC capabilities; develop communications needline analysis; develop a BM/C3I joint Service capabilities/interfaces document; support Data/Interface standardization activities for interoperability.
- o ($6.822M) BM/C3I Integration - Air Force: Develop TMD intelligence support templates (intelligence preparation of the battlespace); develop TMD message software; develop implementation plan for TMD messages on USAF platforms; continue TMD automation under CTAPS; continue gateway software development and testing; support data/interface standardization activities for interoperability.
- o ($2.780M) BM/C3I Integration - Navy: Develop implementation plan for TMD messages on Navy platforms; Begin C^2 trade studies for Navy lower tier; Software modification to Navy simulation models for TMD wargame support; Support data/interface standardization activities for interoperability.
- o ($3.640M) BM/C3I Integration - Joint/Combined: Continue TMD wargame; obtain NATO approval of TMD message standard; develop Air Defense Data model extensions to the DoD C2 Core; standardize TAD/TMD data elements and interfaces; complete TAD/TMD process models "As Is " and dictionary of service terms; develop TAD/TMD process models

for C4 system upgrades; perform analysis of IA to set environments for wargame, exercises, and simulations; prepare a command and control plan in response to OSD TMD Comprehensive Analysis.

(U) FY 1996 Plans:

- ($14.301M) BM/C3I Integration - Army: Demonstrate lower tier/Joint interoperability; participate in systems integration testing; continue prototype integration into TMD weapons systems BM/C3I capabilities; continue TMD BM/C3 automation to include initial JTIDS integration.
- ($17.160M) BM/C3I Integration - Air Force: Start integration of JTIDS on multiple USAF platforms; prototype the decision support aids for JFACC battle management; complete gateway software development and testing; multi-sensor tracking algorithm development; implement situation targeting algorithms; develop, simulate, and demonstrate prototypes of the recommended CTAPS application for the distributed C2 nodes; update IERs and resolve interoperability issues.
- ($4.200M) BM/C3I Integration - Navy: Enhance evolution of JMCIS TBMD segments; refine definition of optimum C2 architecture; participate in Joint TMD war games; complete testing of JTIDS C2P modifications; begin development of ICD for AEGIS/JMCIS interface; begin implementation of TBMD modifications necessary for ACDS. The last two efforts are critical to maintain schedule with Aegis and ACDS.
- ($2.871M) BM/C3I Integration - Joint/Combined: Conduct NATO TMD wargame; conduct command and control (C2) tests to refine C2 procedures; conduct modeling and analysis of JTIDS network structure in support of TMD; support inter-Service integration efforts.

(U) FY 1997 Plans:

- ($17.976M) BM/C3I Integration - Army: Integrate JTIDS into Army systems; demonstrate enclave interoperability; Integrate UOES upper/lower tier; continue TMD Cell/TOC automation.

- o ($17.079M) BM/C3I Integration - Air Force: Integrate JTIDS into additional existing platforms; AOC/CRC upgrades for TMD.
- o ($3.500M) BM/C3I Integration - Navy: Continue evolution of JMCIS/TBMD segment; participate in TMD war game; participate in joint TBMD interoperability demonstrations; complete development and begin implementation for AEGIS/JMCIS interface; continue implementation of TBMD modifications necessary for ACDS.
- o ($3.846M) BM/C3I Integration - Joint/Combined: Conduct TMD wargame; conduct C^2 tests to refine C^2 procedures; conduct tests of operational JTIDS networks; begin software integration of TMD messages.

Acquisition Strategy: The acquisition strategy for this project is to leverage off existing system acquisition programs (which are subject to milestone decisions and testing) as much as possible and accomplish supporting tasks to satisfy BM/C3I performance requirements. A significant portion of this project entails systems engineering to bring together separately funded and managed projects so that all systems will be interoperable when they are fielded.

B. (U) PROGRAM CHANGE SUMMARY:

TMD-BMC3 DEM/VAL:	FY1994	FY1995	FY1996	FY1997	TOTAL COST
Previous President's Budget	12,567	33,500	20,129	20,925	87,121
Appropriated Value		20,676			20,676
Adjustments to Appropriated Value		-667			(667)
Current Budget Submit	12,617	20,009	24,231	24,425	81,282

TMD-BMC3 EMD:	FY1994	FY1995	FY1996	FY1997	TOTAL COST
Previous President's Budget	0	555	16,166	22,976	39,697

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RDT&E, Defensewide / BA 04/05 (Dem/Val / EMD)

PE: 0603864C/0604863C (Proj: 3261)
PE Title: TMD BM/C^{3}I (U)

Appropriated Value		555			555
Adjustments to Appropriated Value		-21			(21)
Current Budget Submit	0	534	14,301	17,976	32,811

Change Summary Explanation:
Funding: This project was funded under Project 3211 in the FY95 President's Budget. FY95 Dem/Val funding was reduced $13M by Congress. FY95 funding was further reduced $.667M as a result of allocation of undistributed Congressional reductions. FY96 Procurement was increased by $32.4M with a similar decrease in FY97 to accelerate the procurement and fielding of JTIDS terminals for the Joint Data Net and to correspond with the Milestone III decision point for the terminal.
Schedule: Procurement and fielding of the JTIDS terminals were accelerated one year to coincide with the JTIDS production decision and to meet UOES schedules of supported projects.

Technical: None.

C. (U) OTHER PROGRAM FUNDING SUMMARY

MILCON/Procurement: As listed on Page 1.

Related RDT&E:		Funding Dependency? (Yes[1]/No)	
1266	Navy Theater TBMD	0603216C	Yes
2154	TMD-GBR	0603861C/0604861C	Yes

2257	PATRIOT	0604865C/0208865	Yes
2260	THAAD	0603861C/0604861C	Yes
2262	Corps SAM	0603869C	Yes
2263	Navy Area TBMD	0603867C/0604867C	Yes
2358	HAWK System	0603863C/0604863C	Yes
2160	TMD Existing Systems	0603872C	Yes
3251	System Engineering and Technical Support	0603872C	Yes

[1]Funding data for related RDT&E efforts that have a funding dependency can be found in the respective project summary/program element.

D. (U) Schedule Profile

	FY1994				FY1995				FY1996				FY1997			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Engineering Milestones																
THAAD/JTAGS Needline Analysis								X								
JTIDS Implementation Plan			*													
JTIDS Validation									X							
JTIDS Integration (multi-platforms)												X				X
Gateway Prototype			*													
TADAP/TCTA Integration													X			
IPB Syria Study				*												

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04/05 (Dem/Val / EMD)

PE: 0603864C/0604863C (Proj: 3261)
PE Title: TMD BM/C^{3}I (U)

IPB Iran Study				X								
Distributed Battle Management												X
AEGIS C2 System Upgrade						X						
T&E Milestones												
Interoperability Certification Test Plan						X						
War Game	*		X			X				X		
C3I Integration Test						X				X		
System Integration Test							X					X
Contract Milestones												
JTIDS Procurement Contract						X						

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RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04/05 (Dem/Val / EMD)

PE: 0603867C / 0604867C (Proj: 2263)
PE Title: Navy Lower (U)

Project Number / Title: 2263 Sea-based Area TBMD (Lower Tier)

Program Name:	FY1994 Actual	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	FY2000 Estimate	FY2001 Estimate	Total Program
0208867CPROC	0	14,394	16,897	91,561	123,037	124,261	210,846	209,194	2,501M
0603867CRDT&E	150,446	139,676	0	0	0	0	0	0	347M
0604867CRDT&E	0	0	237,473	193,600	142,680	151,428	115,482	50,323	891M

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION:

(U) The Navy Area Theater Ballistic Missile Defense (TBMD) project builds on the national investment in AEGIS ships, weapon systems, and missiles. Two classes of ships continue to be deployed with the AEGIS combat system: the CG-47 Ticonderoga-class cruisers and the DDG-51 Burke-class destroyers. Navy theater ballistic missile defense will take advantage of the attributes of naval forces including overseas presence, mobility, flexibility, and sustainability in order to provide protection to debarkation ports, coastal airfields, amphibious objective areas, Allied forces ashore, population centers, and other high value sites. Navy assets will provide an option for initial TBM defense for the insertion of additional land-based TBMD assets and other expeditionary forces in an opposed environment.

(U) This project provides for the following:

- Modifications to the AEGIS combat system (ACS) to include modifications to the command and decision system, the AEGIS display system, and the radar system (AN/SPY-1B/D).

- o Modifications to the Navy Standard Missile (SM-2 Block IV) and the AEGIS weapon control system with a Standard Missile (SM- 2 Block IV A) in FY 2000 capable of engaging TBMs in the endoatmosphere.
- o Fielding a user operational evaluation system (UOES) consisting of the SM-2 Block IV A and selected, limited non-tactical ACS modifications in FY 1998 if required to counter an existing threat.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) In FY94 the program continued design of AEGIS Combat System (ACS) modifications and computer program development to accept external cueing, continued development/design for SM-2 Block IV modifications to provide for capability to intercept TBMs and continued risk mitigation efforts and flight test missile development.

(U) FY 1994 Accomplishments:

- o ($36.000M) Continued design of ACS modifications and computer program development to accept external cueing; initiated a request for proposal (RFP) for tactical AEGIS combat system modifications; demonstrated AEGIS cueing to Patriot system in consonance with the Joint Air Defense Operations/Joint Engagement Zone (JADO/JEZ) event; and developed a plan to demonstrate Patriot acceptance of remote AN/SPY-1 Radar TBM track data.
- o ($102.00M) Continued development/design of SM-2 Block IV modifications to provide for capability to intercept TBMs and continued risk mitigation efforts and flight test missile development.
- o ($12.446M) Initiated procurement of target missiles and continued development of flight test requirements (facilities, ranges, and plans).

(U) FY 1995 Plans:

- ($22.300M) Complete design of initial ACS computer program modifications to enable TBMD detection, tracking and weapon processing to support an SM-2 missile with TBMD capability; conduct land-based and at-sea experiments to demonstrate automated acceptance of long-range (off ship) cueing and SPY radar acquisition using off-ship cueing sources such as external sensors, land-based radars, and other ship radars.
- ($99.0M) Design and integration for SM-2 Block IV A missile,develop and fabricate risk reduction flight test missiles.
- ($9.287M) Commence risk reduction flight tests at White Sands Missile Range (WMSR) to resolve issues of aerothermal blur, IR seeker performance, IR cover survivability and model validation.
- ($4.400M) Conduct lethality testing and analysis.
- ($3.389M) Procure target missiles.
- ($1.300M) Continue system engineering and associated studies and analysis; conduct system level reviews.
- ($14.394M) Procure ACS modifications for ships and development sites, and procure support/training equipment for shore facilities.

(U) FY 1996 Plans:

- ($44.000M) Continue AEGIS computer system development; conduct system design review (SDR) and preliminary design review (PDR); conduct engineering development testing; and develop design specifications.
- ($109.000M) Complete detailed missile design and conduct PDR.
- ($73.100M) Continue flight test missile fabrication and complete White Sands Missile Range (WSMR) risk reduction flight tests.
- ($12.530M) Continue Systems engineering and analysis and conduct Milestone IV DAB.
- ($16.897M) Procure ACS modifications for ships and development sites, and procure support/training equipment for shore facilities.

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RDT&E, Defensewide / BA 04/05 (Dem/Val / EMD)

PE: 0603867C / 0604867C (Proj: 2263)
PE Title: Navy Lower (U)

(U) FY 1997 Plans:

- o ($31.000M) Continue development of tactical computer program; start development of computer program design specification.
- o ($144.500M) Continue missile engineering/manufacturing development. Conduct critical design review (CDR). Initiate fabrication of UOES\WSMR missiles. Initiate procurement of DT/OT flight test missiles.
- o ($10.000M) Continue systems engineering and analysis; define interface for TBMD-related upgrades to AEGIS to Joint Maritime Command Information System (JMCIS).
- o ($8.100M) Procure test targets and conduct test planning.
- o ($91.561M) Procure ACS modifications for ships and development sites, and procure support/training equipment for shore facilities.

Acquisition Strategy: This strategy consists of an Area TBMD Program evolving to a Theater-Wide Defense TBMD program. The Area Program will build on this force structure by modifying the existing SM-2 Block IV missile and AEGIS Combat System to achieve TBMD capability. Overall acquisition strategy is under development.

B. (U) PROGRAM CHANGE SUMMARY:

Navy Lower Tier Dem/Val:	FY1994	FY1995	FY1996	FY1997	TOTAL COST
Previous President's Budget	154,000	179,543	240,224	242,308	816,075
Appropriated Value		140,000			140,000
Adjustments to Appropriated Value		-324			(324)
Current Budget Submit	150,446	139,676	0	0	290,122

Navy Lower Tier EMD:	FY1994	FY1995	FY1996	FY1997	TOTAL COST

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04/05 (Dem/Val / EMD)

PE: 0603867C / 0604867C (Proj: 2263)
PE Title: Navy Lower (U)

Previous President's Budget	0	0	0	0	0
Appropriated Value		0			0
Adjustments to Appropriated Value		0			0
Current Budget Submit	0	0	237,473	193,600	431,073

Change Summary Explanation:
Funding: This project evolved from Project 2213 in FY95 President's Budget. Congress directed a funding reduction of $40M in FY95.
Schedule: The Navy Area TBMD Program within the FY95 President's Budget supported a Unit Operational Evaluation System (UOES) capability in FY97 and First Unit Equipped (FUE) in FY99. The impact of the FY95 Congressional budget cut is a slip in both UOES and FUE dates by one year.
Technical: None

C. (U) OTHER PROGRAM FUNDING SUMMARY

MILCON/Procurement: As listed on Page 1.

Related RDT&E:		Funding Dependency (Yes[1]/No)
*1155 Phenomenology	P.E. 0603872C	Yes
1161 Advanced Sensor technology	P.E. 0603872C	Yes
*1170 TMD Risk Reduction	P.E. 0603872C	Yes
*1266 Navy Theater-wide (Upper)	P.E. 0603868C	Yes
*2259 Israeli Cooperative Projects	P.E. 0603872C	Yes
*3157 Environmental, Siting, & Facilities	P.E. 0603872C	Yes

*3251 Sys Eng and Tech Suppt	P.E. 0603172C		Yes
*3261 BM/C4I DEM/VAL	P.E. 0603864C		Yes
*3265 User interface	P.E. 0603872C		Yes
*3352 Modelling & Simulation	P.E. 0603872C		Yes
*3354 Targets	P.E. 0603872C	Yes	
*3359 System Test & Evaluation	P.E. 0603872C		Yes
*3360 Test Resources	P.E. 0603872C		Yes
*4151 Personnel and Related Costs	P.E. 0605218C		Yes

* These projects provide essential technical engineering, and/or infrastructure support to TMD MDAP programs.
[1]Funding data for related RDT&E efforts that have a funding dependency can be found in the respective project summary/program element.

D. (U) Schedule Profile

	FY1994				FY1995				FY1996				FY1997			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Acquisition Milestone																
- Milestone IV									x							
Engineering Milestone																
- ET&C CSEDS Demo						x										
- ET&C At-Sea Demo								x								
- ACS SDR (Tactical)									x							
- ACS PDR (UOES)											x					
- SM-2 BLK IVA PDR									x							

- SM-2 BLK IVA CDR		x
_ ACS PDR (Tactical)		x
T&E Milestone		
- SM-2 BLK IV A land-based Risk Reduction flight tests at WSMR	x	x
Contract Milestone		
- None		

Planned Milestones Beyond FY1997:
- SM-2 BLK IV A development/operational flight tests at WSMR - FY1998
- SM-2 BLK IV A development/operational flight test at sea - FY2000
- ACS and SM-2 BLK IV A UOES (1 ship/35 missiles) - FY1998
- ACS Mod/SM-2 BLK IV A FUE - FY2000

aRDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)

Budget Activity 04 - Dem/Val

February 1995

Project and Title - 2263 Sea Based Area TBMD

P.E. Number: 0603867C
P.E. Title: Navy Lower (U)

A. Project Cost Breakdown (In Thousands)

Project Cost Categories	1994	1995	1996	1997
a. Program MGMT/Integration	605	0	0	0
b. System Engineering	17,985	38,435	0	0
c. Program Management	2,147	5,160	0	0
d. Program Support	1,896	7,505	0	0
e. Ship System MODS	17,205	0	0	0
f. Design & Analysis	78,270	30,620	0	0
g. Hardware Fab. & Proc.	10,000	23,265	0	0
h. Test & Evaluation	1,000	11,005	0	0
i. Test Equipment	1,400	5,110	0	0
j. Engineering Support	1,100	4,500	0	0
k. Travel	130	100	0	0
l. Developmental Test & Eval.	8,508	13,000	0	0
m. Operational Test & Eval.	0	0	0	0
n. Other/Miscellaneous	10,200	976	0	0
Total	150,446	139,676	0	0

B. Budget Acquisition History and Planning Information

Performing Organizations

Contractor or Government Performing Activity	Contract Method/Type or Funding Vehicle	Award Obligation Date	Performing EAC	Project Office EAC	Total Prior to 1994	Budget 1994	Budget 1995	Budget 1996	Budget 1997	Budget to Complete	Total Program
MARTIN MARIETTA	CPFF					23,607	15,800	0	0	TBD	TBD
NSWC/DAHLGREN	WR/RCP					7,225	7,180	0	0		
APL/JHU	RCP					15,928	15,000	0	0		
HOLLOMAN AFB	MIPR					1,140	1,000	0	0		
RAYTHEON CORP.	CPFF					29,966	22,000	0	0		
HUGHES MSL SYSTEMS CORP.	CPFF					38,568	48,000	0	0		
MOTORLA	CPFF					4,162	2,000	0	0		
RFAS	CPFF					0	0	0	0		
MISCELLANEOUS	VARIOUS					6497	4,421	0	0		
Total Product Development						**127,093**	**115,401**	**0**	**0**		
RAYMOND ENGINEERING	CPFF					50	500	0	0		
NSWC/PORT HUENEME DIVISION	WR					60	160	0	0		
NAWC/POINT MUGU	WR					0	0	0	0		
VITRO	CPAF					2,100	1,400	0	0		
MISCELLANEOUS	VARIOUS					3,922	2,750	0	0		
Total Support & Management						**6,132**	**4,810**	**0**	**0**		
NAWC/WPNDIV-POINT MUGU	WR					2,675	2,343	0	0		
BMDO	PMA					4,142	3,713	0	0		
WHITE SANDS MISSILE RANGE	WR					300	2,950	0	0		
NSWC/PORT HUENEME	WR					240	640	0	0		
NAWC/CHINA LAKE	WR					3,400	2,400	0	0		
MISCELLANIOUS	VARIOUS					6,464	7,419	0	0		
Total Test & Evaluation						**17,221**	**19,465**	**0**	**0**		
Total						**150,446**	**139,676**	**0**	**0**		

Government Furnished Property

Item Description	Contract Method/Type or Funding Vehicle	Award Obligation Date	Performing EAC	Project Office EAC	Total Prior to 1994	Budget 1994	Budget 1995	Budget 1996	Budget 1997	Budget to Complete	Total Program
Product Dev. Property											
Support & Mgmt. Property											
Test & Eval. Property											

Subtotal Product Dev.						127,093	115,401				
Subtotal Support & Mgmt.						6,132	4,810				
Subtotal Test & Evaluation						17,221	19,465				
Total Project						150,446	139,676	0	0	TBD	TBD

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)

Budget Activity 05 - EMD

February 1995

Project and Title - 2263 Sea Based Area TBMD

P.E. Number: 0604867C
P.E. Title: Navy Lower (U)

A. Project Cost Breakdown (In Thousands)

Project Cost Categories	1994	1995	1996	1997
a. Program MGMT/Integration	0	0	1,500	1,000
b. System Engineering	0	0	62,918	48,707
c. Program Management	0	0	5,687	5,104
d. Program Support	0	0	8,285	7,496
e. Ship System MODS	0	0	0	0
f. Design & Analysis	0	0	37,979	8,577
g. Hardware Fab. & Proc.	0	0	80,749	88,102
h. Test & Evaluation	0	0	10,649	9,573
i. Test Equipment	0	0	5,803	5,206
j. Engineering Support	0	0	12,810	7,875
k. Travel	0	0	120	110
l. Developmental Test & Eval.	0	0	10,070	11,100
m. Operational Test & Eval.	0	0	0	0
n. Other/Miscellaneous	0	0	903	750
Total	0	0	237,473	193,600

B. Budget Acquisition History and Planning Information

Performing Organizations

Contractor or Government Performing Activity	Contract Method/Type or Funding Vehicle	Award Obligation Date	Performing EAC	Project Office EAC	Total Prior to 1994	Budget 1994	Budget 1995	Budget 1996	Budget 1997	Budget to Complete	Total Program
MARTIN MARIETTA	CPFF					0	0	37,500	24,000	TBD	TBD
NSWC/DAHLGREN	WR/RCP					0	0	7,340	7,306		
APL/JHU	RCP					0	0	16,988	15,298		
HOLLOMAN AFB	MIPR					0	0	1,000	1,000		
RAYTHEON CORP.	CPFF					0	0	57,430	47,880		
HUGHES MSL SYSTEMS CORP.	CPFF					0	0	71,110	54,940		
MOTORLA	CPFF					0	0	7,716	8,468		
RFAS	CPFF					0	0	575	515		
MISCELLANEOUS	VARIOUS					0	0	15,104	9,896		
Total Product Development						**0**	**0**	**214,763**	**169,303**		
RAYMOND ENGINEERING	CPFF					0	0	710	670		
NSWC/PORT HUENEME DIVISION	WR					0	0	192	174		
NAWC/POINT MUGU	WR					0	0	192	174		
VITRO	CPAF					0	0	1,400	1,400		
MISCELLANEOUS	VARIOUS					0	0	3,190	2,930		
Total Support & Management						**0**	**0**	**5,684**	**5,348**		
NAWC/WPNDIV-POINT MUGU	WR					0	0	768	696		
BMDO	PMA					0	0	563	4,225		
WHITE SANDS MISSILE RANGE	WR					0	0	1,330	1,190		
NSWC/PORT HUENEME	WR					0	0	768	696		
NAWC/CHINA LAKE	WR					0	0	3,710	3,380		
MISCELLANIOUS	VARIOUS					0	0	9,887	8,762		
Total Test & Evaluation						**0**	**0**	**17,026**	**18,949**		
Total						**0**	**0**	**237,473**	**193,600**		

Government Furnished Property

Item Description	Contract Method/Type or Funding Vehicle	Award Obligation Date	Performing EAC	Project Office EAC	Total Prior to 1994	Budget 1994	Budget 1995	Budget 1996	Budget 1997	Budget to Complete	Total Program
Product Dev. Property											
Support & Mgmt. Property											
Test & Eval. Property											

Subtotal Product Dev.					0	0	0	214,763	169,303		
Subtotal Support & Mgmt.					0	0	0	5,684	5,348		
Subtotal Test & Evaluation					0	0	0	17,026	18,949		
Total Project					0	0	0	237,473	193,600	TBD	TBD

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RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE: 0603868C (Proj: 1266)
PE Title: Navy Upper (U)

Project Number / Title: 1266 Sea-based Theater-wide Defense (Upper Tier)

Program Name:	FY1994 Actual	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	FY2000 Estimate	FY2001 Estimate	Total Program
0603868C RDT&E	81,000	68,450	30,442	33,400	0	0	0	0	Continuing

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION:

(U) The Navy Theater-wide Theater Ballistic Missile Defense (TBMD) program will provide an upper tier, sea-based capability to counter the TBM threat. This program will build on the core sea-based program, the lightweight exo-atmospheric projectile (LEAP) technology efforts, and the existing AEGIS ships infrastructure. The current effort includes LEAP flight tests, an independent cost and operational effectiveness analysis, and force investigation studies including concept engineering. The program will also investigate the option of using a Theater High Altitude Area Defense (THAAD) missile variant. This project evolved from project 1216 in the FY95 President's Budget.

(U) Navy Theater-wide TBMD is a candidate to begin the Demonstration and Validation (Dem/Val) Phase in FY98 as one of the Advanced Capabilities (ACAP). This project will be funded as ACAP I in project number 2294 if selected for Dem/Val in FY98 or will continue in concept development as ACAP II or III in project number 1293.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE: 0603868C (Proj: 1266)
PE Title: Navy Upper (U)

In 1994, this project continued the Navy LEAP Technology Demonstration program moving towards two intercept tests in FY95 (FTV-3 and FTV-4). The activity was focused on the final development testing of the new Standard Missile third stage, integrated testing of the ship systems to support the intercepts, and demonstration of the Navy LEAP target as threat representative. Successful testing resulted in safety approval to bring the interceptor missiles aboard ship as well as missile and ship design validation.

(U) FY 1994 Accomplishments:

- ($35.000M) For the Standard Missile and ship system development, conducted a critical design review and completed design validation tests of LEAP modified Standard Missile; and conducted at-sea testing of a shipboard weapon system to support intercept tests.
- ($25.600M) For the kill vehicle assembly and test, completed the assembly and testing of two flight kill vehicles to support intercept tests (FTV-3 and FTV-4) and provided safety and functional inert test articles to support the safety approval process and missile checkout.
- ($ 5.500M) For the advanced propulsion development and demonstration, conducted final qualification tests for kick stage propulsion; and conducted a hover test of a Navy safe solid divert and attitude control system integrated with a kill vehicle.
- ($10.300M) For target fabrication and demonstration, mission and test support, conducted a successful target demonstration flight test (FTV-TD); completed the assembly and testing of three additional targets to support intercept flight tests; and conducted mission analysis and test planning for the first exo-atmospheric TMD intercept tests.
- ($ 4.600M) For the Navy Theater-wide TBMD Program, completed concept definition analysis; completed initial ORD development; solicited innovative/additional input from industry for consideration in the cost and operational effectiveness analysis (COEA); initiated planning for AEGIS/LEAP technology demonstration; continued AEGIS/THAAD compatibility studies; continued to support engineering trade-offs and studies; prepared for Navy Theater-wide TBMD Milestone II in FY98; and initiated C2 analyses for Navy theater defense.

(U) FY 1995 Plans:

- o ($30.000M) Complete flight demonstrations, analysis and closeout of LEAP flight test program paving the way for an advanced AEGIS operational system demonstration.
- o ($20.000M) Continue COEA and AEGIS/THAAD integration studies and evaluation of advanced technologies.
- o ($18.450M) Conduct engineering for the Navy Theater-wide TBMD program; conduct specific concept investigations and technology demonstrations.

(U) FY 1996 Plans:

- o ($15.942M) Continue Navy Theater-wide TBMD planning and studies.
- o ($10.500M) Continue engineering for the Navy Theater-wide TBMD program and continue specific concept investigations and technology demonstrations.
- o ($ 4.000M) Conduct C2 studies and demonstrations; evolve JMCIS TBMD module.

(U) FY 1997 Plans:

- o ($14.600M) Continue Navy Theater-wide Defense planning and studies.
- o ($12.000M) Continue engineering for the Navy Theater-Wide Area Defense program and continue specific concept investigations and technology demonstrations.
- o ($ 6.800M) Continue C2 studies and demonstrations; and continue the evolution of the JMCIS TBMD module.

Acquisition Strategy: The Navy acquisition strategy is to leverage the AEGIS ship anti-air warfare capability development by integrating TBMD capability through contracts with as yet undetermined prime contractors.

B. (U) PROGRAM CHANGE SUMMARY:

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE: 0603868C (Proj: 1266)
PE Title: Navy Upper (U)

	FY1994	FY1995	FY1996	FY1997	TOTAL COST
Previous President's Budget	80,000	17,725	30,590	33,400	161,715
Appropriated Value		75,000			75,000
Adjustments to Appropriated Value		-6,550			(6,550)
Current Budget Submit	81,000	68,450	30,442	33,400	213,292

Change Summary Explanation:
Funding: This project evolved from project 1216 in the FY95 President's Budget. The $50M Congressional increase in FY95 will allow accelerated technology transfer from Terrier to AEGIS weapon systems.
Schedule: LEAP flight test demonstrations will slip into FY95 to permit expanded pre-flight ground assurance testing.
Technical: Additional engineering analysis (THAAD/AEGIS integration and Theater-wide concepts analysis for Navy and BMDO Capstone COEAs).

C. (U) OTHER PROGRAM FUNDING SUMMARY

Related RDT&E:	Funding Dependency? (Yes[1]/No)
*1155, Phenomenology, PE 0603872C	Yes
*1161, Advanced Sensor Tech., PE 0603872C	Yes
*1170, TMD Risk Reduction, PE 0603872C	Yes
*2259, Israeli Cooperative Projects, PE 0603872C	Yes
2263, Navy Area TBMD, PE 0208867C/0603867C/0604867C	Yes

*3251, System Engineering and Technical Support, PE 0603172C	Yes
*3261, BM/C3I Dem/Val, PE 0603864C/0604864C	Yes
*3265, CINC TMD Assessment Program, PE 0603872C	Yes
*3352, Modeling and Simulation, PE 0603872C	Yes
*3354, Targets, PE 0603872C	Yes
*3359, System Test and Evaluation, PE 0603872C	Yes
*3360, Test Resources, PE 0603872C	Yes
4151, Personnel and Related Costs, PE 0605218C	Yes

* These projects provide essential technical, engineering, and/or infrastructure support to TMD MDAP programs.

[1]Funding data for related RDT&E efforts that have a funding dependency can be found in the respective project summary/program element.

D. (U) Schedule Profile

	FY1994				FY1995				FY1996				FY1997			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Acquisition Milestones - DAB Documentation																X
Engineering Milestones																
- Complete AEGIS/THAAD Integration Study						X										
- Complete Navy TBMD COEA									X							
- Complete BM/C3 Studies and Demonstrations																X

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE: 0603868C (Proj: 1266)
PE Title: Navy Upper (U)

T&E Milestones		
- TERRIER/LEAP Flight Test Demos		
>> FTV 3		X
>> FTV 4		X
>> KKV High Altitude Intercept of TBM like target	X	
Other Program Events		
- Complete Congressional Rqmts. of FY95 Approp. Conf.		X

Planned Milestones Beyond FY1997:

Milestone Decision 1Q/FY98

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE: 0603869C (Proj: 2262)
PE Title: CORPS SAM (U)

Project Number / Title: 2262 CORPS SAM

Program Name:	FY1994 Actual	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	FY2000 Estimate	FY2001 Estimate	Total Program
0603869C RDT&E	16,270	14,971	30,442	33,400	0	0	0	0	Continuing

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION:

(U) The CORPS SAM program is focused on satisfying the need to provide low-to-medium theater missile and air defense to the maneuver forces and other U.S. and allied forward deployed critical assets. It will support force projection operations by providing protection from early entry to decisive operations. The CORPS SAM system will consist of missiles, launchers, sensors, and battle management command, control, communications, computers, and intelligence (BMC4I) elements. It will be easily transportable by all strategic and tactical lift aircraft.

(U) CORPS SAM is a candidate to begin Demonstration and Validation (Dem/Val) Phase in FY98 as one of the Advanced Capabilities (ACAP). This project will be funded as ACAP I in project number 2294 if selected for Dem/Val in FY98 or will continue in concept development as ACAP II or III in project number 1293.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE: 0603869C (Proj: 2262)
PE Title: CORPS SAM (U)

(U) CORPS SAM was approved by the Defense Acquisition Board (DAB) for entry into Concept Exploration and Definition phase in August 1990. Extensive government and industry studies and analyses have been conducted to define feasible and cost effective system concepts. These analyses were used to balance the requirements contained in the CORPS SAM Operational Requirements Document that was approved by the Army Deputy Chief of Staff for Operations (ADCSOPS-FD) in Oct 1993. The DAB also directed the CORPS SAM program aggressively pursue international cooperation in the development of the CORPS SAM system. Early discussions were conducted with 11 countries. The greatest potential for cooperation is between Germany, France, and the U.S. in a trilateral cooperative program. CORPS Sam is pursing integration of CORPS Sam BMC4I with the project manager, Air Defense Command and Control Systems to take advantage of previous Army developments that can be incorporated into the CORPS Sam program.

(U) FY 1994 Accomplishments:

- ($ 6.6M) Contractor support provided technical analysis, simulations/modeling, external sensor, BMC4I analyses/assessment, lethality, survivability analysis.
- ($ 5.47M) In-house support finalized request for proposal (RFP); discussed/negotiated and developed international cooperative plans/agreements; conducted Research, Development, and Engineering Center (RDEC) technology assessments efforts; conducted threat/scenario development; conducted modeling and simulation efforts; continued overall program management functions/activities.
- ($ 4.2M) Other Government agencies provided independent assessment activities, combat developer analyses/activities, and government furnished equipment.

(U) FY 1995 Plans:

- ($ 3.6M) Competitively award and execute first increment of two contracts for international teaming with project definition-validation (PD-V) option.

- o ($ 4.0M) Initiate support contracts to provide technical analysis in specialty areas (e.g. lethality, survivability,system simulation/modeling).
- o ($ 6.571M) Continue in-house support to include overall program management support, e.g. conduct source selection activities; continue to discuss/negotiate and develop international cooperative plans/agreements; establish international program management structure; continue RDEC technology assessment efforts; continue threat/scenario updates; continue modeling and simulation efforts.
- o ($ 0.8M) Continue other Government agencies support to perform independent assessment activities and combat developer analyses/activities.

(U) FY 1996 Plans:

- o ($20.9M) Monitor Prime contractor efforts to complete international teaming; exercise option to initiate the PD-V contract efforts.
- o ($ 2.0M) Continue support contracts providing technical analysis, simulation/modeling, external sensor, BMC4I analyses/assessment, and lethality and survivability analyses.
- o ($ 6.942M) Continue in-house support to include overall Program Management Office support; continue RDEC technology assessment efforts; continue threat/scenario updates; continue modeling/simulation efforts.
- o ($ 0.6M) Continue other Government agencies support to perform independent assessment activities and combat developer analyses/activities.

(U) FY 1997 Plans:

- o ($23.4M) Prime contractor -- continue to execute PD-V contract.
- o ($ 2.1M) Continue support contracts providing technical analysis, simulation/modeling, external sensor, BMC4I analyses/assessment, lethality and survivability analysis, and cost estimating.

- o ($ 7.1M) Continue in-house support to include the overall Program Management Office support; continue RDEC technology assessments; continue threat/scenario updates; continue modeling/simulation efforts; initiate activities to support the conduct of the System Requirements Review; initiate the development of RFP for Design and Development contract.
- o ($ 0.8M) Continue other Government agencies support to perform independent assessment activities and combat developer analyses/activities.

Acquisition Strategy: The process to initiate the DEPSECDEF's decision to proceed as a trilateral program among the U.S., Germany, and France began in September 1994. Working groups have been established to refine operation/technical requirements and develop a Memorandum of Understanding and statement of work for trilateral cooperation for the Project Development-Validation (PD-V) phase. The proposed acquisition approach is to select two U.S. industrial teams that will be required to conduct an international teaming and PD-V effort with European industry. During the PD-V phase, the contractors will be required to define/develop a total system concept based upon the Technical Requirements Document, conduct requirements analysis/flowdown, establish a contractor-defined baseline system concept, conduct concurrent engineering design trades, perform simulations/modeling, provide life-cycle-cost estimates, and establish integrated program plans to include a defined risk assessment/abatement plan. Demonstration of critical functions associated with integrated system performance and resolution of key technical issues for the proposed system design concept through the use of end-to-end modeling and digital simulation will be required. Following a successful system design review, an RFP for design and development will be issued to the competing international teams that conducted PD-V. The design and development contract for the remainder of development is envisioned to include all efforts required to accomplish the remaining objectives of the CORPS SAM system development.

B. (U) PROGRAM CHANGE SUMMARY:

FY1994	FY1995	FY1996	FY1997	TOTAL COST

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE: 0603869C (Proj: 2262)
PE Title: CORPS SAM (U)

Previous President's Budget	20,000	17,725	30,590	33,400	101,715
Appropriated Value		15,000			15,000
Adjustments to Appropriated Value		-0,029			(29)
Current Budget Submit	16,270	14,971	30,442	33,400	95,083

Change Summary Explanation:
Funding: This project was funded under PE 0603216C project 2212 during FY1994.
Schedule: CORPS SAM RFP release has been delayed pending the signing of a trilateral Statement Of Intent (SOI) between France, Germany, and the United States governments. The final RFP release is now scheduled for February 1995 with a contract award in the fourth quarter of FY95.
Technical: None.

C. (U) OTHER PROGRAM FUNDING SUMMARY

Related RDT&E:	Funding Dependency? (Yes[1]/No)
*1155, Phenomenology, PE No. 0603872C	Yes
*1170, TMD Risk Reduction, PE No. 0603872C	Yes
1293, Advanced Capability Concept Development, PE No. 0603872C	Yes
2154, TMD-GBR, PE No. 0603862C/0604862C	Yes
2257, PATRIOT, PE No. 0604865C	Yes
2294, Advanced Capability Dem/Val, PE No. 0603872C	Yes

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE: 0603869C (Proj: 2262)
PE Title: CORPS SAM (U)

2358, HAWK, PE No. 0603863C/0604863C	Yes
3153, Architecture Analysis/BMC3 Initiatives, PE No. 0603872C	Yes
*3157, Environmental Siting and Facilities, PE No. 0603872C	Yes
*3251, Systems Engineering and Technical Support, PE No. 0603872C	Yes
*3261, BM/C3I, PE No. 0603864C/0604864C	Yes
*3265, CINC TMD Assessment Program, PE No. 0603872C	Yes
*3352, Modeling and Simulation, PE No. 0603872C	Yes
*3354, Targets, PE No. 0603872C	Yes
*3359, System Test and Evaluation, PE No. 0603872C	Yes

* These projects provide essential technical, engineering, and/or infrastructure support to TMD major defense acquisition programs.

[1]Funding data for related RDT&E efforts that have a funding dependency can be found in the respective project summary/program element.

D. (U) Schedule Profile

	FY1994				FY1995				FY1996				FY1997			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Engineering Milestone																
System Requirements Review									X							
Contract Milestone																
Draft PD-V RFP Release			X*													
Final RFP Release						X										
Int'l Teaming Contract Award								X								

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE: 0603869C (Proj: 2262)
PE Title: CORPS SAM (U)

Exercise PD-V Option		X
Other Program Events		
Rqmts.Harmonization w/GE & FR	X	
Finalize Trilateral MOA	X	
Establish NATO Agency	X	

* Completed milestone

Planned Milestones Beyond FY1997:

Transition to project 1293 or 2294	1Q/FY98

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RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE:0603870C (Proj: 1265)
PE Title: Boost Phase Int. (U)

Project Number / Title: 1265 Boost Phase Interceptor

Program Name:	FY1994 Actual	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	FY2000 Estimate	FY2001 Estimate	Total Program
0603870C RDT&E	37,022	40,000	49,061	44,300	66,300	72,300	0	0	Continuing

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION:

(U) The Boost Phase Intercept (BPI) Technology Program funded and continuing under this project is designed to meet critical future active defense needs. The BPI program is developing new technologies to demonstrate a deterrent and counter in Theater Missile Defense (TMD) by intercepting a theater ballistic missile (TBM) in its boost phase of flight. Present BMDO/TMD architectures focus on midcourse and terminal defenses which allow fragments of the TBM and/or warheads to inflict potential damage on friendly areas. During a TBM's boost phase, the missile is readily visible, slow moving, and extremely vulnerable. Boost phase intercept of TBMs can cause missile debris to fall on enemy territory or to fall short of the intended target(s) and significantly reduce the number of TBMs in post-boost flight, thus thinning out the number of TBMs reaching subsequent defensive layers and reducing the burden on terminal defenses. Interceptor component technologies advanced through the BPI program have potential applicability and benefit to all endoatmospheric interceptors.

(U) The BPI program will integrate and demonstrate critical technologies culminating in BPI technology experiments. BPI experimental elements may include off-board sensor(s) that detect and track TBMs, launch aircraft, battle management (BMC^3), the missile, and lightweight endoatmospheric kinetic kill vehicles (KKVs). To achieve boost phase intercept, the interceptor missile and KKV may achieve hypersonic velocities within the atmosphere. The demonstrations will validate the solution to critical KKV technology associated with high-speed atmospheric flight and will provide: (1) new capabilities with reduced costs/risks compared to

current interceptor weapons systems, and enhancements to other interceptors under development; (2) reduction of technical risks and costs to support an acquisition program; and (3) technical solution to provide contingent residual boost phase intercept capabilities for theater defense. The program also will use existing contracts and technologies currently under development to reduce schedule and cost, and will be planned and conducted with BMDO, Air Force, Navy, and Army elements to maximize user interaction.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) This project has enabled BMDO to successfully integrate critical technologies which will serve the long-term interest of the BPI program and to initiate designs which meet projected BPI requirements. Under TMD funding in FY94, advances in KKV technology, concept development, and test planning activities were conducted by BMDO with significant involvement from the Services. The BPI program initiated concept of operations (CONOPS) development, intercept test planning, and KKV, booster, and kickstage development; conducted KKV cooled window thermal and optical tests at hyperthermal facilities; and completed fabrication of cooled KKV forebodies for aero-optic testing, which is critical for designing the guidance and control algorithms for high-speed endoatmospheric flight.

(U) FY 1994 Accomplishments:

- ($2.300M) Test fired kickstage motor, scale-up to be used for the BPI missile, PE 0603216C.
- ($3.200M) Hyperthermal tests of cooled windows for the kill vehicle, PE 0603216C.
- ($2.400M) KKV seeker development to be used for BPI, PE 0603216C.
- ($8.700M) Program planning and concept of operations for BPI, PE 0603216C.

The following technology investments that were supported in FY94 are associated with the endoatmospheric kill vehicle high-altitude, long-endurance (HALE) UAV flight tests as a BPI/sensor platform, PE 0603218C, (now transferred to DRO).

- ($7.859M) Low altitude flight test of high-altitude long-endurance (HALE) gasoline-powered UAV (RAPTOR Demonstrator) (terminated).
- ($4.912M) Demonstrated miniaturized pumped propulsion technology using a monopropellant via flight test (terminated).
- ($3.701M) Began launch detection and tracking experiments of a ballistic missile.

The following technology investments that were supported in FY94 are associated with the D-2 Hypervelocity Interceptor Program, PE 0603218C.

- ($3.950M) Tested TMD version of aeroshell and sabot in Israel, delivered prototype TMD transceiver and one axis of three axis solid propulsion system for TMD.

(U) FY 1995 Plans:

- ($26.5M) Continue KKV design; evaluate cooled contractor window hardware and seeker in aero-optical shock tunnel and aero-thermal wind tunnel tests; initiate fabrication of flight configured seekers.
- ($3.2M) Continue development of Air Force and Navy CONOPS, architectures.
- ($10.3M) Continue BPI flight experiment mission planning and range requirements definition. Investigate early technology demonstration flight test to characterize KKV seeker performance, to validate KKV flight performance for TMD mission, and to measure the flight environment; begin defining A/C mods and off-board sensors for BPI flight tests; and define axial propulsion modification requirements for interceptor missile to achieve high accelerations.

(U) FY 1996 Plans:

- ($34.0M) Complete BPI seeker and window vibration and flight tests. Complete BPI kill vehicle detailed design and

component ground tests; initiate fabrication of ground test vehicles; conduct divert and attitude control system tests

- ($12.061M) Initiate booster and kickstage development; begin integration of booster and kickstage with kill vehicle; continue propulsion qualification program
- ($3.0M) Define target requirements, integration and flight test support; conduct early flight demonstrations

(U) FY 1997 Plans:

- ($30.7M) Conduct kill vehicle critical design review; complete fabrication of ground test KKVs; begin ground tests
- ($11.0M) Continue integration of booster and kickstage with KKV; conduct launch of control test vehicle, demonstrate staging, and complete KKV ejection and flyout in preparation for full intercept missions
- ($2.6M) Continue target development, integration and test support

Acquisition Strategy: The BPI execution plan involves participation by BMDO, Air Force, Army, and Navy. BMDO will plan, manage, and execute the overall ground and flight test program; oversee service (Air Force and Navy) CONOPS development; develop long-term plans for potential acquisition as a TMD Major Defense Acquisition Program (MDAP); and provide targets of opportunity for KKV seeker and sensor flight tests and threat representative targets for BPI demonstrations. The program plan may consist of development and validation of endoatmospheric kill vehicle technologies required for BPI as well as design, fabrication, and test of the KKVs; missile integration, which includes missile component modifications and integration with the KKV; modification of launch aircraft; integration of all experiment elements; and battle management and communication between the elements required for flight test and intercept demonstration.

On-going, competitively-awarded, CPFF contracts for the KKV will continue through the completion of ground and flight tests. The BMDO manages these contracts. The Navy and the Air Force will define an affordable and practical CONOPS in FY95. The acquisition strategy for the flight tests will be evolved.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE:0603870C (Proj: 1265)
PE Title: Boost Phase Int. (U)

B. (U) PROGRAM CHANGE SUMMARY:

	FY1994	FY1995	FY1996	FY1997	TOTAL COST
Previous President's Budget	36,089	61,100	65,300	70,300	232,789
Appropriated Value		40,000			40,000
Adjustments to Appropriated Value		0			0
Current Budget Submit	37,022	40,000	49,061	44,300	170,383

Change Summary Explanation:
The BPI program was technically restructured after submission of the FY95 CDS for Project 1215 to reflect congressional guidance and the results of the OSD expert panel study on BPI/API. The current execution plan continues endoatmospheric kill vehicle technology development previously funded under Project 1209, and discontinues unmanned aerial vehicle (UAV) and UAV compatible missile activities and exoatmospheric flight tests reflected in the FY95 CDS plan. The revised demonstration plan is compatible with existing Air Force and Navy fire control and launch aircraft.

Funding: Funding includes BPI technology development and demonstration initiated in FY94. Current and outyear funding decreases from prior year submission cause delay of hit-to-kill demonstrations against a powered booster, and may also cause a loss of near-term technical capability.

Schedule: None.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE:0603870C (Proj: 1265)
PE Title: Boost Phase Int. (U)

Technical: None.

C. (U) OTHER PROGRAM FUNDING SUMMARY:

Related RDT&E:			Funding Dependency? (Yes[1]/No)
1270	AIST	PE#0603173C	No
1293	Adv Cpblty Concept Def	PE#0603872C	No
2294	Adv Capability Dem Val	PE#0603872C	No
1265	Boost Phase Intercept	PE#0603871C	Yes
The Air Force is jointly funding this program			Yes

[1]Funding data for related RDT&E efforts that have a funding dependency can be found in the respective project summary/program element.

D. (U) Schedule Profile

	FY1994				FY1995				FY1996				FY1997			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Engineering Milestone						a	b	c								
T&E Milestone										e	f			h,i	j	l
Contract Milestone													g			
Other Program Events								d								k

a) aero-optical shock tunnel tests (window)
b) aerothermal wind tunnel tests (window)

c) aero-optical shock tunnel tests (seeker)
d) AF & Navy conops definition
e) target demo flight
f) seeker demo flight
g) KKV CDR
h) KKV hover
i) CTV flight
j) preliminary FTV-1
k) KKV delivery
l) preliminary FTV-2

Planned Milestones Beyond FY1997:
BPI missile delivery 2-4 Qtr 1998.
BPI intercept flights 1st, 2nd, 3rd, Qtr 1999.

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RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

Feb 1995

RDT&E, Defensewide / BA 04 (Demonstration/Validation)

Program Element Number: 0603871C
PE Title: National Missile Defense (U)

Project Number and Title:	FY1994 Actual	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	FY2000 Estimate	FY2001 Estimate	Total Program
1151 Sensors (Active and Passive)	130,768	107,142	102,675	88,920	64,927	59,923	39,411	35,400	Continuing
1155 Phenomenology Program	84,042	31,028	14,672	17,593	20,767	20,474	20,013	20,013	Continuing
1161 Advanced Sensor Technology	4,021	0	0	0	0	0	0	0	Continuing
1265 Boost Phase Interceptor	2,500	0	0	0	0	0	0	0	Continuing
1267 Ground-Based Interceptor	68,569	137,810	126,646	149,550	182,138	184,047	205,439	206,139	Continuing
1460 BMC3	23,702	27,900	33,538	36,213	38,213	41,213	41,213	43,124	Continuing
3152 NMD System Engineering	41,190	20,402	19,357	17,975	20,475	20,475	20,475	20,475	Continuing
3153 Arch, Analysis / BMC3 Initiatives	11,713	0	3,110	3,125	3,125	3,125	3,125	3,125	Continuing
3157 Environmental, Siting, & Facilities	0	0	1,345	1,351	1,401	1,404	1,409	1,409	Continuing
3160 Readiness Planning	7,924	13,470	14,469	17,302	18,840	19,202	18,757	20,157	Continuing
3265 User Interface	4,373	1,248	1,443	1,530	1,530	1,530	1,530	1,530	Continuing
3270 Threat and Countermeasures Program	0	0	8,272	8,312	1,663	1,663	1,663	1,663	Continuing
3352 Modeling & Simulations	78,017	19,000	15,779	26,834	15,855	15,855	15,855	15,855	Continuing
3354 Targets Support	40,893	0	0	0	0	0	0	0	Continuing
3359 System Test & Evaluation	14,878	14,100	17,904	18,382	18,382	18,382	18,382	18,382	Continuing
3360 Test Resources	24,229	11,558	11,411	11,951	12,025	12,025	12,200	12,200	Continuing
4154 Operations Fluctuation Account	13,154	3,330	0	0	0	0	0	0	Continuing
PE TOTAL	549,973	386,988	370,621	399,038	399,341	399,318	399,472	399,472	

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION:

(U) In mid 1993, the Department of Defense conducted a Bottom-Up Review (BUR) to select the right strategy, force structure, and modernization programs for America's defense in the post-Cold War era. With the dissolution of the former Soviet Union (FSU), the threat to the U.S. homeland from a deliberate or accidental

ballistic missile attack by states of the former Soviet Union or the Peoples Republic of China (PRC) was judged to be highly unlikely. While the propensity of Third World countries to use long-range ballistic missiles may be increasing, the ability of such countries to acquire or develop such a capability over the next 10-15 years was considered uncertain.

(U) As a prudent hedge against this uncertainty, the Department chose to pursue a technology readiness strategy for National Missile Defense (NMD) that develops and maintains an ability to deploy ballistic missile defenses for the United States should a threat emerge. As planning for BMD progressed to support the FY94 budget and FYDP, discussions with the Under Secretary of Defense for Acquisition resulted in further program definition. As a result, the NMD Technology Readiness Program was structured to focus on demonstrating the resolution of technology "long poles" (e.g., the exoatmospheric kinetic kill vehicle) as a precursor to potentially fielding an objective National Missile Defense system capable of defeating existing strategic ballistic missile systems with high confidence. In addition, the Technology Readiness Program would develop and maintain evolutionary contingency deployment options to meet a ballistic missile threat to the U.S. if it emerged sooner than expected.

(U) The FY96/97 Budget submission supports this strategy to develop a national missile defense system that is: capable of contingency deployment within three years to provide a defense against simple threats; and, capable as technology progresses of meeting more stressing threats should they emerge. The BMDO has organized the NMD program to support development of the NMD system into two main areas: system development test and deployment planning.

SYSTEM DEVELOPMENT (U)

(U) The NMD system includes an interceptor element, sensor elements, and a battle management, command and control element. The system architecture and the trade studies which formed the architecture alternatives are dependent on the capabilities of sensor elements (Project 1151) to detect, identify, and track the threat such that the command and control system can target interceptors against it. The fundamental problem of selecting the right sensors, at the right costs, to provide detection, tracking, and sufficiently accurate position information for hand-off to the command and control and weapons systems encompasses a complex set of choices among passive and active sensors (and their mix), as well as specific technology choices for focal plane materials, optics, array structures, transmit/receive elements, power, conditioning, cooling, producibility, survivability, and more. The NMD program depends on a space-based passive sensor, the Space and Missile Tracking System (SMTS), and a ground based x-band radar (GBR) as the sensor elements required to address the full spectrum of potential threats.

(U) The NMD-GBR development builds upon the Theater Missile Defense GBR. To participate in NMD system integration testing, an initial NMD radar will be built at Kwajalein Missile Range as the NMD Radar Technology Demonstrator (RTD). In addition, in the event of an early contingency deployment, an initial over-the-horizon (OTH) track of the threat would depend on upgraded Early Warning Radars (UEWR) to commit interceptors. Resources have been allocated to demonstrate

a prototype EWR software upgrade for this contingency, but not to fund the actual upgrades, since the required modifications can be made in parallel with an NMD contingency deployment.

(U) In the near term, the interceptor front end, the exoatmospheric kinetic kill vehicle (EKV) is the most challenging component in the NMD system development. Project 1267, Ground-Based Interceptor (GBI) has mitigated EKV development risks by funding three contractors (down selected to two in FY94) to develop alternative technical solutions to non-nuclear hit-to-kill interception. A number of technology efforts have also been funded to provide further risk mitigation and technology insertion opportunities to leverage the program against both technical risks and potential changes in the threat. GBI builds upon the success of the Homing Overlay Experiment and the ERIS and LEAP technology programs and advances at a relatively modest risk to support a capable defense by exploiting to the fullest an architecture with the GBR and SMTS.

(U) The BMC3 Program (Project 1460) will use an evolutionary acquisition approach to incrementally prototype the BMC3 functionality required to integrate and demonstrate an NMD system in step with evolving NMD sensors and interceptor element capabilities. BMC3 prototypes will be integrated and demonstrated at the National Test Facility with USSPACECOM/NORAD user participation to refine and focus the BMC3 development and system behavior. NMD BMC3 supports the NMD command and control process required to provide human-in-control; develop, assess, and select missile defense strategies and tactics; fuse and correlate available sensor information; integrate and plan the complimentary coordination of NMD sensors and interceptors for maximum system performance; provide interfaces with existing and planned C3 systems; and, prototype and demonstrate tracking software for contingency upgrade of EWR to support NMD BMC3 operations.

(U) The inter-element relationship within the NMD architecture and the capability they offer against requirements is defined, analyzed, and supported by a continuous system engineering process. System Engineering (Project 3152) develops system requirements and flows them to the elements, interacting with and ultimately defining the architecture required to meet and defeat the threat. Systems engineering is an integral part of requirements definition, component performance verification, test planning and analysis, contingency deployment planning, and system integration. User Interface (Project 3265) provides feedback to the system and element designers from the user (USSPACECOM) via wargames. These exercises simulate real time system and threat engagement.

(U) Threat timelines are a pressing concern. Modern long range missile systems developed by the FSU and the PRC could be acquired by potentially hostile regimes that would challenge the U.S. in areas critical to U.S. interests. These systems already possess significant capability and their acquisition would leave little time to respond with a crash development program. The NMD program Threat and Countermeasures (Project 3270) continually assesses and updates the qualitative and quantitative threat, including actual and prospective technology migration, as well as the indigenous programs of technically immature countries. The primary purpose of this effort is to assure that NMD has the information required to measure the impact of changes in the threat on system requirements so that requirements and technical solutions can be continually updated.

(U) The NMD deployment capability is dependent on the demonstrated system performance of the integrated NMD element prototypes of the sensors, interceptors, and BMC3. Demonstration of this capability must substantiate a level of performance acceptable to the User community, instill confidence in the developer that the risks associated with the evolutionary development path remain within boundary conditions, and allow opportunity for interim contingency deployments. System operational demonstrations are prohibitive from a number of standpoints, not the least of which is cost. The Test and Evaluation program (Project 3359 and 3360) has been designed from the beginning to leverage the entire Department of Defense infrastructure, fund BMDO (TMD, NMD, and Technology) required improvements, and develop a simulation regime that reduces the cost of and dependence on live testing to demonstrate system performance. Realistic flight tests against threat representative targets are planned. Targets are developed, and analysis platforms positioned/developed to ensure the entire test environment can be captured and the data reduced. This information will refine the NMD system simulation called the Integrated System Test Capability fielded at the National Test Facility and at the Advanced Research Center. The NMD phenomenology program (Project 1155) provides background, signatures and measurement studies, test and experiment data reduction, and influences algorithm development required to operate NMD sensors and weapons.

DEPLOYMENT PLANNING (U)

(U) Deployment planning activities address User operational and system effectiveness requirements over the life cycle of the weapon system to meet the challenge for contingency deployment. The NMD program focuses efforts on the planning required to field a prototype system. Environmental siting, facilities assessment, modification, refurbishment, and meeting other beneficial occupancy issues are supported by this effort (Project 3157). Deployment Planning (Project 3160) is being conducted to identify the critical actions and timelines for fielding a contingency system and then focusing resources to reduce the time line and also reduce risks inherent in such a deployment. This is a new effort structured during the transition year (FY94) and ramped up in FY95 to support aggressive studies and planning required to provide confidence that a contingency deployment can be executed within the planning timeline and meet user requirements for operability and system effectiveness.

(U) In summary the program is structured within budget and ABM Treaty limitations to: develop and demonstrate, as soon as possible, the critical technologies needed to achieve a fully effective defense (the Objective Capability) against existing complex threats; develop and maintain, on the path to the objective capability, contingency deployment options based on technical progress achieved in the program at any point in time, and maintain effective interface with DoD and the USAF to ensure that the Space-Based Infrared (SBIR) program proceeds with both Tactical Warning/Attack Assessment(TW/AA) and ballistic missile midcourse track capabilities needed to achieve an effective defense against complex threats.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY1994 Accomplishments:

o NMD Technology Readiness Program:

(U) SYSTEM DEVELOPMENT: System development activities in 1994 focused on restructuring the NMD acquisition program into a technology readiness program.
(U) ($84,042) 1155 - PHENOMENOLOGY Phenomenology activities focused on operating COBRA JUDY and AST to collect radar and optical data, analyzing data, delivering target signatures handbooks, creating a debris/fragment signatures database, and improving modelling codes in support of U.S./U.K. analysis of data sets from joint experimental flight tests. More than 50 gigabytes of missile background data were distributed, and more than 3,000 gigabytes of missile background data archived.

(U) ($130,768) 1151 - SENSORS Work on the NMD-GBR Dem/Val radar was halted and the program was restructured into the NMD Radar Technology Demonstration (RTD). SMTS (BE) activities were focused on the continued development of the Flight Demonstration Satellite Vehicles (FDSV) and essential components for an objective SMTS (BE) system and risk reduction. MSX satellite integration and testing and ground system readiness testing and the FPA pre-pilot demonstration were completed.

(U) ($68,569) 1267 - GROUND-BASED INTERCEPTOR The GBI-X program was refocused on EKV activities. This included the down selection from three to two contractors for the EKV program, initiation of the integration of the EKV sensors for FY96 risk reduction flights, and continued PLV and launch complex activities.

(U) ($23,702) 1460 - BMC3 transitioned from acquisition to technology readiness. This refocused effort on development of prototyping and integration options. Developed and demonstrated interfaces with the NMD Integrated System Test Capability (ISTC) infrastructure to support IGT1 and 2. Demonstrated object oriented prototyping and user interface in JWID94. Provided user situational awareness displays in joint interoperability demonstrations. Conducted demonstrations, tests, and exercises, and facilitated user involvement in assessment of BMC3 prototypes at the NTF.

(U) ($41,190) 3152 - NMD SYSTEM ENGINEERING

Performed architectural definition and supporting analysis required to restructure program to a technology readiness effort. Identified and resolved integration issues via Technology Roadmap, System Maturity Matrix, and NMD System Engineering Notebook (NSEN). Integrated initial BM/C3 information architecture requirements, developed under project 1460, into system/element requirements. Reconciled ORDs with USSPACECOM and Service proponents. Developed requirements and implementation plan for NMD system simulations at NTF. Performed analysis and engineering integration in support of NMD demonstration program and prepared for Integrated Ground Tests (IGTs) 1 and 2.

(U) ($4,373) 3265 - USER INTERFACE Theater and strategic wargaming was conducted to refine Operational Requirements Documents (ORDs) and develop operational concept(s) of operation (CONOPs). Mission analysis for BMD was conducted.

(U) ($78,017) 3352 - MODELING AND SIMULATIONS Infrastructure for the NTF and the ARC to support NMD activities was provided. The NTF hosted BMC3 studies and Systems Engineering Studies.

(U) ($14,878) 3359 - SYSTEM TEST ENVIRONMENT Completed global environment and merged BMD BMC3 with ISTC global environment; developed independent test evaluation methodology; developed options for test center consolidation.

(U) ($24,229) 3360 - TEST RESOURCES Provided test facility infrastructure (digital emulation at KDEC,HWIL testing at KHILS, wind and shock tunnel testing); provided test range infrastructure, upgrades and documentation; provided test range instrumentation upgrades, data collection, and analyses.

(U) DEPLOYMENT PLANNING: Deployment planning activities in 1994 focused on restructuring the NMD acquisition program into a technology readiness program.

(U) ($7,924) 3160 - LOGISTICS READINESS SUPPORT Maintained the LWIR calibration facility and conducted annual review of BMD metrology program. Identified logistics supportability, producibility, and industrial base issues and developed mitigation strategies and plans. Initiated framework to develop contingency deployment planning process. Completed quick reaction deployment analysis of deployment of a NMD system capability. Provided specialty engineering support to the NMD element program managers.

(U) FY1995 Plans:

o ($386,988) NMD Technology Readiness Program:

(U) SYSTEM DEVELOPMENT: Important events occurring in FY95 include: the EKV Critical Design Review (CDR) and EKV down selection, the GBR-RTD Antenna Design Preliminary Design Review (PDR), the BMC3 Integrated Ground Test 2 (IGT2) and EWR experiment, and the SMTS/BE ATP, SDR, and PDR for the FDSV.

(U) ($31,028) 1155 - PHENOMENOLOGY Provide resource support to receive, archive, and distribute BMDO plume and background test data. Provide operating costs for COBRA JUDY and AST to collect radar and optical data, also one third the operating costs of the COBRA DANE system. Continue joint U.S./U.K. analysis of data sets.

(U) ($107,142) 1151- SENSORS Complete MSX satellite rework and integration, launch satellite, and begin MSX target and phenomenology data collection and analysis. Continue passive sensor component development and testing. Continue NMD-RTD antenna design and algorithm development, and procure long lead items. Continue joint U.S./U.K. analysis of data sets. Complete negotiations and sign an agreement with Russia on AGRE. Continue Kwajalein Missile Range (KMR) launch facilities preparation and support activities.

(U) ($137,810) 1267 - GROUND-BASED INTERCEPTOR Conduct EKV CDR and down select to single EKV contractor for EKV flight test. Acquire long lead hardware and perform PLV modifications for two boosters to launch two EKV sensors in FY97. Down select from two to one Pilotline Experimental Technology(PET) long wavelength infrared (LWIR) FPA contractor and from two to one Silicon Hybrid Infrared Intrinsic Long-wavelength Detectors (SHIELD) FPA contractor. Continue preparations to launch two EKV sensors in FY97 using the Payload Launch Vehicle (PLV) system.

(U) ($27,900) 1460 - BMC3 Integrate existing Site BMC3 prototype and demonstrator capability and CINC(formerly Command)BMC3 prototype to support Integrated System Tests and demonstrations. Award BMC3/SE&I contract. Provide BMC3 representation for participation in Integrated Ground Tests. Conduct the EWR experiment and NMD-TMD lower tier cooperative experiment based on the FY93 cued tracking demonstration. Prepare for and conduct BMC3 prototyping source solicitation for award in 4Q95. Establish and demonstrate BMC3 prototype integration methodology.

(U) ($20,402) 3152 - SYSTEM ENGINEERING Continue development, application, and maintenance of tools such as the Technology Roadmap, NMD Maturity Matrix (NMM), and NMD System Engineering Notebook (NSEN). Perform system analysis and issue resolution. Continue to perform program planning, requirements development, and systems integration.

(U) ($1,248) 3265 - USER INTERFACE Continue coordination and work with multi-service users to refine Operational Requirements Documents (ORDs) and

operational concept(s) of operation (CONOPs), and conduct theater and strategic wargaming and mission analysis for NMD.

(U) ($19,000) 3352 - MODELING AND SIMULATIONS Provide NMD share of total infrastructure for the NTF and the ARC and integration support. Provide NMD M&S oversight and support the independent verification and validation (IV&V). Provide civilian personnel consistent with NTBJPO manpower requirements.

(U) ($14,100) 3359 - SYSTEM TEST ENVIRONMENT Develop and integrate initial EKV models into ISTC framework; conduct EKV/BMC^3 integrated ground test; execute independent evaluation methodology and special studies.

(U) ($11,558) 3360 - TEST RESOURCES Provide ground test facility infrastructure for hardware-in-the-loop testing, wind and shock tunnel testing, hover test capability, command and control technology experiments and sensor tests; provide test range infrastructure; provide range instrumentation, upgrades, data collection.

(U) DEPLOYMENT PLANNING: Critical path analysis will determine deployment long poles. Industrial base analysis will identify production and manufacturing requirements. Logistics and specialty engineering will assure operational suitability. Update and modify environmental, siting and facilities annexes.

(U) ($13,470) 3160 - LOGISTICS READINESS SUPPORT Develop contingency deployment guidance and deployment execution plan. Conduct critical path analyses to determine deployment long poles. Conduct industrial base analysis for impacts on production and manufacturing requirements. Perform logistics and specialty engineering assessment of NMD elements to assure operational suitability. Identify and assess critical technology development requirements. Conduct system wide assessments of the programmatic, budget, system effectiveness, and risks of the NMD program.

(U) FY1996 Plans:

o ($370,621) NMD Technology Readiness Program:

(U) SYSTEM DEVELOPMENT: Important events occurring in FY96 include: the first and second EKV sensor flight tests are planned, GBI software design review, continue design and development of NMD-RTD system, the BMC^3 integrated ground test 3 (IGT^3), and the SMTS FDS CDR.

(U) ($8,272) 3270 - THREAT & COUNTERMEASURES Continue development of threat system characterizations and scenario descriptions to support NMD analysis, continue to update and produce threat modeling capability and threat tapes through the NTF, continue to conduct countermeasures parallel studies.

(U) ($14,672) 1155 - PHENOMENOLOGY Continue to provide resource support to receive, archive, and distribute BMDO plume and background test data and to upgrade data retrieval and data analysis tools. Provide AST operating costs to continue optical data collection. Continue algorithm and model development to include joint analysis of data sets.

(U) ($102,675) 1151- SENSORS Continue to collect MSX data and provide data and resulting analysis to SMTS and other BMDO and DOD customers. Continue passive sensor component development and testing. Continue NMD-RTD system design, deliver software Block 1, and fabricate pilot array. Conduct two AGRE launches and begin development of instrument payloads for third AGRE mission. Launch next Red Tigress mission. Deliver and integrate STRV-2 experiment.

(U) ($126,646) 1267 - GROUND-BASED INTERCEPTOR Integrate EKV sensors with PLV boosters in preparation for FY97 seeker flight tests. Acquire long lead hardware for FY98 kill vehicle flight test and interface with BMC^3 for 98 test. Start to fabricate EKV for FY98 kill vehicle flight test. Conduct MSLS demo launch and conduct target launch for two flight tests.

(U) ($33,538) 1460 - BMC3 Develop initial BMC3 demonstrator configuration. Provide an integrated BMC3 prototype for IGT-3 in FY96 and integrated flight test 1 and 2 in FY97. Provide BMC3 integration support to ground and flight tests in FY97. Continue EWR development and test of object tracking prototype software for BMC^3 tests and demonstrations.

(U) ($19,357) 3152 - SYSTEM ENGINEERING Finalize interface and configuration control requirements in support of early deployment option. Analyze/validate result of IGT-3; support preparations for IGT-4 and IFT-1. Update tools such as technology roadmap, NMM, NSEN. Continue to perform program planning, requirements development, and systems integration.

(U) ($3,110) 3153 - ARCHITECTURE ANALYSIS & BMC3 INITIATIVES Update architecture based on performance/evolving requirements, continue investigations of special topics and unique system concepts. Support refinement of NMD and TMD information architecture evolutionary development process for BMC3.

(U) ($1,443) 3265 - USER INTERFACE Continue coordination and work with multi-service requirements. Refine CONOPS and conduct strategic wargaming and mission analysis.

(U) ($15,779) 3352 - MODELING AND SIMULATIONS Provide NMD share of total infrastructure for NTF and the ARC/SC. The NTF will host BMC^3 integrated ground test 3, systems engineering studies to evaluate operation concepts and requirements for NMD, and NMD threat scenario generation by the special

program center. The ARC/SC conducts research and development activities for Army and ground based elements. This activity also provides M&S oversight and supports independent verification and validation (IV&V).

(U) ($17,904) 3359 - SYSTEM TEST ENVIRONMENT Integrate for testbed with ISTC. Conduct an integrated ground test with battalion BMC^3 and EKV interoperable representations. Execute independent evaluation methodology and process. Provide T&E technical support.

(U) ($11,411) 3360 - TEST RESOURCES Provide ground test facility infrastructure and upgrades for BMDO testing. Completion of the wide-based IR scene processor (WISP) at Kinetic Kill Vehicle Hardware in the Loop Simulation (KHILS) and completion of Aero Optical Evaluation Center. Provide test range infrastructure upgrades.

(U) DEPLOYMENT PLANNING: Continue critical path analysis to determine deployment long poles and logistics, and continue specialty engineering. Continue to update and modify environmental, siting and facilities annexes, execute FYDP NMD military construction and facility design and construction projects.

(U) ($1,345) 3157 - ENVIRONMENTAL, SITING, & FACILITIES Update and modify environmental, siting, and facilities annexes for the NMD contingency deployment plans. Conduct facility planning and preliminary design for NMD contingency deployment options. Execute and manage the FY96-00 NMD Military Construction, Minor Military Construction, and RDT&E facility design and construction projects and activities with emphasis on the NMD Ground Based Radar Technical Demonstration Program facility project at U.S. Army Kwajalein Atoll, Marshal Islands.

(U) ($14,469) 3160 - LOGISTICS READINESS SUPPORT Update and modify NMD contingency development plans based on NMD readiness program developments. Execute pre deployment timeline reduction activities as determined from deployment critical path analyses. Perform site development activities to support early option deployment. Conduct logistics and specialty engineering assessments. Identify producibility and industrial base issues and develop risk mitigation plans necessary to reduce deployment lead time. Contribute to the development and transfer of critical manufacturing technologies. Conduct system wide assessments of the programmatic, budget, system effectiveness, and risks of the NMD program.

(U) FY1997 Plans:

o ($399,038) NMD Technology Readiness Program

(U) SYSTEM DEVELOPMENT: Important events in FY97 include fabrication, integration and test of critical active and passive sensor hardware and software,

EKV flight tests and data analyses, EKV/PLV booster hardware integration, and user assessments of BMC^3 software upgrades.

(U) ($8,312) 3270 - THREAT & COUNTERMEASURES Continue to develop/update threat system characterizations in terms of specialty threats, targets analyses, and operational threat environment intelligence assessments. Upgrade threat modelling capability and develop scenarios depicting employed threat systems to support NMD analysis.

(U) ($17,593) 1155 - PHENOMENOLOGY Perform data collection and sensor development efforts including use of high altitude aircraft to collect spectral data on natural backgrounds and signatures. Maintain BMDO data centers and demonstrate active and passive algorithm architectures on LDS testbed. Field test NMD-RTD discrimination and kill assessment algorithms.

(U) ($88,920) 1151- SENSORS Complete NMD algorithm and application and operation software development. Support IGT4 with NMD-RTD RDS and HWIL; conduct PDR and CDR; complete NMD-RTD facility construction. Continue live testing of coolers and thermal storage devices. Continue to collect background, target and surveillance data from MSX. Conduct third AGRE mission.

(U) ($149,550) 1267 - GROUND-BASED INTERCEPTOR Conduct EKV sensor flight tests and complete data analysis. Incorporate required changes in FY98 flight test. Fabricate and assemble test EKV components. Complete EKV/PLV booster hardware and software integration, flight qualification, and acceptance testing. Update and validate EKV sensor and Kill vehicle models and simulations. Complete brass board LADAR sensor components.

(U) ($36,213) 1460 - BMC3 Continue development of BMC^3 demonstrators (IFT-3). Conduct user assessments of BMC^3 prototype software. Continue BMC3 development and integration. Continue development and test of EWR object tracking prototype software.

(U) ($17,975) 3152 - SYSTEM ENGINEERING Finalize interface and configuration control requirements in support of mid-term deployment option. Provide analyses of integrated ground and flight tests. Update technical documentation baseline and National Test Facility system simulations.

(U) ($3,125) 3153 - ARCHITECTURE ANALYSIS & BMC3 INITIATIVES Provide assessment of baseline and contractor element designs to update architecture performance estimates; evaluate advanced technology concepts; develop and refine BMC3 information architecture and analyze implementation of software reuse.

(U) ($1,530) 3265 - USER INTERFACE Refine ORD documentation based on results of NMD threat assessment and mission analysis. Refine CONOPS and conduct strategic wargaming and mission analysis.

(U) ($26,834) 3352 - MODELING AND SIMULATIONS Provide NMD share of total NTF and ARC/SC infrastructure. This activity also provides M&S oversight and supports independent verification and validation (IV&V).

(U) ($18,382) 3359 - SYSTEM TEST ENVIRONMENT Interface ISTC with BMC3 Block I. Develop "mid-term" T&E documentation. Execute independent evaluation methodology and process. Provide T&E technical support.

(U) ($11,951) 3360 - TEST RESOURCES Provide ground test facility infrastructure and upgrades for BMDO testing. Provide test range infrastructure, upgrades, and environmental documentation. Provide range instrumentation, upgrades, data collection, and analyses for BMDO.

(U) DEPLOYMENT PLANNING: Conduct and update critical path analyses and contingency development plans to reflect changes in candidate systems and SMTS. Continue to update and modify environment, siting, and facilities annexes. Execute FYDP NMD military construction and facility design and construction projects.

(U) ($1,351) 3157 - ENVIRONMENTAL, SITING, & FACILITIES Update the environmental, siting, and facilities annexes for the NMD contingency deployment plans to reflect advances and changes in candidate systems. Continued facility planning for near term NMD deployment options. Plan, execute, and manage the FY97-00 NMD Military Construction, Minor Military Construction, and RDT&E facility design and construction projects and activities. Prepare 35% facilities designs for initial contingency deployment facilities. Execute design and constructibility trade studies.

(U) ($17,302) 3160 - LOGISTICS READINESS SUPPORT Update contingency development plans to reflect NMD technical advances and changes in architecture. Conduct and update critical path analyses relative to development and deployment of SMTS. Conduct environmental impact analysis to support site activation, if necessary. Develop site pollution prevention plan. Execute selected pre-deployment activities where appropriate to prepare for a deployment decision. Continue logistics and specialty engineering assessments focused on the addition of SMTS to the NMD architecture. Develop and execute industrial base plans to apply critical manufacturing techniques for element development. Conduct system wide assessments of the programmatic, budget, system effectiveness, and risks of the NMD program.

Acquisition Strategy: While not an acquisition program, NMD does develop technologies and related hardware/ software for the purpose of demonstrating BMD capabilities. BMDO defines the NMD system architecture and design, integrates requirements and technology, and provides central management for all elements of the NMD system. The Services execute each of the NMD element programs with the exception of the integrating BM/C3 element which is executed by the BMDO.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Demonstration/Validation)

Program Element Number: 0603871C
PE Title: National Missile Defense (U)

B. (U) Program Change Summary:

	FY1994	FY1995	FY1996	FY1997	TOTAL COST
Previous President's Budget	560,509	587,062	589,000	581,700	2,318,271
Appropriated Value		400,000			400,000
Adjustments to Appropriated Value		-13,012			(13,012)
Current Budget Submit	549,973	386,988	370,621	399,038	1,706,620

Change Summary Explanation:
Significant differences/Reductions

1151	Sensors	$12M
1155	Phenom	$13M
1267	GBI	$13M
1460	BMC3	$13M

Funding:

1151 Sensors: NMD-RTD program realigned to leverage off EKV flight test and TMD-GBR program. MSX dedicated target missions reduced from 2 to 1. Many passive sensor programs slipped.

1155 Phenomenology: Reduction in funding due to termination of BMDO sponsorship of COBRA JUDY.

1267 GBI: Decreased funding results in less risk reduction component technology.

1460 BMC3: Plans for service realignment of existing BMC3 capabilities and development of a BMC3 mission planner at USAKA, prior to transition to the BMC3/SEI contractor, will not be executed. Other projects receiving no money in NMD for FY95: Arch analysis, ENV siting, and Threat.

Schedule:

1151 Sensors: Failure within the cooling system for the infrared sensor which requires repairs caused a projected 4 month launch delay in MSX, which will delay delivery of data and analysis products. The schedule slip for SMTS(BE) caused some sensor component technology development schedules to slip.

1267 GBI: EKV CDR moved to 4Q95 for one of the two contractors due to extended contract negotiations. MSLS demo moved to 1QFY96 due to integration delays. This will not impact planned flight test schedule.

Technical: None.

C. (U) Other Program Funding Summary

Related RDT&E:	FY1994 Actual	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	FY2000 Estimate	FY2001 Estimate
0602173C SPT TECH EXP DEV	70,160	84,005	93,308	105,313	105,003	100,397	95,568	93,669
0603173C SPT TECH ATD	252,862	134,402	79,387	87,823	57,823	57,823	66,323	66,323
0603861C THAAD SYSTEM DEM/VAL	710,093	651,901	576,327	72,188	0	0	0	0
0603863C HAWK DEM/VAL	29,629	26,800	23,188	0	0	0	0	0
0603864C TMD-BMC3 DEM/VAL	12,617	20,009	24,231	24,425	25,237	20,751	22,193	22,278
0603865C PAC3 DEM/VAL	77,584	0	0	0	0	0	0	0
0603867C NAVY L/T DEM/VAL	150,446	139,676	0	0	0	0	0	0
0603868C NAVY U/T DEM/VAL	81,000	68,450	30,442	33,400	0	0	0	0
0603869C CORPS SAM DEM/VAL	16,270	14,971	30,442	33,400	0	0	0	0
0603870C BPI DEM/VAL	37,022	40,000	49,061	44,300	66,300	72,300	0	0
0603872C OTHER TMD DEM/VAL	272,388	386,368	460,470	449,908	613,099	551,654	951,981	1,116,700
0604861C THAAD SYSTEM EMD	0	0	0	664,000	838,000	619,100	212,000	86,000
0604864C TMD-BMC3 EMD	0	534	14,301	17,976	25,977	20,861	29,201	29,314
0604865C PAC3 EMD	42,097	276,283	247,921	160,070	65,005	775	487	98
0604866C PAC3 RISK EMD	97,000	74,000	19,485	9,760	0	0	0	0
0604867C NAVY L/T EMD	0	0	237,473	193,600	142,680	151,428	115,482	50,323
0605218C MGMT	205,948	163,206	185,542	188,418	224,742	219,543	230,014	223,971

D. (U) Schedule Profile

	FY1994				FY1995				FY1996				FY1997			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Engineering Milestones				4Q[a]		2Q[b]			1Q[c]		3Q[d]			2Q[e]		4Q[f]
T&E Milestone						2Q[g]	3Q[h]		1Q[i/j]	2Q[k]			1Q[l]	2Q[m/n]		4Q[o]
Contract Milestone			3Q[o/p]		1Q[q]		3Q[r]									

Engineering Milestones

a	Complete MSX integration; complete STARS, ODES development
b	Complete redevelopment of NMD Systems Requirement Documents Maturity Matrix
c	Complete EKV critical design review capability
d	Complete NMD Technology Readiness System level-Interface Control Documents
e	NMD-RTD PDR
f	NMD-RTD-CDR

T&E Milestones

g	Integrated Ground Test 1
h	MSX Launch
i	Functional Interface Demo at ISTC
j	AGRE 1 Launch
k	AGRE 2 Launch
l	Conduct 1st EKV sensor flight
m	Conduct 2nd EKV sensor flight
n	AGRE 3 Launch/Launch STRV-2/on-orbit experiment tests

Contract Milestones

o	Down select to two EKV contractors
p	Complete Options Assessment Contracts
q	NMD RTD Contract Modification Complete
r	Award BMC3/SE&I

Planned Milestones Beyond FY 1997:

Conduct EKV flight test with BM/C3 on-line	2QFY98
Conduct EKV flight test with BM/C3 in line and RTD on-line	1QFY99
Conduct NMD system flight test with EKV, BM/C3 in-line, RTD in line, and MWIR SMTS on-line	1QFY00
MSX Spacecraft End of Life	3QFY00

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Demonstration/Validation)

Program Element Number: 0603871C
PE Title: National Missile Defense (U)

Conduct NMD system flight test with EKV and IFTU/TOM from BM/C3 GEP	4QFY00
Conduct NMD system flight test with EKV, BM/C3 in-line, RTD in-line, and MWIR SMTS on-line	1QFY01

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE:0603871C (Proj: 1151)
PE Title: NMD Tech (U)

Project Number / Title: 1151 Sensors (Active & Passive)

Program Name:	FY1994 Actual	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	FY2000 Estimate	FY2001 Estimate	Total Program
0603871C RDT&E	130,768	107,142	102,675	88,920	64,927	59,923	39,411	35,400	Continuing

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION:

(U) The National Missile Defense (NMD) Program's goal is to develop and maintain the option to deploy a cost effective, operationally effective, and Anti-ballistic Missile (ABM) Treaty compliant system designed to protect the United States against limited ballistic missile threats, including accidental or unauthorized launches or third world attacks. The NMD system elements are the Ground Based Interceptor (GBI), the Ground-based Radar (GBR), the Space and Missile Tracking System (SMTS) (Brilliant Eyes (BE) now executed as part of the USAF Space Based Infrared System), and Battle Management, Command, Control, and Communications (BM/C^3). This summary addresses only the GBR, the BE Probe studies, and supporting technologies.

(U) The NMD system requires a ground-based radar and space-based missile and tracking system to provide midcourse precision tracking, discrimination, and kill assessment data to the BM/C^3 element for committing and updating the interceptors. The NMD sensors program, restructured as a technology readiness program, will collect required data, demonstrate critical performance, and develop passive and active sensor system elements and components that will enable the NMD technology readiness program to address existing and future threats. Required data and functional operations will be demonstrated through technology demonstrations and prototypical element demonstrations. Integration with the interceptor and BM/C^3 elements will progressively be demonstrated through Integrated Ground Tests (IGTs) first using computer simulations and phasing in hardware-in-the-loop representations of the GBR and SMTS (BE) elements. By FY00, integrated flight tests will demonstrate NMD interoperability among the GBI

Exoatmospheric Kill Vehicle (EKV), BM/C^3, NMD-Radar Technology Demonstrator (RTD), and the SMTS (BE) Flight Demonstration System (FDS).

(U) National Missile Defense Radar Technology Demonstrator (NMD-RTD): As a primary fire control sensor for the NMD system, the radar performs surveillance, acquisition, track, discrimination, fire control support, and kill assessment. To support pre-commit, the radar will plan and schedule its sensor resources to search autonomously or in response to a cueing handover. The NMD-RTD will acquire, track, classify/identify and estimate object trajectory parameters. In post-commit, the radar schedules its sensor resources to continue tracking the target to provide an In-Fight Target Update (IFTU), and a Target Object Map (TOM) to the assigned interceptor. The NMD-RTD provides a low cost, capable sensor to fully test and validate the integrated operation of all prototype elements in a NMD system for hit to kill operation. Resolution of the critical radar issues will reduce design, fabrication, and test time associated with deploying an NMD-GBR in CONUS. Resolution of system integration issues will also substantially reduce deployment leadtime and risk for the NMD system.

(U) The NMD-RTD is an incremental program that leverages from developments under the TMD-GBR program to resolve the radar critical issues applicable to NMD. These critical issues are discrimination, target object map (TOM), kill assessment, and electromechanical scan. The program includes algorithm development, real-time software and hardware-in-the-loop (HWIL) simulations, and radar validation testing with other NMD elements. The alignment of the NMD-RTD program with the TMD-GBR Dem/Val program and the EKV flight tests has reduced overall program costs. However, the realigned schedule has increased the fiscal demands in FY96 in excess of the original NMD-RTD plan. The NMD-RTD will leverage from the TMD-GBR Transmit/Receive production line further reducing costs. FY96 activities concentrate on continuation of algorithm development, system analysis and design, and software and hardware simulation development activities begun in FY95. FY97 activities concentrate on completing design activities, validating software builds, and fabrication of the antenna subsystems. In FY98, the NMD-RTD will

convert existing TMD-GBR Dem/Val hardware into a larger, limited field-of-view unit with sufficient range to support NMD test requirements beginning in FY99.

(U) Midcourse Space Experiment (MSX): MSX will provide data on real midcourse targets against real backgrounds at realistic ranges for use in system ground demonstrations; demonstrate key functions such as acquisition, tracking, handoff and bulk filtering; provide multi-wavelength target phenomenology data for assessing optical discrimination algorithms; and demonstrate the capability to integrate key technologies into a working platform similar to proposed operational midcourse sensor designs. MSX will provide target signature data, statistically significant background data, functional demonstrations with post-test analysis, and technology demonstrations necessary to support achieving exit criteria for milestone decisions for a space-based tracking sensor and other infrared sensor/seeker systems. MSX will launch in 1995, and will perform a variety of experiments, including target observations, background observations, and surveillance demonstrations, during its five year life (18 month cryogen IR). MSX will observe one dedicated target mission, five sounding rockets (NMD/TMD combined experiments), and three cooperative AGRE launches. MSX data will flow to the users throughout the five year life of the program.

(U) MSX Targets: This program provides dedicated and cooperative targets for MSX orbital tests and for TMD/NMD joint experiments. These targets will be used to test the limits of a passive sensor to detect, track, and characterize both strategic and tactical threat ballistic missiles.

(U) Active Geophysical Rocket Experiment (AGRE): AGRE is a joint project involving both the Johns Hopkins University Applied Physics Laboratory (JHU/APL) and the Russian Academy of Sciences Institute for the Dynamics of Geospheres (IDG). The program has two objectives: first, to perturb and observe the effect on the nighttime atmosphere and ionosphere at 500 km by an impulsive high speed plasma jet; and second, to provide realistic national missile defense-type targets for observation by BMDO's Midcourse Space Experiment (MSX) satellite. The AGRE program will provide three large vehicle launches for observation

by MSX satellite. The four diagnostic payloads carried into orbit with the IDG's plasma jet generator will monitor the signatures of the atmospheric/ionospheric disturbance. Three of the payloads will be instrumented by IDG and one by JHU/APL. The MSX data will be analyzed and delivered to the Air Force's space-based tracking sensor program. The JHU/APL and Russian data analysis reports will also be submitted to the space-based tracking sensor program.

(U) Red Tigress: This program continues the data analysis and distribution from the Red Tigress II mission and develops and validates infrared and radar discrimination algorithms. The data analysis being performed is on the telemetry data collected by the sensors on-board the Red Tigress II craft. The next launch is planned for FY96.

(U) BE Probe studies: The minimum deployment time to fully deploy the objective SMTS (BE) system is about five years following a deployment decision around the turn of the century. Compared to the other three elements of the NMD system (radar, interceptor and BM/C^3) this leaves about two years in which the other elements are ready and full CONUS protection will not be available (without the SMTS (BE) constellation). To remedy this situation with a cost-effective solution, the BE Probe concept is being examined in which a rocket-borne probe sensor based on the SMTS (BE) FDS design could be deployed within three years of a deployment decision along with the other NMD elements as the SMTS (BE) development and deployment continues. The BE Probe would use the FDS track sensor design, but add LWIR capability, and many of the same subsystems. This reliance on the FDS allows the BE Probe to completely rely on the FDS development and require no near term funding to progress the design and provide this as a viable option for a midterm deployment. The BE Probe is only meant as a stop-gap measure and not an objective system capability. Starting in FY98, minor funding would be required to design the unique hardware and software for the BE Probe and ready the concept for development and deployment following a decision in late FY99.

(U) Passive Sensor Technology: A set of research and development efforts is being conducted for critical sensor components in support of over the horizon long wave infrared tracking and discrimination functions for midterm and objective NMD system. The

projects in optics, electronics, focal plane arrays (FPAs), long lifetime cryogenic coolers, and signal and data processing will develop state-of-the-art technologies for a space-based tracking sensor and EKV elements. The NMD architecture requires passive sensor components to operate in the space environment and view targets against the earth limb and space background. In particular, the high radiation levels and large temperature swings in space stress the ability of sensor components to perform to their requirements. The background noise of space is low, and FPAs are being developed with low noise to take advantage of this. The FPAs developed under this project are different from those developed under Project 1161 Advanced Sensor Technology, Project 1267 Ground Based Interceptor, and Project 1651 Innovative Science and Technology. Projects 1161 and 1651 are developing very advanced FPAs which are not mature enough to fit into the development schedule of the objective space-based tracking sensor system. Project 1267 is developing FPAs for interceptor environments (for the EKV), which have a higher background noise, and do not meet the low noise requirement for a space-based tracking sensor. Signal and data processors, and associated memories, will be developed in order to meet the high performance and reliability requirements in the harsh space environment. Cryocoolers are evaluated for vibration, cooling capability, life expectancy, reliability, and failure mechanisms. Focal plane arrays are tested for response, uniformity of response, harsh environment operation and recovery, dissipated heat, thermal response, and pixel operability. Optical components are evaluated for radiation and shock response, and optical performance. Contamination control devices are evaluated for keeping optical components clean from matter that degrades mirror and filter performance. Electronics components are tested for reliability, speed, and performance to determine any degradation from temperature and radiation effects. Certain commercial-off-the-shelf components are tested to determine whether they meet a space-based midcourse tracking sensor's requirements, thereby eliminating development costs of these components.

(U) STRV-2: STRV-2 is a BMDO multinational (US and UK)/multiagency (AF, NASA, and OSD) funded flight demonstration program in a similar orbital environment to the space-based tracking satellites. A UK developed MWIR system will obtain background/clutter data using filters supplied by the SMTS (BE) program office; a one-year mission duration and elliptical orbit (400-1800 km) will provide seasonal and altitude variations. Contamination, radiation damage to a space-based midcourse tracking sensor

focal plane array and microelectronics, advanced vibration isolation/suppression techniques, micrometeoroite and debris (MM&D) monitors, space environment effects on advanced materials, and the performance of a high bandwidth laser communications system will be evaluated. This program is in design hardware manufacturing and currently a candidate for Space Test Program (STEP) Mission 5.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Brief Description of Element section of each Program Element Summary.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) Active and passive sensor technologies have progressed significantly in support of the restructured NMD readiness program. Passive sensor technology component testing remains on schedule allowing technology development to continue to the next phases in support of a space-based tracking sensor program objectives. Data reduction activities remain on schedule in support of NMD system development. Contract modification negotiations have been completed for the implementation of the NMD-RTD program. Memorandum of Understanding and Agreement for the STRV-2 program have been finalized and implemented.

(U) FY 1994 Accomplishments:

- ($79.366M) MSX: Completed satellite integration and testing. Completed ground system readiness testing. Provided lessons learned in experiment and operations planning, and sensor calibration, characterization and contamination control to a space-based midcourse tracking sensor.
- ($23.630M) NMD-RTD: Stopped work on NMD-GBR Dem/Val radar and began restructuring into NMD-RTD program. Continued solid state demonstration array risk reduction program, established pilot production lines for modules, and

completed design of demonstration array. Began modifying TMD-GBR algorithms for NMD-RTD. Began real-time software development and preliminary design for the NMD-RTD.

- o ($17.604M) Passive Sensor Components: Continued development of essential cooled telescope optic components for an objective space-based tracking system and as a risk reduction. One 150 Kelvin prototype cryogenic cooler, for medium wavelength infrared detectors and telescope optics, was completed. Prototype 60 Kelvin Stirling coolers (for detectors slightly longer wavelength than medium wave infrared) were fabricated, characterized, and modified. A reduced risk 60 Kelvin turbocooler was completed and delivered for testing. Lifetime is a key issue for coolers, and testing continues to determine their lifetime performance. One lot of LWIR HgCdTe test detector arrays from each of two contractors was processed, and one lot of VLWIR silicon FPAs was hybridized with readouts from each of two contractors. Tested a three color Mosaic Array Data Compression and Processing module suitable for on-FPA processing of a silicon FPA, making this module available for flight demonstration. Began development of a module suitable for HgCdTe FPAs which require more compact designs. Initiated advanced microelectronics packaging program and continued development, testing, and verification of reliable, radiation hardened, space quality, 32-bit processors. Developed 1 megabyte static random access memories, and various non-volatile memories. Developed and demonstrated initial design of 12-bit, 10 MHz analog-to-digital converter (ADC) and began associated precision voltage reference unit.
- o ($7.880M) Red Tigress and SPAS III: Continued Red Tigress II on-board sensor telemetry data distribution and analysis to develop and validate infrared and radar discrimination algorithms. Termination of the Shuttle Pallet Satellite (SPAS) III mission.
- o ($1.561M) STRV-2: International and interagency agreements MOU/MOAs signed. Program plan, schedule, payload module concept design and draft interface control documents completed. Integration team established and space test program candidacy secured.
- o ($0.157M) MSX Targets: Supported MSX target design.

(U) FY 1995 Plans:

- o ($45.114M) MSX: Complete rework and reintegration following infrared sensor failure. Launch satellite. Begin MSX target and phenomenology data collection by onboard sensors, and delivery of data and analysis products to the space-based tracking sensor program and other BMDO and DoD users. Observe MSX dedicated and cooperative target experiments.
- o ($22.000M) MSX Targets: Provide targets for MSX orbital test and for TMD/NMD joint experiments. The MSX dedicated target mission, using the STARS, will be launched from the Kauai Test Facility and delivers its payload into the Kwajalein Missile Range. The TMD/NMD joint mission experiments, launched from Wallops, will provide viewing and measurement opportunity for MSX.
- o ($22.000M) NMD-RTD: Develop NMD-RTD intelligence-based algorithms and design microdynamic discrimination, target object map, and mechanical/electronic scan control algorithms. Begin modifying the TMD applications and operations software for NMD uses. Leverage from TMD-GBR transmit/receive (T/R) module production for an NMD-RTD T/R module production line and order long lead items. Begin NMD-RTD antenna design and continue radar performance analysis. Begin adapting TMD-GBR Real-time Digital Software simulation to NMD-RTD use. Begin adapting TMD-GBR HWIL simulator for NMD-RTD use. Conduct environmental, facility, and siting analysis at USAKA. Deliver Facility Requirements Document. Begin Electromagnetic Radiation/Electromagnetic Interference (EMR/EMI) studies with Electromagnetic Compatibility Analysis Center. Begin developing Reliability, Availability, Maintainability (RAM) analysis.
- o ($11.282M) Passive Sensor Components: Initiate life testing of the 150 Kelvin cooler. Build and deliver two additional units. Continue life testing 60 Kelvin cooler. Initiate a two stage 35 Kelvin Stirling cooler program and continue a risk reduction 35 Kelvin pulse tube cooler program required for operation of the long wave infrared FPA. Design and build breadboard components for the two-stage Stirling cooler. Deliver three units for the pulse tube cooler. Test (radiometric and radiation) one lot of hybridized silicon FPAs for the VLWIR. Fabricate and deliver two development lots of LWIR HgCdTe. Test HgCdTe for radiometric response and operability. Two contractors carried due to difficulty in resolving material defects which reduce operability. Complete and test reliable, radiation hardened 12-bit, 10 MHz self-calibrating ADC chipset and

associated precision voltage reference unit. Develop, fabricate, and test high density, radiation hardened 1 Mbit SRAM devices. Test components under development, as well as commercial-off-the-shelf components that also may be used in space to characterize their performance, reliability, and any degradation due to total dose radiation effects.

- o ($4.046M) AGRE: JHU/APL will complete negotiations and sign an agreement with Russia on AGRE in 2QFY95. Beginning in FY95, development will start on the instrument payloads for the second launch and completed in 4QFY95.
- o ($2.500M) STRV-2: Complete detailed design. Payload module fabricated. Host S/C design and establish interface. Initiate experiments fabrication.
- o ($0.200M) Red Tigress: Delay data reduction, analysis, and distribution activities for the Red Tigress II mission until FY96. Starting in FY96, a reduced data reduction activity will continue to develop and validate infrared and radar discrimination algorithms. This program is a continuing US/UK cooperative experiment. The current funding in FY95 only shows the U.S. intention to continue this effort. Final cost for Red Tigress is being negotiated between the U.S. and the U.K.

(U) FY 1996 Plans:

- o ($37.782M) NMD-RTD: Code and validate NMD-RTD discrimination and kill assessment algorithms. Deliver Software Block 1 build which includes software for antenna mount control, RF emissions, and external communications. Test real-time software algorithms. Begin design modifications to Beam Steering Generator, Data Processor, Signal Processor, and Receiver Exciter/Test Target Generator. Complete modifications to TMD-GBR RDS simulation. Complete NMD-RTD HWIL simulation and support IGT 3. Procure remaining piece parts for NMD-RTD antenna including antenna mounts, radome, and antenna support equipment. Complete fabrication of T/R modules procured for NMD-RTD. Fabricate and integrate pilot array. Begin near field verification testing with pilot array. Conduct Facility 90% and Final Design Review. Award contract for facility and begin construction at USAKA.

- o ($32.910M) MSX: Continue to collect background, target and surveillance data to satisfy the requirements levied by the BMDO system elements, and deliver this data and the resulting analysis to the space-based tracking sensor office and other BMDO and DoD customers.
- o ($21.276M) Passive Sensor Components: Complete and characterize the two-stage 35 Kelvin Stirling cooler. Begin fabrication of prototype flight units for the two-stage 35 Kelvin Stirling and 35 Kelvin pulse tube cooler. Continue life testing of the 150 Kelvin cooler. Develop advanced, more efficient 60 Kelvin cooler and begin life testing. Restart effort to fabricate a 10K cooler for very long wavelength IR detectors. Fabricate two additional development lots of long wave infrared HgCdTe. Produce one additional lot of silicon detectors. Initiate investigation of alternative LWIR detectors to reduce risk. Initiate the development of a flight ready optics contamination control device for demonstration of extension of the space-based tracking sensor operational life. Initiate development of survivable, long life reflective and refractive optical coatings and filters necessary for a space-based tracking sensor operation in the harsh space environment. Initiate development of an all silicon carbide telescope for light weighting of a space-based tracking sensor design. Continue to develop, fabricate, and test advanced packaging, radiation hardened, space quality 32-bit processors, higher speed ADCs and precision voltage references, and high density, radiation hardened SRAM devices and non-volatile memories. Complete maintenance and enhancement phase for Reduced Instruction Set Computer Ada Environment (RISCAE). Develop ability to convert commercial electronic component designs to radiation hardened designs by using Electronic Design Automation tools.
- o ($5.274M) AGRE: The development will start on the instrument payloads for the third launch and completed in 1QFY97. The integration of the first instrumented payloads on Russian boosters will be completed. Two launches will be conducted in FY96: the first, will be an uninstrumented test of the explosive type generator, and the second will have payloads instrumented by the Russians and JHU/APL. The data analysis from the missions will begin in FY96 and be completed in FY97. The JHU/APL data analysis reports will be submitted to the space-based tracking sensor office and contractors.
- o ($2.488M) STRV-2: Deliver and integrate experiment. Complete full module qualification test. Deliver payload module to S/C integrators.

- o ($2.945M) Red Tigress: This funding is for the US/UK joint experiment called Red Tigress. The experiment will be an NMD and TMD sensor and phenomenology experiment. A launch is currently scheduled for 2QFY96.

(U) FY 1997 Plans:

- o ($43.000M) NMD-RTD: Complete NMD algorithm and application and operation software development. Support IGT 4 with NMD-RTD RDS and HWIL simulations. Test HWIL simulation against technical requirement document missions. Conduct Preliminary Design Review. Complete NMD-RTD antenna design. Conduct Critical Design Review and baseline NMD-RTD system design. Deliver Software Block Build 2 which includes software for calibration and diagnostics, waveforms and test assistance. Procure, fabricate, integrate and test Beam Steering Generator. Begin fabrication of antenna subsystems. Finish construction of NMD-RTD facility with a Beneficial Occupancy Date of 3QFY97. Deliver radome, antenna mounts, support equipment and PGU to USAKA for integration into facility. Begin modifications to existing TMD-GBR Dem/Val hardware for NMD-RTD uses.
- o ($22.220M) Passive Sensor Components: Continue life testing of the 150 Kelvin and 60 Kelvin coolers, life testing of the two-stage Stirling 35 Kelvin cooler and the 35 Kelvin pulse tube cooler. Complete thermal storage device. Continue to develop heat transfer devices. Continue effort to fabricate a 10 Kelvin cooler for operation of the silicon focal plane arrays for the very long wavelength infrared. Complete a system element producibility readiness demonstration program for the very long wavelength infrared HgCdTe and downselect to one contractor. Restart the very long wavelength infrared silicon detector program and fabricate two development lots. Continue development of a flight ready optics contamination control device for demonstration of extension of the space-based tracking sensor operational life. Continue program to develop survivable, long life reflective and refractive optical coatings and filters. Continue development of an all silicon carbide telescope. Initiate mirror surfacing effort to reduce mirror fabrication cost. Continue development of denser, radiation hardened memories and ADCs. Develop highly reliable non-volatile memories for critical components. Continue development of radiation hardened

32-bit processors for a space-based tracking sensor objective system. Continue radiation testing of electronics components, and development of Electronic Design Automation tools.

- o ($17.400M) MSX: Continue to collect background, target and surveillance data to satisfy the requirements levied by the BMDO system elements and meet exit criteria for design decisions, and deliver this data and the resulting analysis to the space-based tracking sensor program and other BMDO and DoD customers.
- o ($5.300M) AGRE: The integration of the second set of instrumented payloads on Russian boosters will be completed. The third launch will occur in 2QFY97. The data analysis from launches will be completed along with an exchange of data analysis reports with the Russians. The JHU/APL and Russian data analysis reports will be submitted to the space-based tracking sensor program and contractors.
- o ($1.000M) STRV-2: Launch STRV-2 and initiate data reduction. The STRV-2 will be launched on an Air Force Space Test Program (STEP) Mission 5.

Acquisition Strategy: This program focuses on providing advanced, integrated and proven radar and space-based passive infrared sensor elements for NMD. These objectives will be accomplished under continuing efforts, modifications to existing contracts, or through new MOU/MOAs.

BE Probe studies: Studies will be conducted under existing SMTS (BE) contracts.

NMD-RTD: The NMD-RTD is being procured as a member of the Ground Based Radar Family of Radars by the Army's Program Executive Office, Missile Defense for the BMDO. The Family of Radars acquisition approach emphasizes commonalty of hardware and software components that simultaneously satisfy TMD and NMD missions. A full and open competition resulted in the award of the GBR Family of Strategic and Theater Dem/Val Radars contract to the Raytheon Company on 17 September 1992. The contract contains the development and test of the NMD-GBR Dem/Val Radar (GBR-T) which was restructured into the NMD-RTD program in

FY94. The TMD-GBR Dem/Val provides the basis for the NMD-RTD program, and in turn, the NMD-RTD provides the technology, hardware, and software needed to resolve the critical developmental issues associated with a NMD-GBR. The facility for the NMD-RTD will be awarded in FY96 with construction beginning that year.

MSX: The MSX effort is performed under existing contracts with USU/SDL, JHU/APL, McDonnell Douglas, and NRC. The JHU/APL effort will transfer from the Navy's contract to a task order under the new BMDO JHU/APL contract.

Passive Sensor Components: The passive sensor component development and fabrication is performed by industry with cost plus fixed fee and award fee contracts that are awarded on a competitive basis. Initial testing is performed in contractor facilities, however, compliance testing is performed in Government labs. These components are high risk and there is no commercial market for them. The components with the highest risk, the 35 Kelvin coolers and long wavelength infrared HgCdTe FPAs, will be maintained as dual approaches in order to reduce the technical risk. The availability of the FPAs and electronics need to be assured when it comes time to procure the flight components.

AGRE: The primary contractor for AGRE will be JHU/APL in a task order under the new BMDO JHU/APL contract. The JHU/APL will contract with the Russians for the IDG's instrument payloads, and for the launch vehicles and launch services.

Red Tigress: The Red Tigress telemetry data distribution and analysis will be continued under an existing contract with the National Air Intelligence Center.

STRV-2: Program execution for STRV-2 consists of U.K. and U.S. contracts managed by UK/DRA to build the MWIR system. U.S. contractors managed by BMDO provide a composite structures module and space environmental effects test modules. JPL and PL are module integrators and co-manage the AF/NASA vibration isolation system in-house and contractual efforts. Radiation MM&D and the microelectronics testbed are JPL (funded by BMDO) and NASA in-house and subcontracted efforts. All contracts are currently in place and were awarded through full and open competition.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE:0603871C (Proj: 1151)
PE Title: NMD Tech (U)

B. (U) PROGRAM CHANGE SUMMARY:

This program represents the consolidation and realignment of the following PMAs/Tasks: 1101 (Passive Sensors) except A1106/07; A1102/06 (Large Radar Technology); 1104 (Signal Processing); A1106/04 (MSX), F1106/21 and 22 (MSX), N1106/11 (MSX), and S1106/25 (MSX); S1106/32 (Red Tigress); 1504 (Materials and Structures); A2104/37 (GBR RTD); and A3304/38 (MSX targets)

	FY1994	FY1995	FY1996	FY1997	TOTAL COST
Previous President's Budget	128,218	236,200	248,900	246,600	859,918
Appropriated Value		108,212			108,212
Adjustments to Appropriated Value		-1,070			(1,070)
Current Budget Submit	130,768	107,142	102,675	88,920	429,505

Change Summary Explanation:
Funding:

- o SMTS (BE): Although BMDO requested funds for BE in BMDO's (President's Budget for FFY1994 and FY1995, no BMDO funds were authorized or appropriated for BE in either year, as the Congressional Appropriation for each year placed SMTS (BE) in an Air Force Program Element (PE 0603440F in FY94 and 0603441F in FY95). The integration of the SMTS (BE) program into the SBIRS has moved all outyear funding for SMTS (BE) from BMDO to the Air Force.
- o NMD-RTD: As a result of the restructuring of the NMD-GBR program from an acquisition program to a technology readiness program $700M has been removed from the program funding between FY94 and FY99. Included in this reduction was

$25.0M for the GBR-T facility and $60.0M for the two dedicated radar targets. The NMD-RTD program has been realigned to leverage off the EKV flight tests and the TMD-GBR program. This has further reduced program costs, however, it has placed an increase on FY96 and FY97 fiscal demands in excess of originally planned.

- MSX Targets: Due to reductions in the overall targets budget in FY95, MSX dedicated target missions were reduced from two STARS/Operational Deployment Experiment Simulator (ODES) to one STARS/ODES and five joint TMD/NMD sounding rocket missions.
- Passive Sensor Components: Due to the schedule change for the space-based tracking system, the schedule for developing sensor components was slipped. This caused a reduction in the FY95 budget from $30.5M down to only $10.737M, which caused many programs to be suspended in FY1995. The Air Force is funding their highest priority projects in FY95 only and BMDO will continue funding these programs (through Project 1151) in the future. The remainder of the projects will grow beyond corporate internal funding and receive government funding again in FY96. Due to extremely limited funds this year, certain programs are being put off to the outyears. The optics and contamination control projects, as well as Electronic Design Automation tools will be initiated in FY96. Development of the 32-bit processors was partially funded by the Air Force this year. It will receive no BMDO funding through project 1151, but will be funded in the outyears.

Schedule:

- NMD-RTD: The NMD-RTD program has been realigned to leverage off the EKV flight tests and the TMD-GBR program. The NMD-RTD will use the 1QFY99 EKV flight test as a verification test instead of a FY00 dedicated radar flight test.
- MSX: A failure within the cooling system for the infrared sensor which requires repairs caused a projected six month launch delay, which will delay delivery of data and analysis products to the space-based tracking sensor program and other BMDO and DoD users.
- Passive Sensor Components: The schedule slip for the space-based tracking sensor program caused some sensor component technology development schedules to slip in the outyears.

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Technical:

- o Passive Sensor Components: The very long wavelength infrared silicon focal plane arrays has been postponed indefinitely. Without funding there is a potential that the United States will lose this capability. A defect reduction program to improve HgCdTe materials in order to meet space-based tracking sensor requirements has been dropped, relying on industrial internal funding. Lower priority cryogenic cooler efforts such as heat pipes and thermal storage devices are being delayed by one year. Alternative approaches to many of these technologies, as risk reduction efforts, will not be funded.

C. (U) OTHER PROGRAM FUNDING SUMMARY

Related RDT&E:	Funding Dependency? (Yes[1]/No)
1155 Phenomenology Program, PE 0603871C	Yes
1161 Advanced Sensor Technology, PE 0603871C	No
1267 Ground-Based Interceptor, PE 0603871C	No
1270 Advanced Interceptors, PE 0603871C	No
1460 Battle Management, Command, Control, and Communications, PE 0603871C	No
2154 Theater Missile Defense Ground-Based Radar, PE 0603872C	Yes
3152 NMD System Engineering, PE 0603871C	No
3157 Environmental, Siting & Facilities, PE 0603871C	No
3160 Deployment Planning, PE 0603871C	No
3251 System Engineering and Technical Support, PE 0603871C	No
3265 User Interface, PE 0603871C	No
3352 System Test Environment, PE 0603871C	No
3354 Targets Support, PE 0603871C	No

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PE Title: NMD Tech (U)

3359 System Test & Evaluation, PE 0603871C	No
3360 Test Resources, PE 0603871C, 0603873C	No
Space and Missile Tracking System, PE 0603441F	No

[l]Funding data for related RDT&E efforts that have a funding dependency can be found in the respective project summary/program element.

D. (U) Schedule Profile

	FY1994				FY1995				FY1996				FY1997			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Engineering Milestone				X[a]									X[b]	X[c]		
T&E Milestone							X[f]	X[g]	X[h/i/j]	X[k]	X[l]	X[m]	X[n]	X[o]		
Tech Demo Milestone							X[q]		X[r]			X[s]	X[t]	X[u]	X[v]	
Contract Milestone				X[x]	X[y]		X[z]									

[a]Complete MSX integration; complete STARS/ODES development [b]NMD-RTD PDR
[c]NMD-RTD CDR [f]-IGT 1: Inter-element message transfer demo at Integrated System Test Capability (ISTC) [g]MSX Launch [h]MSX Dedicated Target Test [i]IGT 2: Functional interface demo at ISTC [j]AGRE 1 Launch [k]AGRE 2 Launch [l]IGT 3: On-line early

functional interoperability [m]AGRE 3 Launch [n]Launch STRV-2/On orbit experiment tests [o]IGT4: Expanded threat scenario with expanded functional interoperability [q]Test LWIR FPAs [r] Deliver rad-hard ADC; demonstrate RH-32 advanced demonstration module; test RAD 6000 single chip computer, deliver 1Mbit SRAM [s]Begin life testing 2nd 60K PSC [t]Complete Red Tigress II data analysis [u]MSX Cryogen End of Life [v]Deliver 3rd 60K PSC [x]MOU/MOA for STRV-2 signed [y]NMD-RTD Contact Modification Complete [z]US/Russia AGRE agreements signed

Planned Milestones Beyond FY1997:

o	Deliver survivable LWIR filters and coatings	2QFY98
o	NMD-RTD verification test (leverage from EKV flight test)	1QFY99
o	STRV-2 demonstrating thermal silicon carbide telescope	4QFY98
o	STRV-2 data demonstrating optical contamination control	2QFY99
o	Deliver LWIR focal plane arrays	3QFY99
o	Conduct NMD system flight test with EKV, BM/C3, NMD-RTD, and SMTS (BE) FDS	1QFY00
o	Downselect 35 Kelvin cooler based on life test data	1QFY00
o	MSX Spacecraft end of life	3QFY00
o	Complete cooler life tests	4QFY00
o	Conduct NMD system flight test with EKV, BM/C3, NMD-RTD, and SMTS (BE) FDS	1QFY01

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RDT&E, Defensewide / BA 04 (Dem/Val)

PE:0603871C (Proj: 1155)
PE Title: NMD Tech (U)

Project Number / Title: 1155 Phenomenology Program

Program Name:	FY1994 Actual	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	FY2000 Estimate	FY2001 Estimate	Total Program
0603871C RDT&E	84,042	31,028	14,672	17,593	20,767	20,474	20,013	20,013	Continuing

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION:

(U) The National Missile Defense (NMD) Program's goal is to develop and maintain the option to deploy a cost effective, operationally effective, Antiballistic Missile (ABM) Treaty compliant system designed to protect the United States against limited ballistic missile threats, including accidental or unauthorized launches or third world attacks. The NMD system elements are the Ground Based Interceptor (GBI), the Ground-Based Radar Technology Demonstrator (NMD-RTD), the Space and Missile Tracking System (SMTS), and Battle Management, Command, Control and Communications (BM/C^3).

(U) Data collection platforms, data centers, and algorithm and model development provides the sensor developers (radar and electro-optical) with accurate target and signature data, at design wavelengths under varying and stressing atmospheric conditions, to ensure that critical evaluation data sets and design parameters can be generated. All aspects of target recognition are accomplished, to include acquisition, tracking, discrimination, handover, aimpoint selection, and kill assessment, all of which depend on the rapid distinction of incoming missile targets from natural and clutter backgrounds and/or penaids. Dedicated assets, facilities, and tools are required to collect, store and make available these critical data to all weapons systems developers.

(U) Activities under this project include collection of radar data on missile targets and intercept events for NMD-RTD and GBI discrimination and kill assessment algorithm development. Application of background data (Midcourse Space Experiment

(MSX) and Miniature Sensor Technology Integration (MSTI)) to GBI and SMTS to (a) evaluate algorithms which allow detection, tracking, and discrimination of strategic incoming targets from background clutter, and (b) upgrade background and target models and codes. Specific phenomenology signature models and integrated tools are developed, such as the Synthetic Scene Generation Model (SSGM) for a realistic evaluation of surveillance, acquisition, tracking, and discrimination techniques. Discrimination and kill assessment algorithms are developed and evaluated. The Lexington Discrimination System (LDS) is used to evaluate discrimination performance and serve as test bed for development of discrimination architectures. Storage, archiving and retrieval of data takes place in the BMDO-funded Background, Plume, and Missile Defense data centers.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Brief Description of Element section of each Program Element Summary.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) The continuing mission of this project is to manage the data collection assets (Airborne Surveillance Testbed (AST), COBRA JUDY, and COBRA EYE); to collect, store, retrieve, and distribute critical data to BMDO users; and to apply resulting phenomenological data to develop and validate discrimination algorithms and architectures, and plume/background models, that directly support NMD systems development. This project identifies gaps in data base and recommends specific data collection events. This project monitors other BMDO data collection programs.

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RDT&E, Defensewide / BA 04 (Dem/Val)

PE:0603871C (Proj: 1155)
PE Title: NMD Tech (U)

(U) FY 1994 Accomplishments:

- o ($6.000M) Data Centers and Management. Plume and Backgrounds Data Centers processed a total of 1000 requests from GBI and other programs for missile plumes and backgrounds data. More than 50 gigabytes of missile background data distributed, and more than 3,000 gigabytes of missile background data archived.
- o ($57.550M) Data Collection Platforms. COBRA JUDY full operating costs and AST core operating costs to collect radar and optical data on missile targets. COBRA JUDY and AST collected data on the ODES Development Flight (ODF) mission. Mission costs for AST are provided by Project 1170. Provided for storage of COBRA EYE sensor system.
- o ($20.492M) Algorithm and Model Development. Analyzed data from BMDO sensors (COBRA JUDY, COBRA DANE, AST, and High Altitude Observatory (HALO)) and developed optical and radar discrimination algorithms applicable to NMD-RTD, GBI, and SMTS. Delivered Target Signatures Handbook (Edition 3) used in development of signature codes. Created database of debris/fragment signatures. Continued natural background analysis of CIRRIS 1A mission data and delivered the data set to the Backgrounds Data Center. Released target optical signature, plume signature, and synthetic scene generation prediction and modelling codes to the BMDO user community. These codes were improved to allow personal computer use, improved viewing geometry options, and expanded terrain and cloud data base options, respectively. Supports U.S./U.K. analysis of data sets from joint experimental flight tests (e.g., Zodiac Beauchamp, Red Tigress) under U.S./U.K. Scientific Cooperative Research Exchange (SCORE) Program.

(U) FY 1995 Plans:

- o ($1.784M) Data Centers and Management. BMDO data centers will receive, archive, and distribute BMDO plume and backgrounds test data for use by the NMD program offices and contractor community. Provides needed upgrades for data storage and retrieval to support NMD program offices. Also provides for tools and techniques to be used in the exploitation of MSX background data.

- o ($24.589M) Data Collection Platforms. COBRA JUDY full operating costs and AST core operating costs to collect on MSX Dedicated Targets (MDT) and MSX Theater Targets (MTT) test flights and other technology readiness target and threat replica programs. Mission costs for AST are provided by Project 1170. Provides one third operating costs of the COBRA DANE system. Maintains storage of COBRA EYE sensor system.
- o ($4.655M) Algorithm and Model Development. Develops, evaluates and implements radar discrimination algorithms to support NMD-RTD. Provides direct algorithm support to NMD-RTD prime contractor for implementing and testing discrimination algorithms. Prepares LDS testbed for GBI and SMTS element data streams and algorithms, allowing end-to-end NMD testing. Provides upgrades to the optical signatures code used for prediction of target and background irradiance in NMD scenarios.

(U) FY 1996 Plans:

- o ($2.351M) Data Centers and Management. BMDO data centers will receive, archive, and distribute BMDO plume, background, and signature test data for use by the NMD program offices and contractor community. Provides minimal upgrades to data retrieval and data analysis tools.
- o ($6.250M) Data Collection Platforms. AST core operating costs to continue optical data collection in support of GBI sensor flights and other technology readiness programs.
- o ($6.071M) Algorithm and Model Development. Continue development of radar and optical discrimination algorithms and architectures tailored to support NMD-RTD, SMTS and GBI capabilities. Demonstrate active and passive algorithm architectures of multiple targets and single sensors on LDS testbed. Selects and develops candidate algorithms for NMD-RTD field trials. Develop real-time algorithms for tumbling targets and high resolution imaging in support of NMD-RTD. Continue development and release of improved backgrounds and target phenomenology codes, including incorporation of Optical Signature Code (OSC) into Sensor Response Model to support analysis of GBI and SMTS capabilities. Develops integrated discrimination information for target designation. Continue participation in international technical exchange programs

(U.S./U.K. SCORE, NATO Extended Air Defense (EAD)/TMD Ad Hoc Working Group - Plume Phenomenology Expert Group (U.S., U.K., France, Canada), U.S./French Bilateral Group - Plumes, Backgrounds, and Reentry Signatures, U.S./Israeli TBM Signature and Phenomenology Research, and U.S./German Phenomenology Research) in the areas of optical and radar discrimination, reentry, and background and plume phenomenology.

(U) FY 1997 Plans:

- (\$2.363M) Data Centers and Management. BMDO data centers will receive, archive, and distribute BMDO plume, background, and signature test data for use by the NMD program offices and contractor community.
- (\$8.780M) Data Collection Platforms. AST core operating costs to collect optical data of GBI intercept tests. Additional funding is provided for expanded data collection and sensor development efforts including the use of existing high altitude aircraft to collect spectral data on natural backgrounds and signatures of ballistic missiles during their boost and mid-course phases of flight. These efforts also includes the development and testing of new long wavelength sensing techniques for discrimination on airborne and space borne platforms. The feasibility of placing an X-band high resolution radar on an aircraft to enable rapid response collection of radar track and image data will be evaluated.
- (\$6.450M) Algorithm and Model Development. Demonstrate active and passive algorithm architectures of multiple targets and multiple sensors on LDS testbed. Candidate discrimination and kill assessment algorithms are field tested in the NMD-RTD for real-time verification. Real-time algorithms for battlefield learning, target object mapping, and aimpoint selection for GBI are demonstrated. Continued upgrades and deliveries of phenomenology background models and scene generation models. Continue participation in international technical exchange programs in the areas of optical and radar discrimination, TBM reentry, and background and plume phenomenology.

Acquisition Strategy: This project funds data centers, data collection platforms, and algorithm and model development through executing agents in the Air Force, Army, Navy and BMDO via existing contracts.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE:0603871C (Proj: 1155)
PE Title: NMD Tech (U)

B. (U) PROGRAM CHANGE SUMMARY:

This project represents the roll up of the following projects: 1105 (Discrimination) except for the TMD Countermeasures Program (TCMP) and Kill Assessment Program which are now part of Project 1170, part of project 1101 (Optical Signature Code), part of project 3300 (Data Centers and AST), and part of project 3152 (Technical Analysis).

	FY1994	FY1995	FY1996	FY1997	TOTAL COST
Previous President's Budget	86,643	43,582	29,686	27,086	186,997
Appropriated Value		34,475			34,475
Adjustments to Appropriated Value		-3,447			(3,447)
Current Budget Submit	84,042	31,028	14,672	17,593	147,335

Change Summary Explanation:
Funding: The reduction in funding from FY94 to FY95 is due to: 1) Project roll up described in the paragraph above, 2) NMD, TMD, and Technology began cost sharing the project, and 3) Funding constraints within the NMD program have forced reductions and terminations of planned NMD efforts in Algorithm and Model Development: plume and background phenomenology, Synthetic Scene Generation Model (SSGM), Optical Discrimination Algorithms (ODA), Unconventional Passive Discrimination (UPD), Combined Optical Measurements Experiment Team (COMET), and Phenomenology Scientific Advisory Group (PSAG).

The reduction in Data Collection Platform funding from FY95 to FY96 is due to the termination of BMDO funding for the COBRA JUDY. COBRA JUDY will be transferred to Air Force in FY96.

RDT&E, Defensewide / BA 04 (Dem/Val)

PE:0603871C (Proj: 1155)
PE Title: NMD Tech (U)

The increase in Data Collection Platform funding from FY96 to FY97 is due to start of expanded data collection and sensor development efforts in support of GBI and NMD-RTD.

Schedule: None
Technical: None

C. (U) OTHER PROGRAM FUNDING SUMMARY

Related RDT&E:	Funding Dependency? (Yes[1]/No)
1155 Phenomenology PE: 0603173C	Yes
1155 Phenomenology PE: 0603872C	Yes
1151 Sensors (Active/Passive) PE: 0603871C	No
1267 Ground Based Interceptor PE: 0603871C	No
1360 Directed Energy Programs PE: 0603173C	No
3360 Test Resources PE: 0603871C	No

[1]Funding data for related RDT&E efforts that have a funding dependency can be found in the respective project summary/program element.

D. Schedule Profile

	FY1994				FY1995				FY1996				FY1997			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Data Collection					(a)	(b)(a)		(a)		(a)						

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE:0603871C (Proj: 1155)
PE Title: NMD Tech (U)

Algorithm and Model Development	(d)* (g)*	(c)*	(e)* (g)	(d)	(f) (g)	(e)	(d)	(f)	(c)	(d)

(a) Support MDT, MTT, GBI missions
(b) End BMDO sponsorship of COBRA JUDY system
(c) Delivery of CIRRIS 1A data
(d) NMD RTD - deliver software releases (radar discrimination algorithms)
(e) Midcourse Sensor Programs - deliver software releases (plumes, backgrounds, optical discrimination algorithms)
(f) GBI - deliver software releases (plumes, backgrounds, optical discrimination algorithms)
(g) Deliver new software releases (SSGM, OSC)

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PE:0603871C (Proj: 1161)
PE Title: NMD Tech (U)

Project Number / Title: 1161 Advanced Sensor Technology

Program Name:	FY1994 Actual	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	FY2000 Estimate	FY2001 Estimate	Total Program
0603871C RDT&E	4,021	0	0	0	0	0	0	0	Continuing

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION:

(U) This program develops and demonstrates survivability technologies to ensure that strategic ballistic missile defense elements can perform their mission in adverse environments and in the face of expected hostile threats. Approaches include: studies/analyses; defense suppression threat mitigation technologies development; survivability/operability demonstrations; and hardened technology integration. Specifically, the effect of low-power laser illumination on space-based MWIR and SWIR sensors will be evaluated. Technologies will be available for incorporation into NMD elements at EMD and will also provide near-term improvements to existing systems. Demonstrations will provide necessary risk reduction evidence to support milestone decisions. This program has been terminated in FY95 due to zero funding.

(U) This project in FY94 also provided funding for the Miniature Sensor Technology Integration (MSTI) technology development program. The MSTI program provides for the integration and demonstration of existing space-based surveillance systems and operational concepts in realistic scenarios. MSTI demonstrates off-the-shelf capabilities for quickly and relatively inexpensively addressing outstanding space-based infrared science and design issues confronting both the military and civilian remote sensing communities. Additionally, the MSTI program will explore the potential use of space-based sensors for environmental/ecological monitoring and for executing joint international space missions. Funds were provided to the MSTI program by this project in FY94 to

support survivability testing of the sensors on board the MSTI-3 payload. The MSTI program has been transferred to the Air Force in FY95. Funding support has been stopped.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Mission Description and Budget Item Justification section of each Program Element Summary.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) In FY94, sea-based and joint BM/C3 systems for survivability evaluation were identified and test criteria were developed. Final development of sensor hardening technology continued for incorporation onto the MSTI 2/3 satellites. Support continued to develop guidelines for survivable system designs and integration of survivability enhancement options into systems. Finally, planning was initiated for joint international backgrounds observations and on-orbit demonstrations (MSTI). These efforts have been terminated in FY95 due to zero funding.

(U) FY 1994 Accomplishments:

- ($0.550) Identified sea-based and joint service BM/C3 systems for survivability evaluation and developed survivability test criteria for sea-based and joint service BMD BM/C3
- ($1.025) Continued final development of sensor hardening technology and began conduct of acquisition and tracking experiment on MSTI 2/3 satellites
- ($1.171) Continued to support: system electromagnetic requirements evaluations, development of guidelines for survivable system design, integration of survivability designs into systems, and execution of survivability and operability demonstrations
- ($0.575) SCORE program support and sensor survivability technology development

- o ($0.700) Assessed feasibility and began planning of joint international backgrounds observations and on-orbit demonstrations (MSTI)

(U) FY 1995 Plans:
- o MSTI program transferred to the Air Force
- o NMD Survivability program terminated

(U) FY 1996 Plans:
- o None

(U) FY 1997 Plans:
- o None

Acquisition Strategy:
- o None

B. (U) PROGRAM CHANGE SUMMARY:

	FY1994	FY1995	FY1996	FY1997	TOTAL COST
Previous President's Budget	3,321	3,000	3,000	4,000	13,321
Appropriated Value		0			0
Adjustments to Appropriated Value		0			0
Current Budget Submit	4,021	0	0	0	4,021

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RDT&E, Defensewide / BA 04 (Dem/Val)

PE:0603871C (Proj: 1161)
PE Title: NMD Tech (U)

Change Summary Explanation:

Funding:	FY94:	Consolidation of projects; added $700K for MSTI support.
	FY95-97:	No activity due to zero funding.
Schedule:	None	
Technical:	None	

C. (U) OTHER PROGRAM FUNDING SUMMARY: None

D. (U) Schedule Profile MSTI program transferred to the Air Force in FY95.

Planned Milestones Beyond FY1997:

o None

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE: 0603871C (Proj: 1265)
PE Title: NMD Tech (U)

Project Number / Title: 1265 Boost Phase Intercept (BPI)

Program Name:	FY1994 Actual	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	FY2000 Estimate	FY2001 Estimate	Total Program
0603871C RDT&E	2,500	0	0	0	0	0	0	0	Continuing

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION:

(U) The Boost Phase Intercept (BPI) Technology Program funded and continuing under this project is designed to meet critical future active defense needs. The BPI program is developing new technologies to demonstrate a deterrent and counter in Theater Missile Defense (TMD) by intercepting a theater ballistic missile (TBM) in its boost phase of flight. Present BMDO/TMD architectures focus on midcourse and terminal defenses which allow fragments of the TBM and/or warheads to inflict potential damage on friendly areas. During a TBM's boost phase, the missile is readily visible, slow moving, and extremely vulnerable. Boost phase intercept of TBMs can cause missile debris to fall on enemy territory or to fall short of the intended target(s) and significantly reduce the number of TBMs in post-boost flight, thus thinning out the number of TBMs reaching subsequent defensive layers and reducing the burden on terminal defenses. Interceptor component technologies advanced through the BPI program have potential applicability and benefit to all endoatmospheric interceptors.

(U) The BPI program will integrate and demonstrate critical technologies culminating in BPI technology experiments. BPI experimental elements may include off-board sensor(s) that detect and track TBMs, launch aircraft, battle management (BMC^3), the missile, and lightweight endoatmospheric kinetic kill vehicles (KKVs). To achieve boost phase intercept, the interceptor missile and KKV may achieve hypersonic velocities within the atmosphere. The demonstrations will validate the solution to critical KKV technology associated with high-speed atmospheric flight and will provide: (1) new capabilities with reduced costs/risks compared to

current interceptor weapons systems, and enhancements to other interceptors under development; (2) reduction of technical risks and costs to support an acquisition program; and (3) technical solution to provide contingent residual boost phase intercept capabilities for theater defense. The program also will use existing contracts and technologies currently under development to reduce schedule and cost, and will be planned and conducted with BMDO, Air Force, Navy, and Army elements to maximize user interaction.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Mission Description and Budget Item Justification section of each Program Element Summary.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) This project has enabled BMDO to successfully integrate critical technologies which will serve the long-term interest of the Boost Phase Intercept program and to initiate designs which meet projected BPI requirements. Under program element 0603871C in FY94, advances in KKV technology, concept development, and test planning activities were conducted by BMDO with significant involvement from the Army.

(U) FY 1994 Accomplishments:

- ($1.5M) Continued fabrication of cooled windows.
- ($0.7M) Prepared test plans for testing cooled windows in aero-optic facility; program planning for BPI.
- ($0.3M) Continued plans for active RF component development for endoatmospheric applications.

(U) FY 1995 Plans: None.

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RDT&E, Defensewide / BA 04 (Dem/Val)

PE: 0603871C (Proj: 1265)
PE Title: NMD Tech (U)

(U) FY 1996 Plans: None.

(U) FY 1997 Plans: None.

Acquisition Strategy: On-going, competitively-awarded, CPFF contracts for the kill vehicles were exercised for this activity The BMDO manages these contracts.

B. (U) PROGRAM CHANGE SUMMARY:

	FY1994	FY1995	FY1996	FY1997	TOTAL COST
Previous President's Budget	2,500	0	0	0	2,500
Appropriated Value		0			0
Adjustments to Appropriated Value		0			0
Current Budget Submit	2,500	0	0	0	2,500

Change Summary Explanation:
The BPI program was technically restructured after submission of the FY95 CDS for Project 1215 to reflect congressional guidance and the results of the OSD expert panel study on BPI/API. The current execution plan continues endoatmospheric kill vehicle technology development previously funded under Project 1209, and discontinues unmanned aerial vehicle (UAV) and UAV compatible missile activities and exoatmospheric flight tests reflected in the FY95 CDS plan. The revised demonstration plan is compatible with existing Air Force and Navy fire control and launch aircraft.

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RDT&E, Defensewide / BA 04 (Dem/Val)

PE: 0603871C (Proj: 1265)
PE Title: NMD Tech (U)

Funding: None.
Schedule: None.
Technical: None.

C. (U) OTHER PROGRAM FUNDING SUMMARY

Related RDT&E:	Funding Dependency? (Yes[1]/No)
1265 Boost Phase Intercept PE#0603870C	Yes

[1]Funding data for related RDT&E efforts that have a funding dependency can be found in the respective project summary/program element.

D. (U) Schedule Profile Project continues under Program Element 0603870C.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE: 0603871C (Proj: 1267)
PE Title: NMD Tech (U)

Project Number / Title: 1267 Ground-Based Interceptor

Program Name:	FY1994 Actual	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	FY2000 Estimate	FY2001 Estimate	Total Program
0603871C RDT&E	68,569	137,810	126,646	149,550	182,138	184,047	205,439	206,139	Continuing

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION:

(U) The National Missile Defense (NMD) Program's goal is to develop and maintain the option to deploy a cost effective, operationally effective, Antiballistic Missile (ABM) Treaty compliant system designed to protect the United States against limited ballistic missile threats, including accidental or unauthorized launches or third world attacks. The NMD system elements are the Ground Based Interceptor (GBI), the Ground-Based Radar Technology Demonstrator (NMD-RTD), the Space and Missile Tracking System (SMTS) (now executed as part of the USAF Space Based-Infrared System), and Battle Management, Command, Control, and Communications (BM/C^3).

(U) The GBI project, structured as a technology readiness program, will continue to develop the required Exoatmospheric Kill Vehicle (EKV) such that a capable missile defense system could be deployed if and when required. Specifically, an EKV will be developed and flight tested for the NMD interceptor system which can accomplish intercepts of high speed, long range Intercontinental Ballistic Missile (ICBM) and Submarine Launched Ballistic Missile (SLBM) reentry vehicles (Rvs) in the midcourse of their trajectories. Since exoatmospheric intercept is the key to an effective NMD system, the project will develop an interceptor capable of acquiring a threat cluster from information supplied by midcourse sensors, selecting the RV, and destroying it by force of impact (kinetically). The interceptor must be capable of combining NMD sensor information with the scene its on-board seeker

observes and selecting the lethal object for its target. If insufficient information is available from the rest of the NMD system, the interceptor must also be able to determine the lethal object through on-board discrimination and target selection.

(U) To preserve a near term contingency deployment capability, the initial focus of GBI development will be the front end of the missile, the EKV. Development of a booster and the associated launch control equipment will be deferred until after FY00. Thus near term resources will be concentrated on the EKV, the most critical and most technically challenging part of the interceptor. In the interim, kill vehicle flight tests will be flown on-board the Payload Launch Vehicle (PLV), a booster made up of the Minuteman II second and third stages.

(U) The GBI project also includes risk reduction interceptor technology, targets for flight testing, and the necessary range support and facilities to conduct essential intercept flight testing. GBI risk reduction technology efforts enhance the baseline interceptor program. These technology efforts focus on critical components such as on-board seekers, hardened focal planes, light weight communications components, optical baffles, and flexseal booster nozzles. These items have payoff potential for improved military utility/capability. The time line for technology infusion is post-FY99, depending on the results of EKV testing. GBI test plans include cold chamber sensor measurements, simulations, hardware-in-the-loop (HWIL), and flight testing. The computer simulations and ground testing will make maximum use of data gathered in other BMDO interceptor, sensor, and phenomenology programs.

(U) The EKV sensor flight tests, scheduled in FY97, will mitigate EKV risk by demonstrating two things which cannot be duplicated on the ground: seeker operation in the tactical environment and target selection algorithm performance against realistic (vice electronically simulated) targets. The EKV intercept flights will incrementally demonstrate NMD system capability, beginning with a limited BM/C^3 operating on-line. The first test is scheduled in FY98. By FY00, the flight tests will demonstrate NMD interoperability between the EKV, in-line BM/C^3, NMD Radar Technology Demonstrator (RTD), and on-line medium wavelength infrared (MWIR) Space and Missile Tracking System (SMTS). Flight testing will prove the GBI's ability to intercept representative

targets under real engagement conditions, reliably and repeatedly. The interceptor must also be able to determine the lethal object through on-board discrimination and target selection.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Brief Description of Element section of each Program Element Summary.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) GBI, originally an acquisition program, has made the transition to a technology readiness program. The technology readiness approach is based on the successes of the earlier GBI-Experimental (GBI-X) program, including FY92-93 breadboard and brass board demonstrations of critical and/or contractor-unique kill vehicle components. The most important components demonstrated were focal planes, cryocoolers, and telescopes for the on-board seeker, and the software needed for target selection. In addition, the launch vehicle which will be used to fly the kill vehicle during exoatmospheric testing has undergone design modification to accept the EKV payload and test instrumentation. In parallel with these efforts, the supporting EKV technologies have demonstrated focal plane array (FPA) producibility, breadboard laser radar (ladar) components for discrimination of advanced or future threats, flexseal booster nozzles for the objective GBI booster, and advanced kill vehicle structure manufacturing techniques.

(U) FY 1994 Accomplishments:

- o ($30.65M) Transitioned from GBI-X to EKV activities. Continued program risk mitigation efforts with three contractors for half of the fiscal year. In 3QFY94, performed down select from three to two contractors for the EKV program. Accomplished the BUR-directed refocus from NMD GBI acquisition to NMD interceptor technology readiness. Efforts included preparation

of the Technical Review Data Package used in the down select process, EKV design, subsystem testing, and development of final specifications and drawings.

- o ($14.1M) Initiated fabrication of the EKV sensors for FY97 risk reduction flights. Performed EKV sensor ground testing and cold chamber characterization for reference data and calibration. Performed HWIL and simulation activities in preparation for sensor flights.
- o ($8.9M) Continued PLV and launch complex activities. Completed destruct firing unit design qualification to support EKV sensor and kill vehicle launches. Planned for EKV sensor flights and interfaced with associate GBI-X contractors.
- o ($12.913M) Completed FPA pre-pilot demonstration. Demonstrated upgraded breadboard inertial measurement unit (IMU) which reduced EKV risk by providing an alternative technology path. Completed Long wavelength infrared Advanced Technology Seeker (LATS) first Technology Seeker Evaluation Unit, began second unit testing, and completed flight evaluation unit. Performed ladar power amplifier acceptance tests, designed and built preamplifier, completed breadboard ladar integration, and demonstrated 4 cm agile beam director for potential component infusion to allow a hedge against a reactive, mature threat and to assure robustness of the objective NMD system.
- o ($1.348M) Ended space communications component effort and accomplished transition to ground-based applications.
- o ($0.658M) Completed pathfinder booster nozzle pressure/vectoring bench test. Completed data analysis for flight visible waveband baffle. Prepared preliminary ground plane and electromagnetic interference shielding design in interceptor composite structures.

(U) <u>FY 1995 Plans</u>:

- o ($14.0M) Initiate government preparation for EKV seeker flights, including Kwajalein Missile Range (KMR) launch facility preliminary tasks and support activities.
- o ($78.0M) Complete fabrication and assembly of infrared FPA/cryocooler assembly, analog signal processor, and optics for EKV sensor flight tests by both contractors. Integrate, acceptance-test, and deliver sensor flight test units. Continue software

development, including validation and simulation updates; conduct HWIL simulations to qualify seeker for flight testing. Continue to develop EKV design, conduct 4QFY95 critical design review (CDR), and conduct a down select to a single EKV contractor for EKV flight testing. Continue multi-service participation in reviews and source selection activities.

- o ($28.0M) Continue preparations to launch two EKV sensors in FY97 using the PLV system. Acquire long-lead hardware and perform PLV modifications for two boosters. Upgrade command and launch equipment for EKV flight testing.
- o ($1.988M) Down select from two to one Pilotline Experimental Technology (PET) long wavelength infrared (LWIR) FPA contractor and from two to one Silicon Hybrid Infrared Extrinsic Long-wavelength Detectors (SHIELD) FPA contractor. Preserve remaining SHIELD and PET FPA efforts pending completion of the down select to a single EKV contractor. Terminate LATS effort.
- o ($1.0M) Design a 20/44 Ghz transceiver for interceptor-to-ground communications.
- o ($0.822M) Fabricate booster nozzle subassembly and conduct static pressure test.
- o ($15.0M) Continue development of targets to support EKV sensor flight tests in FY97. Complete development of Multi-Service Launch System (MSLS) booster system and prepare for MSLS demo launch in FY96.

(U) FY 1996 Plans:

- o ($30.3M) Integrate EKV sensors with PLV boosters and interface the missile with the test range. Acquire long-lead booster hardware for FY98 kill vehicle flight test and fabricate PLV upper stage. Interface with BM/C^3 element for FY97 flight test.
- o ($63.272M) Fabricate EKV seeker, avionics processor, structure, and propulsion subsystems for the FY98 kill vehicle flight test. Integrate hardware and software and conduct HWIL and simulations on the EKV flight test vehicle.
- o ($10.7M) Continue preparation for EKV seeker flights, including reactivation of KMR facilities and supporting activities.
- o ($7.464M) Resume FPA readout electronics and hardening design work. Resume LADAR sensor component breadboard development and testing as hedge for advanced threats.

- o ($2.488M) Reduce 20/44 Ghz transceiver size, weight, and power enroute to flight weight levels. Begin development of programmable modem and frequency hopping communications components for tactical encrypted communications requirements.
- o ($0.995M) Execute simulated high altitude booster nozzle static firing. Build infrared sensor baffle section prototypes. Fabricate composite multi-functional structure components using closed mold methods, and evaluate producibility parameters.
- o ($11.427M) Conduct MSLS demo launch. Complete target builds for FY97 seeker flights. Initiate target build for first EKV intercept mission in FY98.

(U) FY 1997 Plans:

- o ($42.0M) Conduct EKV sensor flight tests, complete data analysis, and incorporate any required changes in preparation for the FY98 flight test. Fabricate, assemble, and test EKV long-lead components for FY98 flight test. Interface with BM/C^3 and Radar elements for FY98 flight test.
- o ($37.4M) Continue EKV/PLV booster hardware and software integration, flight qualification, and acceptance testing. Acquire long-lead booster hardware for mid-term EKV flight tests.
- o ($37.6M) Update and validate EKV sensor and kill vehicle models and simulations based on seeker data. Refine program plan and kill vehicle technical requirements based on multi-service input and EKV flight test results.
- o ($7.15M) Begin radiation-hardened FPA and readout electronics production. Complete brass board LADAR sensor components.
- o ($3.7M) Deliver intermediate 20/44 Ghz receiver. Complete modem development. Continue frequency hopping communications component development. Transition to final phase of EKV transceiver packaging.
- o ($1.7M) Fabricate booster nozzle subassembly and conduct vectoring static tests. Build and deliver two infrared flight baffles. Qualification-test EKV closed mold multi-functional composite structure components.

- ($20.0M) Conduct target launches for two EKV seeker flights. Continue preparation for first EKV intercept mission. Also initiate targets development for NMD System Integration Tests.

Acquisition Strategy: GBI development parallels the overall NMD technology readiness program, which evolves incrementally over approximately three- to four-year time periods starting in FY95. The program builds on the technical progress from a number of programs over the last decade. They include the Homing Overlay Experiment (HOE), Exoatmospheric Reentry vehicle Interceptor Subsystem (ERIS), Space Based Interceptor (SBI), High Endoatmospheric Defense Interceptor (HEDI), Brilliant Pebbles (BP), and Lightweight Exoatmospheric Projectile (LEAP), Ground Based Interceptor-Experimental (GBI-X), and interceptor and sensor component technology programs. The strategy for the early time frame concentrates on resolving the unique and difficult technical issues of the front end of the interceptor (the EKV) and demonstrating early NMD intercept capability. It defers development of an optimized booster and launch equipment, which are not required for the early or mid-term EKV test program, and instead uses existing PLV boosters and launch equipment. The EKV program also initially concentrates on developing and planning for the capability for an early contingency deployment option which could be deployed in less than four years and which would provide good capability against simple threats. The most critical EKV issues include threat target selection/discrimination, and cost effective improvement of the engagement volume. Risk reduction in these areas will continue through improvements in on-board sensors, divert propulsion, and discrimination hardware and software by leveraging from other BMDO programs. The resulting EKV and subsystems will be extensively tested in ground tests (HWIL, cold chambers) and the designs validated in risk reduction fly-by sensor flights and intercept tests. The existing GBI-X Cost Plus Award Fee (CPAF)/Cost Plus Incentive Fee (CPIF) contracts were competitively awarded in October 1990 to work EKV technology. These contracts, along with the PLV contract, are the focus of meeting the early time frame objectives. A GBI-X down select from three to two EKV contractors, based on technical progress and design review, was conducted in FY94. A second down select is planned at the end of FY95 after CDR but before the EKV sensor flights due to limited resources. Both contractors will conduct sensor flight tests to collect data needed for discrimination algorithms and seeker characterization. However, only one contractor will fly the EKV intercept flight tests.

(U) New contract(s) are planned for development activities in the mid-term and/or objective time frames. Mid-term engineering efforts will increase EKV reliability and effectiveness. Integrated system flight testing starting in FY00 will demonstrate limited NMD capability and EKV/RTD/ BM/C^3/MWIR SMTS interoperability. The objective time period will systemize the EKV into a GBI by developing booster, launcher, and ground support interfaces to other elements of the NMD system, and integrating them with the EKV. Extensive integrated simulation activities, HWIL ground testing, and system intercept flight tests with SMTS are planned to obtain confidence in overall NMD system capability against the full spectrum of existing threats. Logistic, site planning, and manufacturing issues will be addressed to further reduce contingency deployment time lines. Supporting component technology development will continue to provide a hedge against unexpected threats or element unavailability in any time frame. Completion of each time frame results in the demonstration of a significant improvement in capability and a reduction in contingency deployment time lines.

B. (U) PROGRAM CHANGE SUMMARY:

	FY1994	FY1995	FY1996	FY1997	TOTAL COST
Previous President's Budget	72,119	154,700	151,500	147,100	525,419
Appropriated Value		146,532			146,532
Adjustments to Appropriated Value		-8,722			(8,722)
Current Budget Submit	68,569	137,810	126,646	149,550	482,575

Change Summary Explanation:
Funding: Per BUR guidance, FY94 was a transition year, with GBI funding constrained to preserve critical efforts. FY95 marks the resumption of progress on NMD interceptor technology readiness. The funding growth is primarily due to increases in the interceptor targets budget to procure hardware for and conduct flight tests. The decreased adjustments in FY94-96 will result in less risk reduction component

technology efforts and a six month slip in the flight test schedule and subsequent activities, compared to the President's Budget. This increases program risk slightly and delays seeker hardening efforts required for a deployable system.
Schedule: EKV CDR moved to 4QFY95 for one of the two contractors due to extended contract negotiations. MSLS demo moved to 1QFY96 due to integration delays. This will not impact planned flight test schedule. Seeker flights moved to 1Q and 2QFY97 and EKV intercept flight moved to 2QFY98 due to OSD PDM 721 (FY96 reductions).
Technical: None.

C. (U) OTHER PROGRAM FUNDING SUMMARY

Related RDT&E:		Funding Dependency? (Yes[1]/No)	
1151	Sensors (Active & Passive)	PE 0603871C	No
1155	Phenomenology Program	PE 0603871C	No
1270	Applied Interceptor Materials & Systems Technology	PE 0603173C	No
1460	Battle Management, Command, Control & Communications	PE 0603871C	No
3152	NMD System Engineering	PE 0603871C	No
3157	Environmental, Siting, and Facilities	PE 0603871C	No
3160	Deployment Planning	PE 0603871C	No
3265	User Interface	PE 0603871C	No
3359	System Test and Evaluation	PE 0603173C	No
3360	Test Resources	PE 0603173C	No

[1]Funding data for related RDT&E efforts that have a funding dependency can be found in the respective project summary/program element.

D. (U) Schedule Profile

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RDT&E, Defensewide / BA 04 (Dem/Val)

PE: 0603871C (Proj: 1267)
PE Title: NMD Tech (U)

	FY1994				FY1995				FY1996				FY1997			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Engineering Milestone								4Q[a]								
T&E Milestone						2Q[b]		4Q[c]	1Q[d]				1Q[e]	2Q[f]		
Contract Milestone			3Q[g]*					4Q[h]								

[a] - Complete critical design review
[b] - Inter-element message transfer demo at Integrated System Test Capability (ISTC)
[c] - Functional interface demo at ISTC
[d] - Functional interface demo at ISTC
[e] - Conduct 1st EKV sensor flight
[f] - Conduct 2nd EKV sensor flight
[g] - Down select to two EKV contractors
[h] - Down select to one EKV contractor
* - Denotes completed milestone

Planned Milestones Beyond FY1997:

Conduct EKV flight test with BM/C3 on-line	2QFY98
Conduct EKV flight test with BM/C^3 in line and RTD on-line	1QFY99
Conduct NMD system flight test with EKV, BM/C^3 and RTD in line, and MWIR SMTS on line	1QFY00
Conduct NMD system flight test with EKV, BM/C^3 and RTD in line, and MWIR SMTS on line	2QFY00
Conduct NMD system flight test with EKV and In-flight target Update (IFTU)/ Target Object Map (TOM) from BM/C^3 Ground Entry Point (GEP)	4QFY00
Conduct NMD system flight test with EKV and IFTU/TOM from BM/C^3 GEP	2QFY01
Begin dedicated GBI booster fabrication and ground test	4QFY01
Conduct NMD flight test with EKV and IFTU/TOM from BM/C^3 GEP	4QFY01
Conduct NMD flight test with EKV and IFTU/TOM from BM/C^3 GEP	2QFY02

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE: 0603871C (Proj: 1460)
PE Title: NMD Tech (U)

Project Number / Title: 1460 BMC3

Program Name:	FY1994 Actual	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	FY2000 Estimate	FY2001 Estimate	Total Program
0603871C RDT&E	23,702	27,900	33,538	36,213	38,213	41,213	41,213	43,124	Continuing

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION:

(U) The National Missile Defense Program's goal is to develop and maintain the option to deploy a cost-effective, operationally effective and ABM treaty compliant system designed to protect the United States against limited ballistic missile threats, including accidental or unauthorized launches or third world attacks. The National Missile Defense (NMD) system elements are the Ground Based Radar (GBR), the Space and Missile Tracking System (SMTS) (now executed as part of the USAF Space Based-Infrared System), the Ground Based Interceptor (GBI), and Battle Management, Command, Control and Communications (BMC3). This summary addresses only the BMC3 element. The BMC3 program was project number 2300 and 2304 prior to FY95. Projects 2300, 1403 (Computer Engineering), and 2304 (Software Engineering) were combined in FY95 to create project 1460.

(U) The mission of BMC3 is to integrate available NMD elements with current and planned command and control structures to provide a militarily effective NMD system. Since exoatmospheric mid-course intercept is the key to an effective NMD system, the BMC3 program will develop the capability to obtain information from sensors and supply sufficient target object map and in-flight target update information to the in-flight interceptor to permit successful destruction of a reentry vehicle (RV). The objectives of the BMC3 program are: (1) develop the processes, procedures and the functional software needed to demonstrate an early operational BMC3 capability and the integration of battle management, command and control and sensor data among, and between NMD elements and supporting external systems; (2) develop human-in-control and related functional capabilities required by the User; (3)

identify BMC3 technology, manufacturing, producability, and deployability long-poles and performance parameters to minimize these issues in the event of a contingency deployment decision; and, (4) support the development of mature operational requirements and concept of operation (CONOPS) which ensure the development of the desired end-to-end system behavior.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) The BMC3 Program has successfully established the engineering foundation for system-level BMC3 and initiated its translation and refinement into an object-oriented, multi-dimensional NMD Domain Information Architecture (IA). This program established the BMC3 Element Support Center (BESC) at the National Test Facility (NTF) for rapid prototype development of BMC3 capabilities. FY93/94 demonstrations of BMC3 prototyping and general development concepts were successfully conducted at the BESC and demonstrated integration of independent BMC3 technology and prototyping projects previously delivered. Executed Options Assessment (OA) contracts that independently demonstrated best-commercial-practices for BMD integration and BMC3 development. In FY94 the program transitioned from an acquisition program to a technology readiness program with three streamlined areas of concentration: Site-level BMC3 (Site-level Operations and Integrated Engagement Planning); CINC-level BMC3 (NMD Command decision making, Course of Action/Mission/Task development, and Integrated Engagement Planning) and External Systems Interfaces; and BMC3 system-level integration. Primary focus was to maintain capabilities needed to support the technology readiness program at minimal levels. During FY95 a BMC3/SE&I contract is planned for award. This contract will provide: (1) NMD BMC3 development and integration, and NMD System Engineering and Integration for the Technology Readiness Program; and (2) TMD System Engineering and Integration. This project is directly supported by and sponsors the NMD BMC3 development and integration portion of this contract. R-2 Exhibits 3152 and 3251 address NMD and TMD SE&I, respectively.

(U) FY 1994 Accomplishments:

- ($4.097M) Site (formerly Battalion)/Fire Control: Developed and demonstrated BMC3 model interfaces with the NMD Integrated System Test Capability (ISTC) infrastructure.
- ($3.911M) Force Operations and External Interfaces: Provided User decision support situational awareness displays in joint interoperability demonstrations.
- ($15.694M) Integration: Completed Options Assessment (OA) contracts and incorporated results in NMD development package. Conducted demonstrations, tests, and exercises, and facilitated user involvement in assessment of BMC3 prototypes at the NTF. Participated in joint Warrior Interoperability Demonstration (JWID)-94. Refined NMD Domain Information Architecture (IA). Initiated contingency deployment planning process.

(U) FY 1995 Plans:

- ($5.855 M) Site/Fire Control: Integrate existing Site-level BMC3 and Engagement Planner prototype and demonstrator capability to support Integrated System Tests and demonstrations. Transition contractor-identified products to the Battle Management, Command, Control and Communications, and System Engineering and Integration (BMC3/SE&I) contractor upon contract award. Support Integrated NMD System Test and Evaluation and CDO planning.
- ($5.362 M) Force Operations and External Interfaces: Integrate existing CINC-level (formerly Command) BMC3 prototype and demonstrator capability to support Integrated System Tests and demonstrations. Transition contractor-identified products to the BMC/SE&I contractor upon contract award. Support Integrated NMD System Tests and CDO planning. Develop initial prototype Early Warning Radar (EWR) software. (NOTE: A software modification for BMC3 tests and demonstrations, not an EWR system upgrade.)
- ($13.403 M) Integration: Award BMC3/SE&I contract. Define BMC3 capabilities required for Integrated NMD BMC3 System. Provide this information to the BMC3/SE&I contractor. Configure BMC3 Element Support Center (BESC) at the NTF for operational prototype integration and User involvement. Begin initial BMC3 integration of current NMD elements,

relying heavily on non-developmental items. Provide BMC3 representation for participation in Integrated Ground Tests 1 and 2. Provide Baseline NMD Domain Information Architecture (IA). Project 3153 (BMC3 Initiatives) will provide support to the development and implementation of the IA. 3153 addresses BMDO Director-level mission area oversight to address and resolve BMDO-wide technical issues. Conduct critical path analyses to identify long-poles to determine risk and time reduction solutions that can be addressed prior to a contingency deployment decision that will shorten the post-decision deployment timeline.

- o ($3.280M) Computer Engineering: Conduct real-time missile tracking demonstration and data fusion, test automated quantification of BMC3 requirements. Conduct two demonstrations: EWR Experiment, and NMD-TMD lower tier BMC3 cooperative experiment based on the FY93 cued tracking demonstration. This effort ends in FY95. It was added to the BMC3 project for FY95. The results of the experiments and demonstrations will be incorporated into the BMC3 development effort.

(U) FY 1996 Plans:

- o ($22.825M) BMC3 Prototyping and Evaluation: This line combines the funding used for the Site/Fire Control, Force Operations and External Interfaces, and the BMC3/SE&I contract portion of the Integration lines shown in the FY95 Plans paragraph above. Develop the initial BMC3 Demonstrator configuration, which includes Site-level BMC3, Engagement Planning and CINC-level BMC3 subelements. Deliver and install required BMC3 to allow integrated operation of interceptor and surrogate sensor communications at USAKA. Develop initial configuration prototypes of interfaces with the ALERT System and EWR. Provide integrated BMC3 prototype for Integrated Ground Test (IGT)-3.
- o ($8.713M) BMC3 Integration: Continue BMC3 development and integration efforts. Plan for and conduct BMC3 test and evaluation and provide the BMC3 capability for IGT-3. Facilitate User involvement in assessment of BMC3 prototypes and CONOPS refinement. Continue critical path analyses to reduce risk and develop deployment decision response time reduction solutions in preparation for a Contingency Deployment decision.
- o ($2.000M) Early Warning Radar: Continue development and test of EWR object tracking prototype software to support

BMC3 tests and demonstrations.

(U) FY 1997 Plans:

- o ($26.125M) BMC3 Prototyping an Evaluation: Continue development of BMC3 Demonstrators. Provide integrated BMC3 prototype for IFT-1 and IFT-2. Conduct User assessments of BMC3 prototype software. Deliver and integrate initial configuration prototypes of interfaces with ALERT System and EWR. Provide integrated BMC3 prototype for IGT-4. Continue to provide BMC3 prototype support for the completion of IGT-3.
- o ($8.088M) BMC3 Integration: Continue BMC3 development and integration efforts. Plan for and conduct BMC3 test and evaluation, and provide the BMC3 capability for Integrated System Tests (IGT-3 completion, IGT-4 and IFTs-1&2). Facilitate User involvement in assessment of BMC3 prototypes and CONOPS refinement. Continue critical path analyses to reduce risk and develop deployment decision response time reduction solutions in preparation for Contingency Deployment decision.
- o ($2.000M) Early Warning Radar: Continue development and test of EWR object tracking prototype software to support BMC3 tests and demonstrations.

Acquisition Strategy: The BMC3 program is using an evolutionary acquisition strategy, an approach tailored for large software development programs. The approach capitalizes on current technology and uses proven, non-developmental items (both commercial-off-the-shelf (COTS) and government-off-the-shelf (GOTS) software and hardware) to reduce cost and schedule risks. A BMC3/SE&I contract, planned for award in 3QFY95, will provide the vehicle for development of the BMC3 system and for NMD System Integration. The effort performed in this contract will develop requirements, appropriate service BMC3 prototypes, and will provide for integration of NMD elements (GBI, GBR, SMTS). BMC3 development under this contract and funded by this project, is integrated with the overall NMD technology readiness program, which evolves incrementally over approximately three year time periods starting in FY95. The BMC3 program strategy is to concentrate on developing and planning for the capability to support early contingency deployment options which could be finalized and deployed in less than four years, and which would provide good

capability against simple threats. The BMC3 system will be extensively tested through integrated ground testing in FY95 and integrated flight tests beginning in FY96.

B. (U) PROGRAM CHANGE SUMMARY:

	FY1994	FY1995	FY1996	FY1997	TOTAL COST
Previous President's Budget	23,411	59,213	59,213	59,213	201,050
Appropriated Value		27,718			27,718
Adjustments to Appropriated Value		182			182
Current Budget Submit	23,702	27,900	33,538	36,213	121,353

Change Summary Explanation:

The Difference between the President's Budget and current budget submissions will cause significant impacts to the BMC3 program. Technology Readiness Program development efforts must be curtailed causing increased technical and schedule risk.

Funding: EWR track capability planned to support IFT-1 will be cancelled. Earliest BMC3 on-line test of system kill capability will be IFT-3 in FY98. BMC3 demonstrator builds will be delayed 6 months. Increased NMD system integration risks due to BMC3 capability slippage behind EKV schedule. $21M in FY95 funds was transferred to the Ground Based Radar program. Projects 2300, 1403 and 2304 were combined to create project 1460, adding $3.493M to the FY95 program and $0.213M to the FY96 and FY97 programs. PBD-721 reduced FY96 BMC3 funding by $2.675M. Plans for Service refinement of existing BMC3 capabilities and development of a BMC3 Mission Planner at USAKA, prior to the transition of these capabilities to the BMC3/SE&I contractor, will not be executed due to further funding reductions. Funding for EWR prototype tracking software development was reduced from $2.0M to $1.0M. Emphasis will be on the integration of existing Service BMC3 capabilities to support Integrated System Tests and for transition to the new BMC3/SE&I contractor.

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PE Title: NMD Tech (U)

Schedule: None.
Technical: Increased technical risk to BMC3 in-line capabilities to support IFT-4 in FY99.

C. (U) OTHER PROGRAM FUNDING SUMMARY

Related RDT&E:	Funding Dependency? (Yes[1]/No)	
1151 Sensors (Active & Passive)	0603871C	No
1267 Ground Based Interceptor	0603871216C	No
2260 THAAD	0603861C/0604861C	No
3152 NMD System Engineering	0603871C	No
3160 Readiness Planning	0603871C	No
3265 User Interface	0603871C	No
3359 System Test and Evaluation	0603871C	No

[1]Funding data for related RDT&E efforts that have a funding dependency can be found in the respective project summary/program element.

D. (U) Schedule Profile

	FY1994				FY1995				FY1996				FY1997			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
T&E Milestones			X(a)		X(c)		X(e)				X(f)	X(g)		X(i)		
											X(h)----------X(h)					

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PE Title: NMD Tech (U)

Contract Milestones X(b) X(d)
Other Program Events

(a) Joint Warrior Interoperability Demonstration (JWID)-94
(b) Complete Options Assessment Contracts
(c) Integrated Ground Test (IGT)-1 (Demonstration at ISTC)
(d) Award BMC3/SE&I
(e) IGT-2 (Demonstration at ISTC)
(f) Integrated Flight Test (IFT)-1
(g) IFT-2
(h) IGT-3
(i) IGT-4

Planned Milestones Beyond FY1997:

IFT-3 (Conduct EKV flight test with BMC3 on-line)	1QFY98
IFT-4 (Conduct EKV flight test with BMC3 in-line)	1QFY99
IFT-5 (Conduct NMD system flight test with EKV, BMC3 in-line, and RDT)	1QFY00
IFT-6 (Conduct NMD system flight test with EKV and IFTU/TOM from GEP)	1QFY01
IFT-7 (Conduct NMD flight test with EKV and IFTU/TOM from GEP)	3QFY01

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E Defensewide / BA 04 (Dem/Val)

PE:0603871C (Proj: 3152)
PE Title: NMD Tech (U)

Project Number / Title: 3152 NMD System Engineering

Program Name:	FY1994 Actual	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	FY2000 Estimate	FY2001 Estimate	Total Program
0603871C RDT&E	41,190	20,402	19,357	17,975	20,475	20,475	20,475	20,475	Continuing

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION:

(U) The National Missile Defense (NMD) Program's goal is to develop and maintain the option to deploy a cost-effective, operationally effective and ABM Treaty compliant system designed to protect the United States against limited ballistic missile threats, including accidental or unauthorized launches or third world attacks. The NMD system elements are the Ground-Based Interceptor (GBI); the Ground-Based Radar (GBR), the Space and Missile Tracking System (SMTS) (now executed as part of the USAF Space Based-Infrared System), and Battle Management, Command, Control and Communication (BM/C3).

(U) This project provides the engineering, analysis, and documentation necessary: to translate user requirements into system and element requirements needed to build, integrate, and test the system; to evaluate alternative system architectures (combinations of system elements) for the purpose of selecting those that best meet program needs and constraints; to develop and evaluate various contingency deployment options as a hedge against the emergence of unexpected threats; and, to develop an investment strategy that leverages TMD developments and supporting technologies in a way that best utilizes scarce program resources. Funds are provided to develop system simulations at the NTF which support user concept of operation development and evaluation (wargaming), identifying C2 interfaces and interoperability issues, and modeling architecture alternatives. The project also includes survivability assessments.

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RDT&E Defensewide / BA 04 (Dem/Val)

PE:0603871C (Proj: 3152)
PE Title: NMD Tech (U)

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Mission Description and Budget Item Justification section of each Program Element Summary.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) A sound system engineering and integration process tailored to the unique demands of a technology readiness program was established and has started to yield the data products necessary to define, develop, test, and ultimately field - if the decision is made to do so - a national defense capability against ballistic missiles. In addition to ongoing activities such as requirements evolution, TMD technology sharing assessments, and architecture refinement, near-term plans include performing analyses and tradeoffs in support of integrated ground tests in FY95 and flight tests in FY96 (sensor) and FY97 (intercept).

(U) FY 1994 Accomplishments:

- ($14.700M) Performed architectural definition and supporting analysis required to restructure program to a technology readiness effort.
- ($14.692M) Identified and resolved NMD integration issues via Technology Roadmap, System Maturity Matrix and NMD System Engineering Notebook (NSEN).
- ($ 4.728M) Integrated initial BM/C3 information architecture requirements, developed under project 1460, into system/element Requirements.
- ($ 1.430M) Reconciled User Operation Requirements Document (ORDs) with USSPACECOM and Service proponents.
- ($ 2.100M) Developed requirements and implementation plan for NMD system simulations at NTF.
- ($ 3.540M) Performed analysis and engineering integration in support of NMD demonstration program. Prepared for

Integrated Ground Tests (IGTs) 1 and 2.

(U) FY 1995 Plans:

- ($ 4.520M) Assess evolving user requirements, resolve ORD issues with user and Services, develop system requirements, and develop element requirements in participation with the Services.
- ($ 4.462M) Continue to identify and resolve alternative architecture performance, system integration, and technology issues by developing, applying, and maintaining tools such as the Technology Roadmap, NMM, and NSEN.
- ($ 3.976M) Perform program planning, including cost/schedule/performance trades, investment strategy studies, and program resource allocation/management structure analyses.
- ($ 3.166M) Provide system analyses in support of contingency option development and planning.
- ($ 2.880M) Continue integration of BM/C3 Information Architecture into system requirements process, and implement system simulations/wargaming at the NTF.
- ($ 1.398M) Support Service analyses of IGT 1&2 results and preparations for IGT3, IFT1&2. Validate test results and update test requirements and documentation as appropriate.

(U) FY1996 Plans:

- ($ 5.705M) Continue to mature user requirements. Finalize interface and configuration control requirements in support of Early deployment option. Analyze and update alternative future contingency deployments.
- ($ 2.081M) Analyze and validate results of IGT3; support preparations for IGT4 and IFT1.
- ($ 5.587M) Update technical documentation baseline (Technology Roadmap, NMM, and NSEN) and NTF system simulations based upon test results to date.
- ($ 1.930M) Develop and integrate baseline system survivability requirements based upon FY94 assessments. Perform data

fusion trade studies to establish system requirements.

- o ($ 4.054M) Update program plans, including cost/schedule/performance trades, investment strategies, and program resource allocations.

(U) FY1997 Plans:

- o ($ 5.620M) Continue to mature user requirements. Finalize interface and configuration control requirements in support of Mid-Term deployment option. Analyze and update objective contingency deployment.
- o ($ 3.517M) Analyze and validate results of IGT4 and IFT1; support preparations for IFT2.
- o ($ 4.785M) Update technical documentation baseline (Technology Roadmap, NMM and NSEN) and NTF system simulations based upon test results to date.
- o ($ 4.053M) Continue to adjust program planning based on element program technical, cost, and schedule performance, technology progress and infusion, and NMD program resource allocations.

Acquisition Strategy: The NMD System Engineering function is provided through a combination of BMDO staff and contractor expertise. Contractor support will be competed through a full and open competition in 2QFY95 and awarded 3QFY95. This contract will provide: system engineering for the NMD program; NMD BM/C3 development (funded under project 1460); and, TMD system engineering (funded under project 3251). Anticipated size and complex nature of this system engineering/BMC3 contract precludes a small business set aside.

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RDT&E Defensewide / BA 04 (Dem/Val)

PE:0603871C (Proj: 3152)
PE Title: NMD Tech (U)

B. (U) PROGRAM CHANGE SUMMARY:

	FY1994	FY1995	FY1996	FY1997	TOTAL COST
Previous President's Budget	35,530	21,987	21,987	21,987	101,491
Appropriated Value		19,412			19,412
Adjustments to Appropriated Value		990			990
Current Budget Submit	41,190	20,402	19,357	17,975	98,924

Change Summary Explanation:

(U) The FY1995 RDT&E Descriptive Summary (Project 3101, Engineering/Integration Support, dated February 1994) included both Theater Missile Defense (TMD) and National Missile Defense (NMD) engineering and integration activities. As part of a continuing BMDO initiative to better comply with Congressional direction and to improve BMDO internal management and accounting of TMD and NMD efforts, Project 3101 has been divided into two primary efforts -- Project 3251 TMD system engineering and Project 3152 NMD system engineering. Other smaller activities formerly a part of Project 3101 include: 2304 (System Software Engineering) which was integrated with BM/C3 Technologies in Project 1460; and Projects 3103 (Measurement Standards), 3104 (Logistics Integration), and 3105 (Producibility and Manufacturing) which were consolidated with NMD Deployment Planning under Project 3160.

(U) The two-thirds funding reduction from FY94 to FY95 and the outyears, reflects the program's transition from an acquisition to a technology readiness program and budget reductions. Approximately five percent of the NMD annual budget request is allocated to this project which is the program's primary source of technical description, analysis, integration, and risk assessment/mitigation. As such, the project shares data products with NMD projects: 1267 (Exoatmospheric Kill Vehicle), 1151 (GBR), 1460 (BM/C3), 3160 (Deployment Planning), 3180 (System Integration), and 3265 (User Interface).

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PE:0603871C (Proj: 3152)
PE Title: NMD Tech (U)

Funding: FY94 changes were as a result of implementing the DoD Bottom-Up Review (BUR), and restructuring NMD to a technology readiness program. FY95-97 changes are a result of completing the conversion to a technology readiness program.

Schedule: FY95-97 changes are the result of replacing NMD acquisition milestones/events with technology readiness events. Revised NMD funding and budget projections results in stretching the time between major events. (Section D)

Technical: Beginning in FY94, this project is restructured to focus on NMD in a technology readiness context while maintaining a contingency deployment option.

C. (U) OTHER PROGRAM FUNDING SUMMARY

Related RDT&E:	Funding Dependency? (Yes[1]/No)
1151 Sensors (Active & Passive) 0603871C	No
1267 Ground-Based Interceptor 0603871C	No
1460 BM/C3 0603871C	No
3265 User Interface 0603871C	No
3160 Deployment Planning 0603871C	No
3153 Architecture Analysis and BM/C3 0603871C	No
3270 Threat and Countermeasures 0603871C	No
3252 Modeling and Simulations 0603871C	No

[1]Funding data for related RDT&E efforts that have a funding dependency can be found in the respective project summary/program element.

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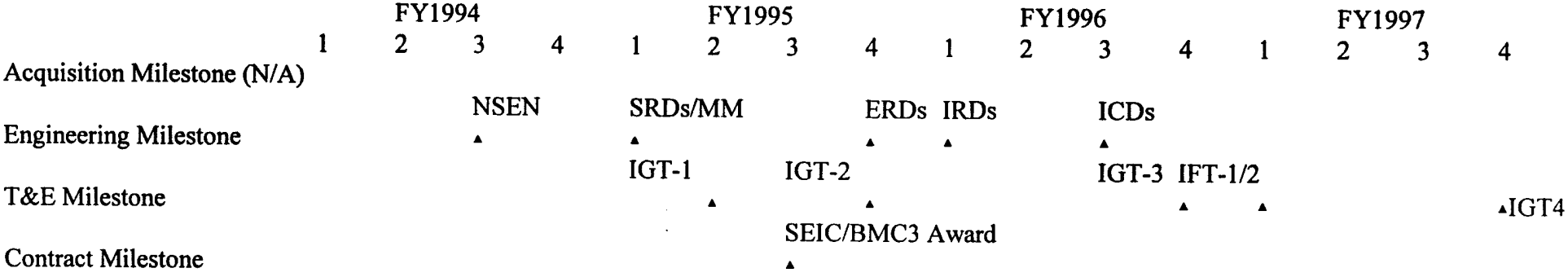
RDT&E Defensewide / BA 04 (Dem/Val)

PE:0603871C (Proj: 3152)
PE Title: NMD Tech (U)

D. (U) Schedule Profile



Schedule Legend:

NSEN	Complete Initial NMD Engineering Notebook (NSEN)
SRDs/MM	Complete redevelopment of NMD - System Req't Documents Maturity Matrix (1Q95)
ERDs	Complete NMD Technology Readiness Systems - Element Requirements Document (4Q95)
IRDs	Complete NMD Technology Readiness Systems level - Interface Requirements Document (1Q96)
ICDs	Complete NMD Technology Readiness System level - Interface Control Documents (3Q96)
IGT-1	Integrated Ground Test 1 (2Q95)
IGT-2	Integrated Ground Test 2 (4Q95)
IGT-3	Integrated Ground Test 3 (4Q96)
IFT-1	Integrated Flight Test 1 (1Q97)

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PE Title: NMD Tech (U)

IFT-2	Integrated Flight Test 2 (1Q97)
IGT-4	Integrated Ground Test 4 (4Q97)
SEIC/BMC3	Award of SEIC/BMC3 contract (3Q95)

Planned Milestones Beyond FY 1997:
FY 98 Flight Test 3rd Qtr
FY 99 Flight Test 3rd Qtr

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RDT&E, Defensewide / BA 04 (Dem/Val)

PE: 0603871C (Proj: 3153)
PE Title: NMD Tech (U)

Project Number / Title: 3153 Architecture Analysis and BMC3 Initiatives

Program Name:	FY1994 Actual	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	FY2000 Estimate	FY2001 Estimate	Total Program
0603871C RDT&E	11,713	0	3,110	3,125	3,125	3,125	3,125	3,125	Continuing

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION:

(U) This project supports the creation for FY95 of two new offices within BMDO to ensure that appropriate issues relating to system architecture and BMC3 are addressed in a coordinated and synergistic manner across all BMDO NMD and TMD efforts. The new offices Architecture Integrator (DA), and the BMC3 Office (DB), report directly and independently to the BMDO Director (BMDO/D) to provide the necessary mission-area oversight of critical BMDO technical issues. Neither DA or DB efforts are funded via this Program Element during FY95. However, beginning in FY96, relevant DA and DB activities will be continued via this Program Element to address specific NMD requirements.

(U) In this project, BMDO supports systems analysis work to determine the expected operational performance and effectiveness of missile defense systems under development. Computer simulation models are developed and used to investigate architecture and system level capability and to resolve critical technical issues related to the development of specific elements of the architecture. Tradeoffs in alternative elements, specific designs, inventory and integration of systems are conducted in detail to determine the most cost effective approach for a particular missile defense mission. The work is performed on a continuing basis in order to determine the impact of changing threats, mission requirements, and advances in technology.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE: 0603871C (Proj: 3153)
PE Title: NMD Tech (U)

(U) The work is sponsored by the BMDO Architecture Integrator (DA) and provides the Director and his Deputies an independent assessment of the expected effectiveness of major programs under development and requirements for supporting technology. The work is separated into two program elements, one for TMD and the other for NMD.

(U) In the program element described here, the focus is on NMD systems and technology. The primary thrust of the work is to investigate alternative architectures for the NMD mission. Single site (ABM Treaty compliant) and multiple site defense options are considered against a number of threats, ranging from a few Rvs launched from a third world nations to a complicated engagement of multiple/pen-aided missiles launched from Russia. Defenses based on different surveillance/tracking sensors including missile early warning assets is an important consideration, as is the design options for a highly capable interceptor missile. Important issues such as the tracking sensor to missile seeker target handover, midcourse RV/decoy discrimination, the effect of nuclear environments, etc. are investigated under this program element.

(U) Future DB efforts will provide for the mission-area oversight and coordination of all BMDO BMC3 development and acquisition activities in the role of senior advisor to the Director, BMDO. This effort will provide for the synergistic evaluation of relevant BMC3 technical issues; the formulation of appropriate plans, programs, and policies to facilitate the coordination of all BMD Advanced Development BMC3 research, development, and acquisition activities across TMD and NMD program activities; promote appropriate reuse strategies to maximize BMD reuse capabilities; and minimize the duplication of BMC3 research and development efforts across all NMD and TMD development efforts.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Mission Description and Budget Item Justification section of each Program Element Summary.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1994 Accomplishments:
Architecture Analysis (DA):

- ($ 11.713M) Analysis work was completed to support the current NMD program plan, including a thorough investigation of alternative missile interceptor designs. Analysis work was completed to show the capability and limitations of system alternatives driven by interpretations of the ABM treaty. The requirements for space sensors in the NMD architecture were evaluated. RV/decoy discrimination algorithms and target kill assessment techniques were investigated as part of a continuing response to excursion threats suggested by the BMDO Red Team.

BMC3 Initiatives (DB):

- Effort are not funded via this P.E. during FY94.

(U) FY 1995 Plans:

- This effort was not funded via this P.E. during FY95.

(U) FY 1996 Plans:
Architecture Analysis (DA):

- ($ 2.000M) The capability of an evolving NMD architecture (matched to threat advances over time) will be evaluated. Alternatives to defend Alaska and Hawaii (separate from CONUS defense) will be evaluated. A more thorough evaluation of the space tracking sensor (Space and Missile Tracking System) under development by the Air Force will be made as contractor specific designs are made available. RV/decoy discrimination techniques will continue to be evaluated. Application of advances in TMD components/ technology to NMD systems will be evaluated, especially in the design and development of

large phased array radars. Continuation of systems analysis work to evaluate architecture/system level issues as threats, missions, and development programs change. Examination of novel concepts for NMD proposed by members of the scientific community.

BMC3 Initiatives (DB):

- o ($ 1.110M) Support development of mission-area policies, processes, and guidance to support the coordinated system-level implementation of a seamless development environment for BMD BMC3 software development from requirements through design and production of BMC3 executable code. Promote the implementation of emerging evolutionary development processes across the BMD Community; support BMDO efforts in the formulation, and implementation of advanced BMC3 research and development efforts appropriate to support evolving BMDO NMD and TMD BMC3 requirements. Efforts will include support in defining NMD and TMD BMC3 development process requirements; analysis and implementation of appropriate NMD/TMD software reuse capabilities and requirements consistent with BMDO requirements and DoD guidance and objectives; coordination in the analysis and implementation of various DoD initiatives and implications relating to BMDO NMD/TMD BMC3 development; support to NATO or other allied concerns outside the BMDO community in activities related to BMC3 development; ongoing support of BMC3 demonstrations relating to joint NMD/TMD inter-operability, JWID, BMC3 CONOPS, etc.; implementation of appropriate software engineering requirements across all BMDO BMC3 software development efforts including support of Software Engineering Institute (SEI) Software Capability Evaluations (SCEs) for BMDO source selection efforts; and provide the mission-area capability to address emerging BMC3 system requirements and concerns and facilitate their resolution in a synergistic environment across all NMD and TMD development efforts.

(U) FY 1997 Plans:

Architecture Analysis (DA):

- o ($ 2.000M) Continuation of systems analysis work related to NMD issues.

BMC3 Initiatives (DB):

- o ($ 1.125M) Continuation of FY96 efforts related to NMD issues.

Acquisition Strategy: Systems analysis work under this project is done under contract. In November 1995, a two year contract for this work (with two, one year extension options) was awarded to a ten-member corporate team led by SPARTA, Inc., Laguna Hills, Calif under full and open competition. For BMC3 Initiatives efforts, expertise of Government, FFRDC, SEIC, and SETA personnel will be leveraged in the execution of project activities, utilizing existing contracts to the maximum extent possible. Specifically, USASSDC and USAF/ESC Government and contractor personnel are expected to lead Information Architecture and development efforts; existing and follow-on SETA and SEIC contracts will provide the core of technical expertise for a variety of BMC3 activities; and existing IDA contract vehicles will provide state-of-the-art technical expertise in Software Engineering and related technical areas. Additional contractor services will be procured if needed to meet emerging program requirements.

B. (U) PROGRAM CHANGE SUMMARY:

	FY1994	FY1995	FY1996	FY1997	TOTAL COST
Previous President's Budget	11,000	0	0	0	11,000
Appropriated Value		0			0
Adjustments to Appropriated Value		0			0
Current Budget Submit	11,713	0	3,110	3,125	17,948

Change Summary Explanation: Architecture analysis and integration efforts performed as part of this project were performed under PE 0603173C (Project 3153) in FY95. Prior to FY95 the work was reported under Project 3207. Beginning in FY96, activities comprising FY95 CDS Project 3153 will be funded and performed via a combination of both TMD and NMD Program Elements, as appropriate.

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RDT&E, Defensewide / BA 04 (Dem/Val)

PE: 0603871C (Proj: 3153)
PE Title: NMD Tech (U)

Funding: Reflects reductions in funding directed by Congress.
Schedule: None. This project is not an acquisition program, but supports BMD long-term planning.
Technical: Reductions in funding result in a reduced level of effort.

C. (U) OTHER PROGRAM FUNDING SUMMARY

Related RDT&E:	Funding Dependency? (Yes[1]/No)
3153 Arch. Anal.& BMC3 Initiatives P.E. 0603872C	No

[1]Funding data for related RDT&E efforts that have a funding dependency can be found in the respective project summary/program element.

D. (U) SCHEDULE PROFILE

	FY1994				FY1995				FY1996				FY1997			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Acquisition Milestone																
Engineering Milestone																
- Software Policy Update								x								
- BMD IA (CONOPS)					x											
- Software Engineering Documentation Updates						x			x							
T&E Milestone																
Contract Milestone																

- Award Arch. Analysis Support Contract		x										
Other Program Events												
- Annual Contract Program Review				x				x				x
- Tech. Analyses, Reports, & Briefings As Req'd.	x	x	x	x	x	x	x	x	x	x	x	x

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RDT&E, Defensewide / BA 04 (Dem/Val)

PE:0603871C (Proj: 3157)
PE Title: NMD Tech (U)

Project Number / Title: 3157 Environment, Siting and Facilities

Program Name:	FY1994 Actual	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	FY2000 Estimate	FY2001 Estimate	Total Program
0603871C MILCON	2,977	530	832	974	631	688	547	547	Continuing
0603871C RDT&E	0	0	1,345	1,351	1,401	1,404	1,409	1,409	Continuing

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION:

(U) The National Missile Defense (NMD) Program's goal is to develop and maintain the option to deploy a cost effective, operationally effective, Antiballistic Missile (ABM) treaty compliant system designed to protect the United States against limited ballistic missile threats, including accidental or unauthorized launches or third world attacks. The NMD system elements are the Ground Based Interceptor (GBI), the Ground-Based Radar Technology Demonstrator (NMD-RTD), the Space and Missile Tracking System (SMTS) (now executed as part of the USAF Space Based-Infrared System), and Battle Management, Command, Control and Communications (BM/C^3).

(U) This project provides environmental program guidance, environmental impact analyses and documentation, real property facility siting, and facility management and acquisition support for the National Missile Defense (NMD) system to maintain the option to deploy a cost-effective, operationally effective and ABM Treaty compliant system. The project plans, programs, budgets, and oversees the NMD facility acquisition through Military Construction (MILCON) and RDT&E construction projects to support the contingency deployment planning and readiness activities focused on critical path analyses to ensure minimum required lead time for site activation. The project provides guidance and leads BMDO NMD environmental compliance, pollution prevention, other

environmental efforts, and the Environmental Assessment and Environmental Impact Statement process for NMD activities. The project develops guidance for Executing Agents on facility siting, facility acquisition, and environmental matters to support the contingency deployment plan which is used to guide the ongoing NMD readiness program and to execute a limited NMD contingency deployment if needed. The project provides MILCON design funds to support design of BMDO's NMD major and minor MILCON projects.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Mission Description and Budget Item Justification section of each Program Element Summary.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1994 Accomplishments: Refer to Project 3157 (PE: 0603173C) for detailed accomplishments.

(U) FY 1995 Plans: Refer to Project 3157 (PE: 0603173C) for detailed plans.

(U) FY 1996 Plans:

- ($ 0.800M) Update and modify environmental, siting, and facility annexes for the NMD contingency deployment plans based on NMD readiness program developments. Develop siting, basing deployment plans, environmental compliance, environmental analysis, studies, and documentation for critical NMD contingency deployment options. Begin siting and environmental work for Objective System fielding.
- ($ 0.150M) Conduct facility planning and preliminary design for NMD contingency deployment options.

- o ($ 0.395M) Execute and manage the FY 96-00 NMD Military Construction, Minor Military Construction, and RDT&E facility design and construction projects and activities. Emphasis is on the NMD Ground Based Radar Technical Demonstration Program facility project at U.S. Army Kwajalein Atoll, Marshall Islands. Manage Final Design Approval for NMD Radar Technology Demonstration Project, U.S. Kwajalein Atoll (Project Funded by Project 2154). Manage Award Contract for NMD Radar Technology Demonstration Project, U.S. Kwajalein Atoll (Project Funded by Project 2154)

(U) FY 1997 Plans:

- o ($ 0.700M) Update the environmental, siting, and facility annexes for the NMD contingency deployment plans to reflect NMD advances and changes in candidate systems. Support technology readiness programs with siting, environmental compliance, pollution prevention, studies, and environmental analysis and documentation. Program increases cover costs associated with maturing acquisition programs, planned fielding of systems, and test and evaluation programs.
- o ($ 0.125M) Continue facility planning for near term NMD deployment options to reduce NMD contingency deployment lead time.
- o ($ 0.526M) Plan, execute, and manage the FY 97-02 NMD Military Construction, Minor Military Construction, and RDT&E facility design and construction projects and activities. Prepare 35% facilities designs for initial contingency deployment facilities. Execute design and constructibility trade studies. Complete Construction Surveillance for NMD Radar Technology Demonstration Project, U.S. Kwajalein Atoll (Project Funded by Project 2154). Complete NMD site-specific Environmental Impact Statement. Complete preliminary design (35%) for site-specific deployment.

Acquisition Strategy: BMDO contractor support (Currently under a small business Cost Plus Fixed Fee contract; this contract will be recompeted for similar contract-type award in FY 95) will be utilized for technical and overview assistance of Facilities, Siting, and Environmental activities. Other similar small business contracts, as well as full and open competition Cost Plus Fixed Fee and Fixed

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PE Title: NMD Tech (U)

Price contracts, by U.S. Army Space and Strategic Defense Command and the U.S. Army Program Executive Office-Missile Defense will be utilized for additional technical assistance for the development of Facilities, Siting, and Environmental documentation requirements. BMDO tasks the Services through Program Management Agreements to perform the required tasks in support of the NMD program. BMDO performs quarterly on-site reviews to verify and validate completed tasks.

B. (U) PROGRAM CHANGE SUMMARY:

	FY1994	FY1995	FY1996	FY1997	TOTAL COST
Previous President's Budget	0	0	0	0	0
Appropriated Value		0			0
Adjustments to Appropriated Value		0			0
Current Budget Submit	0	0	1,345	1,351	2,696

Change Summary Explanation:
Funding: None
Schedule: None
Technical: None

C. (U) OTHER PROGRAM FUNDING SUMMARY

MILCON/Procurement: As listed on Page 1.

Related RDT&E: Funding Dependency ? (Yes[1]/No)

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PE:0603871C (Proj: 3157)
PE Title: NMD Tech (U)

3160	Readiness Planning	0603871C	No
2154	Ground Based Radar	0603862C	No
1267	Kinetic Kill Vehicle	0603871C	No
3359	System Test & Eval	0603871C	No
3360	Test Resources	0603871C	No
1151	Sensors	0603871C	No

[1]Funding data for related RDT&E efforts that have a funding dependency can be found in the respective project summary/program element.

D. (U) Schedule Profile

	FY1994				FY1995				FY1996				FY1997			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Other Program Events									Xa/Xb/Xc				Xd/Xe/Xf			

Xa Finalize Facility, Environmental, and Siting Annex for Contingency Deployment Plan (Plan funded by Project 3160)

Xb Manage Final Design Approval for NMD Radar Technology Demonstration Project, U.S. Kwajalein Atoll (Project Funded by Project 2154)

Xc Manage Award Contract for NMD Radar Technology Demonstration Project, U.S. Kwajalein Atoll (Project Funded by Project 2154)

Xd Complete Construction Surveiliance for NMD Radar Technology Demonstration Project, U.S. Kwajalein Atoll (Project Funded by Project 2154)

Xe Complete NMD site-specific Environmental Impact Statement

Xf Complete preliminary design (35%) for site-specific deployment

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PE:0603871C (Proj: 3157)
PE Title: NMD Tech (U)

Planned Milestones Beyond FY 1997:

Environmental, siting, and facility NMD deployment planning milestones track the NMD readiness program milestones:

- Complete design on site-specific deployment facilities
- Execute construction of site-specific deployment facilities should an end of FY 1997 decision be made
- Continue to develop objective system plans should the FY 1997 decision not be made.

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RDT&E, Defensewide / BA 04 (Dem/Val)

PE: 0603871C (Proj: 3160)
PE Title: NMD Tech. (U)

Project Number / Title: 3160 Deployment Planning

Program Name:	FY1994 Actual	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	FY2000 Estimate	FY2001 Estimate	Total Program
0603871C RDT&E	7,924	13,470	14,469	17,302	18,840	19,202	18,757	20,157	Continuing

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION:

(U) The National Missile Defense Program's goal is to develop and maintain the option to deploy a cost-effective, operationally effective and ABM Treaty compliant system designed to protect the United States against limited ballistic missile threats, including accidental or unauthorized launches or third world attacks. The NMD system elements are the Ground Based Interceptor (GBI), the Ground Based Radar (GBR), the Space and Missile Tracking System (SMTS) (now executed as part of the USAF Space Based-Infrared System), and Battle Management, Command, Control and Communications (BM/C3).

(U) The logistics readiness support will identify deployment activities and impacts on fielding an operationally effective, treaty compliant ABM capability within the shortest possible time. The near term program activities focus on critical path analysis to identify those activities providing the greatest time reduction potential. This effort not only identifies time reduction activities, but monitors those activities to ensure time reduction reality and it includes such items as state-of-the-art element/component insertion, producibility engineering, industrial base capacity assessment, specialty engineering, risk mitigation activities, development of site activation requirements, and supportability planning for schedule and affordability issues resolution. This information, and its relationship to the NMD program, is described in a contingency deployment planning document and includes all NMD architecture options. Yearly funding increases are necessary to resolve critical time line issues to include site design, environmental impact, and

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RDT&E, Defensewide / BA 04 (Dem/Val)

PE: 0603871C (Proj: 3160)
PE Title: NMD Tech. (U)

MILCON as the NMD Readiness program reaches its first phase of maturity. The contingency deployment plan, updated annually, will guide the NMD Readiness Program and define the NMD Contingency Deployment System. Systems analysis efforts focus on NMD-wide assessments of budget formulation and execution, systems integration, and systems effectiveness. These assessments contribute to reducing NMD program risks and ensuring the availability of a cost effective ABM system. This effort also includes identifying and tracking the U.S. industrial base capabilities, as well as the support and training infrastructure needed for a potential NMD deployment. The operational suitability activities integrate specialty engineering functions at the Ballistic Missile Defense (BMD) level including producibility, acquisition logistics, training, etc, for NMD. Another emphasis of the program is to ensure that critical pacing of subsystems meet required performance criteria. This emphasis is currently in metrology, to generate measurement standards for long wave length infrared focal planes critical for both TMD and NMD components.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Brief Description of Element section of each Program Element Summary.

PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) The initial study was completed that explores the time required and the costs associated with deploying a contingency NMD capability based on a 1997 deployment decision. This study consolidated data from multiple sources and identified preliminary critical path activities. Developed data to identify long poles that delay contingency deployment. Developed initial draft of the capstone contingency deployment basic plan and outlined planning process. Completed initial streamlining and standardization of ILS and Producibility infrastructure to drive down program costs and meet BMDO affordability objectives. Restructured BMDO supportability and producibility policies for consistency with DoD acquisition Directives and policy.

(U) FY 1994 Accomplishments:

- ($0.309) Maintained the LWIR calibration facility. Conducted annual review of BMD metrology program.
- ($0.248) Identified, logistics supportability, producibility and industrial base issues and developed mitigation strategies and plans.
- ($7.367) Initiated framework to develop contingency deployment planning process. Completed quick reaction deployment analysis of deployment of a NMD system capability. Provided specialty engineering support to the NMD element program managers. Provided systems analysis support to NMD program for programmatic, technical, and budgetary issues.

(U) FY 1995 Plans:

- ($5.130) Develop Contingency Deployment guidance and deployment execution plan. Conduct critical path analyses to determine deployment long poles. Develop decision support tools to assess deployment activities.
- ($0.390) Conduct analysis of industrial production and manufacturing requirements. Perform logistics and specialty engineering assessment of NMD elements to assure operational suitability. Assess and identify critical manufacturing technology development requirements.
- ($0.450) Develop Metrology Technology Standards and provide standards to commercial and DoD agencies for NMD program testing, development, production and support as funding permits. This effort leverages TMD investments.
- ($7.500) Evaluate program to ensure adequate resources are applied against prototype development deployment long poles. Identify resource issues which impact lead time to deploy. Monitor/assess architecture engineering trades for changes to the baseline which impact cost, schedule, and performance of the overall system. Monitor/assess technology baseline; identify infusion opportunities which reduce leadtime to deploy; improve system effectiveness; and reduce prototype development deployment risk. Perform system wide assessments for program, budget, system effectiveness, and technology risks for the NMD system and Technology Support programs.

(U) FY 1996 Plans:

- o ($6.110) Update and modify NMD contingency deployment plans based on NMD readiness program developments. Execute pre-deployment timeline reduction activities as determined from deployment critical path analyses. Perform site development activities to support early option deployment. Conduct deployment logistics and sustainment support analysis for the early deployment option.
- o ($0.426) Complete characterization of LWIR detector transfer standards. Enhance capability for out-of-band blocking measurements on narrow band filters.
- o ($0.369) Conduct logistics and specialty engineering assessments for the NMD Readiness Programs. Identify producibility and industrial base issues and develop risk mitigation plans necessary to reduce contingency deployment lead time. Contribute to the development and transfer of critical manufacturing technologies.
- o ($7.564) Continue to evaluate Technology Readiness Program to ensure adequate resources are identified to reduce deployment long poles. Monitor/assess architecture engineering trades for changes to the baseline which impact cost, schedule, and performance of the overall system. Monitor/assess technology baseline; identify infusion opportunities which reduce leadtime to deploy; improve system effectiveness; and reduce prototype development deployment risk. Perform system wide assessments for program, budget, system effectiveness, and technology risks for the NMD system and Technology Support programs.

(U) FY 1997 Plans:

- o ($8.462) Update the contingency deployment plans to reflect NMD technical advances and changes in the architecture. Conduct and update critical path analyses relative to development and deployment of a midcourse tracking system. Conduct environmental impact analysis to support site activation if necessary. Develop site pollution prevention plan. Execute selected pre-deployment activities where appropriate to prepare for a deployment decision.
- o ($0.450) Initiate development of capability for IR spectral emissivity measurements.

- o ($0.390) Continue logistics and specialty engineering assessments focused on the addition of SMTS to the NMD architecture. Develop and execute industrial base plans to apply critical manufacturing techniques for element development.
- o ($8.000) Continue to evaluate Technology Readiness Program to ensure adequate resources are identified to reduce deployment long poles. Monitor/assess early capability architecture engineering trades impacting cost, schedule, and performance of the overall system. Monitor/assess technology baseline; identify infusion opportunities which reduce leadtime to deploy; improve system effectiveness; and reduce prototype development deployment risk. Perform system wide assessments for program, budget, system effectiveness, and technology risks for the NMD system and Technology Support programs.

Acquisition Strategy: This project uses the integrated expertise of BMDO and industry officials and developers to implement deployment readiness. The primary executing agent for this project is a Joint Service team comprised of the US Army National Missile Defense Project Office, the US Air Force Electronics Systems Center, US Air Force Space and Missile Center, US Space Command, Army Space Command, Air Force Space Command and Navy Space Command. This joint team is supported by competitively awarded existing and future SETA contracts.

B. (U) PROGRAM CHANGE SUMMARY:

	FY1994	FY1995	FY1996	FY1997	TOTAL COST
Previous President's Budget	6,907	12,053	12,144	12,144	43,248
Appropriated Value		14,324			14,324
Adjustments to Appropriated Value		-0,854			(854)
Current Budget Submit	7,924	13,470	14,469	17,302	53,165

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RDT&E, Defensewide / BA 04 (Dem/Val)

PE: 0603871C (Proj: 3160)
PE Title: NMD Tech. (U)

Change Summary Explanation:
Program 3160 consolidates a number of homogeneous projects under single management at an overall lower cost to focus on reducing (1) the time to deploy a contingency system, and (2) the producibility and deployment risks. The FY95 projects that were consolidated include: 3103 Metrology; 3104 Integrated Logistics Support; 3105 Producibility and Manufacturing and 4402 System Analyses.

Funding: The FY95 President's Budget submission included activities in metrology, supportability, specialty engineering, industrial base assessment and systems analysis. Funding estimates for these activities is unchanged. The current budget submission reflects the additional funding for contingency deployment planning and systems analysis activities. Yearly budget increases reflect increased efforts in the contingency deployment time reduction program and preparatory actions to track with the evolution of the technology readiness program and to respond to a potential deployment decision after FY97.

Schedule: None.

Technical: None.

C. (U) OTHER PROGRAM FUNDING SUMMARY

Related RDT&E:	Funding Dependency? (Yes[1]/No)	
1151 Sensors (Active and Passive)	0603871C	No
1267 Ground-Based Interceptor (GBI)	0603871C	No
1460 Battle Management, Command, Control, and Communications (BMC3)	0603871C	No
3152 NMD Systems Engineering	0603871C	No

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RDT&E, Defensewide / BA 04 (Dem/Val)

PE: 0603871C (Proj: 3160)
PE Title: NMD Tech. (U)

3265 User Interface	0603871C	No
3359 System Test & Evaluation	0603871C	No

[1]Funding data for related RDT&E efforts that have a funding dependency can be found in the respective project summary/program element.

D. (U) Schedule Profile

	FY1994				FY1995				FY1996				FY1997			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Engineering Milestone									Xc					Xf	Xg	
T&E Milestone											Xd	Xd				
Contract Milestone									Xe							
Other Program Events						Xa/Xb				Xa/Xb				Xa/Xb		

Xa - Annual Industrial Base Assessment
Xb - Contingency Deployment Plan
Xc - GBI CDR
Xd - EKV Sensor Flights
Xe - EKV Downselect
Xf - NMD-RTD CDR
Xg - NMD-RTD BOD

Planned Milestones Beyond FY1997:
NMD Deployment planning milestones track the NMD Readiness Program milestones.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E Defensewide / BA 04 (Dem/Val)

PE: 0603871C (Proj: 3265)
PE Title: NMD Tech. (U)

Project Number / Title: 3265 User Interface

Program Name:	FY1994 Actual	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	FY2000 Estimate	FY2001 Estimate	Total Program
0603871C RDT&E	4,373	1,248	1,443	1,530	1,530	1,530	1,530	1,530	Continuing

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION:

(U) The National Missile Defense (NMD) Program's goal is to develop and maintain the option to deploy a cost-effective, operationally effective and ABM Treaty compliant system designed to protect the United States against limited ballistic missile threats, including accidental or unauthorized launches or third world attacks. The NMD system elements are the Ground-Based Interceptor (GBI); the Ground-Based Radar (GBR), the Space and Missile Tracking System (SMTS) (now executed as part of the USAF Space Based-Infrared System), and Battle Management, Command, Control and Communication (BM/C3).

(U) Development of an effective NMD program requires a close user interface to ensure user and developer consistency with respect to operational requirements, concepts of operation, and integration of multi-service systems. This project supports BMDO's NMD interface with the military operational community through integrated development of wargame simulations using NMD Models to evaluate operational requirements and concepts of operations. Analyses and simulations are performed to address system effectiveness of proposed NMD system architectures against near and far - term ballistic missile threats. Results support activities required for strategic gaming with CINCs to identify roles, missions, and requirements for NMD. Funds from this project are also provided to operational users for development and refinement of operational requirements and concepts of operation for employment of NMD. NMD wargames are the vehicle by which these concepts are integrated into the overall BMD system deployment strategy and planning. The approximately two-thirds funding reduction from FY94 to FY95 and the outyears, reflects the program's transition

from an acquisition to a technology readiness program and budget reductions. This project develops information critical to the successful accomplishment of several other NMD projects: 1267 (Exoatmospheric Kill Vehicle), 1151 (GBR), 1460 (BM/C3), 3152 (System Engineering), and 3160 (Deployment Planning).

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Mission Description and Budget Item Justification section of each Program Element Summary.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) In FY94 much effort was devoted to refining operational requirements and concept of operations documents. Support included wargaming, CINC/services requirements definition of operational evaluation of R&D activities, and mission analysis for BMD. Support was also provided to the Army's operational concept development planning for User Operational Evaluation Systems (UOES). FY95 through FY97 activities will focus on NMD wargames, requirements documentation, and user concepts of operations (CONOPS).

(U) FY1994 Accomplishments:
- o ($ 1.184M) Refined Operational Requirements Documents (ORDs).
- o ($ 1.297M) Developed operational concept(s) of operation (CONOPS).
- o ($ 0.532M) Conducted theater and strategic wargaming, including GLOBAL 94.
- o ($ 1.360M) Conducted mission analysis for BMD.

(U) FY1995 Plans:

- o ($ 0.326M) Coordinate and work with the multi-service users to refine ORDs and provide input to the NMD Maturity Matrix (NMM).
- o ($ 0.514M) Coordinate and work with the multi-service user to refine NMD CONOPS based on results of the Early Warning Radar (EWR) experiments.
- o ($ 0.408M) Conduct strategic wargaming, and mission analysis for NMD.

(U) FY1996 Plans:

- o ($0.377M) Continue to refine ORDs based on results of NMD threat assessment and mission analysis.
- o ($0.595M) Refine NMD CONOPS using simulations and progress of BM/C3 and SMTS programs.
- o ($0.471M) Conduct strategic wargaming and NMD mission analysis to support deployment readiness.

(U) FY1997 Plans:

- o ($0.400M) Continue work with the multi-service users to refine ORDs based on results of NMD threat assessment and NMD mission analysis
- o ($0.630M) Refine CONOPS for NMD based on radar HWIL simulations testing and flight testing.
- o ($0.500M) Conduct strategic wargaming and mission analysis for NMD to support NMD deployment readiness.

Acquisition Strategy: This is a planning and analysis project most of which will be accomplished in-house with some limited support from competitively awarded contracts with industry.

B. (U) PROGRAM CHANGE SUMMARY:

FY1994	FY1995	FY1996	FY1997	TOTAL COST

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RDT&E Defensewide / BA 04 (Dem/Val)

PE: 0603871C (Proj: 3265)
PE Title: NMD Tech. (U)

Previous President's Budget	4,373	1,530	1,530	1,530	8,963
Appropriated Value		1,530			1,530
Adjustments to Appropriated Value		-0,282			(282)
Current Budget Submit	4,373	1,248	1,443	1,530	8,594

Change Summary Explanation:
Funding: Funding was reduced for this task, consistent with the transition from an acquisition program to a technology readiness program.
Schedule: None.
Technical: In FY94 this project included theater efforts. In FY95 theater related user interface efforts are described in a separate project. This project includes user interfaces for an NMD contingency deployment only.

C. (U) OTHER PROGRAM FUNDING SUMMARY:

Related RDT&E:		Funding Dependency? (Yes[1]/No)
Project 1267, EKV	PE 0603871C	No
Project 1151, Sensors	PE 0603871C	No
Project 1460, BMC3	PE 0603871C	No
Project 3152, System Engineering	PE 0603871C	No
Project 3160, Deployment Planning	PE 0603871C	No

[1]Funding data for related RDT&E efforts that have a funding dependency can be found in the respective project summary/program element.

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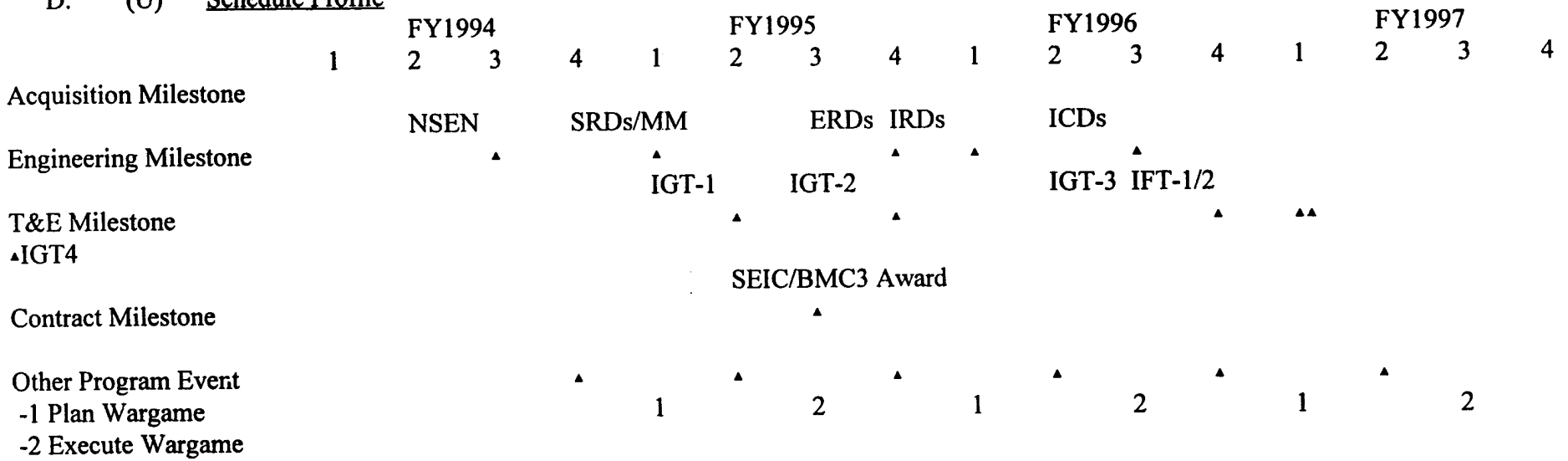
RDT&E Defensewide / BA 04 (Dem/Val)

PE: 0603871C (Proj: 3265)
PE Title: NMD Tech. (U)

D. (U) Schedule Profile



NSEN - Engineering Notebook
SRDs/MM - System Req't Documents/Maturity Matrix
ERDs - Element Req't Document
IRDs - Interface Req't Documents
ICDs - Interface Control Documents

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE: 0603871C (Proj: 3270)
PE Title: NMD Tech (U)

Project Number / Title: 3270 Threat and Countermeasures Program

Program Name:	FY1994 Actual	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	FY2000 Estimate	FY2001 Estimate	Total Program
0603871C RDT&E	0	0	8,272	8,312	1,663	1,663	1,663	1,663	Continuing

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION:

(U) Threat and Countermeasures Program. The BMDO National Missile Defense (NMD) Threat Program defines potential adversary military forces, principally theater strategic missiles: ICBMs and SLBMs which the Ballistic Missile Defense (BMD) system could confront. To accomplish this mission, BMDO has a threat development program which is based on Intelligence Community projections and is traceable to quantifiable analysis. The Program comprises three component task: Intelligence Threat, Countermeasures Integration, and System Threat Scenario Generation. This Project was previously funded under Project 3202, 3203, and 3206 in the FY95 President's Budget and is transitioning from Project 3270, PE0603173C.

(U) Intelligence Threat Task. The purpose of the Intelligence Threat task is to provide an Inteliigence Community-validated NMD threat description. The Intelligence Threat task divides the threat into four major categories: Operational Threat Environment, Targets, System Specific Threats (SST), and Reactive Threats. The Operational Threat Environment includes assessments of the ICBM and SLBM operational and technological environments and projects the effects of developments and trends on NMD mission capability. The Targets category includes a projection of foreign ICBM and SLBM threat systems and NMD countermeasures that enhance their performance. This includes force structure, performance characteristics, and sample signatures. System Specific Threat addresses threats to the NMD system including reconnaissance, surveillance, and target acquisition; lethal and non-lethal threats; and

regional integrated SST assessments. The Reactive threats are those that an adversary may develop as a result of deployment of a U.S. NMD system.

(U) System Threat Scenario Generation Task. The accurate specification and characterization of ballistic missiles and the appropriate development and integration of scenarios using these characterizations are critical to the analysis of alternative ballistic missile architectures, the performance assessments of potential technology applications, and the operational performance evaluations of candidate designs. This task provides baseline and excursion scenario descriptions in documentary and electronic form for use in NMD system and architecture analyses. These descriptions are the only approved threat employment portrayals authorized for acceptable BMDO analysis. This task:

(1) Identifies user needs for threat scenario descriptions.
(2) Identifies analyses needed to fully specify and characterize the threat missile systems, penetration aids, tactics, etc., and ensures the analyses is accomplished.
(3) Provides the analysis results to all interested agencies for review and comment.
(4) Addresses critical threat issues which arise during the analysis process.
(5) Ensures all supporting agencies' views on threat issues are fully aired.
(6) Reviews, approves, produces, and distributes all System Threat Scenario Descriptions.
(7) Produces threat computer electronic media and supporting documentation for use by the development and acquisition communities.

(U) Countermeasures Integration Task. The BMDO Countermeasure Integration (CMI) Program assists the NMD technology readiness program in developing technologies for national missile defense systems that are robust to potential countermeasures which are practical and within the means of anticipated adversaries. Included in this mission is CMI Program support to the NMD threat development process and advance warning to BMDO system designers. The BMDO CMI Program reviews NMD system concepts for

susceptibilities and identifies potential countermeasures, determines credibility through analyses and tests, characterizes credible NMD countermeasures by providing designs and performance parameters, informs intelligence and system threat developers of potential countermeasures, informs NMD system designers with advance warning of potential countermeasures, and assists NMD system designers in developing counter-countermeasures. Providing vulnerability and susceptibility information to the system designers early enables them to build robustness into their designs during the early stages of the system development process, a cost-effective means for providing a flexible high-performance design.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Mission Description and Budget Item Justification section of each Program Element Summary.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1994 Accomplishments:
Not applicable

(U) FY 1995 Plans:
Not applicable

(U) FY 1996 Plans:
- ($2.003M) Intelligence Threat task: Specialty Threats, Targets Analyses, Operational Threat Environment Intelligence Assessments.

- o ($1.715M) System Threat Scenario Generation task: Continue the development of threat system characterizations and scenario descriptions in response to the analysis needs of the NMD system/element developers, Upgrade the threat modeling capability and produce electronic media threat tapes and supporting documentation through the NTF, Develop scenarios depicting employed threat systems to support NMD analysis.
- o ($4.554M) Countermeasures Integration task: NMD CM Red/Blue activities and Counter-countermeasure Parametric Studies, NMD CM technical experiments and evaluations, CM Skunkworks teams conduct CM concept, design, fabrication, and flight tests, Non-technical analysis, oversight, and database management.

(U) FY 1997 Plans:

- o ($2.013M) Intelligence Threat task: Specialty Threats, Targets Analyses, Operational Threat Environment Intelligence Assessments.
- o ($1.723M) System Threat Scenario Generation task: Continue the development of threat system characterizations and scenario descriptions in response to the analysis needs of the NMD system/element developers, Upgrade the threat modeling capability and produce electronic media and supporting documentation through the NTF, Develop scenarios depicting employed threat systems to support NMD analysis.
- o ($4.576M) Countermeasures Integration task: NMD CM Red/Blue activities and Counter-countermeasure Parametric Studies, NMD CM technical experiments and evaluations, CM Skunkworks teams conduct CM concept, design, fabrication, and flight tests, Non-technical analysis, oversight, and database management.

Acquisition Strategy: The acquisition strategy for the Threat Program is to ensure continuity in the threat development and scenario generation process. Funding is provided to Executing Agents who accomplish tasks under existing contracts (via MIPRS, SETAs, and FFRDCs).

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE: 0603871C (Proj: 3270)
PE Title: NMD Tech (U)

B. (U) PROGRAM CHANGE SUMMARY:

	FY1994	FY1995	FY1996	FY1997	TOTAL COST
Previous President's Budget	0	0	0	0	0
Appropriated Value		0			0
Adjustments to Appropriated Value		0			0
Current Budget Submit	0	0	8,272	8,312	16,584

Change Summary Explanation:
Funding: This Project was Previously funded under Project 3202, 3203, and 3206 in the FY95 President's Budget. Funding for the CMI program is split between the TMD and the NMD Program Elements for a total of $18.303M.
Schedule: None.
Technical: None.

C. (U) OTHER PROGRAM FUNDING SUMMARY

Related RDT&E:	Funding Dependency? (Yes[1]/No)
1266 Sea-based Theater-wide Defense (Upper Tier) 0603868C	No
2154 TMD-GBR 0603861C	No
2257 PATRIOT 0208865C	No
2260 THAAD 0603861C/0604861C	No
2263 Sea-based Area TBMD (Lower Tier) 0603867C/0604867C	No

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE: 0603871C (Proj: 3270)
PE Title: NMD Tech (U)

3352 Modeling and Simulations 0603216C/0603217C	No
3270 Threat and Countermeasures 0603872C/0603173C	Yes

[1]Funding data for related RDT&E efforts that have a funding dependency can be found in the respective project summary/program element.

D. (U) Schedule Profile

	FY1994				FY1995				FY1996				FY1997			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
STAR Published								X								
CM Skunkworks																
Threat Scenario Generation (as required)																

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE:0603871C (Proj: 3352)
PE Title: NMD Tech (U)

Project Number / Title: 3352 Modeling and Simulations

Program Name:	FY1994 Actual	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	FY2000 Estimate	FY2001 Estimate	Total Program
0603871C RDT&E	78,017	19,000	15,779	26,834	15,855	15,855	15,855	15,855	Continuing

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION:

(U) The National Missile Defense (NMD) Program's goal is to develop and maintain the option to deploy a cost effective, operationally effective, Antiballistic Missile (ABM) Treaty compliant system designed to protect the United States against limited ballistic missile threats, including accidental or unauthorized launches and third world attacks. The NMD system elements are the Ground Based Interceptor (GBI), the Ground-Based Radar Technology Demonstator (NMD-RTD), the Space and Missile Tracking System (SMTS) (now executed as part of the USAF Space Based-Infrared System), and the Battle Management, Command, Control, and Communications (BM/C3).

(U) This project provides for the development of validated models and simulation techniques and tools that are critical in assessing the performance capabilities of BMD systems. This is a highly complex problem requiring high-performance vector and parallel processing super-computers as well as scalar processors and advanced graphic workstations. This cost effective approach will reduce high cost missile test programs and will establish requirements for future technology. This capability is housed at the National Test Facility (NTF), and the Advanced Research Center/Simulation Center (ARC/SC). These facilities are capable of operating in a distributed integrated simulation environment and hosts modeling and simulation wargames that provide the analysis, integration, demonstration, and performance verification capability for BMD systems. These facilities are provided to all Services and procedures have been established that ensure efficient utilization and sound verification, validation, and accreditation.

(U) The funding for these facilities is distributed across three Program Elements (PEs) in FY95 (NMD,TMD, and Support Technology), and two PEs in FY96 and beyond (NMD,TMD). This cost sharing approach maximizes synergy and minimizes duplication of modeling and simulation resources. These PEs cover the total costs for operations and maintenance of these facilities which includes: computer hardware and software, communications networks, security, and other essential capabilities necessary to develop and operate reconfigurable, multiple experiment test bed environments. This document describes the NMD portion of funding for these activities.

(U) This project's effort provides super-computing resources at the NTF and integration support including operations and maintenance of the facility, computer hardware and software, communication networks, security, and other essential capabilites that support Ballistic Missile Defense.

(U) The project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Mission Description and Budget Item Justification section of each Program Element Summary.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) This project has developed and maintained the modeling and simulation capabilities of the NTF and ARC/SC facilities. In FY94, NMD research and development efforts conducted at the NTF include: NMD/TMD wargame, the evaluation and demonstration of a BMC3 prototype simulation for system level performance, and scenario development and technical excursions for threat generation. In FY94, NMD research and development efforts conducted at the ARC/SC include: modifications and enhancements of the Ground Based Radar Test Bed, and continued simulation planning efforts to support GBI ground and flight software development.

In the future these facilities will continue to utilize and enhance current tools while developing new modeling and simulation tools and techniques, and maintaining and upgrading super-computing hardware to meet the evolving needs of the NMD program.

(U) FY 1994 Accomplishments:

- o ($65.150M) Provided super-computing resources at the NTF which were utilized to develop BMC3 simulations to maximize system level performance of NMD elements (GBI,GBR,SMTS). BMC3 capabilities and prototypes to integrate engagement planning, site level and CINC level operations were initiated. Systems Engineering studies to evaluate operational concepts and requirements for NMD ground and flight tests were also executed at the NTF.
- o ($12.000M) Provided super-computing resources at the ARC/SC to develop and operate a multiple experiment test bed environment for conducting research and development activities for the Army and Ground Based Elements.
- o ($0.867M) Provide the Navy personnel consistent with National Test Bed Joint Program Office (NTBJPO) manpower requirements.

(U) FY 1995 Plans:

- o ($13.100M) Provide super-computing resources at the NTF which will be utilized for BMC3 Integrated Ground Tests 1 and 2, and Systems Engineering studies to evaluate operational concepts and requirements for NMD ground and flight tests. Three wargames are planned using the Human-In-Control Test Bed (HICTB).
- o ($4.900M) Provided super-computing resources at the ARC/SC to develop and operate a multiple experiment test bed environment for conducting research and development activities for the Army and Ground Based Elements. Development of a Real-time Digital Simulator for NMD-RTD based upon a previously established TMD based model will begin this year.
- o ($1.000M) Provide the Navy civilian personnel consistent with NTBJPO manpower requirements.

(U) FY 1996 Plans:

- o ($9.931) Provide super-computing resources at the NTF which will be utilized for BMC3 Integrated Ground Test 3, Systems Engineering studies to evaluate operational concepts and requirements for NMD, and NMD Threat Scenario Generation by the Special Program Center (SPC). Four wargames are planned using the HICTB.
- o ($2.936M) Provide super-computing resources at the ARC/SC to develop and operate a multiple experiment test bed environment for conducting research and development activities for the Army and Ground Based Elements. NMD RTD hardware in the loop (HWIL) simulation will be developed and completed and available for Integrated Ground Test in the fourth quarter of this year.
- o ($2.663M) Provide NMD M&S oversight and support the independant verification and validation (IV&V), and head-to-head comparisons required for accreditation by the Services.
- o ($0.249M) Provide the Navy civilian personnel consistent with NTBJPO manpower requirements.

(U) FY 1997 Plans:

- o ($19.958M) Provide super-computing resources at the NTF which will be utilized for BMC3 studies to maximize system level performance of NMD elements (GBI,GBR,SMTS), Systems Engineering studies to evaluate operational concepts and requirements for NMD, and NMD Threat Scenario Generation by the SPC. Four wargames are planned using the HICTB.
- o ($3.426M) Provide NMD M&S oversight and support the independant verification and validation (IV&V), and head-to-head comparisons required for accreditation by the Services.
- o ($2.950M) Provide super-computing resources at the ARC/SC to develop and operate a multiple experiment test bed environment for conducting research and development activities for the Army and Ground Based Elements. NMD RTD software and hardware configuration items will be validated using the Real-time digital and HWIL simulators in preparation for integration into the RTD system.
- o ($0.500M) Provide the Navy civilian personnel consistent with NTBJPO manpower requirements.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE:0603871C (Proj: 3352)
PE Title: NMD Tech (U)

Acquisition Strategy: The tasks in this project have been met through full and open contractual competition to support NMD/TRP modeling and simulation requirements. Primary M&S support is performed at the National Test Facility, the Advanced Research Center/Simulation Center, and other testbed facilities. Overall BMDO M&S oversight is provided by BMDO/AQM. The operations and Maintenance (O&M) contractor at the NTF was previously Martin Marietta but a new O&M contract was awarded to Loral in 1QFY95. The ARC/SC O&M contract is a CPFF with COLSA first awarded in June of 1989.

B. (U) PROGRAM CHANGE SUMMARY:

	FY1994	FY1995	FY1996	FY1997	TOTAL COST
Previous President's Budget	78,000	19,000	19,000	19,000	135,000
Appropriated Value		19,000			19,000
Adjustments to Appropriated Value		0			0
Current Budget Submit	78,017	19,000	15,779	26,834	139,630

Change Summary Explanation:
Funding: This project was formerly a subset of project number 3300 in the FY95 President's Budget. Previous President's Budget values state total M&S funding amounts which are now reported in three separate PE's (under this project 3352) to reflect funding by TMD, NMD, and Technology follow-ons. This explains the large differences between previous and current appropriated values. A large reduction in budget occurred between FY94 and FY95 because NMD and TMD began to share costs at the NTF and ARC/SC which were previously fully funded by NMD in FY94. The large increase in FY97 costs at the NTF is a result of a one year change in the distribution of funding responsibilities at the NTF between NMD and TMD. A corresponding one year reduction will be reflected in the TMD M&S CDS. Funding levels at the NTF and ARC/SC have been reduced resulting in single shift operation at both facilities.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE:0603871C (Proj: 3352)
PE Title: NMD Tech (U)

Schedule: None.
Technical: None.

C. (U) OTHER PROGRAM FUNDING SUMMARY

Related RDT&E:	Funding Dependency? (Yes[1]/No)
1151, Sensors (Active & Passive)	PE 0603871C No
1267, Ground-Based Interceptor	PE 0603871C No
3270, Threat and Countermeasures	PE 0603871C No
3352, Modeling and Simulation	PE 0603173C Yes
3352, Modeling and Simulation	PE 0603873C Yes

[1]Funding data for related RDT&E efforts that have a funding dependency can be found in the respective project summary/program element.

D. (U) Schedule Profile

	FY1994				FY1995				FY1996				FY1997			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Engineering Milestone								A1								
T&E Milestones						B1		B2				B3				
Contract Milestone					C1											
Other Milestones					D1			D2								

A1 BMDO IVV&A Directive

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE:0603871C (Proj: 3352)
PE Title: NMD Tech (U)

B1 BMC3 Integrated Ground Test 1
B2 BMC3 Integrated Ground Test 2
B3 BMC3 Integrated Ground Test 3
C1 (NTF O&M and R&D Contract Awarded)
D1 NMD/TMD Game 95-A (CENTCOM)
D2 NMD/TMD Game 95-B (EUCOM)

Planned Milestones Beyond FY1997: None

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE: 0603871C (Proj: 3354)
PE Title: NMD Tech (U)

Project Number / Title: 3354 Target Support

Program Name:	FY1994 Actual	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	FY2000 Estimate	FY2001 Estimate	Total Program
0603871C RDT&E	40,893	0	0	0	0	0	0	0	Continuing

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION:

(U) The National Missile Defense (NMD) Program's goal is to develop and maintain the option to deploy a cost effective, operationally effective, Antiballistic Missile (ABM) Treaty compliant system designed to protect the United States against limited ballistic missile threats, including accidental or unauthorized launches or third world attacks. The NMD system elements are the Ground Based Interceptor (GBI), the Ground-Based Radar Technology Demonstrator (NMD-RTD), the Space and Missile Tracking System (SMTS) (now executed as part of the USAF Space Based-Infrared System), the Battle Management, Command, Control and Communications (BM/C3).

(U) Target and launch services are provided for the testing and evaluation of Ballistic Missile Defense (BMD) Technology Readiness Programs. As a part of the BMDO Consolidated Targets Program (CTP), this project provides threat-credible ballistic missile target system support to interceptor and sensor development and acquisition programs. The MSX and EKV programs require target system support to accomplish their planned test and evaluation. The MSX program intends to use the STARS target system launched from Barking Sands, Kauai; while the EKV program plans to use MMII equipped with the Multi-Service Launch System (MSLS), launched from Vandenberg AFB.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE: 0603871C (Proj: 3354)
PE Title: NMD Tech (U)

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Mission Description and Budget Item Justification section of each Program Element Summary.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

Accomplishments for FY94 include the completion of the STARS II with a demonstration launch in the 3QFY94 and continuation of the construction of targets to support the MSX and EKV projects.

(U) FY 1994 Accomplishments:
- o ($13,000M) Completed development, demonstration, and testing of the Strategic Target System II (STARS II)
- o ($9,893M) Continued target build for MSX and EKV. These targets consisted of reentry vehicles and penetration aids/decoys.
- o ($18,000M) Supported BMD targets infrastructure to include refurbishment of retired missile systems to be provided as GFE to construct target systems.

(U) FY 1995 Plans:
- o Starting in FY95 and beyond funding for targets are included in the appropriate NMD Technology Readiness projects.

(U) FY 1996 Plans: None

(U) FY 1997 Plans: None

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE: 0603871C (Proj: 3354)
PE Title: NMD Tech (U)

Acquisition Strategy: US Army SSDC is BMDO Executing Agent. Sandia National Laboratory developed the STARS system and also provides for launch support at Barking Sands. The Air Force is responsible for the development and launch activities of the MMII/MSLS from Vandenberg AFB.

B. (U) PROGRAM CHANGE SUMMARY:

	FY1994	FY1995	FY1996	FY1997	TOTAL COST
Previous President's Budget	38,035	4,000	10,000	10,000	62,035
Appropriated Value		0			0
Adjustments to Appropriated Value		0			0
Current Budget Submit	40,893	0	0	0	40,893

Change Summary Explanation:
Funding: Starting in FY95 and beyond funding for targets are included in the appropriate NMD Technology Readiness projects. No impact to the Targets Program.
Schedule: None
Technical: None.

C. (U) OTHER PROGRAM FUNDING SUMMARY

Related RDT&E:	Funding Dependency? (Yes[1]/No)
1267, Ground Based Interceptor, 0603871C	Yes

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE: 0603871C (Proj: 3354)
PE Title: NMD Tech (U)

3157, Environmental, Siting & Fac, 0603871C	No
3359, System Test and Evaluation, 0603871C	No
3360, Test Resources, 0603871C	No

[1]Funding data for related RDT&E efforts that have a funding dependency can be found in the respective project summary/program element.

D. (U) Schedule Profile

	FY1994				FY1995				FY1996				FY1997			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Engineering Milestone			IOC (STARSII)						X (MSLS)							
T&E Milestone																
Contract Milestone																

Planned Milestones Beyond FY1997: NONE

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE: 0603871C (Proj: 3359)
PE Title: NMD Tech (U)

Project Number / Title: 3359 System Test & Evaluation

Program Name:	FY1994 Actual	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	FY2000 Estimate	FY2001 Estimate	Total Program
0603871C RDT&E	14,878	14,100	17,904	18,382	18,382	18,382	18,382	18,382	Continuing

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION:

(U) The National Missile Defense (NMD) Program's goal is to develop and maintain the option to deploy a cost effective, operationally effective, Antiballistic Missile (ABM) Treaty compliant system designed to protect the United States against limited ballistic missile threats, including accidental or unauthorized launches or third world attacks. The NMD system elements are the Ground Based Interceptor (GBI), the Ground-Based Radar Technology Demonstrator (NMD-RTD, the Space and Missile Tracking System (SMTS) (now executed as part of the USAF Space Based-Infrared System), and Battle Management, Command, Control and Communications (BM/C3).

(U) This effort provides for Test Readiness Program (TRP) planning oversight and coordination of integrated Test and Evaluation activities and inter-element, as well as inter-service Test and Evaluation efforts. Provides Independent Evaluation of systems technology programs and special reviews. This effort provides funding for the TRP Test and Evaluation Summary (TES) which outlines testing for the NMD TRP. It also provides funding for the Integrated System Test (ISTC) Development. This tool provides NMD system level Hardware-in-the-Loop (HWIL) testing. Another objective of this program is the execution of independent technical reviews, system analyses and performance evaluations which contribute to the development of the BMD family of systems and to the successful achievement of acquisition milestones. The performance evaluation has as its primary goals the identification and

understanding of system-level performance drivers and the mitigation of technical risk. Efforts include short-term special studies, focused technical investigations, and participation in test readiness reviews intending to ensure successful tests and experiments.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Mission Description and Budget Item Justification section of each Program Element Summary.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) This project and predecessor projects have been responsible for the establishment of NMD test plans and ISTC POP and ISTC/CTD demonstrations. This development represents the principal NMD test tool.

(U) FY 1994 Accomplishments:

- o ($11,005M) Completed global environment and merge BMD BMC3 with ISTC global environment. Developed NMD Test and Evaluation Summary
- o ($1,457M) Developed independent evaluation methodology. Conducted independent readiness review of the MSX spacecraft.
- o ($1,458M) Provided T&E Technical Support. Reviewed, analyzed, and critiqued T&E Cost Analysis Requirements Document (CARD). Researched and analyzed BMD T&E projects for nomination and award as OSD sponsored Reliance Investment Projects. Researched, analyzed, and proposed options for consolidating BMDO Data Centers.
- o ($0,958M) Final reports on sub-launched lethality efforts.

(U) FY 1995 Plans:

- o ($12,000M) Develop and integrate initial EKV models into ISTC framework. Conduct EKV/BMC3 integrated ground test. (Integrated Ground Test - 1 and IGT-2). Update ISTC global environment.
- o ($1,050M) Execute independent evaluation methodology and process. Conduct special studies on EKV Targets and Sensor Test Bed. Monitor technology maturation for possible incorporation into current acquisition programs.
- o ($1,050M) Provide T&E technical support. Review, analyze, and critique the BMDO/NMD T&E program. Research, analyze, and document NMD T&E issues and findings for the T&E Working Group and the T&E Steering Group.

(U) FY 1996 Plans:

- o ($14,180M) Integrate GBR testbed with ISTC. Conduct an integrated ground test with Battalion BMC3 and EKV interoperable representations. Conduct integrated sensor/EKV ground tests.
- o ($1,862M) Execute independent evaluation methodology and process. Conduct ad hoc special studies and analyses. Monitor technology maturation for possible incorporation into current Acquisition programs.
- o ($1,862M) Provide T&E technical support. Review, analyze, and critique the BMDO/NMD program. Research, analyze, and document NMD T&E issues and findings for the T&E Working Group and the T&E Steering Group.

(U) FY 1997 Plans:

- o ($15.000M) Interface ISTC with BMC3 Block 1 Develop "Mid-Term" T&E documentation. (EKV Radar and RKV-2) Conduct integrated tests (Integrated Flight Test-1 and IFT-2,) IGT-4)
- o ($1,691M) Execute independent evaluation methodology and process. Conduct ad hoc special studies and analyses. Monitor technology maturation for possible incorporation into current Acquisition programs.
- o ($1,691M) Provide T&E technical support. Review, analyze, and critique the BMDO/NMD T&E program. Research, analyze, and document NMD T&E issues and findings for the T&E Working Group and the T&E Steering Group.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE: 0603871C (Proj: 3359)
PE Title: NMD Tech (U)

Acquisition Strategy: This effort will utilize Service executing agents to construct a NMD system level HWIL capability (ISTC) and execute live flight tests used to validate the ISTC performance. The effort provides for BMDO to develop test plans (TES) to effectively test the NMD TRP. BMDO will also develop the HWIL ISTC specification to meet HWIL requirements necessary to execute tests defined in the TES. It also provides Service and system evaluation funding. Technical survey of all BMDO programs will be performed on an on-going basis in order to create and maintain the foundation of technical knowledge necessary to execute the independent evaluation process. Special studies and technical investigations will be conducted in response to emerging issues and concerns on an ad hoc basis. Performance evaluation is an on-going effort. In order to ensure an early estimate and timely updates, the processes will be executed on an iterative basis, with initial assessments expected to identify needed refinements in information or in the evaluation methodology. Subsequent iterations are expected to result in refined performance estimates and increased confidence in those estimates.

B. (U) PROGRAM CHANGE SUMMARY:

	FY1994	FY1995	FY1996	FY1997	TOTAL COST
Previous President's Budget	15,673	17,100	17,100	18,100	67,973
Appropriated Value		14,100			14,100
Adjustments to Appropriated Value		0			0
Current Budget Submit	14,878	14,100	17,904	18,382	65,264

Change Summary Explanation:
Funding: System Test and Evaluation Activities, project 3359, were included in projects 1502 and 3300 in the FY95 President's Budget.
Schedule: none
Technical: none

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE: 0603871C (Proj: 3359)
PE Title: NMD Tech (U)

C. (U) OTHER PROGRAM FUNDING SUMMARY

Related RDT&E:	Funding Dependency? (Yes[1]/No)
1267, Ground Based Interceptor, 0603871C	No
1460, BMC3, 0603871C	No
1151, Sensors, 0603871C	No
3157, Environmental, Siting & Env, 0603871C	No
3354, Targets, 0603871C	No
3360, Test Resources, 0603871C	No

[1]Funding data for related RDT&E efforts that have a funding dependency can be found in the respective project summary/program element.

D. (U) Schedule Profile

	FY1994				FY1995				FY1996				FY1997			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Acquisition Milestone																
Engineering Milestone (Build)						X[a]					X[b]			X[c]		
T&E Milestone (Tests)						X[d]		X[e]				X[f]	X[g]/X[h]			X[i]
Contract Milestone																
Other Program Events								X[j]				X[k]	X[l]			

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE: 0603871C (Proj: 3359)
PE Title: NMD Tech (U)

X^a - ISTC/CTD
X^b - ISTC/EKV
X^c - EKV Radar
X^d - IGT-1
X^e - IGT-2
X^f - IGT-3
X^g - IFT-1
X^h - IFT-2
X^i - IGT-4
X^j - TES
X^k - EKV Brassboard Seeker
X^l - EKV-1

Planned Milestones Beyond FY1997: Support NMD System Test depicted in NMD program R-2.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE: 0603871C (Proj: 3360)
PE Title: NMD Tech (U)

Project Number / Title: 3360 Test Resources

Program Name:	FY1994 Actual	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	FY2000 Estimate	FY2001 Estimate	Total Program
0603871C RDT&E	24,229	11,558	11,411	11,951	12,025	12,025	12,200	12,200	Continuing

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION:

(U) The National Missile Defense (NMD) Program's goal is to develop and maintain the option to deploy a cost effective, operationally effective, Antiballistic Missile (ABM) Treaty compliant system designed to protect the United States against limited ballistic missile threats, including accidental or unauthorized launches or third world attacks. The NMD system elements are the Ground Based Interceptor (GBI), the Ground-Based Radar Technology Demonstrator (NMD-RTD), the Space and Missile Tracking System (SMTS) (now executed as part of the USAF Space Based-Infrared System), and Battle Management, Command, Control and Communications (BM/C^3).

An essential part of achieving this goal is validation of developed system capability through integrated realistic system test and evaluation which reduces overall risk and increases confidence. This project provides for BMDO planning oversight and coordination of integrated Test and Evaluation activities and inter-element, as well as inter-service Test and Evaluation efforts and provides for test infrastructure for common ground test facilities, common range facilities and range instrumentation. The common ground test facilities include: the Kinetic Kill Vehicle Hardware-in-the-Loop Simulator (KHILS) at Eglin AFB, Fort Walton Beach, FL; the Hypervelocity Wind Tunnel Number 9 (Tunnel 9) at the Naval Surface Warfare Center, White Oak, MD; the National Hover Test Facility (NHTF) at Edwards AFB, CA; the Kinetic Energy Weapon Digital Emulation Center (KDEC) at U.S.Army Space and Strategic Defense Command, Huntsville, AL; the Aero-optical Evaluation Center (AOEC) located at Calspan Corp., Buffalo, NY; the

Center for Research Support (CERES) located at Falcon AFB, Colorado Springs, CO; the Army Missile Optical Range (AMOR) at the U.S. Army Missile Command, Huntsville, AL; the Portable Optical Sensor Tester (POST) and the Characterization of Low Background Mosaics (CALM) at Rockwell International, Anaheim, CA; the Naval Research and Development (NRD) facility located at the Naval Command, Control and Ocean Surveillance Center, San Diego, CA; and the infra-red and blackbody standards at the National Institute of Standards and Technology (NIST) in Gaithersburg, MD. The common range facilities include national ranges such as: the Kwajalein Missile Range (KMR) located in the Marshall Islands; the Eastern Test Range (ETR) located at Patrick AFB, Cape Canaveral, FL; and the Western Test Range (WTR) at Vandenberg AFB, Lompoc, CA. The range instrumentation includes special test equipment, data collection assets, and range instrumentation upgrades including: the High Altitude Observatory (HALO) with the Infrared Imaging System (IRIS) sensor, based at Aeromet, Inc., Tulsa, OK; and the Rapid Optical Beam Steering (ROBS) system, based at White Sands Missile Range, Las Cruces, NM. These ground test, range and instrumentation assets provide valuable program risk reduction and test implementation capability in support of the National Missile Defense Technology Readiness test and evaluation program. The ground test facilities provide a cost effective method of testing and evaluating applicable component, sub-system and system level technologies. The common range facilities provide a cost effective method of flight testing missile and target components applicable to the NMD program. The range instrumentation provides a cost effective capability to collect target signature characteristics, phenomenology data, and target/interceptor diagnostics on flight tests. These facilities and capabilities support systems design, verification and validation of target realism, and the evaluation of test results. This project was a portion of Project 3300 in the FY95 President's budget and will be transitioned to Project 3360 (P.E. 0603871) and 3360 (P.E. 0603872) starting in FY96.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Mission Description and Budget Item Justification section of each Program Element Summary.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE: 0603871C (Proj: 3360)
PE Title: NMD Tech (U)

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1994 Accomplishments:

- ($ 11.534M) Provided ground test facility infrastructure and upgrades for BMDO testing including: digital emulation at KDEC, hardware-in-the-loop testing at KHILS, wind tunnel testing at Tunnel 9, shock-tunnel testing at the AOEC, hover test capability at the NHTF. Initial operating capability (IOC) of the full flight duplication capability at Tunnel 9. Limited command and control capability at the CERES. Design and planning of the Wide-Band IR Scene Projector (WISP) at the KHILS facility.
- ($ 3.650M) Provided test range infrastructure, upgrades, and environmental documentation for BMDO testing including development of NMD and Technology Readiness range facilities, and associated range instrumentation sites.
- ($ 9.045M) Provided range instrumentation, upgrades, data collection, and analyses for BMDO testing including: deployment of Rapid Optical Beam Steering (ROBS) system, and data collecting and processing by the High Altitude Observatory (HALO) with the Infrared Imaging System (IRIS) sensor.

(U) FY 1995 Plans:

- ($ 6.600M) Provide ground test facility infrastructure and upgrades for BMDO testing including: digital emulation at KDEC, hardware-in-the-loop testing at KHILS, wind tunnel testing at Tunnel 9, shock-tunnel testing at AOEC, hover test capability at NHTF, command/control technology experiments from CERES, sensor testing at POST, CALM and NRD, and phenomenology characterization at AMOR and KHILS. Completion of the full flight duplication capability at Tunnel 9, and full command and control capability at CERES. IOC of the WISP at KHILS and IOC of AOEC.
- ($ 2.250M) Provide test range infrastructure, upgrades, and environmental documentation for BMDO testing including development of NMD and Technology Readiness range facilities, and associated range instrumentation sites.

- ($ 4.708M) Provide range instrumentation, upgrades, data collection, and analyses for BMDO testing including: IOC of the Rapid Optical Beam Steering (ROBS) system, and data collecting and processing by the High Altitude Observatory (HALO) with the Infrared Imaging System (IRIS) sensor.

(U) FY 1996 Plans:

- ($ 5.067M) Provide ground test facility infrastructure and upgrades for BMDO testing including: digital emulation at KDEC, hardware-in-the-loop testing at KHILS, wind tunnel testing at Tunnel 9, shock-tunnel testing at AOEC, hover test capability at NHTF, command/control technology experiments from CERES, sensor testing at POST, CALM and NRD, phenomenology characterization at AMOR and KHILS, and primary infra-red standards at the NIST. Completion of the WISP at KHILS and completion of AOEC.
- ($ 2.985M) Provide test range infrastructure, upgrades, and environmental documentation for BMDO testing including development of NMD and Technology Readiness range facilities, and associated range instrumentation sites.
- ($ 3.359M) Provide range instrumentation, upgrades, data collection, and analyses for BMDO testing including: the Rapid Optical Beam Steering (ROBS) system, and data collecting and processing by the High Altitude Observatory (HALO) with the Infrared Imaging System (IRIS) sensor.

(U) FY 1997 Plans:

- ($ 5.650M) Provide ground test facility infrastructure and upgrades for BMDO testing including: digital emulation at KDEC, hardware-in-the-loop testing at KHILS, wind tunnel testing at Tunnel 9, shock-tunnel testing at AOEC, hover test capability at NHTF, command/control technology experiments from CERES, sensor testing at POST, CALM and NRD, phenomenology characterization at AMOR and KHILS, and primary infra-red standards at the NIST.
- ($ 3.000M) Provide test range infrastructure, upgrades, and environmental documentation for BMDO testing including development of NMD and Technology Readiness range facilities, and associated range instrumentation sites.

- ($ 3.301M) Provide range instrumentation, upgrades, data collection, and analyses for BMDO testing including: the Rapid Optical Beam Steering (ROBS) system, and data collecting and processing by the High Altitude Observatory (HALO) with the Infrared Imaging System (IRIS) sensor.

Acquisition Strategy: In the selection and acquisition of ranges and test facilities the BMDO implements a Reliance process which a) maintains perspective of national technical test capabilities; b) is responsive to program requirements; c) uses existing test resources where possible; d) requires coordination prior to development of new resources; and e) consolidates management of existing resources where possible and practicable. This policy results in a variety of acquisition methods. Executing Agent Project Managers for the elements and tasks under this project include the three services and the BMDO, to take best advantage of existing strengths and capabilities. Service Project Manager organizations specifically include : the U.S. Army Space and Strategic Defense Command (USASSDC), the U.S. Navy Office of Naval Research, Navy Ballistic Missile Defense Technology and the U.S. Air Force Phillips Laboratory. The majority of the ground test facilities are government owned and operated, many with some degree of contractor support, which support multiple BMDO users. The ranges on this project supporting NMD are part of the DoD Major Range and Test Facility Base (MRTFB) (KMR, ETR, and WTR). The HALO and the IRIS sensor are operated by competitively awarded contracts. The ROBS laser radar was developed by a contractor who is providing continuing technical support through the initial check-out and operation.

B. (U) PROGRAM CHANGE SUMMARY:

	FY1994	FY1995	FY1996	FY1997	TOTAL COST
Previous President's Budget	26,234	14,697	14,478	14,478	69,887
Appropriated Value		14,697			14,697

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE: 0603871C (Proj: 3360)
PE Title: NMD Tech (U)

Adjustments to Appropriated Value		-3,139			(3,139)
Current Budget Submit	24,229	11,558	11,411	11,951	59,149

Change Summary Explanation:

Funding: Project 3360 has combined all of the projects which have previously been designated 3310, 3311, and 3313. The FY95 RDT&E Descriptive Summary of these previous projects were combined in CDS 3300 with other test and evaluation support projects.

Schedule:

Technical:

C. (U) OTHER PROGRAM FUNDING SUMMARY

Related RDT&E:	Funding Dependency? (Yes[1]/No)
1151, Sensors, 0603871C	No
1155, Phenomenology Program, 0603871C	No
1161, Advanced Sensor Technology, 0603173C	No
1265, Boost Phase Interceptor, 0603870C	No
1267, Ground Base Interceptor, 0603871C	No
1270, Advanced Interceptors, 0603173C	No
1360, Directed Energy, 0603173C	No
1651, Innovative Science and Technology, 0602173C	No
2358, HAWK System BMC3, 0603863C	No
3157, Environmental, Siting & Fac, 0603871C	No

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE: 0603871C (Proj: 3360)
PE Title: NMD Tech (U)

3354, Targets, 0603871C	No
3359, System Test and Evaluation, 0603871C	No
3360, Test Resources, 0603872C, 0603173C	Yes

[1]Funding data for related RDT&E efforts that have a funding dependency can be found in the respective project summary/program element.

D. (U) Schedule Profile

Milestones	FY1994				FY1995				FY1996				FY1997			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
KHILS WISP IOC								X								
KHILS WISP FOC													X			
KHILS Support EKV											X	----------	----------	X		
Tunnel 9 Full Flight Dup IOC					X											
Tunnel 9 Phenomenology Support					X											
Tunnel 9 AIT Support								X	----------	X						
AOEC IOC							X									
AOEC FOC													X			
AOEC AIT Support						X	----------	----------	----------	----------	----------	X				
CERES IOC				X												

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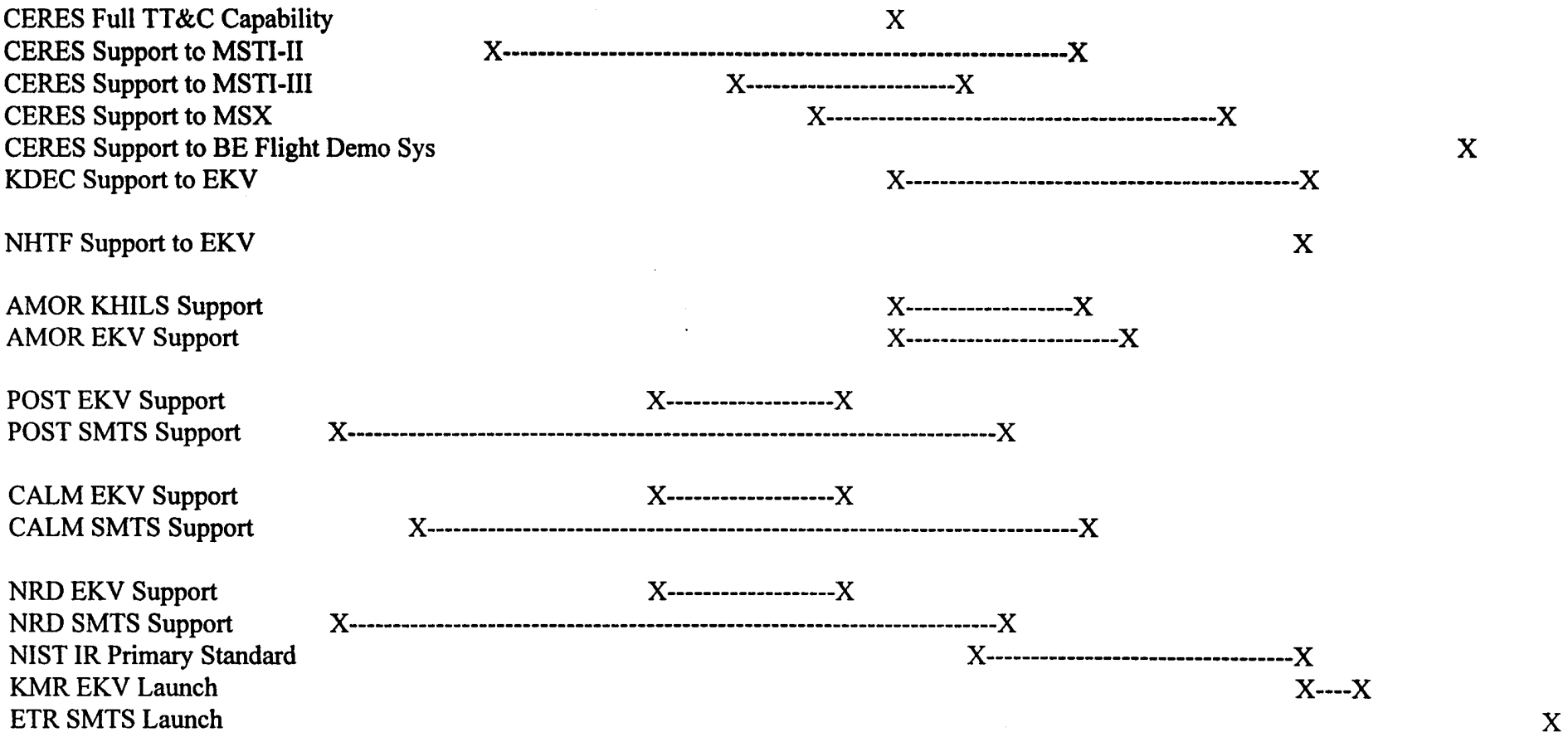
RDT&E, Defensewide / BA 04 (Dem/Val)

PE: 0603871C (Proj: 3360)
PE Title: NMD Tech (U)



RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE: 0603871C (Proj: 3360)
PE Title: NMD Tech (U)

Milestones	FY1994				FY1995				FY1996				FY1997			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
WTR MSTI-II Launch			X													
WTR MSTI-III Launch							X									
WTR MSX Launch							X									
HALO/IRIS MSX Target Phenom							X									
HALO/IRIS EKV Launch										X	----	X				
HALO/IRIS Red Tigress Phenom										X						
ROBS Initial Deployment		X														
ROBS Test and Checkout	X	---------	X													
ROBS IOC						X										
ROBS FOC								X								
ROBS Sensor Test Bed														X		

Planned Milestones Beyond FY1997: Continued BMDO required range resources upgrades.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE:0603871C (Proj: 4154)
PE Title: NMD Tech (U)

Project Number / Title: 4154 Operations Fluctuation Account

Program Name:	FY1994 Actual	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	FY2000 Estimate	FY2001 Estimate	Total Program
0603871C RDT&E	13,154	3,330	0	0	0	0	0	0	Continuing

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION:

(U) This project provides funding to meet operational, contractual, and statutory fiscal requirements. Operational requirements include reimbursable services acquired through the Defense Business Operating Fund (DBOF), such as accounting services provided by the Defense Finance and Accounting Service (DFAS). Contractual requirements include reserves for special termination costs on designated contracts and provisions for terminating other programs as required. BMDO has additional requirements to provide for foreign currency fluctuations on its limited number of foreign contracts. Statutory requirements also require funding for charges to cancelled appropriations in accordance with Public Law 101-510. This project also provides the capability for maintaining the funding for new initiatives or execution facts of life changes that are not specifically know at this time.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Mission Description and Budget Item Justification section of each Program Element Summary.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1994 Accomplishments:

- o Funding is used on as needed basis.
- o Funding for this project has enabled and will enable BMDO and BMDO's executing agents to centralize funding for these types of activities where they can relate to various different technology programs. This optimizes their value across the entire range of BMDO projects and allows for management of these costs centrally. This strategy of centralized management will continue to occur throughout this program.

(U) FY 1995 Plans:

- o Funding is used on as needed basis.
- o Funding for this project has enabled and will enable BMDO and BMDO's executing agents to centralize funding for these types of activities where they can relate to various different technology programs. This optimizes their value across the entire range of BMDO projects and allows for management of these costs centrally. This strategy of centralized management will continue to occur throughout this program.

(U) FY 1996 Plans:

- o Funding is used on as needed basis.
- o Funding for this project has enabled and will enable BMDO and BMDO's executing agents to centralize funding for these types of activities where they can relate to various different technology programs. This optimizes their value across the entire range of BMDO projects and allows for management of these costs centrally. This strategy of centralized management will continue to occur throughout this program.

(U) FY 1997 Plans:

- o Funding is used on as needed basis.
- o Funding for this project has enabled and will enable BMDO and BMDO's executing agents to centralize funding for these

types of activities where they can relate to various different technology programs. This optimizes their value across the entire range of BMDO projects and allows for management of these costs centrally. This strategy of centralized management will continue to occur throughout this program.

Acquisition Strategy: This project is centrally funded within the management account starting in FY95.

B. (U) PROGRAM CHANGE SUMMARY:

	FY1994	FY1995	FY1996	FY1997	TOTAL COST
Previous President's Budget	28,545	0	462	462	29,469
Appropriated Value		0			0
Adjustments to Appropriated Value		3,330			3,330
Current Budget Submit	13,154	3,330	0	0	16,484

Change Summary Explanation:
Funding: Changes reflect activity since January 1994 FY95 President's Budget
Schedule: None
Technical: None

C. (U) OTHER PROGRAM FUNDING SUMMARY
All BMDO projects in this PE receive support from this project.

D. (U) Schedule Profile Not Applicable

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Demonstration/Validation)

Program Element Number: 0603872C
PE Title: Other Theater Missile Defense (U)

Project Number and Title:	FY1994 Actual	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	FY2000 Estimate	FY2001 Estimate	Total Program
1155 Phenomenology Program	2,861	40,348	44,011	52,777	60,684	59,661	58,855	59,065	Continuing
1161 Advanced Sensor Technology	3,024	2,739	3,782	3,800	3,694	3,586	3,607	3,586	Continuing
1170 TMD Risk Reduction	14,295	25,550	46,458	40,000	40,831	28,590	28,715	28,826	Continuing
1293 Advance Capability 2/3 Concept Design	0	0	0	0	35,494	37,937	23,669	23,857	Continuing
2160 TMD Existing System Modifications	20,004	15,701	26,869	25,000	14,583	14,537	0	0	Completed
2259 ACES / ADP	64,771	48,068	56,558	44,200	47,539	51,849	52,075	52,277	Continuing
2294 Advanced Capabilities -- Acquisition	0	0	0	0	99,649	93,551	480,632	640,615	Continuing
3153 Arch, Analysis / BMC3 Initiatives	0	4,820	9,330	9,375	9,114	9,086	9,125	9,161	Continuing
3157 Environmental, Siting, & Facilities	0	0	4,036	4,054	4,097	4,084	4,108	4,123	Continuing
3160 Readiness Planning	0	1,146	1,951	1,960	1,906	1,900	1,908	1,915	Continuing
3251 Systems Engineering and Technical Support	33,372	53,207	47,836	56,926	66,714	59,375	67,991	70,276	Continuing
3265 User Interface	10,574	12,603	16,843	16,926	11,594	11,558	16,608	16,653	Continuing
3270 Threat and Countermeasures Program	0	0	24,810	24,931	31,580	31,580	31,580	31,580	Continuing
3352 Modeling & Simulations	31,475	64,801	70,521	57,486	61,990	59,181	60,023	60,257	Continuing
3354 Targets Support	43,051	64,042	26,091	29,900	40,637	20,704	47,695	47,880	Continuing
3359 System Test & Evaluation	34,042	27,758	47,137	46,720	48,056	29,667	29,896	30,978	Continuing
3360 Test Resources	14,919	25,585	34,237	35,853	34,937	34,808	35,494	35,651	Continuing
PE TOTAL	272,388	386,368	460,470	449,908	613,099	551,654	951,981	1,116,700	

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION:

Theater Missile Defense programs, projects, and activities in Advanced Development that have as a primary objective the development of technologies capable of supporting systems, components, and architectures that could produce highly effective defenses against theater missile threats. Includes manpower authorizations and the associated costs specifically identified and measured to the performance of these programs.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Demonstration/Validation)

Program Element Number: 0603872C
PE Title: Other Theater Missile Defense (U)

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:
(U) FY 1994 Accomplishments: See individual R-2 project summaries.
(U) FY 1995 Plans: See individual R-2 project summaries.
(U) FY 1996 Plans: See individual R-2 project summaries.
(U) FY 1997 Plans: See individual R-2 project summaries.

Acquisition Strategy: See individual R-2 project summaries.

B. (U) Program Change Summary:

	FY1994	FY1995	FY1996	FY1997	TOTAL COST
Previous President's Budget	268,657	438,681	447,392	444,100	1,598,830
Appropriated Value		381,931			381,931
Adjustments to Appropriated Value		4,437			4,437
Current Budget Submit	272,388	386,368	460,470	449,908	1,569,134

Change Summary Explanation:

Funding: See individual R-2 project summaries.
Schedule: See individual R-2 project summaries.
Technical: See individual R-2 project summaries.

C. (U) Other Program Funding Summary

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Demonstration/Validation)

Program Element Number: 0603872C
PE Title: Other Theater Missile Defense (U)

Related RDT&E:	FY1994 Actual	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	FY2000 Estimate	FY2001 Estimate
0602173C SPT TECH EXP DEV	70,160	84,005	93,308	105,313	105,003	100,397	95,568	93,669
0603173C SPT TECH ATD	252,862	134,402	79,387	87,823	57,823	57,823	66,323	66,323
0603861C THAAD SYSTEM DEM/VAL	710,093	651,901	576,327	72,188	0	0	0	0
0603863C HAWK DEM/VAL	29,629	26,800	23,188	0	0	0	0	0
0603864C TMD-BMC3 DEM/VAL	12,617	20,009	24,231	24,425	25,237	20,751	22,193	22,278
0603865C PAC3 DEM/VAL	77,584	0	0	0	0	0	0	0
0603867C NAVY L/T DEM/VAL	150,446	139,676	0	0	0	0	0	0
0603868C NAVY U/T DEM/VAL	81,000	68,450	30,442	33,400	0	0	0	0
0603869C CORPS SAM DEM/VAL	16,270	14,971	30,442	33,400	0	0	0	0
0603870C BPI DEM/VAL	37,022	40,000	49,061	44,300	66,300	72,300	0	0
0603871C NMD DEM/VAL	549,973	386,988	370,621	399,038	399,341	399,318	399,472	399,472
0604861C THAAD SYSTEM EMD	0	0	0	664,000	838,000	619,100	212,000	86,000
0604864C TMD-BMC3 EMD	0	534	14,301	17,976	25,977	20,861	29,201	29,314
0604865C PAC3 EMD	42,097	276,283	247,921	160,070	65,005	775	487	98
0604866C PAC3 RISK EMD	97,000	74,000	19,485	9,760	0	0	0	0
0604867C NAVY L/T EMD	0	0	237,473	193,600	142,680	151,428	115,482	50,323
0605218C MGMT	205,948	163,206	185,542	188,418	224,742	219,543	230,014	223,971

D. (U) Schedule Profile
See individual R-2 project summaries.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE:0603872C (Proj: 1155)
PE Title: Other TMD (U)

Project Number / Title: 1155 Phenomenology Program

Program Name:	FY1994 Actual	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	FY2000 Estimate	FY2001 Estimate	Total Program
0603872C RDT&E	2,861	40,348	44,011	52,777	60,684	59,661	58,855	59,065	Continuing

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION:

(U) This project provides direction (in response to Theater Missile Defense (TMD's) radar and electro-optical signature needs) and associated sensor costs for the Cobra Judy and Airborne Surveillance Testbed (AST) data collection platforms. This project funds the operating costs of the Cobra Judy radar platform and the core operating costs of the AST optical data collection platform. The mission signature requirements are provided either directly by various projects or through the Target Signature Working Group (TSWG). This project manages the facilities (data centers) that are needed to store and make available the critical data to the TMD user community. This project provides for radar and optical algorithm and model development to aid in the rapid distinction of incoming missile targets from natural and clutter backgrounds and/or penaids.

(U) Activities under this project include the tasking and direction for the collection of radar and optical data on TMD missile targets and intercept events to satisfy the needs and requirements levied through the TSWG (Project 1170) and by the various project offices. Discrimination algorithms that are specific to TMD applications are developed and evaluated. The Lexington Discrimination System (LDS) is used to evaluate discrimination algorithm performance and serve as a test bed for development of discrimination architectures. Storage, archiving and retrieval of data takes place in the BMDO-funded Background, Plume, and Missile Defense data centers.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE:0603872C (Proj: 1155)
PE Title: Other TMD (U)

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Brief Description of Element section of each Program Element Summary.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) The continuing mission of this project is to manage the data collection assets (Airborne Surveillance Testbed (AST), Cobra Judy and Cobra Eye); to collect, store, retrieve, and distribute critical data to BMDO users; and to apply resulting phenomenological data to develop and validate discrimination algorithms and architectures, and plume/background models, that directly support TMD systems development. This project identifies gaps in the database and recommends specific data collection events. This project monitors other BMDO data collection programs.

(U) FY 1994 Accomplishments:

- o ($2.861M) Data Centers and Management. Missile Defense Data Center processed a total of 500 requests from THAAD/GBR and other TMD programs for missile hardbody and signature data. More than 250 gigabytes of signature data distributed, and more than 1,000 gigabytes of missile signature data archived.

(U) FY 1995 Plans:

- o ($2.557M) Data Centers and Management. BMDO data centers will receive, store, archive, and distribute BMDO missile hardbody and signature test data for use by the TMD program offices and contractor community. Provides needed upgrades for data storage and retrieval to support TMD program offices.
- o ($32.412M) Data Collection Platforms. Cobra Judy operating costs and AST core operating costs to collect radar and optical data on Storm and Hera test targets, THAAD flight test vehicles, THAAD intercept events, Navy lower tier Block IVA and

LEAP tests, Countermeasures Hands-On Program (CHOP) Skunkworks missile launches, and other technology readiness target and threat replica programs. Mission costs for AST provided by Project 1170. Maintains storage of Cobra Eye sensor system.

- o ($7.204M) Algorithm and Model Development. Develop, implement, and test real-time TMD infrared/radar algorithm architectures for threat typing, discrimination, target object map generation, and aimpoint selection. Continue development and application of new techniques including image analysis, radar cross-section polarimetric analysis, and data fusion. Hosts TMD-GBR prime contractor's radar discrimination architecture on LDS testbed for independent verification and validation. Upgrades LDS testbed to demonstrate active algorithm architectures of multiple targets and single sensors. Performs simulation and analysis of THAAD Dem/Val scenarios, and develops and tests optical discrimination and aimpoint algorithms to aid THAAD contractors in validating their optical discrimination algorithms. Develop initial capability for reentry hardbody breakup and debris for discrimination needed for target handoff. Integrates above-the-horizon/below-the-horizon background models to include updating PLEXUS 3.0 code by incorporating clouds, atmospherics, terrain and celestial backgrounds models.

(U) <u>FY 1996 Plans</u>:

- o ($7.053M) Data Centers and Management. BMDO data centers will receive, archive, and distribute BMDO background, plume and missile signature test data for use by the TMD program offices and contractor community. Provide minimal upgrades to data retrieval and data analysis tools.
- o ($18.747M) Data Collection Platforms. AST core operating costs to continue optical data collection in support of THAAD intercept events, Capricorn Blue, the TMD Critical Measurements Program (TCMP) campaign, and other technology readiness programs.
- o ($18.211M) Algorithm and Model Development. Develop, refine, and demonstrate active and passive algorithm architectures of multiple targets and single sensors on LDS testbed. Develop multi-sensor data fusion algorithms which perform efficient

data resource allocation. Use LDS to develop and evaluate real-time algorithms for tumbling targets and high resolution imaging in support of THAAD/GBR. Perform statistical evaluation of radar/optical discrimination algorithms using field test data. Continue simulation/analysis of THAAD Dem/Val optical discrimination and aimpoint algorithms, and finalize prototype algorithms (target selection, aimpoint selection, and kill assessment) for THAAD objective system. Complete and distribute MOSART 2.0 (low altitude atmospheric structure model) to TMD system designers. Develop integrated handover/discrimination information for aimpoint selection using interceptor foreground and integrated RF hardbody and radar plume signatures for early detection of TBMs. Continue participation in international technical exchange programs (U.S./U.K. Scientific Cooperative Research Exchange (SCORE) Program - Target Signatures & Backgrounds Panel, NATO Extended Air Defense (EAD)/TMD Ad Hoc Working Group - Plume Phenomenology Expert Group (U.S., U.K., France, Canada), U.S./French Bilateral Group - Plumes, Backgrounds, and Reentry Signatures, U.S./Israeli TBM Signature and Phenomenology Research, U.S./German Phenomenology Research) in the areas of optical and radar discrimination, reentry, and background and plume phenomenology.

(U) FY 1997 Plans:

- o ($7.088M) Data Centers and Management. BMDO data centers will receive, archive, and distribute BMDO background, plume, and missile signature test data for use by the TMD program offices.
- o ($26.339M) Data Collection Platforms. AST core operating costs for continued optical data acquisition of THAAD intercept events, Navy Lower tier Block IVA tests, and PAC-3 tests. Additional funding is provided for expanded data collection and sensor development efforts including the use of existing high altitude aircraft to collect spectral data on natural backgrounds and signatures of ballistic missiles during their boost and mid-course phases of flight. These efforts also includes the development and testing of new long wavelength sensing techniques for discrimination on airborne and space borne platforms. The feasibility of placing an X-band high resolution radar on an aircraft to enable rapid response collection of radar track and image data will be evaluated.

- ($19.350M) Algorithm and Model Development. Demonstrate active and passive algorithm architectures of multiple targets and multiple sensors on LDS testbed. Demonstrate real-time algorithms for battlefield learning, target object mapping, and aimpoint selection for PAC-3, THAAD/GBR, and Corps SAM. Field candidate algorithms for real-time verification. Continue support to TMD programs in sensor design, discrimination, aim point selection, and algorithm development. Continue development and release of improved backgrounds codes for THAAD. Integrate radar ground clutter model for TMD-GBR and Corps SAM. Continue participation in international technical exchange programs in the areas of optical and radar discrimination, TBM reentry, and background and plume phenomenology.

Acquisition Strategy: This project funds data centers, data collection platforms, and algorithm and model development through executing agents in the Air Force (Phillips Laboratory and Arnold Engineering Development Center), Army (Space and Strategic Defense Command), Navy (Naval Research Laboratory) and BMDO (Institute for Defense Analysis) via existing contracts.

B. (U) PROGRAM CHANGE SUMMARY:

	FY1994	FY1995	FY1996	FY1997	TOTAL COST
Previous President's Budget	3,000	58,011	38,125	38,125	137,261
Appropriated Value		49,420			49,420
Adjustments to Appropriated Value		-9,072			(9,072)
Current Budget Submit	2,861	40,348	44,011	52,777	139,997

Change Summary Explanation:
Funding: This project represents the realignment/consolidation of the following projects from the FY95 President's Budget: 1105 (Discrimination) except for TCMP and the Kill Assessment Program which are now part of Project 1170, part of Project 1101 (Optical

Signature Code), part of Project 3300 (Data Centers and AST), and part of Project 3152 (Technical Analysis). The increase in funding from FY94 to FY95 is due to: 1) Project roll up described in the paragraph above, 2) TMD began to contribute to the cost sharing of this project, and 3) reductions and terminations of planned TMD funding for efforts in Algorithm and Model Development.

The increase in Data Centers and Management funding from FY95 to FY96 is due to (1) an increase in the TMD proportion of the cost sharing, and (2) restoration of funding to planned levels. The reduction in Data Collection Platform funding from FY95 to FY96 is due to the termination of BMDO funding for Cobra Judy. Cobra Judy program will be transferred to the Air Force in FY96. The increase in Algorithm and Model Development funding from FY95 to FY96 is due to (1) the increase in the TMD proportion of the cost sharing, (2) the shifting of funding responsibility from Technology to TMD and NMD cost sharing.

The increase in Data Collection Platform funding from FY96 to FY97 is due to start of expanded data collection and sensor development efforts that support TMD programs.

Schedule: None

Technical: None

C. (U) OTHER PROGRAM FUNDING SUMMARY

Related RDT&E:	Funding Dependency? (Yes[1]/No)
1155, Phenomenology, 0603173C	Yes
1155, Phenomenology, 0603871C	Yes
1170, TMD Risk Reduction, 0603872C	Yes
2154, TMD-GBR, 0603862C/0604862C	Yes
2257, PAC-3, 0603865C/0604865C	Yes

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RDT&E, Defensewide / BA 04 (Dem/Val)

PE:0603872C (Proj: 1155)
PE Title: Other TMD (U)

2260, THAAD, 0603861C/0604861C	Yes
2262, Corps SAM, 0603869C	Yes
1266, Navy Theater-wide TBMD, 0603868C	Yes
2263, Navy Area TBMD, 0603867C/0604867C	Yes
3360, Test Resources, 0603872C	Yes
3359, System Test & Evaluation, 0603872C	Yes

[1]Funding data for related RDT&E efforts that have a funding dependency can be found in the respective project summary/program element.

D. (U) Schedule Profile

	FY1994				FY1995				FY1996				FY1997			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Data Collection			(a)*		(a)	(a)	(b)									
Algorithm Development		(c)*			(d)			(c)	(e)	(d)		(c)		(c)	(d)	

(a) Support THAAD test flight program
(b) End BMDO sponsorship of COBRA JUDY system
(c) THAAD - deliver software releases (backgrounds, optical discrimination algorithms)
(d) TMD-GBR - deliver software releases (radar discrimination algorithms)
(e) Navy Area TBMD (Lower Tier) - deliver software releases (optical/radar discrimination algorithms)
(e) Corps SAM, Navy Theater Wide (Upper Tier) - deliver software releases (plumes, backgrounds, optical/radar discrimination algorithms)

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE: 0603872C (Proj: 1161)
PE Title: Other TMD (U)

Project Number / Title: 1161 Advanced Sensor Technology

Program Name:	FY1994 Actual	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	FY2000 Estimate	FY2001 Estimate	Total Program
0603872C RDT&E	3,024	2,739	3,782	3,800	3,694	3,586	3,607	3,586	Continuing

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION:

(U) Survivability (TMD)

(U) The goal of this program is to develop and demonstrate survivability technologies to insure that ballistic missile defense systems can perform their mission in all required environments. Ballistic missile defenses must be able to operate in disturbed environments and against countermeasure rich threats. The requirements for this Survivability program are: define, develop and demonstrate survivability enhancement options for theater missile defense systems; develop and transfer survivability enhancement option (SEO) technology base to research and development centers and laboratories; provide risk reductions to support THAAD/GBR Milestone II.

(U) This program develops and demonstrates survivability technologies to ensure that Theater Missile Defense (BMD) elements can perform their mission in all expected hostile threats. Approaches include: studies/analyses; defense suppression threat mitigation technologies development; developing enhanced shelters applying camouflage, concealment and deception (CCD), SEO development; Electromagnetic Environmental Effects (E3) engineering support, survivability/operability demonstrations, development of issue resolution approaches, development of Anti-Radiation Missile (ARM) Countermeasure Evaluator (ACE), and hardened technology integration. Technologies will be available for incorporation into missile defense systems at EMD and will also provide near-term

improvements to existing systems. Demonstrations will provide necessary risk reduction evidence to support THAAD System milestone decisions.

(U) This project is assigned to the Budget Activity and Program Element Codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Mission Description and Budget Item Justification section of each Program Element Summary.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) In FY94, this program developed tools to evaluate TMD-GBR performance under defense suppression threats, and in hostile environments. These evaluations will support the THAAD/GBR Milestone II decisions. The Anti-radiation Missile Countermeasure Evaluator operational capability was completed. Countermeasures for precision guided missiles and cruise missiles continued to be developed. Camouflage, concealment and deception techniques applied to the TMD-GBR were evaluated for effectiveness in battlefield conditions. Requirements for the TMD-GBR to be protected against electromagnetic environmental effects were reviewed, and criteria were identified.

(U) FY 1994 Accomplishments:

- ($1.620M) Completed ACE development and conducted initial Hardware in the loop electronic counter-countermeasure/Decoy survivability enhancement option assessment
- ($0.900M) Completed SEO definition for TMD user operational evaluation system (UOES)
- ($0.504M) Completed E3 criteria for TMD-GBR and THAAD

(U) FY 1995 Plans:

- o ($1.689M) ACE. Upgrade ACE with additional threat modeling. ACE combines the desirable effects of low-cost digital simulations and actual hardware testing of actual ARM hardware in open and closed-loop flight simulations. ACE will be used to develop initial ARM ECCM techniques for GBR and PATRIOT.
- o ($0.800M) CCD. The multi-spectral signature of the deployed TMD-GBR system will require application of extensive CCD technologies which have been developed by the Army Labs. This program will publish initial CCD signature suppression and conventional hardening SEO design guidelines. In addition, it will develop an enhanced shelter proof of principle test, and conduct a SAR countermeasures proof of principle test.
- o ($0.100M) E^3. GBR transmit/receive modules and antenna elements cannot be shielded. This program will provide E^3 guidelines which detail the effects of electromagnetic threats to the TMD-GBR. This program will also test the UOES T/R modules to EMP and HPM conditions to evaluate their susceptibility to these environments.
- o ($0.150M) Technology assessments, program reviews, and technical assistance.

(U) FY 1996 Plans:

- o ($2.000M) ACE. Use ACE to evaluate the performance effectiveness of GBR BM/C3 in hostile environment.
- o ($1.200M) CCD. Conduct CCD countermeasures tests and ballistic hardening trades to optimize and allocate SEOs across the reconnaissance, surveillance, tracking, acquisition (RSTA) threat.
- o ($0.582M) Conduct analysis of vulnerability to precision guided munitions, and analysis of PGM SEO designs.

(U) FY 1997 Plans:

- o ($2.700M) Conduct ACE evaluation of Corps SAM countermeasures
- o ($1.000M) Conduct PGM SEO Proof of Principle test
- o ($0.100M) Upgrade E^3/NBC guidelines

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE: 0603872C (Proj: 1161)
PE Title: Other TMD (U)

(U) Acquisition Strategy The survivability technology program supports the tailored and streamlined acquisition strategy employed by the element acquisition managers. Survivability technologies chosen for evaluation/development will be based on requirements. Within the executing agents, free and open competitive contracts will be used to the maximum extent possible to accomplish specific work packages in accordance with field laboratory acquisition procedures. Contract proposals will be evaluated according to innovative technology approaches, responsiveness to program requirements, quality of proposed deliverables, and cost.

B. (U) PROGRAM CHANGE SUMMARY:

	FY1994	FY1995	FY1996	FY1997	TOTAL COST
Previous President's Budget	3,024	4,900	3,800	3,800	15,524
Appropriated Value		3,000			3,000
Adjustments to Appropriated Value		-0,261			(261)
Current Budget Submit	3,024	2,739	3,782	3,800	13,345

Change Summary Explanation:
Funding: This project was funded under Program 1501 in the FY95 Presidents budget. For FY95, Congress appropriated $3M, but also reduced RDT&E funding. $216K is this project's share of the undistributed reduction.

Schedule: The program plan has been modified to account for the reduced program, as well as for the 1Q97 schedule slip of the THAAD milestone.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE: 0603872C (Proj: 1161)
PE Title: Other TMD (U)

Technical: none

C. (U) OTHER PROGRAM FUNDING SUMMARY

Related RDT&E:	Funding Dependency?(Yes[1]/No)
2154 TMD Ground Based Radar PE 0603861C	Yes

[1]Funding data for related RDT&E efforts that have a funding dependency can be found in the respective project summary/program element.

D. (U) Schedule Profile

	FY94				FY95				FY96				FY97			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Acquisition Milestones													Xm			Xp
Engineering Milestones								Xb		Xd					Xg	
T&E Milestones																
Contract Milestones																
Other Program Events					Xa			Xc		Xe	Xf				Xh	Xi

a ACE eval of BMC3
b CCD shelter POP
c E3-GBR susceptibility Guide
d ACE test of BMC3 SEO suite
e SEO design to counter PGM

f	CCD SEO test/trades
g	CCD SEO POP
h	ACE eval of Corps SAM
i	E3 guidelines update
m	THAAD Milestone II
p	PAC 3 Milestone III

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE:0603872C (Proj: 1170)
PE Title: Other TMD (U)

Project Number / Title: 1170 TMD Risk Reduction

Program Name:	FY1994 Actual	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	FY2000 Estimate	FY2001 Estimate	Total Program
0603872C RDT&E	14,295	25,550	46,458	40,000	40,831	28,590	28,715	28,826	Continuing

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION:

(U) This project is the primary BMDO risk mitigation program addressing TMD target/threat signature (and the signature-to-system interface) issues for all TMD systems. This project consists of four programs: TMD Critical Measurements Program (TCMP) which builds, flies, observes, and analyzes targets with signature characteristics similar to those anticipated on foreign threats; the Target Signature Measurements Program which observes and directs the analysis of signatures from BMDO test targets (Storm, Hera, etc.) to obtain target signature truth data, and which exploits other similar threat signature opportunities; the Focal Plane Array Flight Test Program which flies an airborne sensor package carrying a THAAD type focal plane array to directly observe BMDO interceptor targets to obtain representative seeker data; and the Kill Assessment Program which investigates target intercept phenomenology. In all cases, the target signature truth data and the analyses address the specific areas of discrimination, target object map handover, aim point selection, and kill assessment. The core sensor costs used in this project to collect target signature and truth data will be provided under projects 1155 and 3360. This project will be used to fund the specific sensor tasks for each mission.

(U) TMD Critical Measurements Program. This program supports the risk mitigation efforts in TMD signatures. TCMP is a flight test program where threat representative targets are flown at the Kwajalein Missile Range (KMR) in order to observe typical threat-like objects in flight with a sophisticated suite of sensors. These sensors give both target truth data and representative signature data as seen by TMD system sensors. The TCMP program performs the analysis on the data obtained in these flights. In all cases, the target

and threat truth data and the analysis address the specific areas of discrimination, target object map handover, aim point selection, and kill assessment. The hardware, flight instrumentation and analysis of the TCMP flights are all included in the TCMP budget. TCMP-II will consist of four flights in the third quarter of FY96.

(U) Kill Assessment. This program is developing the technical basis that will lead to a battle management decision capability for the TMD architecture. This capability will enable the battle manager to respond nearly "real-time" following a target intercept engagement to either proceed with a cease fire or to order a second shot and/or to cue the lower tier for appropriate action. This kill assessment capability will also help measure defense system effectiveness and identify threat warhead type. In support of this shoot-look-shoot doctrine, the program is conducting a series of specialized sensor data collections of TMD interceptor tests, follow-on data analysis, and algorithm development. The most challenging aspect is gathering enough pertinent data from various types of intercept scenes to identify and evaluate those observable characteristics that will correctly serve this decision process. Since opportunities to observe actual TMD missile intercepts are rare, more emphasis in this two year old program is being made on ground test measurements.

(U) Focal Plane Array Flight Tests. This program will provide for the integration, testing, calibration, and mission support of an airborne optical infrared (IR) sensor using a focal plane array (FPA) similar to the THAAD seeker. The sensor fabrication is complete and will be placed on the high altitude observatory (HALO) aircraft to assist in assessing the platinum silicide (PtSi) FPA performance against TMD-like targets. The sensor will take optical measurements on various TMD tests to include the THAAD Dem/Val. The sensor data will support seeker algorithm and modeling development efforts leading to a more robust system performance capability. This program also supports performance enhancements and survivability issues of the PtSi FPA in direct support of the THAAD seeker.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE:0603872C (Proj: 1170)
PE Title: Other TMD (U)

(U) Target Signature Measurements. This program is the source of direction and funds for per mission costs to acquire truth data using sophisticated sensor platforms (Airborne Surveillance Testbed, HALO, Sealite Beam Director, etc.) on BMDO interceptor target flights (Lance, Storm, Hera, etc.). These data are then utilized by the acquisition programs, by the Target Signatures Working Group (TSWG), and by the Targets Program to establish the in-flight signature characteristics of these targets for use in target hardware development and interceptor algorithm assessment.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Mission Description and Budget Item Justification section of each Program Element Summary.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1994 accomplishments included completing the TCMP Campaign I final report and beginning planning for the next TCMP campaign. A comprehensive data base of optical and radar signatures was compiled during FY 1994 and continues to be updated with each mission. The Airborne Optical Sensor design was completed and fabrication of the sensor was initiated during FY 1994. Target signature measurements of foreign TBMs were also conducted during FY 1994.

(U) FY 1994 Accomplishments:

- ($1.945M) Prepared TCMP Campaign I final report; prepared TCMP Campaign II test plan; began design and fabrication of the Fly Along Sensor (FAS) for support of aim point selection efforts.
- ($2.35M) Collected pulse doppler radar data during sled tests at Holloman AFB, collected multi-spectral (radar and optical) data during ERINT, PATRIOT and Navy LEAP tests; supported Lexington Discrimination System (LDS)/Optical Discrimination Algorithm (ODA) kill assessment algorithm development.

- o ($6.7M) Initiated design and fabrication of airborne optical sensor for TMD phenomenology data collection efforts.
- o ($3.3M) Conducted radar cross section (RCS) measurements on foreign TBMs and TBM targets at TBM wavelengths of interest; supported measurement cost for airborne sensors for data collections during major TMD tests.

(U) FY 1995 Plans:

- o ($17.315M) Continue preparation and planning for TCMP Campaign II experimental flight test to include testing of the FAS; purchase and test TCMP flight hardware; begin planning for TCMP Campaign III experimental flight test.
- o ($3.647M) Develop radar and optical algorithms for real-time kill assessment testing; implement radar and optical kill assessment algorithms and data base on LDS test bed; continue sensor data collection efforts and analyze live fire intercept tests for kill assessment.
- o ($2.338M) Complete fabrication of airborne optical sensor for TMD phenomenology data collection; initiate support for data collection missions using the optical sensor; enhance PtSi Focal Plane Array performance and survivability.
- o ($2.250M) Measure optical and RF signatures of Storm and Hera targets for use by all TMD programs.

(U) FY 1996 Plans:

- o ($32.458M) Conduct TCMP Campaign II experimental flight test; analyze, and report test results; complete TCMP Campaign III experimental flight test plan.
- o ($7.0M) Continue radar/optical kill assessment algorithm development; downselect, transfer, and incorporate into the TMD major defense acquisition programs (MDAP) prototype kill assessment techniques for test and evaluation.
- o ($4.0M) Use airborne optical sensor to collect IR data during available flight test, enhance sensor and focal plane array performance in support of TMD interceptors.
- o ($3.0M) Continue to collect data to characterize Storm and Hera targets; collect data on Capricorn Blue flights.

(U) FY 1997 Plans:

- o ($25.0M) Continue preparation and planning for TCMP Campaign III with an expected launch date during the first quarter, fiscal year 1998.
- o ($9.0M) Continue to analyze sensor data of intercept tests and transfer kill assessment technology to TMD MDAPs; evaluate and upgrade, as required, kill assessment algorithm performance.
- o ($5.0M) Continue electro-optical infrared development for missile seekers and continue TMD phenomenology data collection efforts using airborne sensor.
- o ($1.0M) Continue target measurements and observe and characterize THAAD limited user tests.

Acquisition Strategy: The programs in this project are specifically addressing risk areas for TMD systems. Use of Government labs and existing facilities is stressed. Contracting actions for specific hardware devices and flight missions are accomplished by BMDO and SSDC using standard contracting procedures.

B. (U) PROGRAM CHANGE SUMMARY:

	FY1994	FY1995	FY1996	FY1997	TOTAL COST
Previous President's Budget	13,700	30,500	46,000	38,000	128,200
Appropriated Value		28,000			28,000
Adjustments to Appropriated Value		-2,450			(2,450)
Current Budget Submit	14,295	25,550	46,458	40,000	126,303

Change Summary Explanation

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE:0603872C (Proj: 1170)
PE Title: Other TMD (U)

Funding: This project was funded under PE 0604216C project numbers 1105 and 1106 in the FY1995 President's Budget. Funding constraints in FY95 required reducing funds for this project. Due to the reduced funding level, TCMP Campaign II is now scheduled for 3Q/FY96 vice 2Q/FY96. Funds were increased in FY96 and FY97 in order to allow for TCMP Campaign III to remain in 2Q/FY98.
Schedule: TCMP Campaign II scheduled for 3Q/FY96 vice 2Q/FY96.
Technical: None.

C. (U) OTHER PROGRAM FUNDING SUMMARY

Related RDT&E:	Funding Dependency? (Yes[1]/No)
1155, Phenomenology Program, 0603872C	Yes
1293, Advanced Capability Concept Development, 0603872C	Yes
2154, TMD-GBR, 0603862C/0604862C	Yes
2260, THAAD, 0603861C	Yes
2294, Advanced Capability Dem/Val, 0603872C	Yes
3251, Systems Engineering and Technical Support, 0603872C	Yes
3261, BM/C3I, 0603864C/0604864C	Yes
3354, Targets, 0603872C	Yes
3360, Test Resources, 0603872C	Yes

[1]Funding data for related RDT&E efforts that have a funding dependency can be found in the respective project summary/program element.

D. (U) Schedule Profile

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE:0603872C (Proj: 1170)
PE Title: Other TMD (U)

	FY1994				FY1995				FY1996				FY1997			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Acquisition Milestone																
Engineering Milestone																
Complete Optical Sensor (OS)					X											
Begin OS Aircraft Integration																
T&E Milestone																
TCMP I Final Report	X*															
Collect Flight Test Data				X*	X	X	X	X	X	X	X	X	X	X	X	X
OS Data Collection						X	X	X	X	X	X	X	X	X	X	X
Contract Milestone																
Other Program Events																
Measured Foreign TBM RCS			X*													
TCMP Campaign II											X					
Deliver THAAD Algorithms				X												

Planned Milestones Beyond FY1997:

Conduct TCMP Campaign III	2Q/FY98
Kill assessment Efforts	Continuing
Phenomenology Efforts	Continuing

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE: 0603872C (Proj: 1293)
PE Title: Other TMD (U)

Project Number / Title: 1293 Advanced Capability Concept Development Program

Program Name:	FY1994 Actual	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	FY2000 Estimate	FY2001 Estimate	Total Program
0603872C RDT&E	0	0	0	0	35,494	37,937	23,669	23,857	Continuing

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION:

(U) The advanced capability programs are required to counter the theater missile threat that is anticipated to exist in the 2010 to 2015 timeframe. These capabilities will provide improved theater missile defense above and beyond the core program's capabilities.

(U) Today, there are three pre-Milestone 1 programs: 1) Navy Theater Wide TBMD, 2) Corps SAM, and 3) Boost Phase Intercept. Beginning in FY 1998, each of the three programs will transition into one of two new projects: Advanced Capability Concept Development Program (1293) or Advanced Capability DEM/VAL Program (2294).

(U) During FY 1998, one program will proceed into the next acquisition phase under the Advanced Capability DEM/VAL Program (2294) and the two remaining programs will continue as concept development programs under the Advanced Capability Concept Development Program (1293). Of the two concept development programs, one will proceed into the next acquisition phase in FY 2000, again under the Advanced Capability DEM/VAL Program (2294) while the remaining program will continue in concept development until FY 2004. At that point a decision will be made to move the remaining program into the next acquisition phase under the Advanced Capability DEM/VAL Program (2294). As a program transitions into Advanced Capability DEM/VAL Program (2294) the exact acquisition phase will depend upon the selected program.

(U) This time phased implementation approach is consistent with future military needs and available resources. The first program to enter the Advanced Capability DEM/VAL Program (2294) will then be designated as Advanced Capability I (ACAP I) in FY 1998, the second program as Advanced Capability II (ACAP II) in FY 2000, and the final program as Advanced Capability III (ACAP III) in FY 2004.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Mission Description and Budget Item Justification section of each Program Element Summary.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1994 Accomplishments: No programs will transition into this project until FY1998.

(U) FY 1995 Plans: None

(U) FY 1996 Plans: None

(U) FY 1997 Plans: None

(U) Acquisition Strategy:Today, there are three pre-Milestone 1 programs: 1) Navy Theater Wide TBMD, 2) Corps SAM, and 3) Boost Phase Intercept. Beginning in FY 1998, each of the three programs will transition into one of two new projects: Advanced Capability Concept Development Program (1293) or Advanced Capability DEM/VAL Program (2294).

(U) During FY 1998, one program will proceed into the next acquisition phase under the Advanced Capability DEM/VAL Program (2294) and the two remaining programs will continue as concept development programs under the Advanced Capability Concept Development Program (1293). Of the two concept development programs, one will proceed into the next acquisition phase in FY 2000, again under the Advanced Capability DEM/VAL Program (2294) while the remaining program will continue in concept development until FY 2004. At that point a decision will be made to move the remaining program into the next acquisition phase under the Advanced Capability DEM/VAL Program (2294). As a program transitions into Advanced Capability DEM/VAL Program (2294) the exact acquisition phase will depend upon the selected program.

(U) This time phased implementation approach is consistent with future military needs and available resources. The first program to enter the Advanced Capability DEM/VAL Program (2294) will then be designated as Advanced Capability I (ACAP I) in FY 1998, the second program as Advanced Capability II (ACAP II) in FY 2000, and the final program as Advanced Capability III (ACAP III) in FY 2004.

The exact acquisition strategy will depend upon the programs which transition into this project in FY1998.

B. (U) PROGRAM CHANGE SUMMARY:

	FY1994	FY1995	FY1996	FY1997	TOTAL COST
Previous President's Budget	0	0	0	0	0
Appropriated Value		0			0
Adjustments to Appropriated Value		0			0
Current Budget Submit	0	0	0	0	0

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE: 0603872C (Proj: 1293)
PE Title: Other TMD (U)

Change Summary Explanation:
Funding: This project was funded under PE 0604216C project number 2215 in the FY1995 President's Budget.
Schedule: None
Technical: None

C. OTHER PROGRAM FUNDING SUMMARY

Related RDT&E:	Funding Dependency? (Yes[1]/No)
1155, Phenemenology Program, 0603872C	Yes
1170, TMD Risk Reduction, 0603872C	Yes
1265, Boost Phase Intercept, 0603872C	Yes
1266, Navy Theater Wide TBMD, 0603868C	Yes
2262, Corps SAM, 0603869C	Yes
2294, Advanced Capability Dem/Val Program, 0603872C	Yes
3153, Architecture Analysis/BMC3 Initiatives, 0603872C	Yes
3251, Systems Engineering and Technical Support, 0603872C	Yes
3261, BM/C3I, 0603872C	Yes
3270, Threat and Countermeasures Program, 0603872C	Yes
3359, System Test And Evaluation, 0603872C	Yes

[1]Funding data for related RDT&E efforts that have a funding dependency can be found in the respective project summary/program element.

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RDT&E, Defensewide / BA 04 (Dem/Val)

PE: 0603872C (Proj: 1293)
PE Title: Other TMD (U)

D. (U) Schedule Profile

Planned Milestones Beyond FY1997:

Select ACAP I	1Q98
Select ACAP II	1Q00
Select ACAP III	1Q04

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE:0603872C (Proj: 2160)
PE Title: Other TMD (U)

Project Number / Title: 2160 TMD Existing System Modifications

Program Name:	FY1994 Actual	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	FY2000 Estimate	FY2001 Estimate	Total Program
0603872C RDT&E	20,004	15,701	26,869	25,000	14,583	14,537	0	0	Completed

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION:

(U) The Theater Missile Defense (TMD) program is structured to field a defensive capability against theater ballistic missiles as quickly as possible by upgrading existing active defense systems while developing more advanced TMD capabilities. As such, TMD improvements can be made incrementally.

(U) This project provides the enhancement of warning and surveillance capabilities, including fixed and mobile tactical processing of launch detection data (from the Defense Support Program (DSP), space early warning systems, or other means) and netted surveillance to support intercepts and broader defense coverage.

(U) This project implements non-major defense acquisition programs modifications to current and existing warning and surveillance systems that result in fielded improvements to TMD capabilities. This project consists of three programs; Cueing and Netting, Talon Shield, and the Extended Airborne Global Launch Evaluator (EAGLE).

(U) Cueing And Netting. Cueing and Netting is a program developing software and hardware modifications for PATRIOT which will allow PATRIOT to receive and process cueing data from theater sensors such as the Joint Tactical Ground Station (JTAGS) and the AN/TPS-59. These cues allow early track initiation and allow planning for multiple shot engagements.

(U) Talon Shield. Talon Shield processing equipment, located at Falcon Air Force Base, receives and processes DSP and other national intelligence data on TBM events to provide timely warning of TBM launch point, time, and azimuth, and impact point prediction to tactical units. Processing equipment is located at the NTF. This program is related to Army JTAGS and Air Force ALERT programs.

(U) EAGLE. The EAGLE is developing and fielding a TBM detection, tracking, and cueing system aboard Air Force E-3 AWACS aircraft. Consisting of a passive infrared search and track (IRST) sensor and an eye-safe laser-ranger, EAGLE provides precise cues to deployed TMD-GBR and SPY-1 fire control radars, as well as early, highly accurate improved estimates of TBM launch points and impact points. EAGLE's precise tracking begins before booster burnout and continues through the early post-boost phase of missile flight. Against long-range TBMs, EAGLE will track inflight missiles prior to their detection by surface-based radars, which are constrained by viewing limitations imposed by curvature of the earth. EAGLE target cues will be much more accurate than those available from Talon Shield or JTAGS, which do not support extended range, single-beam radar acquisition of long-range TBMs. EAGLE's highly accurate prediction of a TBM's future trajectory makes it unnecessary for fire control radars to search for the missile, enabling the radars to acquire the TBM earlier, at longer range, using a single, precisely pointed radar beam. This longer range acquisition permits earlier launch of interceptors, yielding a dramatic increase in the defended area (footprint) for THAAD and SM-2/Blk IVA.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Mission Description and Budget Item Justification section of each Program Element Summary.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) Cueing and Netting. A tactical demonstration of JTAGS and the TPS-59 cueing of the PATRIOT MPQ-53 radar was conducted at White sands Missile Range (WSMR) during FY94.

(U) Talon Shield. Talon Shield development testing for DSP inputs was completed during FY94. The baseline hardware and software configuration was provided to the Air Force for implementation under the ALERT program.

(U) EAGLE. The EAGLE program conducted studies of E-3 AWACS TMD capability and potential TMD laser range/trackers. These efforts verified the technical feasibility and the TMD force multiplier potential of fielding TBM detection, tracking, and cueing sensors on Air Force E-3 AWACS aircraft.

(U) FY 1994 Accomplishments:

- o ($2.639M) Cueing and Netting. Analyzed results of MPQ-53 cueing demonstration at WSMR; developed tactical cueing program plan; Initiated Current Systems Improvement Program (CSIP); Analyzed three proposed improvements to existing systems as part of CSIP.
- o ($16.488M) Talon Shield. Completed Talon Shield DSP development tests; Prepared to begin Air Force Talon Shield (ALERT) operations.
- o ($0.877M) EAGLE. Completed E-3 AWACS TMD capability study. Demonstrated substantial TMD fire control radar performance enhancements are achievable with EAGLE target cueing. Completed TMD Laser Ranger evaluation. Confirmed operational adequacy of available laser ranger technology for TBM detection and tracking, given laser power and pulse rate, calculated two-way transmission losses due to atmospheric scattering and turbulence, detection sensitivity, position determination accuracy, and pointing accuracy and stability. Identified and evaluated alternative sensor configurations and sensor-aircraft integration options.

(U) FY 1995 Plans:

- o ($.998M) Cueing and Netting. Conduct MPQ-53/JTAGS tactical cueing demonstration; begin final tests of cueing software.
- o ($3.974M) Talon Shield. Begin Air Force Talon Shield (ALERT) operations; make key Talon Shield improvements; purchase second Talon Shield processing string for classified sensor data; support concept of operations tests.
- o ($9.4M) EAGLE. Release request for proposals and award the contract for the EAGLE system prime contractor (system integrator); complete System Requirements Review.
- o ($1.329M) EAGLE. Confirm sensor field of regard requirements using real-time, interactive theater air defense simulations at the Air Force Theater Air Command and Control Simulation Facility (TACCSF); refine specification of operational, technical performance and interface requirements for providing target cues to TMD-GBR and SPY-1 fire control radars, and supporting TMD BMC3 with TBM launch estimates and impact point predictions; demonstrate operational utility, and support joint service integration planning, using surrogate sensor platform (e.g., Airborne Surveillance Testbed, Cobra Ball) participation in field exercises; conclude memoranda of agreement (MOA) with foreign governments detailing foreign participation in component or subsystem design, development, and fabrication; employ ARPA's Airborne Infrared Measurements System (AIRMS) test aircraft to collect flight test data (under operating conditions comparable to those expected for the AWACS EAGLE sensor system) that are appropriate to demonstrate the planned AWACS EAGLE concept of operations, and perform studies and analyses of TBM IR detection and tracking issues relevant to the definition of AWACS EAGLE technical requirements and concept of operations.

(U) FY 1996 Plans:

- o ($1.99M) Cueing and Netting. Conduct operational MPQ-53/TPS-59/JTAGS tactical cueing demonstration and analyze results.

- o ($4.976M) Talon Shield. Complete Talon Shield processor and calibration upgrades; fully demonstrate added capability of DSP processing of classified sensor data.
- o ($19.0M) EAGLE. Complete sensor preliminary design review (PDR) and system critical design review (CDR); finalize system design; commence sensor rapid prototyping; complete fabrication of sensor components and integrate sensor subsystems; conduct tests in contractor laboratories to characterize component, subsystem, and integrated system performance under controlled conditions; and initiate ground field tests at various locations throughout the United States to further characterize sensor performance in more realistic but less controlled environments.
- o ($0.903M) EAGLE. Continue demonstration of EAGLE operational utility, and support of EAGLE joint service integration planning, using surrogate sensor platform participation in field exercises; complete joint service specification of operational procedures for providing target cues to TMD-GBR and SPY-1 fire control radars, and supporting TMD BMC3 with TBM launch point estimates and impact point predictions.

(U) FY 1997 Plans:

- o ($4.0M) Talon Shield. Continue Talon Shield test and evaluation activities; demonstrate fusion and processing of other intelligence data.
- o ($21.0M) EAGLE. Prior to prototype integration on the AWACS TS-3 test aircraft, fully characterize sensor performance under conditions more characteristic of the system operational environment (e.g., in the presence of atmospheric turbulence) by conducting integrated system flight tests on an airborne laboratory against TBM targets of opportunity and surrogate targets at ranges beyond earth limb; integrate the EAGLE sensor aboard the TS-3 aircraft.

Acquisition Strategy: Cueing and Netting and Talon Shield. Modifications to existing systems will be developed as engineering changes to those systems and will follow the acquisition strategy for those systems' engineering change proposals (ECP).

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE:0603872C (Proj: 2160)
PE Title: Other TMD (U)

(U) EAGLE. The majority of EAGLE funding available under this project will be provided to the Air Force Electronic Systems Center, the program Executing Agent, to fund the award of a planned sole source contract to the Boeing Company, to serve as the prime contractor and system integrator, for design, development, fabrication, delivery, integration, and testing of the EAGLE prototype sensor into a system that is fully integrated into the E-3 mission systems. Assuming a favorable EAGLE production decision, ESC will award a contract in 4Q/FY98 for a transition to production, beginning 1Q/FY99, of objective EAGLE sensor systems and the integration of the production sensors aboard operational Air Force E-3 AWACS aircraft.

B. (U) PROGRAM CHANGE SUMMARY:

	FY1994	FY1995	FY1996	FY1997	TOTAL COST
Previous President's Budget	20,366	22,000	27,000	25,000	94,366
Appropriated Value		14,971			14,971
Adjustments to Appropriated Value		730			730
Current Budget Submit	20,004	15,701	26,869	25,000	87,574

Change Summary Explanation:

Funding: This project was funded under PE 0604216C project 1106 in the FY1995 President's Budget. Due to reduced funding, the EAGLE contract award was delayed from 2Q/FY95 to 3Q/FY95 and the scope of the Talon Shield integration efforts with classified sensors was reduced.

Schedule: EAGLE contract award delayed from 2Q/FY95 to 3Q/FY95.

Technical: None.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE:0603872C (Proj: 2160)
PE Title: Other TMD (U)

C. OTHER PROGRAM FUNDING SUMMARY

Related RDT&E:	Funding Dependency? (Yes[1]/No)
2154, TMD-GBR, 0603864C/0604864C	Yes
2257, PATRIOT, 0604865C	Yes
2260, THAAD, 0603861C/0604861C	Yes
2263, Navy Area TBMD, 0603867C/0604867C	Yes
2358, HAWK System BM/C3, 0603863C	Yes
3251, Systems Engineering and Tech Support, 0603872C	Yes
3261, BM/C3I, 0603872C	Yes

[1]Funding data for related RDT&E efforts that have a funding dependency can be found in the respective project summary/program element.

D. (U) Schedule Profile

	FY1994				FY1995				FY1996				FY1997			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Acquisition Milestone																
Engineering Milestone																
EAGLE TMD Study		X*														
EAGLE Ladar Eval			X*													
EAGLE SRR								X								
EAGLE SDR									X							
EAGLE PDR										X						
EAGLE CDR											X					

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RDT&E, Defensewide / BA 04 (Dem/Val)

PE:0603872C (Proj: 2160)
PE Title: Other TMD (U)

Talon Shield Processor Mods														X						
EAGLE Install On TS-3																	X			
T&E Milestone																				
Talon Shield Op Testing Complete	X*																			
Talon Shield T&E Complete																			X	
EAGLE Ground Lab Tests										X		X		X						
EAGLE Field Ground Tests														X		X		X		
EAGLE Air Lab Tests																	X		X	
EAGLE Prototype Flight Tests																			X	X
Contract Milestone																				
EAGLE Release RFP				X																
EAGLE Award Contract								X												
Other Program Events																				
Cueing Demo X*						X														
Talon Shield Begin ALERT Opns		X*																		
EAGLE Negotiate Intl Participation	X*	X*	X	X	X															

Planned Milestones Beyond FY1997:

EAGLE Contingency Deployment Availability	1Q/FY98
EAGLE Complete Prototype Flight Tests	3Q/FY98
EAGLE Refine Prototype Design	1Q/FY98 - 3Q/FY98
EAGLE Acquisition Decision	3Q/FY98
EAGLE Award Production Contract	4Q/FY98

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE: 0603872C (Proj: 2259)
PE Title: Other TMD (U)

Project Number / Title: 2259 Israeli Co-Operative Projects

Program Name:	FY1994 Actual	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	FY2000 Estimate	FY2001 Estimate	Total Program
0603872C RDT&E	64,771	48,068	56,558	44,200	47,539	51,849	52,075	52,277	Continuing

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION:

(U) These projects include the Arrow Continuation Experiments (ACES) Project, the Arrow Deployability Project (ADP), the Israeli Test Bed (ITB), the Israeli System Engineering and Integration (ISE&I) Project, and the Israeli Co-Operative Research and Development project. The U.S. derives considerable benefits from its participation in the Arrow/ACES Projects. Primary benefits are gains in U.S. technology and data base information that will reduce risks in U.S. TMD development programs. The U.S. could also benefit from the eventual presence of an anti-missile defense system in Israel, through the potential contribution to the deterrence of future tactical ballistic missile (TBM) conflicts in that region the potential contribution to a more robust defensive response if deterrence fails.

(U) ACES is a U.S.-Government of Israel (GOI) initiative to assist the GOI development of an anti-tactical ballistic missile (ATBM) interceptor, to provide the basis for an informed engineering and manufacturing decision for an ATBM defense capability and to provide the U.S. with technology information and data. ACES is a follow-on to the Arrow Experiments project that developed the preprototype Arrow I interceptor. The first phase of ACES, completed in the third quarter FY 94, featured critical lethality tests using the Arrow I interceptor with the Arrow II warhead. The second phase of ACES consists of the design, development and test of the Arrow II interceptor. If successful, the Arrow II will satisfy the Israeli requirement for an interceptor for defense of military assets and population centers and will support U.S. technology base requirements for new advanced antitactical ballistic missile technologies that could be incorporated into the U.S. two-tier theater missile defense (TMD) system.

(U) After U.S. planning activities in FY 94, the Arrow Deployability Project (ADP) in FY 95 will start to pursue the research and development of technologies associated with the deployment of the Arrow Weapon System and to permit the Government of Israel to make a decision on its own initiative regarding deployment of this system without financial participation by the U.S. beyond the R&D stage. This effort will include three system-level flight tests of the U.S.-Israeli cooperatively developed Arrow II interceptor and launcher supported by the Israeli-developed fire control radar and battle management control center. Studies will be done to define interfaces required for Arrow Weapon System interoperability with U.S. TMD systems, lethality, kill assessment and producibility. Prior to obligation of funds to execute ADP R&D efforts, the President must certify to the Congress that a Memorandum of Agreement (MOA) exists with Israel for these projects, that each project provides benefits to the U.S., that the Arrow missile has completed a successful intercept, and that the Government of Israel continues to adhere to export controls pursuant to the Missile Technology Control Regime (MTCR). Subsequent U.S.-Israeli cooperative R&D on other ballistic missile defense concepts would occur in the future.

(U) The Israeli Test Bed (ITB) Program is a cooperative effort between the U.S. and the GOI. The ITB is a medium-to-high fidelity theater missile defense simulation that provides the capability to evaluate potential Israeli missile defenses, aids the Israeli Ministry Of Defense (IMOD) in the decision of which defense systems to field, provides insights into man's role in TMD, and trains personnel to function in a TMD environment. A structured set of joint U.S./Israeli experiments is being executed to evaluate the role of missile defenses in both mature and contingency Middle East theater operations. This funding also provides for a portion of the operation and maintenance of the ITB and planned enhancements. Completed experiments identified additional enhancements needed to improve the ITB as an analysis tool. The enhancements incorporated in the ITB to date include an adaptive radar simulation, an improved threat model and a Boost Phase Intercept (BPI) simulation. The BPI enhancement benefits the Israeli BPI study. The planned Adaptive Battle Management Center (BMC) enhancement will benefit the U.S. by enabling the ITB to simulate a wide variety of command and control and interoperability issues.

(U) The Israeli System Engineering and Integration (ISE&I) continues to provide analyses and Arrow Weapon System architecture options in support of the Israeli Missile Defense System. The specific activities that comprise the SE&I effort are: Arrow Weapon System Design, ACES Conformance, ITB Conformance, Hyper Velocity Weapon System Study, Lethality Study, Kill Assessment Study, and analysis of experiments conducted on the HYBRID model to address the complex multi-parameter problems that arise in TMD systems analysis. The ISE&I effort provides support to the ITB project by serving as the on-site monitor of ITB enhancement efforts, responding to problems encountered in the experiments effort, obtaining or developing needed algorithms and schemes for accomplishing various defensive tasks, serving as the liaison between the ITB effort and the ACES Project, and serving as the expert on Israeli defensive strategies and plans. The ISE&I effort also provides expert assessments and analysis of radar-related modeling issues.

(U) The Israel Cooperative Research and Development Project will advance emerging TMD technologies to the technology demonstration phase to provide for the defense of the State of Israel, support U.S. technology base needs for these technologies, and pursue interoperability with U.S. TMD systems. Candidate technologies today are the continuation of the electro-thermal gun experiments and advancement of the Israeli Boost Phase Intercept concept. Efforts in this area will not begin until FY 1997. This timing provides for maturation of U.S. requirements for these areas of TMD technologies.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Mission Description and Budget Item Justification section of each Program Element Summary.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) Since program initiation in 1988, Israel successfully improved the performance of its pre-prototype Arrow I interceptor to the point it achieved successful intercept and target destruction occurred. Arrow II design and component testing progressed to the successful

demonstration of the new warhead, electro-optical seeker, radar fuse, first stage booster, sustainer booster, launcher canister and launcher. Negotiations are underway for the new Arrow Deployability Project and for the Congressionally-required Presidential certification.

(U) The Israeli Test Bed became operational in the second quarter of FY 92. The ITB experiments validated the performance of the prospective near-term Israel Theater Missile Defense System. It provided valuable insight into the potential role of Human-In-Control of a TMD system. Also, the U.S. Test Bed Products Office at the Strategic and Space Defense Center benefited from the application of ITB Program experience to the United Kingdom and the U.S. Extended Air Defense Test Bed (EADTB) Projects.

(U) The ISE&I Project activities demonstrated that defense of the State of Israel from tactical ballistic missile (TBM) attacks is feasible and cost-effective. The ISE&I effort analyzed and addressed numerous TMD system issues including human-in-control, resource allocation, and threat analysis. The U.S. benefited from the architecture analysis work, including identification and progress toward resolution of critical TMD system issues such as kill assessment and the lethality study of a novel interceptor warhead.

(U) FY 1994 Accomplishments:

($56.424M) Arrow Continuation Experiments (ACES)

- o Successfully intercepted a surrogate target carrying a simulated chemical bulk warhead with an Arrow I interceptor.
- o Completed risk reduction experiments for the Arrow II interceptor.
- o Conducted electro-optical seeker survivability tests.

($3.500M) ACES Support

- o Continued to provide Arrow data for risk reduction in the THAAD and SM-2 Block IVA programs.

($1.500M) Arrow Deployability Project Support

- o Negotiated mutually beneficial tasks.

- o Collected RF and optical signature data from the successful Arrow I intercept to prepare the Presidential Certification.
  ($1.115M) Israeli Test Bed (ITB)
- o Completed Israeli TMD systems engineering Human-In-Control experiments of TBM defense architecture elements.
- o Completed initial study of Israeli-developed concepts for boost phase intercept (BPI) and implemented BPI simulations in the ITB.
  ($0.927M) Israeli System Engineering and Integration Study (ISE&I)
- o Conducted preliminary Lethality analysis from results of Arrow I intercept test and Arrow II warhead tests.
- o Conducted analysis of ITB Human-In-Control experiments.
- o Completed analysis of high velocity guns as a point defense adjunct to a terminal TMD system.
  ($1.305M) Israeli BPI Study
- o Final report delivered.
- o Executive Summary Report delivered.
- o Identified unmanned BPI platform potential.

(U) FY 1995 Plans:
($29.367M) Arrow Continuation Experiments (ACES) and Support

- o Complete Arrow II interceptor design, development and fabrication.
- o Initiate Arrow II interceptor flight tests.
- o Continue to transfer Arrow data for risk reduction in the THAAD and SM-2 Block IVA programs.
- o Develop and use high fidelity seeker models to analyze seeker performance.
  ($15.000M) Arrow Deployability Project and Support
- o Procure long lead items.
- o Initiate interoperability studies.
- o Negotiate memorandum of agreement (MOA).

- o Complete and provide the Presidential certification to Congress.
  ($2.236M) ITB
- o Award contract for continuation of ITB effort.
- o Initiate Adaptive Battle Management Center enhancements.
  ($1.465M) ISE&I
- o Analyze technical issues associated with TMD system performance including Kill Assessment and Lethality.
- o Evaluate the performance of the near-term TMD against near-term and evolutionary threats.

(U) FY 1996 Plans:
($27.314M) ACES and Support
- o Complete four (4) flight tests and performance analysis.
- o Complete lethality analysis of Arrow II.
- o Evaluate Arrow II performance against surrogate threat HE and bulk chemical warhead targets.
- o Complete analysis of Arrow II flight test data.
- o Provide Arrow II flight data to U.S. TMD interceptor developers.

($25.462M) Arrow Deployability Project and Support
- o Purchase Arrow II interceptors and targets.
- o Evaluate Arrow interoperability with other TMD systems.
- o Evaluate expected Arrow Weapon System test performance.
- o Transfer Arrow Weapon System test plans to U.S. TMD interceptor developers.

($1.891M) ITB
- o Complete Adaptive Battle Management Center enhancements.
- o Conduct experiments on near-term improvements to the TMD system.

($1.891M) ISE&I

- o Provide independent oversight and assessment of near-term TMD system to include capability conformance and test plan traceability with operational specifications.
- o Conduct architecture effectiveness/cost/risk trade study to examine evolution from near-term TMD system.

(U) FY 1997 Plans:

($16.010M) Arrow Deployability Project and Support

- o Initiate Arrow Weapon System integrated flight tests.
- o Evaluate U.S. and Arrow components for electro-magnetic interference.
- o Transfer the results of the Arrow Weapon System tests to U.S. TMD interceptor developers.
- o Complete interoperability, lethality, kill assessment and producibility studies.

($23.990M) Israel Cooperative Research and Development

- o Complete design of technology demonstrator.
- o Begin fabrication of technology demonstrator
- o Transfer design data to U.S. TMD programs.

($1.900M) ITB

- o Continue experiments associated with the deployment of the near-term TMD system and future improvements of the TMD system.
- o Provide improved threat model and Arrow II update enhancements.

($2.300M) ISE&I

- o Analyze results of ITB Interoperability experiments.
- o Continue evaluations of the performance of the near-term TMD system based on ADP system engineering flight tests.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE: 0603872C (Proj: 2259)
PE Title: Other TMD (U)

Acquisition Strategy: This is a cooperative development program. By completing the Arrow Deployability Project, U.S. TMD programs will be afforded state-of-the-art technical data for program risk reduction and the Government of Israel will have developed information to make a sound Arrow Weapon System deployment decision. The planned SE&I and ITB experiments will continue to refine the operational tactics and techniques of the fielded near-term TMD system. The U.S. and the GOI under the umbrella of the various Memoranda of Agreements share in the cost of these projects. The U.S. cost-share ratio is based upon the maturity of the development. Each contract associated with the individual projects is a firm-fixed price (FFP) contract.

B. (U) PROGRAM CHANGE SUMMARY:

	FY1994	FY1995	FY1996	FY1997	TOTAL COST
Previous President's Budget	65,797	57,200	48,800	44,200	215,997
Appropriated Value		56,101			56,101
Adjustments to Appropriated Value		-8,033			(8,033)
Current Budget Submit	64,771	48,068	56,558	44,200	213,597

Change Summary Explanation:
Funding: In the FY 95 Presidents Budget, the ITB was part of the Test and Evaluation Support (Project 3300) and the Israeli System Engineering and Integration (ISE&I) and Israeli BPI Study were part of the Architecture and Studies (Project 3201). This submission puts all the Israeli Co-operative Projects in one budget item. Schedule delays in Arrow II flight tests caused the Arrow Project Office and IMOD to enter discussions for a no cost extension to the ACES contract. The FY 95 ACES funds were decreased because of those delays. The FY 95 released funds were provided to ADP because Congress increased the ADP budget by $10M and were also used to satisfy other unallocated Congressional reductions. The funds are replaced in the FY 96 ACES budget in order to complete the fixed-price ACES contract. The increase in FY 96 ACES Support funds reflects the cost to maintain a U.S program office to manage the contract and provide technical assistance.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE: 0603872C (Proj: 2259)
PE Title: Other TMD (U)

Schedule: The U.S. and the GOI entered into discussions to extend the ACES contract to incorporate a less aggressive flight test schedule for Arrow II based on lessons learned from the Arrow I phase of the program and to reduce technical risk. The funding increase for the Joint U.S./Israeli BPI Assessment was provided in accordance with Congressional guidance. Reduction to the FY 95 ACES budget will have no impact on the Israeli ACES schedule or technical content.

Technical: The successful completion of the Arrow I phase of the ACES program after the intercept in June caused the Arrow Project Office to enter into discussions with the IMOD to extend the ACES contract. The lessons learned from the Arrow I effort prompted a reevaluation of the proposed Arrow II flight test schedule. The APO and IMOD determined that extending the flight test schedule reduced the technical risk of the program. Reduction to the FY 95 ACES budget will have no impact on the Israeli ACES schedule or technical content.

C. (U) OTHER PROGRAM FUNDING SUMMARY

Related RDT&E:	Funding Dependency (Yes[1]/No)
3359 - System Test & Evaluation - 0603872C	Yes
2154 - TMD-GBR - 0603862C	Yes
2257 - PATRIOT (PAC-3) - 0604225C	Yes
2260 - THAAD - 0603861C	Yes
3251 - Sys. Eng. & Tech. Spt - 0603872C	Yes
3352 - Modeling & Simulations - 0603872C	Yes
2259 - Israeli Coop. Projects (IBIS) - 0603173C	Yes
1266 - Navy Theater Wide TBMD - 0603868C	Yes
1265- Boost Phase Interceptor- 0603870C	Yes

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE: 0603872C (Proj: 2259)
PE Title: Other TMD (U)

[1]Funding data for related RDT&E efforts that have a funding dependency can be found in the respective project summary/program element.

D. (U) Schedule Profile

	FY1994				FY1995				FY1996				FY1997			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Acquisition Milestone																
Engineering Milestone																
- Completed design of Arrow II interceptor & launcher						X										
- Arrow II CDR							X									
- Complete Interceptor development									X							
- Complete design of cooperative R&D tech demo													X			
- Complete BPI Studies				X				X								
T&E Milestone																
- Completed Arrow I flight tests			X													
- Initiate Arrow II flight tests					X											
- Initiate Arrow Weapon System integrated flight tests													X			
Contract Milestone																
- Award ITB contract					X											
- Award ADP contract								X								

- Award ISE&I follow-on contract		X		
Other Program Events				
- Negotiated mutually beneficial tasks for ADP	X			
- Complete analysis of Arrow II flight test data			X	
- Complete ITB adaptive BMC enhancement			X	
- Complete ITB threat enhancement				X

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE: 0603872C (Proj: 2294)
PE Title: Other TMD (U)

Project Number / Title: 2294 Advanced Capabilities DEM/VAL Program

Program Name:	FY1994 Actual	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	FY2000 Estimate	FY2001 Estimate	Total Program
0603872C RDT&E	0	0	0	0	99,649	93,551	480,632	640,615	Continuing

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION:

(U) The advanced capability programs are required to counter the theater missile threat that is anticipated to exist in the 2010 to 2015 timeframe. These capabilities will provide improved theater missile defense above and beyond the TMD core program's capabilities.

(U) Today, there are three pre-Milestone 1 programs: 1) Navy Theater Wide TBMD, 2) Corps SAM, and 3) Boost Phase Intercept. Beginning in FY 1998, each of the three programs will transition into one of two new projects: Advanced Capability Concept Development Program (Project 1293) or Advanced Capability Dem/Val Program (Project 2294).

(U) During FY 1998, one program will proceed into the next acquisition phase under the Advanced Capability Dem/Val Program (Project 2294) and the two remaining programs will continue as concept development programs under the Advanced Capability Concept Development Program (Project 1293). Of the two concept development programs, one will proceed into the next acquisition phase in FY 2000, again under the Advanced Capability Dem/Val Program (Project 2294) while the remaining program will continue in concept development until FY 2004. At that point a decision will be made to move the remaining program into the next acquisition phase under the Advanced Capability Dem/Val Program (Project 2294). As a program transitions into Advanced Capability Dem/Val Program (Project 2294) the exact acquisition phase will depend upon the selected program.

(U) This time phased implementation approach is consistent with future military needs and available resources. The first program to enter the Advanced Capability Dem/Val Program (Project 2294) will then be designated as Advanced Capability I (ACAP I) in FY 1998, the second program as Advanced Capability II (ACAP II) in FY 2000, and the final program as Advanced Capability III (ACAP III) in FY 2004.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Mission Description and Budget Item Justification section of each Program Element Summary.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1994-1997 Accomplishments/Plans: No programs will transition into this project until FY1998.

Acquisition Strategy:
(U) Today, there are three pre-Milestone 1 programs: 1) Navy Theater Wide TBMD, 2) Corps SAM, and 3) Boost Phase Intercept. Beginning in FY 1998, each of the three programs will transition into one of two new projects: Advanced Capability Concept Development Program (Project 1293) or Advanced Capability Dem/Val Program (Project 2294).

(U) During FY 1998, one program will proceed into the next acquisition phase under the Advanced Capability Dem/Val Program (Project 2294) and the two remaining programs will continue as concept development programs under the Advanced Capability Concept Development Program (Project 1293). Of the two concept development programs, one will proceed into the next acquisition phase in FY 2000, again under the Advanced Capability Dem/Val Program (Project 2294) while the remaining program will continue in concept development until FY 2004. At that point a decision will be made to move the remaining program into the next acquisition

phase under the Advanced Capability Dem/Val Program (Project 2294). As a program transitions into Advanced Capability Dem/Val Program (Project 2294) the exact acquisition phase will depend upon the selected program.

(U) This time phased implementation approach is consistent with future military needs and available resources. The first program to enter the Advanced Capability Dem/Val Program (Project 2294) will then be designated as Advanced Capability I (ACAP I) in FY 1998, the second program as Advanced Capability II (ACAP II) in FY 2000, and the final program as Advanced Capability III (ACAP III) in FY 2004.

The exact acquisition strategy will depend upon the programs which transition into this project in FY1998.

B. (U) PROGRAM CHANGE SUMMARY:

	FY1994	FY1995	FY1996	FY1997	TOTAL COST
Previous President's Budget	0	0	0	0	0
Appropriated Value		0			0
Adjustments to Appropriated Value		0			0
Current Budget Submit	0	0	0	0	0

Change Summary Explanation:
Funding: This project was funded under Project 2215 in the FY1995 President's Budget.
Schedule: None.
Technical: None.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE: 0603872C (Proj: 2294)
PE Title: Other TMD (U)

C. (U) OTHER PROGRAM FUNDING SUMMARY

Related RDT&E:	Funding Dependency? (Yes[1]/No)
1265, Boost Phase Intercept, 0603872C	Yes
1266, Navy Theater Wide TBMD, 0603868C	Yes
1293, Advanced Capability Concept Development Program, 0603872C	Yes
2262, Corps SAM, 0603869C	Yes
3153, Architecture Analysis/BMC3 Initiatives, 0603872C	Yes
3251, Systems Engineering and Technical Support, 0603872C	Yes
3359, System Test And Evaluation, 0603872C	Yes

[1]Funding data for related RDT&E efforts that have a funding dependency can be found in the respective project summary/program element.

D. (U) Schedule Profile

Planned Milestones Beyond FY1997:

Select ACAP I	1Q98
Select ACAP II	1Q00
Select ACAP III	1Q04

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE:0603872C (Proj: 3153)
PE Title: Other TMD (U)

Project Number / Title: 3153 Architecture Analysis and BMC3 Initiatives

Program Name:	FY1994 Actual	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	FY2000 Estimate	FY2001 Estimate	Total Program
0603872C RDT&E	0	4,820	9,330	9,375	9,114	9,086	9,125	9,161	Continuing

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION:

(U) This project supports systems analysis work for BMDO architecture integration and BMC3 activities to determine the expected operational performance and effectiveness of missile defense systems under development. Computer simulation models are developed and used to investigate architecture and system level capability and to resolve critical technical issues related to the development of specific elements of the architecture. Tradeoffs in alternative elements, specific designs, inventory and integration of systems are conducted in detail to determine the most cost effective approach for a particular missile defense mission. This effort will provide for the synergistic evaluation of relevant BMC3I technical issues; the formulation of appropriate plans, programs, and policies to facilitate the coordination of all BMD Advanced Development BMC3I research, development, and acquisition activities across TMD and NMD program activities; promote appropriate reuse strategies to maximize BMD reuse capabilities; and minimize the duplication of BMC3I research and development efforts. The work is performed on a continuing basis in order to determine the impact of changing threats, mission requirements, and advances in technology.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Mission Description and Budget Item Justification section of each Program Element Summary.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1994 Accomplishments:
- o None

(U) FY 1995 Plans:
- o ($ 4.820M) Follow up analysis work related to the TMD COEA will be conducted. Updates on projected missile threats and new scenarios developed by the BMDO Threat Working Group will be factored into the performance assessment of TMD architecture/system elements. A thorough evaluation of the ability of ballistic missile systems to handle stressing land attack cruise missiles will be made. New concepts for Boost Phase Intercept will be examined, especially systems based on laser devices. The capability of the Navy Upper Tier system to handle population defense over wide areas and the integration of this system in a multi-tier defense of critical military assets will be evaluated.

(U) FY 1996 Plans:
- o ($ 6.000M) Analysis of architectures and systems will continue using new (validated) simulation tools. Work to determine the ability of TMD systems to respond to proposed countermeasures will continue. Active defense will be studied in the context of overall defenses including passive and counterforce options. The capability of potential Russian and Allied missile defense systems will be evaluated.
- o ($ 3.375M) Support development of mission-area policies, processes, and guidance to support the coordinated system-level implementation of a seamless development environment for BMD BMC3 software development from requirements through design and production of BMC3 executable code. Promote the implementation of emerging evolutionary development processes across the BMD Community; support BMDO efforts in the formulation, and implementation of advanced BMC3 research and development efforts appropriate to support evolving BMDO TMD BMC3 requirements. Efforts will include

support in defining TMD BMC3 development process requirements; analysis and implementation of appropriate TMD software reuse capabilities and requirements consistent with BMDO requirements and DoD guidance and objectives; coordination in the analysis and implementation of various DoD initiatives and implications relating to BMDO TMD BMC3 development; support to NATO or other allied concerns outside the BMDO community in activities related to BMC3 development; ongoing support of BMC3 demonstrations relating to joint NMD/TMD inter-operability, BMC3 CONOPS, etc.; implementation of appropriate software engineering requirements across all BMDO BMC3 software development efforts including support of Software Engineering Institute (SEI) Software Capability Evaluations (SCEs) for BMDO source selection efforts; and provide the mission-area capability to address emerging BMC3 system requirements and concerns and facilitate their resolution in a synergistic environment across all NMD and TMD development efforts.

(U) FY 1997 Plans:
($ 6.000M) Continue systems analysis of architecture/system performance and related technical issues as directed by the BMDO Architecture Integrator and the Deputy for Acquisition/Theater Missile Defense.
($ 3.375M) Continuation of FY96 efforts.

Acquisition Strategy: Systems analysis work under this project is done under contract. In November 1995, a two year contract for this work (with two, one year extension options) was awarded to a ten member corporate team led by SPARTA, Inc., Laguna Hills, Calif. For BMC3 Initiatives efforts, expertise of Government, FFRDC, SEIC, and SETA personnel will be leveraged in the execution of project activities, utilizing existing contracts to the maximum extent possible. Specifically, USASSDC and USAF/ESC Government and contractor personnel are expected to lead Information Architecture and development efforts; existing and follow-on SETA (awarded to BDM Federal, December 1994) and SEIC contracts will provide the core of technical expertise for a variety of BMC3 activities; and existing FFRDC contract vehicles will provide state-of-the-art technical expertise in Software Engineering and related technical areas. Additional contractor services will be competitively procured if needed to meet emerging program requirements.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE:0603872C (Proj: 3153)
PE Title: Other TMD (U)

B. (U) PROGRAM CHANGE SUMMARY:

	FY1994	FY1995	FY1996	FY1997	TOTAL COST
Previous President's Budget	0	0	0	0	0
Appropriated Value		5,000			5,000
Adjustments to Appropriated Value		-0,180			(180)
Current Budget Submit	0	4,820	9,330	9,375	23,525

Change Summary Explanation:

Funding: This project was performed under PE 0603173C (Project 3153) in FY95. Prior to FY95 the work was reported under Project 3207. Beginning in FY96, activities comprising FY95 CDS Project 3153 will be funded and performed via a combination of both TMD and NMD Program Elements, as appropriate. Increased required funding to provide for additional analyses in support of evolving TMD options.
Schedule: None.
Technical: None.

C. (U) OTHER PROGRAM FUNDING SUMMARY

Related RDT&E:	Funding Dependency (Yes[1]/No)
3153, Arch. Anal. & BMC3 Initiatives, P.E. 0603217C	No

[1]Funding data for related RDT&E efforts that have a funding dependency can be found in the respective project summary/program element.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE:0603872C (Proj: 3153)
PE Title: Other TMD (U)

D. (U) Schedule Profile

	FY1994				FY1995				FY1996				FY1997			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Acquisition Milestone																
Engineering Milestone																
- Software Policy Update																
- BMD IA (CONOPS)						x										
- Software Engineering Documentation Updates							x			x						
T&E Milestone																
Contract Milestone																
- Award Arch. Analysis Support Contract						x										
Other Program Events																
- Annual Contract Program Review								x				x				x
- Tech. Analyses, Reports, & Briefings As Req'd	x		x		x		x		x		x		x			

Planned Milestones Beyond FY1997: TBD

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE:0603872C (Proj: 3157)
PE Title: Other TMD (U)

Project Number / Title: 3157 Environment, Siting and Facilities

Program Name:	FY1994 Actual	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	FY2000 Estimate	FY2001 Estimate	Total Program
0603872C MILCON	0	0	2,577	2,961	1,993	2,089	1,642	1,642	Continuing
0603872C RDT&E	0	0	4,036	4,054	4,097	4,084	4,108	4,123	Continuing

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION:

(U) Provides environmental program guidance, environmental impact analyses and documentation, real property facility siting, and facility management and acquisition support for the BMDO Theater Missile Defense (TMD) system projects. Plans, programs, budgets, and oversees facility acquisition through Military Construction (MILCON) and RDT&E construction projects. Provides guidance and leads BMDO TMD environmental compliance, pollution prevention, other environmental efforts, and the Environmental Assessment and Environmental Impact Statement process for TMD activities. Develops guidance for Executing Agents on facility siting, facility acquisition, and environmental matters. Provides MILCON design funds to support design of BMDO's TMD major and minor MILCON projects. Provides MILCON Minor Construction funds to support TMD's out-of-cycle unforeseen MILCON projects under $1.5M.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Mission Description and Budget Item Justification section of each Program Element Summary.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE:0603872C (Proj: 3157)
PE Title: Other TMD (U)

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1994 Accomplishments: NONE

(U) FY 1995 Plans: NONE

(U) FY 1996 Plans:

- o ($ 2.180M) Develops siting, basing deployment plans, environmental compliance programs, environmental analyses, and documentation for technology demonstrations, test and evaluation, and weapon system essential technical stationing facilities. (Focus is on PAC-3, THAAD, and Navy Lower-Tier systems).
- o ($ 0.134M) Facility planning and preliminary designs for TMD garrisons and depots.
- o ($ 1.722M) Execute and manage TMD's FY 96-98 Military Construction, Minor Military Construction, and RDT&E facility design and construction projects and acquisition. The emphasis is on the PAC-3 and THAAD EMD, test and deployment facilities, such as THAAD/GBR UOES Facility, THAAD/GBR Test Facility, Maintenance/Repair Target Launch Support Facility, TMD Target Launch Facilities, and THAAD/GBR Objective Facilities.
- o ($ 2.577M) MILCON design activities.

(U) FY 1997 Plans:

- o ($ 2.100M) Supports TMD programs with siting, environmental compliance, pollution prevention, studies, and environmental analysis and documentation. The Program increases cover costs associated with maturing acquisition programs, fielding of systems, and test and evaluation programs.
- o ($ 0.150M) Continues facility planning for fielding the PAC-3 and THAAD programs. It also continues facility planning support for test and evaluation programs.

- o ($ 1.804M) Provides funds to execute and manage TMD's FY 97-99 Military Construction, Minor Military Construction, and RDT&E facility design and construction projects and other activities to provide program support. The emphasis will be to initiate construction on essential PAC-3, THAAD, and Navy Lower-Tier support facilities, and on continued test and evaluation support facilities, such as Maintenance/Repair Target Launch Facility, TMD Target Launch Facilities, THAAD/GBR Objective Facilities, and THAAD Objective Ammunition Facility and fielding the THAAD Second Objective Battalion.
- o ($ 2.961M) MILCON design activities.

Acquisition Strategy: BMDO contractor support (Currently under a small business Cost Plus Fixed Fee contract; this contract will be recompeted for similar contract-type award in FY 95) will be utilized for technical and overview assistance of facilities, siting, and environmental activities. Other similar small business contracts, as well as full and open competition Cost Plus Fixed Fee and Fixed Price contracts, by U.S. Army Space and Strategic Defense Command and the U.S. Army Program Executive Office-Missile Defense will be utilized for additional technical assistance for the development of Facilities, Siting, and Environmental documentation requirements. BMDO tasks the Services through Program Management Agreements to perform the required tasks in support of the TMD program. BMDO performs quarterly on-site reviews to verify and validate completed tasks.

B. (U) PROGRAM CHANGE SUMMARY:

	FY1994	FY1995	FY1996	FY1997	TOTAL COST
Previous President's Budget	0	0	0	0	0
Appropriated Value		0			0
Adjustments to Appropriated Value		0			0

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE:0603872C (Proj: 3157)
PE Title: Other TMD (U)

Current Budget Submit	0	0	4,036	4,054	8,090

Change Summary Explanation:
Funding: This project was submitted as 3107 in the FY95 President's Budget and supported BMDO programs as a whole. Project 3157 is now split out in this submittal between two program elements to help track programmatic funding: Theater Missile Defense (0603872C) and National Missile Defense (0603871C). Project 3157 (Program Element 0603173C) incorporates FY94 and FY95 funding for this activity.

Schedule: None

Technical: None

C. (U) OTHER PROGRAM FUNDING SUMMARY

MILCON/Procurement: As listed on Page 1.

Related RDT&E:		Funding Dependency (Yes[1]/No)
2260 - THAAD	0603861C/0604861C	Yes
1266 - Navy Theater-wide TBMD	0603868C	Yes
2257 - Patriot (EMD)	0604865C	Yes
2263 - Navy Area TBMD	0603867C	Yes
3354 - Targets	0603872C	Yes
3359 - System Test & Evaluation	0603872C	Yes
3360 - Test Resources	0603872C	Yes

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE:0603872C (Proj: 3157)
PE Title: Other TMD (U)

2154 - TMD-GBR	0603862C	Yes
2262 - Corps SAM	0603869C	Yes
1265 - Boost Phase Intercept	0603870C	Yes
1293 - Adv. Capability Concept Dev.	0603872C	Yes
2294 - Adv. Capability Dem/Val	0603872C	Yes

[1]Funding data for related RDT&E efforts that have a funding dependency can be found in the respective project summary/program element.

D. (U) Schedule Profile

	FY1994				FY1995				FY1996				FY1997			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Other Program Events				Xa/ Xb/ Xd	Xc/ Xf			Xa		Xg/ Xh	Xe/ Xi	Xa				Xa

Xa Final DD Forms 1391 for TMD Military Construction Budget Submission

Xb Manage construction contract for TMD PAC-3 and THAAD Dem/Val Target Launch Facilities at Wake Island (Construction supports Projects 2260 & 2257)

Xc	Complete construction of TMD Target Launch Complex Facilities at White Sands Missile Range, NM (Construction supports Project 2260)
Xd	Manage construction contract for Target Launch Facilities at Firing-in-Extension (FIX) north of White Sands Missile Range, NM (Construction supports Project 3354)
Xe	Complete Construction Surveillance for TMD PAC-3 and THAAD Dem/Val Target Launch Facilities
Xf	Complete Construction Surveillance for Target Launch Facilities at FIX
Xg	Manage construction contract for TMD THAAD/GBR Test Facilities (Construction supports Project 2154 & 2260)
Xh	Complete Construction Surveillance for TMD THAAD/GBR Test Facilities
Xi	Manage construction contract for THAAD First Objective Battalion Facilities (Construction supports Project 2260)

Planned Milestones Beyond FY1997:

o	Update BMDO Facility Acquisition Strategy Plan	FY1998
o	Complete design of FY98 MILCON	FY1998
o	Complete facility requirements documentation for FY00 program	FY1998
o	Complete environmental planning for FY99 program	FY1998
o	Update BMDO Facility Acquisition Strategy Plan	FY1999
o	Complete Design of FY99 MILCON	FY1999
o	Complete environmental planing for FY00 program	FY1999
o	Complete facility requirements documentation for FY01 program	FY1999

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE: 0603872C (Proj: 3160)
PE Title: Other TMD (U)

Project Number/Title: 3160 Deployment Planning

Program Name:	FY1994 Actual	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	FY2000 Estimate	FY2001 Estimate	Total Program
0603872C RDT&E	0	1,146	1,951	1,960	1,906	1,900	1,908	1,915	Continuing

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION:

(U) This project supports the development of Theater Missile Defense (TMD) systems with emphasis on producibility trade-offs and logistics supportability concepts and their integration into the diverse TMD elements. The project focuses these activities by coordinating efforts between the Services. TMD readiness activities include producibility and planning for manufacturing, acquisition logistics, metrology, and training. The efforts will concentrate on identifying and analyzing critical TMD systems level deployment, support, producibility and manufacturing (P&M) risks, industrial base capability issues and developing mitigation plans for these areas to ensure operational requirements and BMDO affordability objectives are met. In addition, TMD operational suitability and availability advances and lessons learned are applied to NMD projects.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Brief Description of Element section of each Program Element Summary.

PROGRAM ACCOMPLISHMENTS AND PLANS:

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE: 0603872C (Proj: 3160)
PE Title: Other TMD (U)

(U) This program was begun in FY 95. The program develops and provides required TMD measurement standards and allows continuing infrared calibration services supporting TMD program offices, their contractors, Government laboratories and test centers as funded. This program also provides BMDO industrial base support in the areas of Producibility and Manufacturing and operational suitability planning for TMD programs. This program also provides leverage between TMD programs to identify and address logistic and other supportability issues.

(U) FY 1994 Accomplishments:
- o None.

(U) FY 1995 Plans:
- o ($0.737M) Support the TMD program offices, their contractors, government laboratories and test centers with Infrared (IR) calibration and measurement services. This includes development of IR calibration/measurement standards, specifications, procedures, and techniques traceable to a single national source at the National Institute of Standards and Technology (NIST). Services provided include development of calibration hardware, transfer standards, measurement/characterization of IR sources, filters, attenuators, and detectors and provide access to NIST experts to support on-going and planned TMD systems testing, development, and acquisition (to include TMD contractors) as funding permits.
- o ($0.259M) Integrate TMD producibility and manufacturing issues, identify common problems, and develop mitigation strategies for EMD phases.
- o ($0.150M) Identify operational suitability issues related to TMD concepts of operations, BMC3, and inter-Service operations.

(U) FY 1996 Plans:
- o ($1.041M) Continue to support the TMD program offices, their contractors, government laboratories and test centers with Infrared (IR) calibration and measurement services. This includes development of IR calibration/measurement standards,

specifications, procedures, and techniques traceable to a single national source at the National Institute of Standards and Technology (NIST). Services provided include development of calibration hardware, transfer standards, measurement/characterization of IR sources, filters, attenuators, and detectors and provide access to NIST experts to support on-going and planned TMD systems testing, development, and acquisition (to include TMD contractors) as funding permits.

- o ($0.420M) Integrate producibility issues, resolve TMD system common problems, develop mitigation strategies (both element specific and TMD wide) and review manufacturing planning.
- o ($0.490M) Update operational suitability planning, to address issues related to TMD concepts of operations, BMC3, inter-Service operations, and systems readiness and functional requirements.

(U) FY 1997 Plans:

- o ($1.050M) Continue to support the TMD program offices, their contractors, government laboratories and test centers with Infrared (IR) calibration and measurement services. This includes development of IR calibration/measurement standards, specifications, procedures, and techniques traceable to a single national source at the National Institute of Standards and Technology (NIST). Services provided include development of calibration hardware, transfer standards, measurement/characterization of IR sources, filters, attenuators, and detectors and provide access to NIST experts to support on-going and planned TMD systems testing, development, and acquisition (to include TMD contractors) as funding permits.
- o ($0.420M) Support completion and insertion of producibility and manufacturing mitigation programs developed in FY95 and 96, including non-BMDO programs. Support element program offices in exit criteria development and assessment.
- o ($0.490M) Update operational suitability planning, to address issues related to TMD concepts of operations, BMC3, inter-Service operations, and systems readiness and functional requirements.

Acquisition Strategy: This project uses competitively awarded existing and future BMDO Scientific Engineering Technical Assistance (SETA) contracts and Service executing agents to accomplish the planned activities.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE: 0603872C (Proj: 3160)
PE Title: Other TMD (U)

B. (U) PROGRAM CHANGE SUMMARY:

	FY1994	FY1995	FY1996	FY1997	TOTAL COST
Previous President's Budget	0	1,960	1,960	1,960	5,880
Appropriated Value		1,411			1,411
Adjustments to Appropriated Value		-0,265			(265)
Current Budget Submit	0	1,146	1,951	1,960	5,057

Change Summary Explanation:
Funding: This project was derived from Project 3101 in the FY95 President's Budget and Project 3101 (PE 0603871C) and Support Technology (PE 0603873C). The current funding level will fund metrology and calibration, supportability and specialty engineering, and producibility and manufacturing efforts. This project supports BMDO management initiatives to reduce program costs and maximize leverage with NMD projects.
Schedule: None.
Technical: None.

C. (U) OTHER PROGRAM FUNDING SUMMARY

Related RDT&E:	Funding Dependency? (Yes[1]/No)
Project 1155, Phenomenology, PE 0603872C	Yes

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE: 0603872C (Proj: 3160)
PE Title: Other TMD (U)

Project 2154, TMD GBR, PE 0603862C	Yes
Project 2160, TMD Existing System Modifications, PE 0603872C/0604862C	Yes
Project 2257, PATRIOT, PE0604865C	Yes
Project 2260, THAAD, PE0603861C/060486C	Yes

[1]Funding data for related RDT&E efforts that have a funding dependency can be found in the respective project summary/program element.

D. (U) Schedule Profile

See FY94 - FY97 accomplishments and plans. Other Program Events such as infrared and improved IR dynamic range spectral calibration services are provided throughout.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE:0603872C (Proj: 3251)
PE Title: Other TMD (U)

Project Number / Title: 3251 Systems Engineering and Technical Support

Program Name:	FY1994 Actual	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	FY2000 Estimate	FY2001 Estimate	Total Program
0603872C RDT&E	33,372	53,207	47,836	56,926	66,714	59,375	67,991	70,276	Continuing

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION:

(U) This project provides system engineering and technical support for the integration of Service-supplied weapon systems to facilitate the identification and resolution of inter-Service integration and interoperability issues; technical and engineering assessments and trade-off studies of TMD system architectures and concepts; support for UK sensor data fusion studies; BMD system survivability oversight and assessment; risk reduction and acquisition streamlining support; modeling, simulation, experiment, and flight test support; development and maintenance of technical and programmatic databases; and preparation of technical reports, briefings, and programmatic documentation associated with TMD studies and critical issues.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Mission Description and Budget Item Justification section of each Program Element Summary.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) During FY 1994 the system description and system assessment documents were completed, trade-off studies were conducted, and independent technical and engineering assessments were performed. This project supported various analyses, e.g., the Theater

Defense Netting Study, reviews of technical and engineering documentation, and the resolution of critical issues pertaining to the acquisition of the TMD "family of systems." Modeling and simulation support increased in response to fiscal restraints in other areas. Cooperative architecture studies with the United Kingdom were completed and support to the Services for intra-Service integration continued.

(U) FY 1994 Accomplishments:

- ($ 1.935M) Completed cooperative UK architecture studies; maintained low-level support to the UK sensor data fusion and knowledge-based system efforts; continued development of an artificial intelligence (AI)-based fusion and situation assessment demonstrator and an end-to-end AI-based BM threat discrimination demonstrator.
- ($ 7.367M) Provided scientific, engineering, and technical support for the acquisition, integration, and fielding of TMD systems including: review of products in comparison to standards, specifications, and requirements; modeling and simulation support of architecture analyses and trade-off studies; risk reduction and acquisition streamlining support; engineering and technical support for international programs and BM/C3 efforts; development and maintenance of technical and programmatic databases; and preparation of technical reports, briefings, and programmatic documentation.
- ($11.740M) Using federally funded research and development center (FFRDC) resources, performed independent technical and engineering assessments of TMD system architectures including: system concept development and assessment; cost and operational effectiveness analysis (COEA) support; critical element technical and programmatic assessments including trade-off analyses; reviews of mandated documents, international cooperative programs, and treaty implications; multi-Service and allied BM/C3 integration; modeling, simulation, experiment and flight test support; integration of fielded components into operational units; and specific studies and analyses of critical issues.
- ($ 8.570M) Provided system engineering and integration at the TMD system level included the following efforts: identified inter-Service integration interfaces; developed and updated engineering documents to identify change requirements to the theater air defense C3I systems to incorporate and support TBMD; updated the TMD Integrated Test Plan; completed the

system description and system assessment documents; supported the development of requirements for the TMD System Exerciser; and planned, coordinated, and analyzed C2 wargames in support of CINC concepts of operations (CONOPS) development.

- o ($ 3.760M) Provided support to each Service for intra-Service integration, interoperability, and resolution of interface issues.

(U) FY 1995 Plans:

- o ($ 2.717M) Support a cooperative ATBM systems analysis with the UK; continue support to the UK sensor data fusion effort to deliver the initial Target Oriented Tracking System (TOTS); install TOTS on various BMD testbeds and begin integration testing; demonstrate an enhanced knowledge-based system prototype.
- o ($10.500M) Provide scientific, engineering, and technical support for the acquisition, integration, and fielding of TMD systems including: review of products in comparison to standards, specifications, and requirements; modeling and simulation support of architecture analyses and trade-off studies; risk reduction and acquisition streamlining support; engineering and technical support for international programs and BM/C3 efforts; development and maintenance of technical and programmatic databases; and preparation of technical reports, briefings, and programmatic documentation.
- o ($14.000M) Using FFRDC resources, perform independent technical and engineering assessments of TMD system architectures including: system concept development and assessment; COEA support; critical element technical and programmatic assessments including trade-off analyses; reviews of mandated documents, international cooperative programs, and treaty implications; multi-Service and allied BM/C3 integration; modeling, simulation, experiment and flight test support; integration of fielded components into operational units; and specific studies and analyses of critical issues. Participate in Warfare Analysis Laboratory Exercises (WALEX), a mechanism to study and insert TMD assets into warfighter plans.
- o ($ 4.686M) Provide technical support to the TMD COEA, individual system COEAs, and Congressionally directed studies.
- o ($ 9.581M) Provide system engineering and integration at the TMD system level including the following efforts: competition and contract award for follow-on SEI support contract; identification of inter-Service integration interfaces; development of

engineering documents to identify change requirements to the theater air defense C3I systems to incorporate and support TBMD; update the TMD Integrated Test Plan; update the system description documents; support requirements development for the TMD System Exerciser; and plan, coordinate, and analyze C2 wargames in support of CINC CONOPS development.

- o ($ 5.904M) Provide support to each Service for intra-Service integration, interoperability, identification and resolution of interface issues. Assess PAC-3 hardness criteria against nuclear detonations (NUDETS); assess susceptibility of critical BM/C3 nodes of Army enclave to disruptions caused by user saturation, environmental effects, laser/RF jamming, NUDETS, and anti-radiation missiles and recommend survivability enhancement options; assess C2/C3I vulnerabilities to Navy's Aegis SPY-1 radar system; support TMD program offices in implementing appropriate software engineering policies and standards to reduce technical, cost, and schedule risks across BMD/TMD software development, integration, testing, and maintenance efforts.
- o ($ 4.950M) Technical support to the PEO Missile Defense Program Offices and the PEO Space Program Offices.
- o ($ .869M) Provide support for BMDO services (e.g., security, contracting, supplies).

(U) <u>FY 1996 Plans</u>:

- o ($ 3.254M) Continue Allied architecture studies; continue UK sensor data fusion efforts including TOTS integration testing and development of specific TOTS applications.
- o ($11.500M) Provide scientific, engineering, and technical support for the acquisition, integration, and fielding of TMD systems including: review of products in comparison to standards, specifications, and requirements; modeling and simulation support of architecture analyses and trade-off studies; risk reduction and acquisition streamlining support; engineering and technical support for international programs and BM/C3 efforts; development and maintenance of technical and programmatic databases; and preparation of technical reports, briefings, and programmatic documentation.
- o ($13.250M) Using FFRDC resources, perform independent technical and engineering assessments of TMD system architectures including: system concept development and assessment; COEA support; critical element technical and

programmatic assessments including trade-off analyses; reviews of mandated documents, international cooperative programs, and treaty implications; multi-Service and allied BM/C3 integration; modeling, simulation, experiment and flight test support; integration of fielded components into operational units; specific studies and analyses of critical issues; and WALEX support.

- o ($ 3.704M) Provide technical support to the TMD COEA, individual system COEAs, and Congressionally directed studies.
- o ($ 9.109M) Provide minimum-level system engineering and integration support at the TMD system level will include the following efforts: continue to identify inter-Service integration interfaces; prepare engineering documents that identify changes required in theater air defense C3I systems to incorporate TBMD; update TMD Integrated Test Plan; update system description documents; complete TMD integration trade studies; support requirements development for TMD System Exerciser; and plan, coordinate, and analyze C2 wargames for CINC CONOPS development.
- o ($ 6.619M) Provide continued support to intra-Service integration, interoperability, and resolution of interface issues; support review of SEI contractor integration and assessment documentation; evaluate threat-generated requirements; initiate environmental modeling and simulation tool improvements; continue refinement of SEOs for BM/C3; continue support to TMD program offices in refining software development practices and mitigating technical, cost, and schedule risks across BMD/TMD software development, integration, testing, deployment, and maintenance efforts.
- o ($ .400M) Support for BMDO services (e.g., security, contracting, supplies).

(U) <u>FY 1997 Plans</u>:

- o ($ 1.270M) Continue UK sensor data fusion efforts including TOTS integration testing and development and testing of TOTS applications. Begin use of TOTS in test analysis.
- o ($13.000M) Provide scientific, engineering, and technical support for the acquisition, integration, and fielding of TMD systems including: review of products in comparison to standards, specifications, and requirements; modeling and simulation support of architecture analyses and trade-off studies; risk reduction and acquisition streamlining support; engineering and technical

support for international programs and BM/C3 efforts; development and maintenance of technical and programmatic databases; and preparation of technical reports, briefings, and programmatic documentation.

- o ($14.545M) Using FFRDC resources, perform independent technical and engineering assessments of TMD system architectures including: system concept development and assessment; critical element technical and programmatic assessments including trade-off analyses; reviews of mandated documents, international cooperative programs, and treaty implications; multi-Service and allied BM/C3 integration; modeling, simulation, experiment and flight test support; integration of fielded components into operational units; specific studies and analyses of critical issues; and WALEX support.
- o ($ 7.731M) Provide technical support to the TMD COEA, individual system COEAs, and Congressionally directed studies.
- o ($13.109M) Increase system engineering and integration support at the TMD system level to a more robust level. Continue to identify inter-Service integration interfaces; prepare engineering documents to identify changes required in theater air defense C3I systems to support TBMD; update TMD Integrated Test Plan; update system description documents; support requirements development for TMD System Exerciser; and plan, coordinate, and analyze C2 wargames for CINC CONOPS development.
- o ($ 6.847M) Provide support to Service integration, interoperability, and resolution of interface issues; assess BMC3 for follow-on alternative SEOs; continue environmental modeling and simulation tool improvements; assist in coordinate technology infusion to support preplanned product improvements; continue support to TMD program offices in refining software development practices and mitigating technical, cost, and schedule risks across BMD/TMD software development, integration, testing, and maintenance efforts.
- o ($ .424M) Support for BMDO services (e.g., security, contracting, supplies).

Acquisition Strategy: This project uses a combination of federally funded research and development centers (FFRDC), competitively awarded scientific, engineering and technical assistance (SETA) contracts, and a Memorandum of Understanding with the United Kingdom Ministry of Defence.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE:0603872C (Proj: 3251)
PE Title: Other TMD (U)

B. (U) PROGRAM CHANGE SUMMARY:

	FY1994	FY1995	FY1996	FY1997	TOTAL COST
Previous President's Budget	37,943	72,249	78,449	81,668	270,309
Appropriated Value		46,255			46,255
Adjustments to Appropriated Value		6,952			6,952
Current Budget Submit	33,372	53,207	47,836	56,926	191,341

Change Summary Explanation

Funding: This project was previously funded under projects 3101 and 3201 in the FY95 President's Budget. Current funding for FY95 is lower than the amount requested in the FY95 President's Budget due to Congressional direction. The FY96 budget request is lower than the FY95 budget request due to the completion of some tasks and the reprioritization of efforts by OSD and BMDO. In FY97 the budget request returns to a level that is not much higher than the FY95 level. This increase is necessary to support the planned system engineering and integration program as well as special studies and reports required by Congress and OSD. Larger increases are planned for FY98 and FY00, the two years in which the actual start-up of a major defense acquisition program for the first two of the three proposed advanced concepts (i.e., Corps SAM, Navy Theater Wide TBMD, or Boost Phase Intercept) is scheduled.

Schedule: N/A

Technical: The reduction in FY95 and FY96 funding increases the risk that the system engineering and integration contractor will not provide sufficient interoperability and integration engineering data to permit timely and informed government assessment and decisions.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE:0603872C (Proj: 3251)
PE Title: Other TMD (U)

C. (U) OTHER PROGRAM FUNDING SUMMARY

Related RDT&E:	Funding Dependency? (Yes[1]/No)
1170 - TMD Risk Reduction - 0603872C	Yes
1293 - Advanced Capability Concept Development - 0603872C	Yes
1266 - Navy Theater Wide - 0603868C	Yes
2154 - GBR - 0603862C/0604862C	Yes
2160 - Existing Sys. Mods. - 0603872C	Yes
2257 - Patriot - 0604865C/0604866C	Yes
2259 - Israeli Cooperative Projects - 0603872C	Yes
2260 - THAAD - 0603861C/0604861C	Yes
2262 - Corps SAM - 0603869C	Yes
2263 - Navy Area TBMD (Lower) 0603867C/0604867C	Yes
2294 - Advanced Capability Dem/Val - 0603872C	Yes
2358 - HAWK - 3863C/0604863C	Yes
3261 - BM/3I- 0603864C/0604864C	Yes

[1]Funding data for related RDT&E efforts that have a funding dependency can be found in the respective project summary/program element.

D. (U) Schedule Profile:

	FY 1994				FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Acquisition Support																

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RDT&E, Defensewide / BA 04 (Dem/Val)

PE:0603872C (Proj: 3251)
PE Title: Other TMD (U)

- TMD COEA x x x x x
- TMD Commonality Study x x
- TPS-59 Milestone (MS) III x
- Hawk ADCP MS II and MS III x x
- PAC-3 missile MS II/IV
  ASARC and DAB x* x*
- SM-2 Blk IVA MS IV Review x
- Navy Area TBMD COEA x
- Support THAAD MS II Review x
- Support TMD-GBR MS II Review x
- Corps SAM MS I x

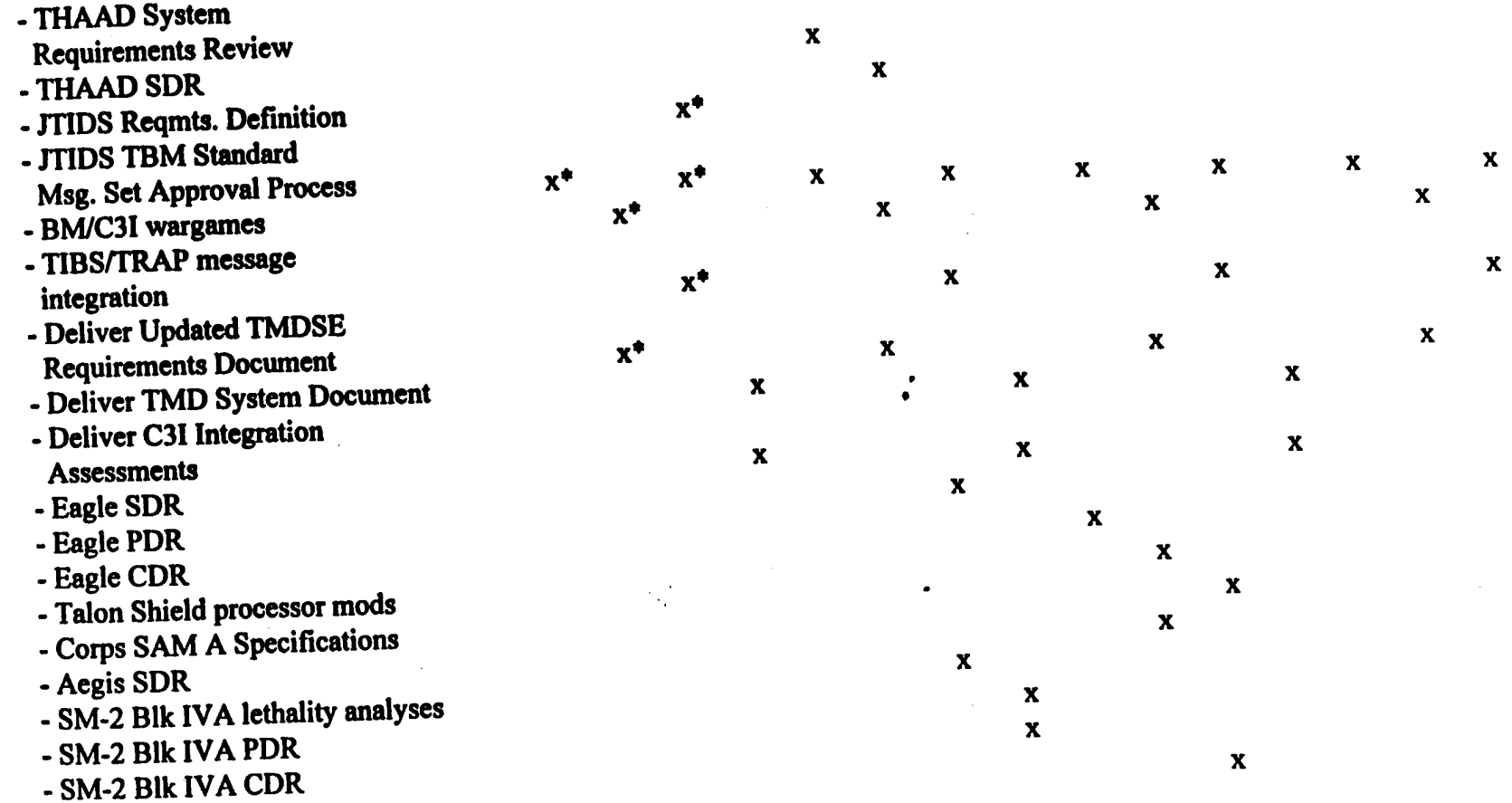
Engineering Support

- TMD Interface
  Management Document x* x*
- TMD Func. Rqmts. Doc. x*
- Delivery of Enhanced
  KBS Prototype x
- PAC-3 missile
  EMD contract award x*
- PAC-3 missile PDR x
- PAC-3 missile CDR x
- PAC-3 missile LRIP decision x
- THAAD EMD PDR x

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE:0603872C (Proj: 3251)
PE Title: Other TMD (U)



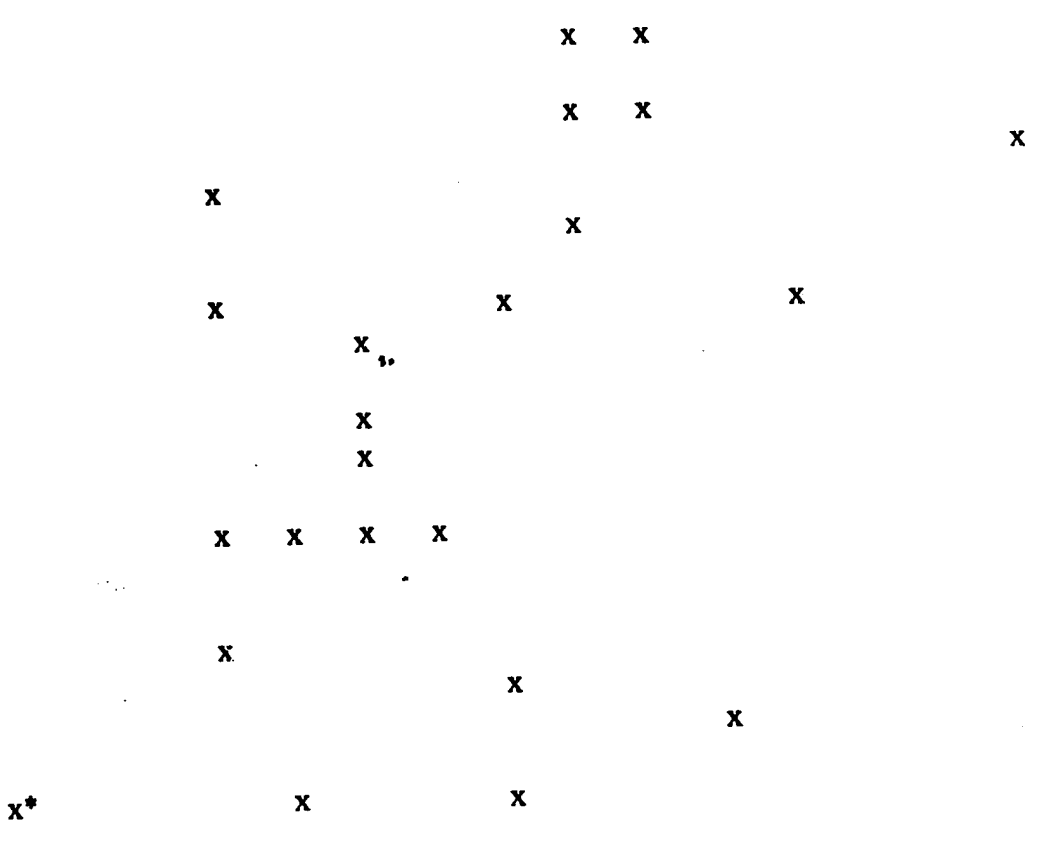
RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE:0603872C (Proj: 3251)
PE Title: Other TMD (U)

Test and Evaluation Support
- TPS-59 development and operational tests
- Hawk ADCP development and operational tests
- Talon Shield T&E completed
- Install TOTS on GBR Testbed
- Complete TOTS testing
- Deliver TMD Integrated Test Plan
- Decision aids field demo.
- SM-2 Blk IVA risk reduction flights at WSMR
- Aegis extended TRACKEX
- THAAD missile and system flight tests

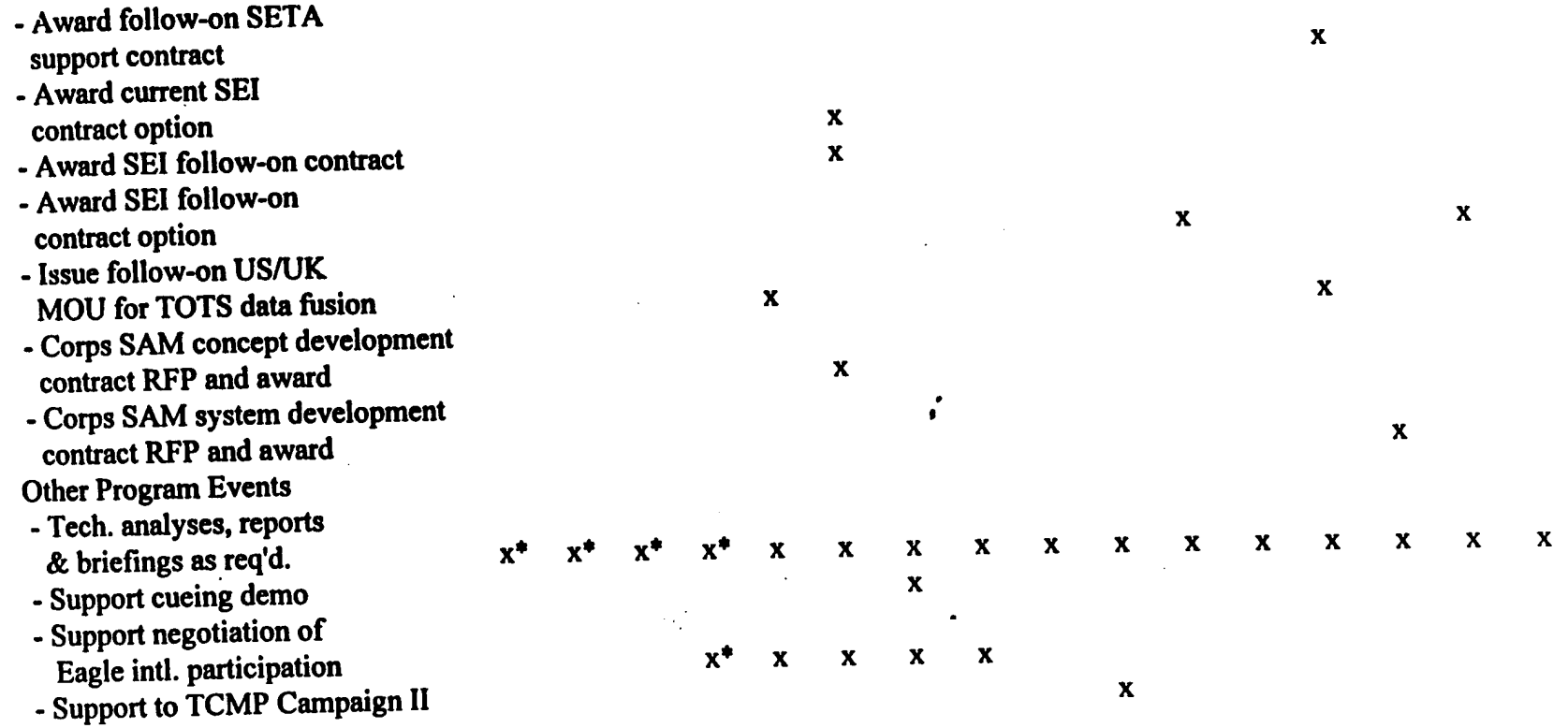
Contract Milestones
- Award POET facility contract option
- Award new POET facility contract
- Award new POET facility contract option
- Award SETA support contract option



RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE:0603872C (Proj: 3251)
PE Title: Other TMD (U)



* Completed

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE:0603872C (Proj: 3265)
PE Title: Other TMD (U)

Project Number / Title: 3265 User Interface

Program Name:	FY1994 Actual	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	FY2000 Estimate	FY2001 Estimate	Total Program
0603872C RDT&E	10,574	12,603	16,843	16,926	11,594	11,558	16,608	16,653	Continuing

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION:

(U) The mission of the Commanders-in-Chief (CINC) Theater Missile Defense (TMD) Assessments Program is to support the CINCs in the execution of various exercises to provide the basis for the assessment, development, and improvement of TMD capabilities. This program integrates new technology and hardware into the CINC exercises to examine its effectiveness and contribution to the TMD mission. The program enables the collection of operational data that is used to evaluate the effectiveness of TMD systems, architectures, and operational concepts. The CINC's TMD Assessment Program provides a framework for the CINCs to perform TMD training and make TMD part of everyday business. Also, this program provides the basis for the integration of User Operational Evaluation Systems (UOES). UOES is a prototype operational system of hardware and procedures which will be user-operated for field evaluation purposes. Through the UOES program, the CINCs develop battle management command, control, and communications architectures, formulate and test operational concepts, and determine operational requirements.

(U) This project also supports the interfaces that must be provided to the military operational community. Analyses and simulations address systems effectiveness of proposed BMD system architectures against ballistic missile threats to U.S.-deployed forces and our allies. Analytical results are used to support activities required for the Defense acquisition process. Theater and strategic gaming with the CINCs is supported to identify roles, missions, and requirements for BMD. Funds are also provided from this project to operational users to enable them to develop and refine their operational requirements documents (ORD) and concepts of operation

(CONOPS) for employing BMD and ensuring that these concepts are integrated into the overall BMD system deployment strategy and planning.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Mission Description and Budget Item Justification section of each Program Element Summary.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) In FY94 this project supported USCENTCOM execution of Joint Project Optic Cobra, USEUCOM execution of Joint Project Optic Needle, and USFK execution of Joint Project Ornate Impact. In addition, the project supported a TMD exercise for the KITTY HAWK Battle group and contributed resources in support of the USACOM TMD exercise with EISENHOWER Battle Group. These exercises resulted in the identification of new TMD operational procedures, the development of better training techniques for warfighters, and the validation of TMD warfighting policies/procedures. The development of a data link between the Warrior Prep Center (WPC) and the National Test Facility enabled responsive broadcasts across the theater early warning networks. The ORD and CONOPS were updated for the U.S. military services allowing the completion of user and developer analyses. Support was provided for theater and strategic wargaming. Continued to support CINC/services in requirements definition of operational evaluation of research and development activities and for policy/strategy development. Completed BMD mission analyses provided better requirements definition and supported the Army in completing operational concept and planning for user operational evaluation systems (UOES).

(U) FY 1994 Accomplishments:

- ($ 9.705M) Provided funding and guidance for the development and execution of USEUCOM

Joint Optic Needle, USCENTCOM Joint Project Optic Cobra, USFK Joint Project Ornate Impact (with GLOBAL 94), KITTYHAWK Battle Group TMD Exercise, and USACOM TMD Exercise with the EISENHOWER Battle Group.

- o ($ .50M) Provided funding to develop Warrior Prep Center (National Test Facility data link).
- o ($ .169M) Provided funding to develop NMD C2 software for TMD applications.
- o ($ .200M) Provided funding to refine ORDs and CONOPs.

(U) FY 1995 Plans:

- o ($ 8.000M) Provide funding to support USEUCOM Joint Project Optic Needle, USCENTCOM Joint Project Optic Cobra, USFK Joint Project Ornate Impact, USACOM TMD Exercises
- o ($ 1.808M) Provide funding to refine Operational Requirements Document (ORDs)
- o ($ 0.370M) Conduct theater and strategic wargaming, including GLOBAL 95.
- o ($ 0.625M) Conduct mission analysis for BMD.

(U) FY 1996 Plans:

- o ($12.000M) Provide funding to support USEUCOM Joint Project Optic Needle, USCENTCOM Joint Project Optic Cobra, USFK Joint Project Ornate Impact, USACOM TMD Exercises, USPACOM TMD Exercises.
- o ($ 2.000M) Provide funding and guidance in the development of the integration of improved TMD models supporting Command Post Exercises and allies/friends.
- o ($ 2.000M) Refine Operational Requirements Document (ORDs) and CONOPs for BMD.
- o ($ 0.843M) Conduct mission analysis and theater/strategic wargaming (including GLOBAL 96) for the U.S., allies, and friends.

(U) FY 1997 Plans:

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE:0603872C (Proj: 3265)
PE Title: Other TMD (U)

- o ($14.000M) Provide funding to support USEUCOM Joint Project Optic Needle, USCENTCOM Joint Project Optic Cobra, USFK Joint Project Ornate Impact, USACOM TMD Exercises, and USPACOM TMD Exercises.
- o ($ 2.000M) Refine Operational Requirements Document (ORDs) and CONOPs for BMD.
- o ($ 0.926M) Conduct mission analysis and theater/strategic wargaming (including GLOBAL 97) for the U.S., allies, and friends.

Acquisition Strategy: This project uses a combination of federally funded research and development centers (FFRDC) and competitively awarded scientific, engineering, and technical assistance contracts (SETA).

B. (U) PROGRAM CHANGE SUMMARY:

	FY1994	FY1995	FY1996	FY1997	TOTAL COST
Previous President's Budget	9,130	13,658	23,629	31,136	77,553
Appropriated Value		10,666			10,666
Adjustments to Appropriated Value		1,937			1,937
Current Budget Submit	10,574	12,603	16,843	16,926	56,946

Change Summary Explanation:
Funding: The CINC's TMD Assessments Program and TMD/NMD User Interface are two activities that were previously under project 3202 in the FY95 President's Budget. The funding increase from FY95 to FY96 is due to two reasons. First, an increasing number of theater commands are participating in the program. Second, the cost and complexity of future exercises will increase as they incorporate future TMD systems. It is planned that by FY98, TMD will be integrated into the routine warfighting operations of a number of commands (e.g.,

USEUCOM, USCENTCOM, USFK). As a result, there will be much less need to sponsor TMD exercises for these commands.
Schedule: None
Technical: None

C. (U) OTHER PROGRAM FUNDING SUMMARY

Related RDT&E:	Funding Dependency? (Yes[1]/No)
1293, Adv. Capability Concept Development, 0603872C	Yes
2294, Adv. Capability Dem/Val, 0603872C	Yes
3153, Architecture Analysis & BMC[3] Initiatives, 0603872C	Yes
3251, Sys. Engineering & Tech. Support, 0603872C	Yes
3261, BM/C3I, 0603864C/0604864C	Yes
3352, Modeling and Simulation, 0603872C	Yes
3359, System Test & Evaluation, 0603872C	Yes

[1]Funding data for related RDT&E efforts that have a funding dependency can be found in the respective project summary/program element.

D. (U) Schedule Profile

	FY1994				FY1995				FY1996				FY1997	
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3
Joint Projects	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Model and Wargame	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Refine ORD/CONOP	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Mission Analysis	x	x	x	x	x	x	x	x	x	x	x	x	x		

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE: 0603872C (Proj: 3270)
PE Title: Other TMD (U)

Project Number / Title: 3270 Threat and Countermeasures Program

Program Name:	FY1994 Actual	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	FY2000 Estimate	FY2001 Estimate	Total Program
0603872C RDT&E	0	0	24,810	24,931	31,580	31,580	31,580	31,580	Continuing

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION:

(U) Threat and Countermeasures Program. The BMDO Theater Missile Defense (TMD) Threat Program defines potential adversary military forces, principally theater ballistic missile (TBM) threats. To accomplish this mission, BMDO has a threat development program which is based on intelligence community projections and is traceable to quantifiable analysis. This project produces capstone threat and counter measure documentation to ensure consistent technical threat definitions across all the Services. It does not duplicate Service-unique activities. The program consists of three component tasks: Intelligence Threat, Countermeasures Integration, and System Threat Scenario Generation. This project was previously funded under Project 3202, 3203, and 3206 in the FY95 President's Budget.

(U) Intelligence Threat Task. The purpose of this task is to provide an intelligence community-validated TMD threat description. The threat is divided into four major categories under this task: Operational Threat Environment, Targets, System Specific Threats (SST), and Reactive Threats. The Operational Threat Environment includes assessments of the TBM operational and technological environments and projects the effects of developments and trends on TMD mission capability. The Targets category includes a projection of foreign TBM systems and countermeasures that enhance their performance. This includes force structure, performance characteristics, and sample signatures. System Specific Threat addresses threats to the TMD "family of systems" including

reconnaissance, surveillance, and target acquisition; lethal and non-lethal threats; and regional integrated SST assessments. The Reactive Threats category includes those that an adversary may develop as a result of deployment of the TMD "family of systems."

(U) System Threat Scenario Generation Task. The accurate specification and characterization of ballistic missiles and the appropriate development and integration of scenarios using these characterizations are critical to the analysis of alternative ballistic missile architectures, the performance assessments of potential technology applications, and the operational performance evaluations of candidate designs. This task provides baseline and excursion scenario descriptions in documentary and electronic form for use in BMDO TMD cost and operational effectiveness analyses (COEA). These descriptions are the only approved threat employment portrayals authorized for acceptable BMDO analysis. This task:

(1) Identifies user needs for threat scenario descriptions.
(2) Identifies analyses needed to fully specify and characterize the threat missile systems, penetration aids, tactics, etc., and ensures the analyses is accomplished.
(3) Provides the analysis results to all interested agencies for review and comment.
(4) Addresses critical threat issues which arise during the analysis process.
(5) Ensures all supporting agencies' views on threat issues are fully aired.
(6) Reviews, approves, produces, and distributes all System Threat Scenario Descriptions.
(7) Produces threat computer tapes electronic media and supporting documentation for use by the development and acquisition communities.

(U) Countermeasures Integration Task. The BMDO Countermeasure Integration (CMI) Program assists TMD acquisition program offices in developing theater ballistic missile defense systems that are robust to potential countermeasures and are practical and within the means of anticipated adversaries. Included in this mission is CMI Program support to the TMD threat development process and advance warning to BMDO system designers. The BMDO CMI Program reviews TMD systems for susceptibilities and identifies

potential countermeasures, determines credibility through analyses and tests, characterizes credible countermeasures by providing designs and performance parameters, informs intelligence and system threat developers of potential countermeasures, informs TMD system designers with advance warning of potential countermeasures, and assists TMD system designers in developing counter-countermeasures. Providing vulnerability and susceptibility information to the system designers early enables them to build robustness into their designs during the early stages of the system development process, a cost-effective means for providing a flexible high-performance design. The CMI Program takes a "rest-of-world" perspective in developing credible, potential countermeasures.

(U) The project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Mission Description and Budget Item Justification section of each Program Element Summary.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1994 Accomplishments:
Not applicable

(U) FY 1995 Plans:
Not applicable

(U) FY 1996 Plans:
o ($ 6.007M) Intelligence Threat Task. Provide Capstone STAR, specialty threats, targets analyses, operational threat environment intelligence assessments, management and planning support.

- o ($ 5.142M) System Threat Scenario Generation Task. Continue to develop threat system characterizations and scenario descriptions in response to the analysis needs of the system/element developers; upgrade the threat modeling capability and produce electronic media and supporting documentation through the National Test Facility (NTF); and develop scenarios depicting threat systems employed in theater environments.
- o ($13.661M) Countermeasures (CM) Integration Task. Support TMD CM Red/Blue activities and counter-countermeasure parametric studies; TMD CM technical experiments and evaluations; CM Skunkworks teams in conducting CM concept, design, fabrication, and testing; and non-technical analysis, oversight, and database management.

(U) FY 1997 Plans:

- o ($ 6.037M) Intelligence Threat Task. Provide Capstone STAR, specialty threats, targets analyses., operational threat environment intelligence assessments, management and planning support.
- o ($ 5.167M) System Threat Scenario Generation Task. Continue to develop threat system characterizations and scenario descriptions in response to the analysis needs of the system/element developers; to upgrade the threat modeling capability and produce threat tapes and supporting documentation through the NTF; and develop scenarios depicting threat systems employed in theater environments.
- o ($13.727M) Countermeasures Integration Task. Support TMD CM Red/Blue activities and counter-countermeasure parametric studies; TMD CM technical experiments and evaluations; CM Skunkworks teams in conducting CM concept, design, fabrication, and testing; and non-technical analysis, oversight, and database management.

Acquisition Strategy: Funding is provided to executing agents who accomplish tasks under existing contracts via Military Interdepartmental Purchase Requests (MIPR); scientific, engineering, and technical assistance (SETA) contracts; and federally funded research and development centers (FFRDC).

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE: 0603872C (Proj: 3270)
PE Title: Other TMD (U)

B. (U) PROGRAM CHANGE SUMMARY:

	FY1994	FY1995	FY1996	FY1997	TOTAL COST
Previous President's Budget	0	0	0	0	0
Appropriated Value		0			0
Adjustments to Appropriated Value		0			0
Current Budget Submit	0	0	24,810	24,931	49,741

Change Summary Explanation:
Funding: This project was funded under projects 3202, 3203, and 3206 in the FY95 President's Budget and is now shared with project 3270 (PE 0603871) beginning in FY96. All previous funding is found in project 3270 (PE 0603873) for FY94 and FY95.

Schedule: None.

Technical: None.

C. (U) OTHER PROGRAM FUNDING SUMMARY

Related RDT&E:	Funding Dependency? (Yes or No)
1266, Navy Theater-wide TBMD, 0603868C	Yes
1293, Advanced Capability Concept Development, 0603872C	Yes
2154, TMD-GBR, 0603862C/0604862C	Yes

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE: 0603872C (Proj: 3270)
PE Title: Other TMD (U)

2257, PATRIOT, 0204865C	Yes
2260, THAAD, 0603861C/0604861C	Yes
2263, Navy Area TBMD, 0603867C/0604867C	Yes
2294, Advanced Capability Dem/Val, 0603872C	Yes
3251, System Engineering and Tech. Support, 0603872C	Yes
3352, Modeling and Simulation, 0603216C/0603217C	Yes
3359, System Test and Evaluation, 0603872C	Yes

[1]Funding data for related RDT&E efforts that have a funding dependency can be found in the respective project summary/program element.

D. (U) Schedule Profile

	FY1994				FY1995				FY1996				FY1997			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
STAR Published																
CM Skunkworks Flight Tests									X		X		X		X	X
Threat Scenario Generation Updates As Required					X	X	X	X	X	X	X	X	X	X	X	X

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE:0603872C (Proj: 3352)
PE Title: Other TMD (U)

Project Number / Title: 3352 Modeling and Simulations

Program Name:	FY1994 Actual	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	FY2000 Estimate	FY2001 Estimate	Total Program
0603872C RDT&E	31,475	64,801	70,521	57,486	61,990	59,181	60,023	60,257	Continuing

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION:

(U) The Theater Missile Defense (TMD) program's goal is to develop, maintain and deploy a cost-effective, Antiballistic Missile (ABM) Treaty compliant system designed to protect the United States and its Allies against the immediate and growing threat from shorter range theater ballistic missiles. The TMD core programs are PATRIOT, Theater High Altitude Area Defense (THAAD), Extended Range Intercept Technology (ERINT), Corps SAM, Navy Theater Wide TBMD and Navy Area TBMD, and Boost Phase Intercept (BPI).

(U) This project provides development and validation of models and simulation techniques and tools that are critical in assessing the performance capabilities of BMD systems. This is a highly complex problem requiring high-performance vector and parallel processing super-computers as well as scalar processors and advanced graphic workstations. This cost effective approach will reduce high cost missile test programs and will establish requirements for future technology. This capability is housed at the National Test Facility (NTF), and the Advanced Research Center/Simulation Center (ARC/SC). These facilities are capable of operating in a distributed integrated simulation environment and host modeling and simulation wargames that provide the analysis, integration, demonstration, and performance verification capability for BMD systems. These facilities are provided to all Services and procedures have been established that ensure efficient utilization and sound verification, validation, and accreditation.

(U) The funding for these facilities is distributed across three Program Elements (Pes) in FY95 (NMD, TMD, and Support Technology), and two Pes in FY96 and beyond (NMD, TMD). This cost sharing approach maximizes synergy and minimizes duplication of modeling and simulation resources. These Pes cover the total cost for operations and maintenance of these facilities which includes: computer hardware and software, communications networks, security, and other essential capabilities necessary to develop and operate reconfigurable, multiple experiment test bed environments. This document describes the TMD portion of funding for these activities.

(U) This project also funds the development, operation, verification, validation, and accreditation of the Extended Air Defense Test Bed (EADTB) and the Extended Air Defense Simulation (EADSIM) which support the analysis required for TMD program acquisition and integration. The EADTB is a flexible simulation tool that can determine the performance of specific existing and conceptual extended air defense systems with the added complexity of theater missile defense threats. This a multi-node test bed that is comprised of high and medium fidelity models of sensors, environments, weapon systems, threats, and BMC3 systems. The capabilities of the EADTB are being incrementally developed and accredited. EADSIM is a low to medium detail simulation system that operates on a stand-alone Silicon Graphics workstation. This simulation is used for architectural analysis of EAD systems and provides user interface for scenario preparation and model description. M&S activities funded by this project include: development, enhancement, and maintenance of the theater test beds and conduct of wargames that provide the analysis, integration, demonstration, and performance verification capability for TMD systems. This project ensures joint usage of simulation tool resources, supports allied and friendly international participation and cooperation in wargaming exercises.

(U) The project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Mission Description and Budget Item Justification section of each Program Element Summary.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE:0603872C (Proj: 3352)
PE Title: Other TMD (U)

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) This project has established an initial operational capability for the EADTB and begun the verification, validation and accreditation of the EADSIM. Over 100 Specific Systems Representations (SSRs), medium to high fidelity models of environments, weapon systems, threats, and BMC3 systems, have already been established at the EADTB and the first remote node has been established at the SHAPE Technical Center (STC). Through an incremental approach these capabilities will be enhanced and accredited while simultaneously adding additional operational nodes. In FY95 and beyond, this project will be responsible for developing and maintaining the modeling and simulation capabilities at the NTF and ARC/SC facilities. Activities support TMD M&S requirements in the areas of simulations, models, test beds, wargames, software, telecommunications networks, and computational facilities in order to meet the evolving needs of the TMD program.

(U) FY 1994 Accomplishments:

- o ($25.805M) Delivered EADTB Capability 1 to establish initial operational capability and provided support for EADTB data collection and experiments which created over 100 SSRs (including: THAAD, Patriot, BMC3, defended areas such as population centers, enemy aircraft, and enemy tactical ballistic missiles), and a limited set of scenarios, and experiments for verification of the software performance and implemented an EADTB node at the STC.
- o ($4.620M) Provided support for UK Test Bed, SDC Test Bed and other TMD cooperative international test bed activities.
- o ($1.300M) Provided development and verification, validation and accreditation (VV&A) support for EADSIM tool enhancements.

(U) FY 1995 Plans:

- o ($26.248M) Deliver EADTB Capability 2 and 2A. These upgrades add new SSRs including a TBMD cruiser and space based sensors. Software functionality improvements were made to provide a more user friendly simulation environment and to

improve output displays and data accessibility. Participate in planned Cost & Operational Effectiveness Analysis (COEA) studies and joint exercises. Rehost software to Silicon Graphics platform (Convex platform retained at present nodes). Deliver remote EADTB access node at NTF. Provide on-site support, operation, and maintenance at the STC, provide software change request enhancements to baseline, and continue VV&A of EADSIM.

- o ($24.225M) Provide super-computing resources at the NTF which will be used by the Threat and Countermeasures program to upgrade model capability, develop scenarios and produce threat tapes. A prototype connection of the Theater Planning Tool (TPT) to existing tactical communications systems will be established through the BMC3 Element Support Center (BESC). Award NTF contract.
- o ($6.915M) Provide super-computing resources at the ARC/SC to operate a multiple experiment test bed environment for conducting research and development activities for the Army and Ground Based Elements including the EADTB and EADSIM.
- o ($2.888M) Provide TMD M&S management oversight and support the independent verification and validation (IV&V), and head-to-head comparisons required for accreditation by the Services.

(U) <u>FY 1996 Plans:</u>

- o ($30.537M) Provide super-computing resources at the NTF which will be used by the TMD Systems Exerciser (TMDSE) to provide credible estimates of Kinetic Energy Weapon lethality against Theater Ballistic Missiles (TBMs). Continue use of facility for threat scenario generation, threat tape production and the development and operation of the TPT.
- o ($23.187M) Rehost EADTB Capability 3 (Convex version) to Silicon Graphics system. Continue development for EADTB Capability 4. These upgrades include SSRs of F15 aircraft, BPI, AWACS, and ground-based command and control centers. Complete Theater Air Combat Control Simulation Facility (TACCSF) and Navy nodes. Provide EADSIM enhancements and improvements.

- o ($8.807M) Provide super-computing resources at the ARC/SC to operate a multiple experiment test bed environment for conducting research and development activities for the Army and Ground Based Elements including the EADTB, EADSIM, and the TMD Ground-Based Radar Test Bed (GBRTB).
- o ($7.990M) Provide TMD M&S management oversight and support the IV&V, and head-to-head comparisons required for accreditation by the Services.

(U) FY 1997 Plans:

- o ($20.900M) Deliver EADTB Capability 4 and 5. These upgrades make the test bed Distributed Interactive Simulation (DIS) compatible and create additional space based sensor SSRs. Provide EADSIM enhancements and improvements.
- o ($20.457M) Provide super-computing resources at the NTF which will be used for the TMDSE to provide credible estimates of kinetic energy weapon lethality against TBMs. Continue use of facility for threat scenario generation, threat tape production and the development and operation of the TPT.
- o ($8.850M) Provide super-computing resources at the ARC/SC to operate a multiple experiment test bed environment for conducting research and development activities for the Army and Ground Based Elements including the EADTB, EADSIM, and GBRTB.
- o ($7.279M) Provide TMD M&S management oversight and support the IV&V, and head-to-head comparisons required for accreditation by the Services.

(U) Acquisition Strategy: The tasks in this project have and will be met through full and open competition. Primary M&S support is performed at the NTF, ARC/SC, and other testbed facilities. The NTF contract was awarded to Loral in 1QFY95. The ARC/SC contract is a CPFF with COLSA, first awarded in June of 1989. The prime contractor for development and operation of the EADTB is Hughes Aircraft which was awarded a C/CPAF contract in September 1989.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE:0603872C (Proj: 3352)
PE Title: Other TMD (U)

B. (U) PROGRAM CHANGE SUMMARY:

	FY1994	FY1995	FY1996	FY1997	TOTAL COST
Previous President's Budget	26,385	68,840	64,640	62,240	222,105
Appropriated Value		60,175			60,175
Adjustments to Appropriated Value		4,626			4,626
Current Budget Submit	31,475	64,801	70,521	57,486	224,283

Change Summary Explanation:
Funding: This project was formerly a subset of project number 3300 in the FY95 President's Budget. Previous President's Budget values state total M&S funding amounts which are now reported in three separate Pes (under this project, 3352) to reflect funding by TMD, NMD, Technology Follow-ons. This explains the large differences between previous and current appropriated values. The increase in funding for this project between FY94 and FY95 is attributed to TMD and NMD shared costs for the NTF and ARC/SC. This was previously funded in the NMD project for FY94. The decrease in FY97 costs at the NTF is a result of a one year change in the distribution of funding responsibilities at the NTF between NMD and TMD. A corresponding one year increase will be reflected in the NMD M&S project. Funding levels at the NTF and ARC/SC have been reduced resulting in single shift operation at both facilities.
Schedule: NONE
Technical: NONE

C. (U) OTHER PROGRAM FUNDING SUMMARY

Related RDT&E:	Funding Dependency? (Yes[1]/No)
1266, Navy Theater Wide, 0603868C	Yes

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE:0603872C (Proj: 3352)
PE Title: Other TMD (U)

2154, TMD Ground Based Radar, 0603861C/0604861C	Yes
2260, THAAD, 0603861C/0604861C	Yes
2262, CORPS SAM, 0603869C	Yes
3251, Systems Engineering, 0603872C	Yes
3261, BMC3I, 0603864C/0604864C	Yes
3270, Threat and Countermeasures, 0603872C	Yes
3352, Modeling and Simulation, 0603871C/0603173C	Yes
3359, System Test & Evaluation, 0603872C	Yes

[1]Funding data for related RDT&E efforts that have a funding dependency can be found in the respective project summary/program element.

D. (U) Schedule Profile

	FY1994				FY1995				FY1996				FY1997			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Acquisition Milestone																
Engineering Milestone				b1	b2	b3	b4&5		b6			b7			b8	
T&E Milestone					c1											
Contract Milestone					d1											
Other Program Events						e1		e2								

b1 Delivery of EADTB Capability 2 (Complete)
b2 Rehost EADTB to Silicon Graphics system
b3 Delivery of EADTB Capability 2A
b4 Delivery of EADTB NTF node

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE:0603872C (Proj: 3352)
PE Title: Other TMD (U)

b5 Delivery of EADTB Capability 3 (Convex)
b6 Delivery of EADTB Capability 3 (S.G.)
b7 Delivery of EADTB Capability 4
b8 Delivery of EADTB Capability 5
c1 Technical Engineering Demonstration
d1 NTF Support Contract Award
e1 NMD/TMD Wargame 95-A (CENTCOM)
e2 NMD/TMD Wargame 95-B (EUTCOM)

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE:0603872C (Proj: 3354)
PE Title: Other TMD (U)

Project Number / Title: 3354 Targets Support

Program Name:	FY1994 Actual	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	FY2000 Estimate	FY2001 Estimate	Total Program
0603872C RDT&E	43,051	64,042	26,091	29,900	40,637	20,704	47,695	47,880	Continuing

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION:

(U) This project provides targets and services needed to support the testing and evaluation of Theater Missile Defense (TMD) programs. It is a segment of the BMDO Consolidated Targets Program (CTP). The CTP mission is to provide threat representative ballistic missile target system support to interceptor and sensor development and acquisition programs. This project funds the development of target systems and Foreign Military Acquisition (FMA) to support TMD test and evaluation. Also funded are the refurbishment and support costs of retired missile systems components that are used to construct the target systems. The THAAD, PAC-3, and Navy programs require target system support to accomplish their planned test and evaluation. The THAAD program intends to use the newly developed Hera target system with planned launches from White Sands NM and Wake Island into the Kwajalein Missile Range (KMR) impact area. The PAC-3 program will use Storm and Hera targets launched from White Sands and the Navy may use Hera targets launched from Pacific Missile Range Facility (PMRF) (Barking Sands, Kauai, HI) into open ocean impact areas.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Mission Description and Budget Item Justification section of each Program Element Summary.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE:0603872C (Proj: 3354)
PE Title: Other TMD (U)

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:
Hera target development was continued, Storm targets were provided for PATRIOT/ERINT tests, and old missiles were refurbished for use as GFE TMD targets.

(U) FY 1994 Accomplishments:
- o ($18.000M) Continued development of the Hera target system to support TMD test and evaluation (THAAD, PAC-3, Navy)
- o ($10.000M) Continued to provide the Storm target in support of PATRIOT/ERINT testing
- o ($15.051M) Supported TMD targets infrastructure to include refurbishment of retired missile systems to be provided as GFE to construct target systems

(U) FY 1995 Plans:
- o ($33.000M) Complete development of the Hera target system and provide target launch support for Patriot and THAAD testing.
- o ($22.980M) Continue to provide TMD targets infrastructure support to include refurbishment of retired missile systems to be provided as GFE to construct target systems. Also, supports Foreign Material Acquisition (FMA) targets program.
- o ($9.562M) Technical support for targets program operations at the executing agent.

(U) FY 1996 Plans:
- o ($5.000M) Continue procurement of additional FMA target systems and target development to support TMD EMD test and evaluation.
- o ($20.091M) Continue to budget for infrastructure to support TMD targets to include refurbishment of retired missile systems to be provided as GFE to construct target systems.
- o ($1.000M) Initiate development of advanced payload to meet future requirements.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE:0603872C (Proj: 3354)
PE Title: Other TMD (U)

(U) FY 1997 Plans:

- o ($7.000M) Continue procurement of additional FMA target systems and target development to support TMD test and evaluation.
- o ($10.900M) Continue to budget for infrastructure to support TMD targets to include refurbishment of retired missile systems to be provided as GFE to construct target systems.
- o ($12.000M) Provide support for the Strategic Target System to include refurbishment of missile components and maintaining launch capability to support TMD EMD test and evaluation.

Acquisition Strategy: The Hera target system, being developed by Coleman Research Corporation (Orlando, FL) will be procured with a contract for a quantity of 25 targets. Two additional options are available for procurement of 25 targets in each option. Orbital Sciences Corporation is under contract to deliver three Storm target systems. Additional targets include STRYPI IX missiles and Lance target system.

B. (U) PROGRAM CHANGE SUMMARY:

	FY1994	FY1995	FY1996	FY1997	TOTAL COST
Previous President's Budget	40,448	32,992	36,818	41,000	151,258
Appropriated Value		50,430			50,430
Adjustments to Appropriated Value		13,612			13,612
Current Budget Submit	43,051	64,042	26,091	29,900	163,084

Change Summary Explanation:

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE:0603872C (Proj: 3354)
PE Title: Other TMD (U)

Funding: Project 3354 was included in project 3300 for the FY95 President's Budget submitted. The funding increase in FY95 was due to a change in the program element structure for FY95 to comply with congressional directives. Funding for this project consolidates targets development cost under one funding line. Each Major Defense Acquisition Program (MDAP) subsequently funds procurement and support for these targets used in program testing. The funding decreases in FY96-97 reflects current program requirement.
Schedule: NONE
Technical: NONE

C. (U) OTHER PROGRAM FUNDING SUMMARY

Related RDT&E:	Funding Dependency? (Yes[1]/No)
2257, PATRIOT,0603486C/0604865C	Yes
2358, HAWK System BMC3, 0603863C	Yes
3157, Environmental, Siting & Fac, 0603872C	Yes
3359, System Test and Evaluation, 0603872C	Yes
3360, Test Resources, 0603872C	Yes
2262, Corps SAM, 0603869C	Yes
2260, THAAD, 0603861C	Yes
1170, TMD Risk Reduction, 0603872C	Yes
1263, Navy Theater WideTBMD, 0603872C	Yes

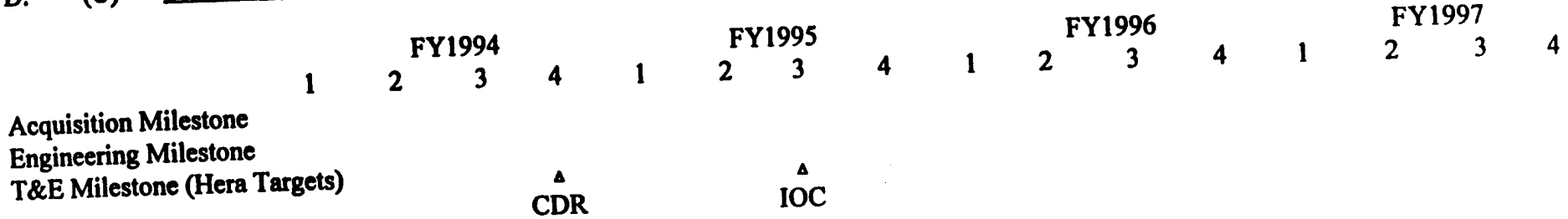
[1]Funding data for related RDT&E efforts that have a funding dependency can be found in the respective project summary/program element.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE:0603872C (Proj: 3354)
PE Title: Other TMD (U)

D. (U) Schedule Profile Hera Targets Program



RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE: 0603872C (Proj: 3359)
PE Title: Other TMD (U)

Project Number / Title: 3359 System Test & Evaluation

Program Name:	FY1994 Actual	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	FY2000 Estimate	FY2001 Estimate	Total Program
0603872C RDT&E	34,042	27,758	47,137	46,720	48,056	29,667	29,896	30,978	Continuing

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION:

(U) This project provides for BMDO planning oversight and coordination of integrated Test and Evaluation activities, as well as inter-service Test and Evaluation efforts. Once the test plans are developed, test resource and target development and support is provided. (Test resources located in project 3360, include test facilities, ranges and test instrumentation; target development and support is found in project 3354). Additionally, this project provides the following: independent test evaluation of systems, technology programs and special reviews; estimates of kinetic energy weapon (KEW) Lethality against Theater Ballistic Missiles; fidelity models and simulation to support system development testing; and execution of independent technical reviews, system analyses and performance evaluations which contribute to the development of the BMD family of systems and achievement of acquisition milestones. The performance evaluation has as its primary goals the identification and understanding of system-level performance drivers and the mitigation of technical risk. Efforts include short-term special studies, focused technical investigations, and participation in test readiness reviews to ensure successful test and experiments.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Mission Description and Budget Item Justification section of each Program Element Summary.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE: 0603872C (Proj: 3359)
PE Title: Other TMD (U)

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) This project provided lethality test data which supported the PAC-3 Milestone II (MSII) decision and will support the THAAD and Sea-Based Area Defense MSII decision. It provided independent evaluations of high interest technical issues for TMD acquisition programs, and TMD system level Test and TMD system level test tools.

(U) FY 1994 Accomplishments:

- ($ 2.930M) Completed theater environment for Proof of Principle (POP) demonstration of the Distributed Theater Missile Defense System Level Exerciser; conducted Proof of Principle demonstration for TMD System Exerciser (TMDSE). Conducted PAC-3/ERINT missile suitability study, THAAD power system study, and THAAD Kinetic Kill Vehicle Hardware-in-the-Loop Simulator (KHILS) evaluation.
- ($28.738M) Live flight data from the Patriot system confirmed destruction of submunitions in hit-to-kill intercepts. Updated PAC-3 lethality codes to support Live Fire Test & Evaluation (LFT&E) analysis for PAC-3 DAB.
- ($1.187M) Developed independent evaluation methodology. Conducted special study of THAAD missile power interrupts. Conducted technical investigation of government Infrared Red hardware-in-the-loop testing facilities. Analyzed and verified attainment of exit criteria for PAC-3 Defense Acquisition Board (DAB) Milestone Review.
- ($1.187M) Provided Test and Evaluation (T&E) technical support. Reviewed, analyzed, and critiqued the Test and Evaluation Master Plans (TEMP's) for PAC-3 and Sea-based Area Defense Programs. Research and analyze BMD T&E issues and policies in support of the Defense Steering Group (DTESG) and the OSD T&E Resources Committee (TERC).

(U) FY 1995 Plans:

- o ($9.782M) Develop interface for TMD System Exerciser, to resolve some of the major theater integration issues, both inter and intra-service; conduct TMD system level interoperability testing and evaluation with System Exerciser. Perform test planning for scheduled System Integrated Tests (SITs). Perform Command, Control, Communications Intelligence Integration Test (C3IITs) in conjunction with the SIT schedule and conduct SITs.
- o ($14.594M) Perform THAAD Interceptor, PAC-3 Lethality and Sea-Based Area Defense sled test. Perform sub-scale interceptor gas-gun scaling experiments.
- o ($1.691M) Execute independent evaluation plan and methodology. Conduct special studies and technical investigations. Participate in THAAD Test Readiness Reviews. Monitor THAAD flight testing and confirm attainment of test objectives. Conduct special studies and analyses in support of the TMD Cost and Operational Effectiveness Analysis (COEA) effort.
- o ($1.691M) Provide Test and Evaluation technical support. Review, analyze, and critique the BMDO TMD T&E program. Research, analyze, and document TMD T&E issues and policies for the OSD BMD Acquisition Executive. Research and analyze BMD T&E issues and policies in support of the Defense T&E Steering Group (DTESG) and the OSD T&E Resources Committee (TERC).

(U) <u>FY 1996 Plans</u>:

- o ($23.131M) Provide sensor integration to the TMDSE. Perform test planning for scheduled SITs. Perform C3IITs in conjunction with the SIT schedule and conduct SITs. For example, two major tests are scheduled at USAKA with Patriot, Aegis and BMC^3 using countermeasures and realistic targets.
- o ($18.533M) Perform lethality sled tests to establish geometry variation with realistic targets for PAC-3 and THAAD. Perform direct hit lethality sled test for Sea-Base Area Defense.
- o ($2.737M) Execute independent evaluation plan and methodology. Conduct special studies and technical investigations. Participate in THAAD Test Readiness Reviews. Conduct Independent Evaluations of TMDSE testing. Monitor THAAD flight testing and confirm attainment of test objective.

- o ($2.736M) Provide Test and Evaluation (T&E) technical support. Review, analyze, and critique the BMDO TMD T&E program. Research, analyze, and coument TMD T&E issues and policies for the OSD BMD Acquisition Executive. Research and analyze BMD T&E issues and policies in support of the Defense T&E Steering Group (DTESG) and the OSD T&E Resources Committee (TERC).

(U) FY 1997 Plans:

- o ($21.518M) Provide service integration to TMDSE. Perform test planning for scheduled SITs. Perform C3IITs in conjunction with the SIT schedule and conduct SITs. Integration tests of the Army enclave will be performed with Patriot, THAAD and BMC^3 using both live and simulated TMDSE capabilities.
- o ($19.702M) Continue PAC-3/THAAD live fire T&E/Lethality sled tests against threat targets. Initiate Sea-Base Area Defense geometry variation sled tests.
- o ($2.750M) Execute independent evaluation plan and methodology. Conduct special studies and technical investigations. Participate in THAAD Test Readiness Reviews. Participate in PAC-3 Test Readincss reviews. Conduct Independent Evaluations of TMDSE testing.
- o ($2.750M) Provide Test and Evaluation (T&E) technical support. Review, analyze, and critique the BMDO/TMD T&E program. Research, analyze, and document TMD T&E issues and policies for the OSD BMD Acquisition Executive. Research and analyze BMD T&E issues and policies in support of the Defense T&E Steering Group(DTESG) and the OSD T&E Resources Committee (TERC).

Acquisition Strategy: This effort will use Service executing agents through existing contracts to construct a TMD Family of Systems HWIL capability (TMDSE) and conduct TMD system level live flight testing. The strategy provides for lethality sled testing managed by BMDO and executed by Service labs against TMD targets. It also provides Service and BMDO system evaluation funding. Various Federally Funded Research and Development Centers (FFRDC) will be used to execute the evaluation process.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE: 0603872C (Proj: 3359)
PE Title: Other TMD (U)

B. (U) PROGRAM CHANGE SUMMARY:

	FY1994	FY1995	FY1996	FY1997	TOTAL COST
Previous President's Budget	33,838	44,650	46,450	45,250	170,188
Appropriated Value		28,531			28,531
Adjustments to Appropriated Value		-0,773			(773)
Current Budget Submit	34,042	27,758	47,137	46,720	155,657

Change Summary Explanation:
Funding: System Test and Evaluation Activities, project 3359, were included in projects 1502 and 3300 for the FY95 President's Budget. Due to Congressional direction program-specific lethality funding has been moved to projects 2257 (PATRIOT), 2260 (THAAD), and 2263 (Navy Area TBMD). Funding increased due to the initiation of System Integration Tests (SITs) in FY96 and the outyears. Underfunding of TMSDE in FY95 resulted in a program slip of approximately six months; FY96 provides increased funding to restore the schedule consistent with major defense acquisition programs' development and their associated integration with the BMC3. Other increased funding is required to implement C3IIT in preparation for and post assessment of SITs. Greater emphasis on lethality and evaluation represents planned growth to reflect the overall pace of the TMD program. Evaluation effort provides funding to support service evaluation efforts (e.g., AMSAA) during intense test periods.
Schedule: None
Technical: None

C. (U) OTHER PROGRAM FUNDING SUMMARY

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE: 0603872C (Proj: 3359)
PE Title: Other TMD (U)

Related RDT&E:	Funding Dependency? (Yes[1]/No)
1155, Phenomenology, 0603872C	Yes
1170, TMD Risk Mitigation, 0603872C	Yes
1266, Navy Theater Wide Defense, 0603868C	Yes
2154, TMD GBR, 0603862C/0604862C	Yes
2260, THAAD, 0603861C	Yes
2257, PATRIOT, 0604865C	Yes
2262, Corps SAM, 0603869C	Yes
2263, Navy Area, 0603867C	Yes
2358, HAWK System BMC3, 0603863C	Yes
3157, Environmental, Siting & Fac, 0603872C	Yes
3251, Sys Eng & Tech Spt, 0603872C	Yes
3261, BMC3I Concepts, 06033864C	Yes
3352, Modeling and Sim, 0603872C	Yes
3354, Targets, 0603872C	Yes
3360, Test Resources, 0603872C	Yes

[1]Funding data for related RDT&E efforts that have a funding dependency can be found in the respective project summary/program element.

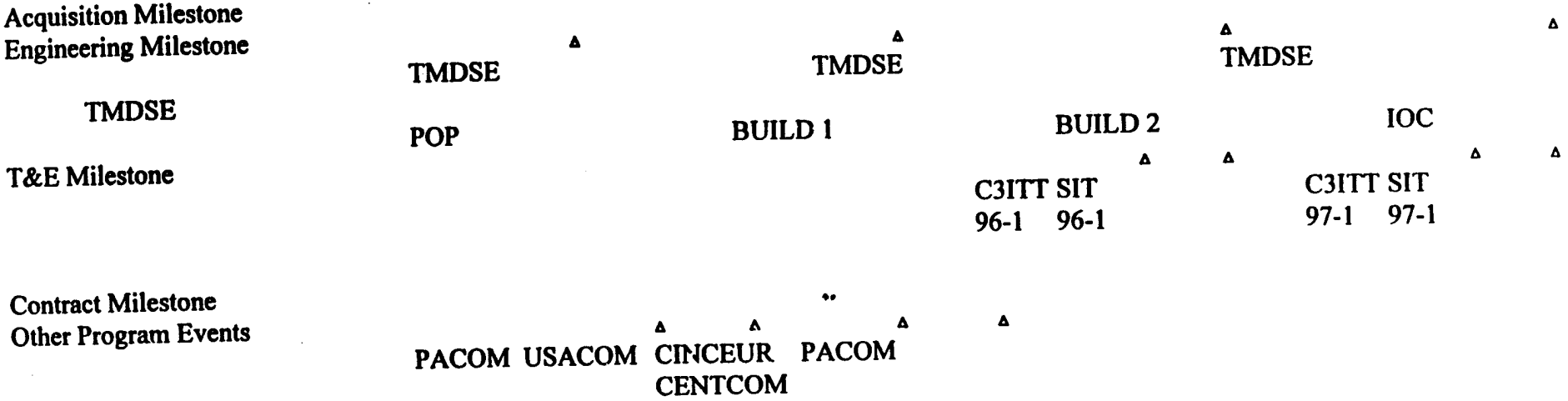
D. (U) Schedule Profile

FY1994				FY1995				FY1996				FY1997			
1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE: 0603872C (Proj: 3359)
PE Title: Other TMD (U)



RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE:0603872C (Proj: 3360)
PE Title: Other TMD (U)

Project Number / Title: 3360 Test Resources

Program Name:	FY1994 Actual	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	FY2000 Estimate	FY2001 Estimate	Total Program
0603872C RDT&E	14,919	25,585	34,237	35,853	34,937	34,808	35,494	35,651	Continuing

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION:

(U) This project provides for BMDO planning, oversight, and coordination of integrated test and evaluation activities, as well as inter-service test and evaluation efforts. Additionally, this project provides the test infrastructure for common ground test facilities, common range facilities, and range instrumentation in direct support of THAAD, PATRIOT, Navy TBMD, theater missile defense (TMD) target phenomenology projects, and the Technology Readiness program. The common ground test facilities include: the Kinetic Kill Vehicle Hardware-in-the-Loop Simulator (KHILS) at Eglin AFB, Fort Walton Beach, FL; the Hypervelocity Wind Tunnel Number 9 (Tunnel 9) at the Naval Surface Warfare Center, White Oak, MD; the National Hover Test Facility (NHTF) at Edwards AFB, CA; the Kinetic Energy Weapon Digital Emulation Center (KDEC) at U.S.Army Space and Strategic Defense Command, Huntsville, AL; the Army Missile Optical Range (AMOR) at the U.S. Army Missile Command, Huntsville, AL; and the infra-red and blackbody standards at the National Institute of Standards and Technology (NIST) in Gaithersburg, MD. The common range facilities include national ranges such as: the White Sands Missile Range (WSMR) located in Las Cruces, NM; the Kwajalein Missile Range (KMR) with the Wake Island Complex located in the Marshall Islands; the Pacific Missile Range Facility (PMRF) located at Kauai, HI; the Gulf Test Range (GTR) located at Eglin AFB, Fort Walton Beach, FL. The range instrumentation includes special test equipment, data collection assets, and range instrumentation upgrades including: the High Altitude Observatory (HALO) with the Infrared Imaging System (IRIS) sensor, based at Aeromet, Inc., Tulsa, OK; the Rapid Optical Beam Steering (ROBS) system, the Sea-Lite Beam Director (SLBD), the Experimental Test System (ETS), and the High Altitude Optical Imaging System (HAOIS)

all based at WSMR. These ground test, range and instrumentation assets provide program risk reduction and test implementation capability in support of the Theater Missile Defense test and evaluation program. These facilities and capabilities support systems design, verification and validation of target realism, and the evaluation of test results. This project was part of project 3300 in the FY95 President's Budget.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Mission Description and Budget Item Justification section of each Program Element Summary.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) This project has provided the test infrastructure for ground test facilities, range facilities and range instrumentation in direct support of the THAAD, PATRIOT, Navy Sea-based Area, and TMD target phenomenology projects as well as the Technology Readiness program in FY94. The full flight duplication capability at the NSWC Wind Tunnel Number 9 and the HERA launch complex (LC 32) at WSMR achieved their initial operating conditions. Successfully collected unique target phenomenology data from airborne and ground sensors for all TMD target/interceptor flights launched at WSMR during FY94 (total of eight flights). Demonstrated initial capabilities of the Rapid Optical Beam Steering (ROBS) system, a laser radar tracking system, at WSMR.

(U) FY 1994 Accomplishments:

- ($ 4.519M) Provided ground test facility infrastructure and upgrades for BMDO testing including: digital emulation at KDEC, hardware-in-the-loop testing at KHILS, wind tunnel testing at Tunnel 9, and propellant loading expertise from the NHTF. Support initial operating capability (IOC) of the full flight duplication capability at Tunnel 9 and the design and planning of the Wide-Band Infra-red (IR) Scene Projector (WISP) at the KHILS facility.

- o ($ 8.250M) Provided test range infrastructure, upgrades, and environmental documentation for BMDO testing including development of TMD launch and range facilities, and associated range instrumentation sites.
- o ($ 2.150M) Provided range instrumentation, upgrades, data collection, and analyses for BMDO testing including: design and planning of the Kwajalein Mobile Range Safety System (KMRSS) at KMR, deployment of ROBS system at WSMR, and data collecting and processing by SLBD and ETS at WSMR and HALO/IRIS.

(U) FY 1995 Plans:

- o ($ 8.657M) Provide ground test facility infrastructure and upgrades for BMDO testing including: digital emulation at KDEC, hardware-in-the-loop testing at KHILS, wind tunnel testing at Tunnel 9, propellant loading expertise from the NHTF, and phenomenology characterization at AMOR and KHILS. Complete the full flight duplication capability at Tunnel 9. Support the IOC of the WISP at KHILS.
- o ($ 7.150M) Provide test range infrastructure, upgrades, and environmental documentation for BMDO testing including development of TMD launch and range facilities at WSMR, Wake Island, and associated range instrumentation sites.
- o ($ 9.778M) Provide range instrumentation, upgrades, data collection, and analyses for BMDO testing including: IOC of KMRSS at KMR, IOC of ROBS system, and data collection and processing by SLBD and ETS at WSMR and the HALO/IRIS sensor. Support the design and planning of HAOIS at WSMR.

(U) FY 1996 Plans:

- o ($15.204M) Provide ground test facility infrastructure and upgrades for BMDO testing including: digital emulation at KDEC, hardware-in-the-loop testing at KHILS, wind tunnel testing at Tunnel 9, propellant loading expertise from the NHTF, phenomenology characterization at AMOR and KHILS, and primary infra-red standards at the NIST. Complete the WISP at KHILS.

- o ($ 8.404M) Provide test range infrastructure, upgrades, and environmental documentation for BMDO testing including development of TMD launch and range facilities at WSMR and Wake Island, and associated range instrumentation sites.
- o ($10.629M) Provide range instrumentation, upgrades, data collection, and analyses for BMDO testing including: FOC of KMRSS at KMR, FOC of the ROBS system, and data collecting and processing by SLBD and ETS at WSMR and the HALO/IRIS sensor. Support the IOC of HAOIS at WSMR.

(U) FY 1997 Plans:

- o ($16.950M) Provide ground test facility infrastructure and upgrades for BMDO testing including: digital emulation at KDEC, hardware-in-the-loop testing at KHILS, wind tunnel testing at Tunnel 9, propellant loading expertise from the NHTF, phenomenology characterization at AMOR and KHILS, and primary infra-red standards at the NIST.
- o ($ 8.950M) Provide test range infrastructure, upgrades, and environmental documentation for BMDO testing including development of TMD launch and range facilities, and associated range instrumentation sites.
- o ($ 9.953M) Provide range instrumentation, upgrades, data collection, and analyses for BMDO testing including: data collecting and processing by ROBS, SLBD and ETS at WSMR and HALO/IRIS sensor. Support the FOC of HAOIS at WSMR.

Acquisition Strategy: In the selection and acquisition of ranges and test facilities, the BMDO implements a reliance process which a) maintains perspective of national technical test capabilities; b) is responsive to program requirements; c) uses existing test resources where possible; d) requires coordination prior to development of new resources; and e) consolidates management of existing resources where possible and practicable. This policy results in a variety of acquisition methods. This project uses Service executing agents through existing contracts in support of TMD testing. Executing agent project managers for the Service projects and tasks under this project include the three services and the BMDO, to take best advantage of existing strengths and capabilities. Service project manager organizations specifically include : the U.S. Army Space and Strategic Defense Command (USASSDC), the U.S.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE:0603872C (Proj: 3360)
PE Title: Other TMD (U)

Navy Office of Naval Research, Navy Ballistic Missile Defense Technology, and the U.S. Air Force Phillips Laboratory. The majority of the ground test facilities are government owned and operated, many with some degree of contractor support, which support multiple BMDO users. The ranges in this project supporting TMD are part of the DoD major range and test facility bases, i.e., WSMR, KMR, PMRF, and GTR. The HALO/IRIS sensors are operated by competitively awarded contracts. The ROBS laser radar was developed by a contractor who is providing continuing technical support through the initial check-out and operation. SLBD is operated by the U.S. Navy (government and contractor personnel). Data from ETS and SLBD is collected and processed by federally funded research and development center personnel.

B. (U) PROGRAM CHANGE SUMMARY:

	FY1994	FY1995	FY1996	FY1997	TOTAL COST
Previous President's Budget	15,026	31,721	31,721	31,721	110,189
Appropriated Value		27,971			27,971
Adjustments to Appropriated Value		-2,386			(2,386)
Current Budget Submit	14,919	25,585	34,237	35,853	110,594

Change Summary Explanation:
Funding: Project 3360 was a portion of project 3300 in the FY95 President's Budget. Increase in FY96 is required for planning and preparation for range instrumentation and test ranges consistent with the pace and growth of the TMD program.
Schedule: None
Technical: None

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE:0603872C (Proj: 3360)
PE Title: Other TMD (U)

C. (U) OTHER PROGRAM FUNDING SUMMARY

Related RDT&E:	Funding Dependency? (Yes or No)
1155, Phenomenology Program, 0603872C	Yes
1265, Boost Phase Interceptor, 0603870C	Yes
1266, Navy Theater-wide TBMD, 0603868C	Yes
1267, Ground-based Interceptor, 0603871C	Yes
1270, Advanced Interceptors, 0603173C	Yes
2257, PATRIOT, 0604865C	Yes
2259, Israeli Cooperative Projects, 0603872C	Yes
2260, THAAD, 0603861C/0604861C	Yes
2263, Navy Area TBMD, 0604867C	Yes
3157, Environmental Siting & Fac, 0603872C	Yes
3354, Targets, 0603872C	Yes
3359, System Test and Evaluation, 0603872C	Yes

[1]Funding data for related RDT&E efforts that have a funding dependency can be found in the respective project summary/program element.

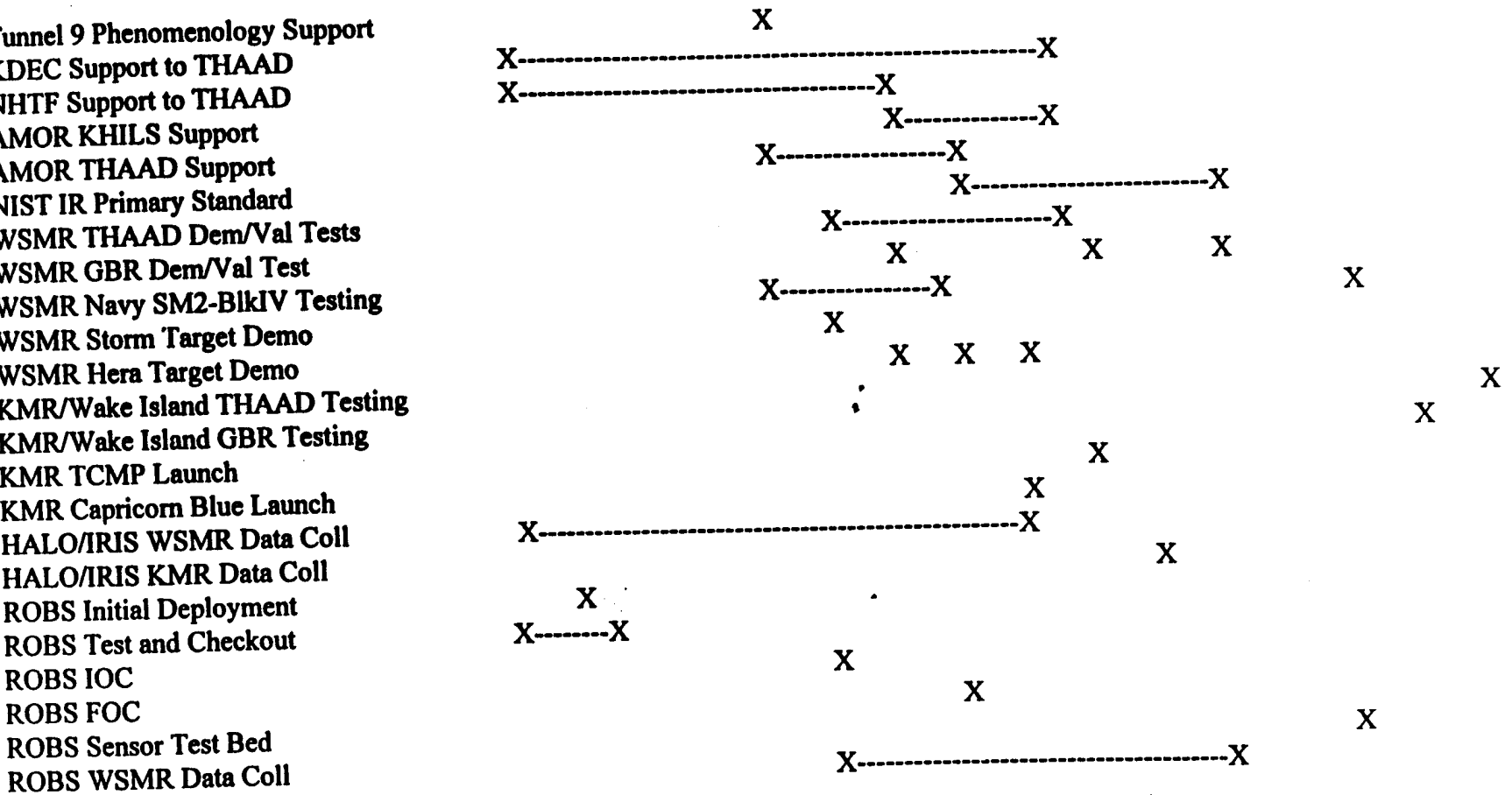
D. (U) Schedule Profile

	FY1994				FY1995				FY1996				FY1997			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
KHILS WISP IOC							X									
KHILS WISP FOC												X				
Tunnel 9 Full Flight Dup IOC				X												

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 04 (Dem/Val)

PE:0603872C (Proj: 3360)
PE Title: Other TMD (U)



RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 05 (EMD)

PE: 0604865C (Proj: 2257)
PE Title: PAC3 (U)

Project Number / Title: 2257 PATRIOT

Program Name:	FY1994 Actual	FY1995* Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	FY2000 Estimate	FY2001 Estimate	Total Program
0208865C PROC	120,115	253,272	399,463	413,608	486,247	423,600	469,050	271,967	3,347M
0603865C RDT&E	77,584	0	0	0	0	0	0	0	629M
0604865C RDT&E	42,097	276,283	247,921	160,070	65,005	775	487	98	804M

* See OTHER PROGRAM FUNDING SUMMARY section

A. MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION:

(U) PATRIOT is a long-range, mobile, field Army and Corps air defense system, which uses guided missiles to simultaneously engage and destroy multiple targets at varying ranges. The PATRIOT Advanced Capability Level 3 (PAC-3) Upgrade Program is the latest evolution of the phased material change improvement program to PATRIOT. The material changes will provide improved performance across the spectrum for system and threat intercept performance. The material changes include a new PAC-3 missile (previously known as ERINT), remote launch capabilities, communications and computer/software improvements, and radar upgrades to enhance system performance by improving its multi-function capability for tracking, and target handling capability against air breathing, ballistic and cruise missile threats. The PATRIOT operates as lower tier of the Army's TMD enclave concept and is developing the capacity to interact with the Navy Cooperative Engagement Capability (CEC) system.

(U) This project is assigned to the Budget Activity and Program Element Codes as identified in this descriptive summary in accordance with existing Department of Defense policy.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 05 (EMD)

PE: 0604865C (Proj: 2257)
PE Title: PAC3 (U)

(U) PROGRAM ACCOMPLISHMENTS AND PLANS

(U) The ERINT was selected as the PAC-3 missile as a result of successful tests and a thorough evaluation of the missiles capabilities by the U.S. Army. The Dem/Val missile conducted three successful intercepts against tactical ballistic missile and air breathing targets. Following the missile selection, a Defense Acquisition Board (DAB) review of the PAC-3 program was conducted resulting in approval for the PAC-3 missile to enter Engineering and Manufacturing Development (EMD). U.S. Army Missile Command (MICOM) released the solicitations for development of the PAC-3 missile and integration of the PAC-3 missile into the PATRIOT system. Milestone III decision was approved for production of Guidance Enhanced Missile (GEM)(Upgrade to the PAC-2 missile). MICOM released solicitations for the Routing Logic Radio Interface Unit (RLRIU). The Army fielded 31 Quick Response Program Kits. Submitted preliminary Engineering Change Proposals for Radar Phase III. The Army conducted the Initial Production Readiness Review for Radar Phase III. Efforts now focus on completing the radar and remote launch enhancements to the system, completing initial work on PATRIOT/ERINT integration, and initiating PAC-3 missile EMD. PATRIOT is pursing integration of PATRIOT BMC3I with the Project Manager, Air Defense Command and Control Systems to take advantage of previous Army developments that can be incorporated into the PATRIOT program. This project was listed as PE: 0604216C/0604225C in the FY1995 President's Budget. The FY1994 accomplishments listed include the accomplishments from the Risk Reduction/Mitigation from PE: 0604866C Proj 2257. The Risk Reduction/Mitigation project was listed as PE: 0604216C (Theater Missile Defense) Proj: 2208 (ERINT) in the FY1995 President's Budget.

(U) FY 1994 Accomplishments

- o Initiated the PAC-3 missile EMD phase.
- o Conducted operational test planning and support.
- o Completed PATRIOT Multimode missile Dem/Val program.

- o Completed Radar Phase III system integration and pre-production quality testing (PPQT); continue Classification, Discrimination, Identification (CDI) Phase III (HRR) development.
- o Continued Remote Launch development.
- o Complete ERINT Dem/Val flight tests; award contract go-ahead for the EMD missile; complete testing of PATRIOT/ERINT integration hardware and software; deliver Dem/Val seeker to support MICOM HWIL testing.

(U) FY 1995 PLANS:

- o ($204.191M) Continue PAC-3 missile EMD; begin PAC-3 missile hardware procurement/fabrication and conduct in-process review (IPRs); hold Software Specification Review (SSR), Preliminary Design Review (PDR), and Critical Design Review (CDR) to complete PAC-3 missile design; develop test plans and procedures for Development Test(DT)/ Operational Tests (OT) /Initial Operational Tests and Evaluation (IOT&E) flight tests.
- o ($20.88M) Continue Remote Launch/communication development program. .
- o ($26.32M) Continue of CDI Phase III development program.
- o ($22.040M) Initiate TMD/THAAD integration and cueing software program to provide basis for interoperability within Theater Missile Defense via Joint Tactical Information Distribution System (JTIDS)/Tactical Air Defense Information Link (TADIL)-J messages to the THAAD Battery Tactical Operations Center (BTOC).
- o ($ 2.852M) Provide hardware to support sled tests and hypervelocity gun tests to support lethality reporting requirements and live fire test preparation. Support digital computer code modeling unique to PATRIOT.

(U) FY 1996 PLANS:

- o ($215.121M) Continue PAC-3 missile EMD program; begin formal flight testing; EMD target and test support.
- o ($11.097M) Continue Remote Launch/communications development program.
- o ($16.649M) Complete integration and testing of CDI Phase III and conduct Production Design Review.

- o ($ 3.064M) Continue TMD/THAAD integration/cueing program.
- o ($ 1.990M) Continue lethality efforts.

(U) FY 1997 PLANS:

- o ($158.57M) Continue PAC-3 missile hardware procurement/fabrication and conduct In Progress Reviews; continue target supports, Development Test and Operational Test flight tests.
- o ($ 1.500M) Continue lethality efforts.

(U) Acquisition Strategy: The PAC-3 Upgrade Program will provide enhancements to the current PATRIOT system through a series of upgrades divided into three configurations which will be individually tested and procured. Missile and ground equipment configurations will be fielded through a hardware retrofit and concurrently released software builds. During EMD, an expanded risk reduction/mitigation program (PE: 0604866C, Proj: 2257) will be implemented to address areas of risk identified during the Dem/Val phase.

B. (U) PROGRAM CHANGE SUMMARY:

PAC-3 DEM/VAL:	FY1994	FY1995	FY1996	FY1997	TOTAL COST
Previous President's Budget	81,184	69,240	30,960	0	181,384
Appropriated Value		0			0
Adjustments to Appropriated Value		0			0
Current Budget Submit	77,584	0	0	0	77,584

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 05 (EMD)

PE: 0604865C (Proj: 2257)
PE Title: PAC3 (U)

PAC-3 EMD:	FY1994	FY1995	FY1996	FY1997	TOTAL COST
Previous President's Budget	42,097	217,200	205,620	134,230	599,147
Appropriated Value		286,440			286,440
Adjustments to Appropriated Value		-10,157			(10,157)
Current Budget Submit	42,097	276,283	247,921	160,070	726,371

Change Summary Explanation:
Funding: This project was previously listed under PE: 0604216C/0604225C, Proj: 2207 in the FY1995 President's Budget. All Dem/Val funding in the FY1995 President's Budget was moved into the EMD program element as the program was approved to enter EMD. The Ballistic Missile Defense Organization is reassessing the mix of Procurement and RDT&E funding for PATRIOT in FY1996. Pending the outcome of this assessment, revised requests with a zero sum gain between Procurement and RDT&E funds may be submitted to the Congressional committees during the FY1996 budget deliberations.

Schedule: None
Technical:None

C. (U) OTHER PROGRAM FUNDING SUMMARY

MILCON/Procurement: As listed on Page 1.

Related RDT&E:	Funding Dependency (Yes[1]/No)
Project 2257 PAC-3 Risk Mitigation PE 0604866C	Yes

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 05 (EMD)

PE: 0604865C (Proj: 2257)
PE Title: PAC3 (U)

*Project 1155 Phenomenology PE:0603872C	Yes
*Project 1170 TMD Risk Mitigation PE:0603872C	Yes
*Project 3157 Environ, Siting, & Facilities PE 0603872C	Yes
Project 3160 Logistics PE:0603872C	Yes
*Project 3251 Sys Eng & Tech Spt PE 0603872C	Yes
*Project 3261 BMC3I PE 0603872C/0604864C	Yes
*Project 3265 CINCs TMD Assessment PE 0603872C	Yes
*Project 3352 Modeling & Simulation PE 0603872C	Yes
*Project 3354 Targets PE 0603872C	Yes
*Project 3359 Sys Test & Eval PE: 0603872C	Yes
*Project 3360 Test Resources PE:0603872C	Yes

* These projects provide essential technical, engineering, and/or infrastructure support to TMD MDAP programs.

(U) FY 1995 efforts totalling $0.600M that are funded in the Other TMD Activities Program Element (PE 0603872C) are included in the program element totals shown on this R-2 Exhibit.

[1]Funding data for related RDT&E efforts that have a funding dependency can be found in the respective project summary/program element.

D. (U) Schedule Profile

	FY1994				FY1995				FY1996				FY1997			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
PAC-3 Missile EMD																

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 05 (EMD)

PE: 0604865C (Proj: 2257)
PE Title: PAC3 (U)

Contract Award	X											
Config-1 Software rel	X											
PAC-3 Missile PDR			X									
Config-1 FUE		X										
Config-2 CDT&E		X										
PAC-3 Missile CDR				X								
Config-2 FOTE						X						
PDB-4 Software Rel							X					
Config-2 FUE							X					
PAC-3 Msl LRIP												X

Planned Milestones Beyond FY1997:

Config-3 IOTE/FOTE	2Q/3QFY98
PAC-3 Missile Milestone III	4QFY98
PDB-5 Software release	4QFY98
Config-3 /PAC-3 Msl FUE	4QFY98
Config-3 /CDT&E	1QFY98

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)

February 1995

Budget Activity 04 - Dem/Val

Project and Title - 2257 PATRIOT

P.E. Number: 0603865C
P.E. Title : PAC-3 (U)

A. Project Cost Breakdown (In Thousands)

Project Cost Categories	1994	1995	1996	1997
a. Multimode Missile Program	55,500	0	0	0
b. Remote Launch	1,135	0	0	0
c. Radar Phase III	20,949	0	0	0
Total	77,584	0	0	0

B. Budget Acquisition History and Planning Information

This PE was restructured in FY1995 and was not funded past FY1994.

Performing Organizations

Contractor or Government Performing Activity	Contract Method/Type or Funding Vehicle	Award Obligation Date	Performing EAC	Project Office EAC	Total Prior to 1994	Budget 1994	Budget 1995	Budget 1996	Budget 1997	Budget to Complete	Total Program
Product Development							0	0	0	0	
Raytheon(Multimode Missile)	SS-CPIF					55,500	0	0	0	0	
Raytheon (Remote Launch)	SS-CPIF					1,135	0	0	0	0	
Raytheon(Radar Phase III	SS-CPIF					20,949	0	0	0	0	
Subtotal Product Dev.						77,584.					
Subtotal Support & Mgmt.											
Subtotal Test & Evaluation											
Total Project						77,584.	0	0	0	0	

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)

February 1995

Budget Activity 05 - EMD

P.E. Number: 0604865C
P.E. Title : PAC-3 (U)

Project and Title - 2257 PATRIOT

A. Project Cost Breakdown (In Thousands)

Project Cost Category	1994	1995	1996	1997
a. PAC-3 Missile (EMD)	42,097	276,283	247,921	160,070

B. Budget Acquisition History and Planning Information

Performing Organizations

Contractor or Government Performing Activity	Contract Method/Type or Funding Vehicle	Award Obligation Date	Performing EAC	Project Office EAC	Total Prior to 1994	Budget 1994	Budget 1995	Budget 1996	Budget 1997	Budget to Complete	Total Program
Product Development											
Raytheon (Radar/CDI III)	SS-CPIF	TBD	44651	44651.0	0	0	30421.0	14230.0	0	0	44651.0
Raytheon (Remote Launch/ Commo)	SS-CPIF	TBD	25186.0	25186.0	0	0	15701.0	9485.0	0	0	25186.0
Loral (Current)	SS-CPIF	15 Jun 94	30000.0	30000.0	0	30000.0	0	0	0	0	30000.0
Raytheon(Integration)	SS-CPIF	18 Nov 94	121000.0	121000.0	0	4521.0	20479.0	20092.0	16837.0	59071.0	121000.0
Loral(EMD)	SS-CPIF	26 Oct 94	515000.0	515000.0	0	4521.0	160479.0	138406.0	77533.0	134061.0	515000.0
RDEC/OGA	PO	15 Oct 93	49207.0	49207.0	0	1491.0	12826.0	12475.0	11605.0	10810.0	49207.0
Undetermined											
Support and Management Organizations											
Coleman	MIPR	TBD	450.0	450.0	0	50.0	400.0	0	0	0	450.0
Delta	MIPR	TBD	3800.0	3800.0	0	0	1800.0	2000.0	0	0	3800.0
Nichols	MIPR	TBD	21790.0	21790.0	0	0	3040.0	5515.0	5255.0	5980.0	19790.0
CAS/0105	SS-CPIF	TBD	19766.0	19766.0	0	0	4850.0	4114.0	4052.0	4750.0	17766.0
OGA/Inhouse	PO	TBD	36271.0	36271.0	0	0	8249.0	8485.0	8402.0	9135.0	34271.0
Raytheon(E/S 94)	SS-CPIF	1-30-94	1114.0	1114.0	0	1114.0	0	0	0	0	1114.0
Raytheon(E/S 95)	SS-CPIF	TBD	11653.0	11653.0	0	0	9283.0	2370.0	0	0	11653.0
Raytheon(E/S 96)	SS-CPIF	TBD	1197.0	1197.0	0	0	0	9557.0	2440.0	0	11997.0
Test and Evaluation Organization											
WSMR/ARL	MIPR	TBD	36095.0	36095.0	0	400.0	8155.0	10694.0	9606.0	7240.0	36095.0
OT&E	MIPR	TBD	4732.0	4732.0	0	0	600.0	547.0	840.0	2745.0	4732.0
Targets	MIPR	TBD	52895.0	52895.0	0	0	0	9951.0	23500.0	19444.0	52895.0

Government Furnished Property

Item Description	Contract Method/Type or Funding Vehicle	Award Obligation Date	Performing EAC	Project Office EAC	Total Prior to 1994	Budget 1994	Budget 1995	Budget 1996	Budget 1997	Budget to Complete	Total Program
Product Dev. Property TBD	Negative										
Support & Mgmt. Property TBD	Negative										
Test & Eval. Property TBD	Negative										
Subtotal Product Dev.					0	40.533	239.906	194.688	105.975	203,942	785,044
Subtotal Support & Mgmt.					0	1.164	27.622	32.041	20.149	19.865	100.841
Subtotal Test & Evaluation					0	.400	8.755	21.192	33.946	29.429	93.722
Total Project					0	42,097	276,283	247,921	160,070	253,236	979,607

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 05 (EMD)

PE: 0604866C (Proj: 2257)
PE Title: PAC3 Risk (U)

Project Number / Title: 2257 PAC3 RISK REDUCTION

Program Name:	FY1994 Actual	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	FY2000 Estimate	FY2001 Estimate	Total Program
0604866C RDT&E	97,000	74,000	19,485	9,760	0	0	0	0	200M

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION:

(U) PATRIOT is a long-range, mobile, field Army and Corps air defense system, which uses guided missiles to simultaneously engage and destroy multiple targets at varying ranges. The PATRIOT Advanced Capability Level 3 (PAC-3) Upgrade Program is the latest evolution of the phased material change improvement program to PATRIOT. The material changes will provide improved performance across the spectrum for system and threat intercept performance. The material changes include a new PAC-3 missile (previously known as ERINT), remote launch capabilities, communications and computer/software improvements, and radar upgrades to enhance system performance by improving its multi-function capability for acquisition, tracking, and target handling capability against air breathing, ballistic and cruise missile threats. The PATRIOT operates as a lower tier of the Army's TMD enclave concept and is developing the capacity to interact with the Navy Cooperative Engagement Capability (CEC). This project provides for risk reduction activities associated with the PAC-3 system including the PAC-3 missile. There are three sets of activities; the PAC-3 missile and system integration activities; the Mountain Top Demonstration; and captive carry and HWIL testing of a 16" seeker. This project addresses PAC-3 missile system risks including; system integration of the PAC-3 missile; maneuvering re-entry threat vehicles; Electronic Counter-Counter Measures; relocation of threat vehicle payloads and low altitude and, low radar cross-section cruise missiles in a high clutter and/or adverse weather environment.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 05 (EMD)

PE: 0604866C (Proj: 2257)
PE Title: PAC3 Risk (U)

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS

(U) The ERINT was selected as the PAC-3 missile as a result of successful tests and a thorough evaluation of its capabilities by the U.S. Army. The Dem/Val missile conducted three successful intercepts against tactical missile and air breathing targets. Following the missile selection, the Defense Acquisition Review Board (DAB) approved the PAC-3 missile to enter Engineering and Manufacturing Development (EMD). MICOM released the solicitations for development of the PAC-3 missile and integration of the PAC-3 missile into the PATRIOT system. This program is focusing on risk reduction/mitigation activities which address overall system integration of the PAC-3 missile and the capability of the system to address the full spectrum of threats including the advanced cruise missile. The FY1994 accomplishments and plans are included in the PE: 0604865C Proj 2207. This PE in FY1994 was listed as ERINT (Proj 2208) under PE: 0604216C (Theater Missile Defense) under the FY1995 President's Budget. The FY1995 through FY1997 funding in PE:0604866C address the PATRIOT Risk Reduction program.

(U) FY 1995 PLANS:

- ($65.5M) Activities include Engineering and Manufacturing Development (EMD) Seeker captive carry and Hardware -in-the-loop (HWIL) testing, upgrading the PATRIOT Flight Mission Simulator to increase the fidelity of operational testing, additional/alternate development of critical PAC-3 missile seeker technologies and designs to further reduce PAC-3 system risks, and HWIL/captive carry testing of a 16" seeker against advanced cruise missile threats.
- ($8.5M) Activities support participation of the PATRIOT system and PAC-3 missile seeker in the Mountain Top Cruise Missile defense Advanced Concept Technology Demonstration. This effort demonstrates and evaluates over-the-horizon detection and engagement of cruise missiles using an elevated sensor platform to detect and track the incoming target.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 05 (EMD)

PE: 0604866C (Proj: 2257)
PE Title: PAC3 Risk (U)

(U) FY 1996 PLANS:
- o ($19.48M) Continuation of the Risk Reduction/Mitigation program. This does not include funding for the Mountain Top Demonstration.

(U) FY 1997 PLANS:
- o ($9.76M) Completion of the Risk Reduction/Mitigation Program.

Acquisition Strategy: The PAC-3 Risk Reduction and Mitigation program is a multi-faceted effort involving two prime contractors and three contracts. The risk reduction/mitigation modification efforts are for existing EMD contracts with each of the two prime contractors. A new separate contract is planned for one of the contractors which will be a phased work effort on the 16" seeker and unpriced options for follow-on phases which include further development and testing. The initiation and execution of the follow-on phases are keyed to events and activities in the EMD program which will indicate the degree of risk remaining in meeting the performance goals of the PAC-3 missile.

B. (U) PROGRAM CHANGE SUMMARY:

	FY1994	FY1995	FY1996	FY1997	TOTAL COST
Previous President's Budget	97,000	58,460	19,580	9,760	184,800
Appropriated Value		74,000			74,000
Adjustments to Appropriated Value		0			0
Current Budget Submit	97,000	74,000	19,485	9,760	200,245

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 05 (EMD)

PE: 0604866C (Proj: 2257)
PE Title: PAC3 Risk (U)

Change Summary Explanation:
Funding: There is a decline in the amount of dollars needed between the different fiscal years as the amount anticipated is not as great in the years following the first year of integrating the PAC-3 missile into the PATRIOT system. Congress directed $8.5 of the FY1995 $74M appropriated, be used solely for the Mountain Top Demonstration. This PE in FY1994 was listed as ERINT (Proj 2208) under PE: 0604216C (Theater Missile Defense).

Schedule: None
Technical: None

C. OTHER PROGRAM FUNDING SUMMARY

Related RDT&E:	Funding Dependency? (Yes[1]/No)
None	

[1]Funding data for related RDT&E efforts that have a funding dependency can be found in the respective project summary/program element.

D. (U) Schedule Profile

	FY1995				FY1996				FY1997			
	1	2	3	4	1	2	3	4	1	2	3	4
Config-1 Software rel	X											
PAC-3 Missile PDR				X								
Config-1 FUE		X										

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 05 (EMD)

PE: 0604866C (Proj: 2257)
PE Title: PAC3 Risk (U)

Config-2 CDT&E	X			
Pac-3 Missile CDR			X	
Config-2 FOTE		X		
PDB-4 Software Release			X	
Config-2 FUE		X		
PAC-3 Missile LRIP Decision				X

Planned Milestones Beyond FY1997:

Config-3 IOTE/FOTE	2Q/3QFY98
PAC-3 Missile Milestone III	4QFY98
PDB-5 Software release	4QFY98
Config-3 FUE	4QFY98
Config-3 CDT&E	1QFY98

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)

February 1995

Budget Activity 05 - EMD

P.E. Number: 0604866C
P.E. Title : PAC-3 Risk (U)

Project and Title - 2257 PATRIOT

A. Project Cost Breakdown (In Thousands)

Project Cost Categories	1994	1995	1996	1997
a. Risk Reduction/Mitigation	97,000	74,000	19,485	9,760

B. Budget Acquisition History and Planning Information

Performing Organizations

Contractor or Government Performing Activity	Contract Method/Type or Funding Vehicle	Award Obligation Date	Performing EAC	Project Office EAC	Total Prior to 1994	Budget 1994	Budget 1995	Budget 1996	Budget 1997	Budget to Complete	Total Program
Product Development											
Lorsl(Erint)	SS-CPIF	Dec 93	67,753	69,753	0	67,753	0	0	0	0	69,753
I/H-OGA	PO	Dec 93	5,978.5	5,978.5	0	5,978.5	0	0	0	0	5,978.5
Loral/Raytheon	TBD	TBD	TBD	TBD			57,573	16,405	7,947	0	82,020
Support and Management Organizations											
Nichols/0038	C-CPAF	Dec 92			0	5,089	0	0	0	0	0
Delta/0029	C-CPAF	Dec 91			0	1,230	0	0	0	0	0
Nichols/SSDC	MIPR	Nov 93			0	75	0	0	0	0	0
I/H-OGA	PO	Oct 93			0	14,874.5	0	0	0	0	0
Nichols (RR)	MIPR	TBD	3,000	3,000	0	0	3,000	0	0	0	3,000
CAS (Risk M)	SS-CPAF	TBD	1,000	1,000]	0	0	1,000	0	0	0	1,000
Other I/H-OGA	PO	TBD	8,820	8,820	0	0	3,927	3,080	1,813	0	8,820
Mountain Top			8,500	8,500	0	0	8,500	0	0	0	8,500
Test and Evaluation Organization											

Government Furnished Property

Item Description	Contract Method/Type or Funding Vehicle	Award Obligation Date	Performing EAC	Project Office EAC	Total Prior to 1994	Budget 1994	Budget 1995	Budget 1996	Budget 1997	Budget to Complete	Total Program
Product Dev. Property TBD	Negative										
Support & Mgmt. Property TBD	Negative										
Test & Eval. Property TBD	Negative										
Subtotal Product Dev.	TBD	TBD			0	75,731.5	57,573	16,405	7,947	0	157,656.5
Subtotal Support & Mgmt.						21,268.5	16,427	3,080	1,813	0	42,588.5
Subtotal Test & Evaluation	Negative										
Total Project					0	97,000	74,000	19,485	9,760	0	200,245

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 06 (Management)

PE:0605218C (Proj: 4000)
PE Title: Management (U)

Project Number / Title: 4000 Operational Support

Program Name:	FY1994 Actual	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	FY2000 Estimate	FY2001 Estimate	Total Program
0605218C RDT&E	205,948	163,206	185,542	188,418	224,742	219,543	230,014	223,971	Continuing

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION:

(U) This project provides support in three basic areas: personnel and related support costs; funding to meeting fluctuation costs and contract terminations; and assistance required to fund support service contracts.

(U) Personnel & related support costs common to all BMDO projects include support of the Office of the Director, Ballistic Missile Defense Organization and his staff located within the Washington, D.C. area, as well as BMDO's Executing Agents within the US Army Space & Strategic Defense Command, U.S. Army PEO Missile Defense, U.S. Navy PEO for Theater Defense, U.S. Air Force PEO office, and the National Test Facility. This project supports funding for personnel salaries, benefits, and supportive costs such as rents, utilities, supplies, etc.

(U) The BMDO prioritizes funding within this project to meet operational, contractual, and statutory fiscal requirements. Operational requirements include reimbursable services acquired through the Defense Business Operating Fund (DBOF), such as accounting services provided by the Defense Finance and Accounting Service (DFAS). Contractual requirements include reserves for special termination costs on designated contracts and provisions for terminating other programs as required. BMDO has additional requirements to provide for foreign currency fluctuations on its limited number of foreign contracts. Finally, statutory requirements include funding for charges to cancelled appropriations in accordance with Public Law 101-510.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 06 (Management)

PE:0605218C (Proj: 4000)
PE Title: Management (U)

(U) Assistance required to support BMDO overhead management functions is contained in this project. This assistance ranges from operational contracts to fully support functions such as ADP operations, Access control offices, and graphics support, to supportive efforts required, as well as to supplement the BMDO government personnel. Typical efforts include cost estimating, security management, contracts management, strategic relations management and information management. These efforts include assessment of technical project design, development and testing, test planning, assessment of technology maturity and technology integration across BMDO projects; and support of design reviews and technology interface meetings. Program control tasks include assessment of schedule, cost, and performance, with attendant documentation of the many related programmatic issues. The requirement for this area is based on most economical and efficient utilization of contractors versus government personnel.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1994 Through FY 1997 Plans:

- o Continue providing management and support for fixed costs such as civilian payroll, travel, rents & utilities and supplies.
- o The funding provided by this project has enabled and will enable the executing agents to centralize funding and management of these common and recurring operating costs.
- o Products are generated on a continuing basis

Acquisition Strategy: Centralized funding of management costs optimizes their value across the entire range of BMDO projects and allows for management of these costs by support functions. This strategy of centralizing management will continue to occur throughout this program. Certain BMDO functions, such as cost estimating, require the use of contractor support to perform independent estimates.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 06 (Management)

PE:0605218C (Proj: 4000)
PE Title: Management (U)

Contractors are used in other areas, such as ADP Operations, where government needs are most cost-effectively met by use of contractors.

B. (U) PROGRAM CHANGE SUMMARY:

	FY1994	FY1995	FY1996	FY1997	TOTAL COST
Previous President's Budget	198,802	215,233	223,077	226,077	863,189
Appropriated Value		197,996			197,996
Adjustments to Appropriated Value		-34,790			(34,790)
Current Budget Submit	205,948	163,206	185,542	188,418	743,114

Change Summary Explanation:
Funding: Several management efforts were restructed in FY 1995 in order to align the type of work/costs into three areas as described above. Previously, the funds for these functions were combined with other work being accomplished in various projects. Additionally, other Government personnel are being transferred to other non-BMDO projects to downsize the number of personnel within the BMDO personnel and related account. BMDO's FY 1995 President's Budget submission of $215 million for management costs was reduced to $162 million. $197 million was appropriated in this account, which included $34.8 million for unrelated TMD targets efforts that have since been removed from this account.

Schedule: None
Technical: None

C. (U) OTHER PROGRAM FUNDING SUMMARY

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit) Feb 1995

RDT&E, Defensewide / BA 06 (Management)

PE:0605218C (Proj: 4000)
PE Title: Management (U)

Related RDT&E:
All BMDO projects in all BMDO PEs receive management support from this PE.

D. (U) Schedule Profile

	FY1994				FY1995				FY1996				FY1997			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Other Program Events:																
BMDO PB Submission		X				X				X				X		
BMDO BES Submission				X				X				X				X
BMDO Report to Congress			X		X				X				X			
Other Program Events																
Cost Estimating Products	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Program Control Products	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Chemical and Biological Defense Progam (CBDP)

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Chemical and Biological Defense Program
FY 1996/1997 R D T & E Program

Exhibit R-1

Appropriation: 0400 D Research Development Test & Eval Defwide

Date: FEB 1995

Line No	Program Element Number	Item	Act	FY 1994	FY 1995	FY 1996	FY 1997	Sec
				Thousands of Dollars				
5	0601384BP	Chemical and Biological Defense Program	1			23,947	25,676	U
		Basic Research				23,947	25,676	
12	0602384BP	Chemical and Biological Defense Program	2		10,000	60,665	55,270	U
		Exploratory Development			10,000	60,665	55,270	
29	0603384BP	Chemical and Biological Defense Program - Advanced Development	3			25,684	36,644	U
		Advanced Development				25,684	36,644	
74	0603884BP	Chemical and Biological Defense Program - Dem/Val	4			32,461	42,755	U
		Demonstration and Validation				32,461	42,755	
79	0604384BP	Chemical and Biological Defense Program - EMD	5		15,200	95,324	102,938	U
		Engineering and Manufacturing Development			15,200	95,324	102,938	
96	0605384BP	Chemical and Biological Defense Program	6		1,700	4,936	5,405	U
		RDT&E Management Support			1,700	4,936	5,405	
Total		Chemical and Biological Defense Program			26,900	243,017	268,688	

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RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: February, 1995

BUDGET ACTIVITY: 1 - Basic Research

PE NUMBER AND TITLE: 0601384BP Chemical/Biological Defense (Basic Research)

COST (*In Thousands*)	FY 1994 Actual	FY 1995 Estimate	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	0	0	23947	25676	26823	27594	28604	29498	Continuing	Continuing
A71A Non-Medical Chem/Bio Defense *			2000	2245	2399	2548	2708	2862	Continuing	Continuing
BS11 Science Base/Medical Chemical Defense *			7259	7875	8501	8717	9013	9271	Continuing	Continuing
BS12 Science Base/Medical Biological Defense *	0	0	14688	15556	15923	16329	16883	17365	Continuing	Continuing

* These projects were previously funded in PE/Projs 61102.71A, 61102.S11, 61102.S12.

A. **Mission Description and Budget Item Justification** Research expands our knowledge in militarily relevant fields and leads to technological breakthroughs. This is the DoD core research program focused on critical research areas that have a high potential to considerably improve the operational performance of present and future DoD components and systems. The program promotes theoretical and experimental research in the following basic research areas: physics; chemistry; and biological and medical sciences. The Army is the DoD Executive Agent for Chemical Warfare (CW) and Chemical and Biological Defense (CBD) research. Basic research is executed mostly by academia and industry. There is also an investment in Historically Black Colleges and Universities and Minority Institutions (HBCU/MIs). This core research program is complemented by the inter-disciplinary research performed under the University Research Initiative (URI) program. In-house research is a coherent, well-integrated program. The in-house program capitalizes on the scientific talent and specialized facilities to expeditiously transition the resulting knowledge and technology into the appropriate developmental activities. This research is focused on sustaining the DoD's technological superiority for effectiveness in the Airland Battle environment to provide a lethal, integrated, supportable, highly mobile force with enhanced soldier effectiveness. Work performed in this PE supports efforts in PEs 62384BP, Exploratory Development; and 63384BP, Advanced Development. The basic research program is coordinated with all Services via the Joint Directors of Laboratories panels, Project Reliance, and other interservice working groups. The work in this program element is consistent with rigorous peer review, the Army Science and Technology Master Plan (ASTMP), Science and Technology Objectives (STOs) milestones and the Joint Service Modernization Plan. The projects in this PE include basic research efforts directed toward providing fundamental knowledge for the solution of military problems and therefore are correctly placed in Budget Activity 1.

Project A71A - Research in Chemical Warfare/Biological Warfare Defense: The purpose of this project is to obtain, through basic research in chemistry, physics and life sciences, fundamental information in support of: new and improved defensive systems for biological agents and toxins; new and improved defensive systems for chemical threat agents; new concepts in decontamination, aerosol studies; determinations of the environmental fate and impact of militarily unique processes.

FY 1994 Accomplishments: Funded under Army PE 61102.A71A

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February, 1995
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601384BP Chemical/Biological Defense (Basic Research)

FY 1995 Planned Program: Funded under Army PE 61102.A71A

FY 1996 Planned Program:
- Begin work on oligosaccharide synthesis for capture of Vibrio cholerae and continue to develop filed assay for DNA hybridization (800)
- Develop a laboratory method for biochemical assay of micron-size (e.g., single cell) bio particles via controlled addition of microdroplet reagents in an electrodynamic balance. (700)
- Complete database and methodology development for advanced mass spectrometry of bacterial components. (500)

FY 1997 Planned Program:
- Transition piezoelectric toxin detector to exploratory development and incorporate nuclear magnetic resonance (NMR) and molecular modeling as a means to understand how conformation effects binding affinity. (850)
- Demonstrate apparatus for rapid simultaneous measurement of fluorescence, multiangle light scattering, and electrodynamic particle sizing of individual aerosol particles in air flow, and investigate the potential for initial bio agent alarm to control bio detection/identification systems. (700)
- Complete research phase of mass spectrometric bacterial discrimination/identification program. (695)

Project BS11- Science Base/Medical Chemical Defense: Basic studies are performed to delineate mechanisms and sites action of identified and emerging chemical threats to generate required information for initial design and synthesis of medical countermeasures.

FY 1994 Accomplishments: Funded under Army PE 61102.BS11

FY 1995 Planned Program: Funded under Army PE 61102.BS11

FY 1996 Planned Program:
- Characterize cellular mechanisms and markers of injury; develop new models of sulfur mustard injury. (2991)
- Characterize cellular and brain mechanisms controlling nerve agent-induced seizures and pathology involving anticonvulsant and other therapy. (1817)
- Explore potential biological scavengers for chemical agents; apply biotechnological approaches to the development of scavengers. (1905)
- Generate hypothesis and models to define mechanisms of action of CW threat agents. (546)

FY 1997 Planned Program:
- Characterize cellular mechanisms and markers of injury; develop new models of sulfur mustard injury. (3149)
- Characterize cellular and brain mechanisms controlling nerve agent-induced seizures and pathology involving anticonvulsant and other therapy. (1972)
- Explore potential biological scavengers for chemical agents; apply biotechnological approaches to the development of scavengers. (2138)

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BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601384BP Chemical/Biological Defense (Basic Research)

- Generate hypothesis and models to define mechanisms of action of CW threat agents. (616)

Project BS12 -Science Base/Medical Biological Defense: This project funds exploratory research on the development of vaccines and drugs to provide an effective medical defense against validated biological threat agents including bacteria, toxins, viruses and other agents of biological origin. By employing biotechnology, medical systems will be designed to rapidly identify, diagnose, prevent, and treat disease due to exposure to biological threat agents.

FY 1994 Accomplishments: Funded under Army PE 61102.BS12

FY 1995 Planned Program: Funded under Army PE 61102.BS12

FY 1996 Planned Program:

- Examine the mechanisms by which disease producing factors are regulated by *Bacillus anthracis* and examine the genetics and physiology of other bacterial threat agents to understand how they cause disease. (4190)
- Investigate the infectious sites on Eastern and Western equine encephalitis viral genomes and develop techniques for determining infectious sites on other viral threat genomes. (1542)
- Evaluate the role of the immune system in mediating biological toxin intoxication. (5831)
- Develop specific medical countermeasures against biological threat agents. (3125)

FY 1997 Planned Program:

- Determine the relevant bacterial gene products required to elicit an immune response to *Brucella* sp. that would lead to a bio-engineered vaccine and develop techniques for identifying immunostimulatory epitopes in other bacterial threat agents. (2621)
- Examine the process by which viruses produce illness in susceptible hosts. (1508)
- Conduct research on the role of the immune system in responding to biological toxins. (5662)
- Evaluate specific medical countermeasures against biological threat agents. (5765)

B. Program Change Summary

	FY 1994	FY 1995	FY 1996	FY 1997
Previous President's Budget	0	0	0	0
Appropriated Value				

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	FY 1994	FY 1995	FY 1996	FY 1997
Adjustments to Appropriated Value				
Current Budget Submit/President's Budget			23947	25676

NOTE: These projects were previously funded in PE/Projs 61102.71A, 61102.S11, 61102.S12.

Change Summary Explanation:

Funding:

Schedule:

Technical:

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: February, 1995

BUDGET ACTIVITY: 1 - Basic Research

PE NUMBER AND TITLE: 0601384BP Chemical/Biological Defense (Basic Research)

PROJECT: A71A

COST (*In Thousands*)	FY 1994 Actual	FY 1995 Estimate	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
A71A Non-Medical Chem/Bio Defense *	——	——	2000	2245	2399	2548	2706	2862	Continuing	Continuing

C. Other Program Funding Summary: See Paragraph A for related efforts.

	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	To Compl	Total Cost

D. Schedule Profile: The efforts funded in this project represent continuing basic research in the area of Chemical Warfare/Biological Warfare Defense, therefore no milestones or events are provided.

FY 1994				FY 1995				FY 1996				FY 1997			
1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4

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BUDGET ACTIVITY: 1 - Basic Research

PE NUMBER AND TITLE: 0601384BP Chemical/Biological Defense (Basic Research)

PROJECT: BS11

COST (*In Thousands*)	FY 1994 Actual	FY 1995 Estimate	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
BS11 Science Base/Medical Chemical Defense *	——	——	7259	7875	8501	8717	9013	9271	Continuing	Continuing

C. Other Program Funding Summary: See para A for related efforts.

FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	To Compl	Total Cost

D. Schedule Profile: The efforts in this project are non-system specific and represent continuing exploratory development research in the area medical technology, therefore no milestones or events are provided.

FY 1994				FY 1995				FY 1996				FY 1997			
1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4

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BUDGET ACTIVITY: 1 - Basic Research

PE NUMBER AND TITLE: 0601384BP Chemical/Biological Defense (Basic Research)

PROJECT: BS12

COST (*In Thousands*)	FY 1994 Actual	FY 1995 Estimate	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
BS12 Science Base/Medical Biological Defense *	0	0	14688	15556	15923	16329	16883	17365	Continuing	Continuing

C. Other Program Funding Summary: See para A for related efforts.

	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	To Compl	Total Cost

D. Schedule Profile: The efforts in this project are non-system specific and represent continuing exploratory development research in the area medical technology, therefore no milestones or events are provided.

FY 1994				FY 1995				FY 1996				FY 1997			
1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4

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RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: February, 1995

BUDGET ACTIVITY: 2 - Exploratory Development

PE NUMBER AND TITLE: 0602384BP Chemical/Biological Defense (Exploratory Development)

COST (*In Thousands*)	FY 1994 Actual	FY 1995 Estimate	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	0	10000	60665	55270	55400	58400	59200	62200	Continuing	Continuing
553 Non-Medical Chem/Bio Defense & General Invest *			24595	24749	26000	27250	28106	30349	Continuing	Continuing
871 Medical Biological Defense *			11244	11819	12478	13290	13263	13617	Continuing	Continuing
872 Medical Chemical Defense *			12922	13597	14323	15257	15225	15630	Continuing	Continuing
313 Shipboard Chem/Bio Technology *			2604	2605	2599	2603	2606	2604	Continuing	Continuing
CP01 Counterproliferation Support Exp Dev	0	10000	9300	2500	0	0	0	0	Continuing	Continuing

* These projects were previously funded under PE/Projs 62622.553, 62787.871, 62787.875, RM33B313, respectively.

A. **Mission Description and Budget Item Justification** This program element provides exploratory development of technologies to enhance the ability of U. S. forces to deter and defend against chemical and biological (CB) warfare. The Army is the DoD Executive Agent for Chemical Warfare (CW) and Chemical and Biological Defense (CBD) research. Despite the significant progress made towards bi- and multi-lateral treaties, the probability of U. S. forces encountering chemical or biological agents during conflicts around the globe remains extremely high. More than 25 countries have the capability to deliver chemical agents and the use of chemical weapons has been documented in recent third world conflicts. The proliferation of both biological and chemical weapons technology to nations with less than stable governments suggests that the likelihood of weapons of mass destruction being used on a future battlefield is increasing. The curtailment of an active U.S. chemical munitions development program drives the need for a significant improvement in CB defense materiel to serve as a deterrent and guard against technological surprise. A robust defense should reduce the probability of a CB attack and enable U.S. forces to survive, continue operations in a CB environment, and win. Exploratory development is conducted for all the services in areas that include Chemical/Biological Defense and General Investigations (Projects Non-Medical CBD & Gen Inv and Shipboard CB Tech), consisting of: contamination avoidance through reconnaissance, detection, identification and warning; individual and collective protection; decontamination; CB defense technologies, anti-terrorism, information dissemination and support to the Program Executive Officer, Armored Systems Modernization (PEO, ASM). This program element also funds exploratory development in DoD medical defense (Projects Medical Bio Def and Medical Chem Def) against chemical agents and medical defense against biological threats, The primary goal of medical research and development is to sustain the medical technology superiority to improve the protection and survivability of U.S. forces on the conventional battlefields as well as in potential areas of low intensity conflict and military operations other than war. This program element is the core DoD technology base to develop methods and materials for: medical chemical defense in the areas of antidotes, drug treatments, medical protection against chemical agents, personnel and casualty decontamination, medical management of chemical casualties, and combat effectiveness and sustainability; medical

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BUDGET ACTIVITY 2 - Exploratory Development	PE NUMBER AND TITLE 0602384BP Chemical/Biological Defense (Exploratory Development)

biological defense and treatment including vaccines, prophylactic and therapeutic drugs, and methods of diagnosis and identification of biological warfare threats or naturally occurring infectious diseases. This program element funds exploratory development of technologies in support of the Counterproliferation program. There is concern over the growing proliferation of weapons of mass destruction. The May 1994 Report to Congress entitled "Report on Nonproliferation and Counterproliferation Activities and Programs" identified several areas for progress in which additional funding could significantly enhance projected capabilities. Technologies funded in this program element specifically address the passive defense shortfalls and are responsive to critical needs. The passive defense area is supported by technologies for BW agent short range and point detection/characterization mounted on an Unmanned Aerial Vehicle (UAV), chemical detection, individual and collective protection and decontamination. The work in this Program Element is consistent with the resource constrained Army Science and Technology Master Plan, Joint Service modernization plans, and Project Reliance. Efforts under this PE transition and provide risk reduction for Advanced Development, Demonstration/Validation and Engineering Development programs in PEs 0603384BP, 0604384BP, and 0605384BP, respectively. Efforts in this Program Element include non-system specific development efforts pointed toward specific military needs and therefore are appropriate to Budget Activity 2.

Project 553- Chemical/Biological (CB) Defense and General Investigations - This project addresses the urgent need to provide all services with defensive materiel to protect individuals and groups from threat chemical-biological agents in the areas of detection, identification and warning; contamination avoidance through reconnaissance; individual and collective protection and decontamination. It also provides for special investigations into CB defense technology to include CB threat agents, operational sciences, modeling, CB simulants, and nuclear, biological, chemical (NBC) survivability. This project also addresses support to Program Executive Offices focusing on horizontal integration of CB defensive technologies across the armored force.

FY1994 Accomplishments: Funded under Army PE 62622.A553

FY1995 Planned Program: Funded under Army PE 62622.A553

FY1996 Planned Program:

- Evaluate Bio Agents point detection technologies such as DNA Probes, electrospray mass spectrometry, planar wave guides and flow cytometry; and technologies for stand-off biological detection. Field test breadboard of tunable ultraviolet laser standoff detector. Standoff biodetection technologies will leverage the CP program (10992)
- Complete antibody development concepts for detector kits and sensors (1133)
- Test, in realistic field trials, small, lightweight (< 1 lb.), prototype Individual Soldier Chemical Detector (1380)
- Expand incorporation of chemical and biological environment, equipment and effects into advanced wargames and enhanced resolution DIS scenarios involving more detailed CB defense equipment (2150)

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BUDGET ACTIVITY 2 - Exploratory Development	PE NUMBER AND TITLE 0602384BP Chemical/Biological Defense (Exploratory Development)

- Investigate enhanced protection systems for masks, finalize integration of advanced mask concepts into 21st century soldier system, continue development of models to assess performance degradation, continue development of bio-protection test methods, and update performance rating tables (1326)
- Investigate novel methods to accomplish chemical decontamination (217)
- Investigate advanced concepts for regenerable filtration including layered Pressure Swing Adsorption Beds and segmented catalysts for combat vehicles (4520)
- Evaluate novel technologies for chemical images, CB Antiterrorism, laser standoff chemical detection; develop standardized test methodologies for CB evaluation; expand laboratory analysis capability for special projects (2877)

FY1997 Planned Program:

- Test and evaluate alternative prototypes of automated biosensor systems. Incorporate neural networks into flow cytometry biodetector to automate system and enhance data interpretation. Continue to evaluate the UV laser for standoff biodetection in support of both the core and CP programs (11246)
- Investigate compatibility of Individual Soldier Chemical Detector with future battlefield communications systems (1000)
- Upgrade wargames and DIS capabilities to include evaluation of virtual prototypes of CB defense equipment (2300)
- Investigate enhanced protection concepts and incorporate into 21st century soldier system, expand performance degradation model to predict and evaluate mask design changes, establish bio-protection test methods, conduct studies to fill gaps in performance rating database (1453)
- Investigate new concepts for rapid light weight decontamination (529)
- Investigate advanced systems and integration concepts for pressure swing adsorption and catalytic oxidation (4797)
- Develop test methodologies for CB evaluation of Army materiel (3424)

Project 871 -Medical Biological Defense: This project funds exploratory research on the development of vaccines and drugs to provide an effective medical defense against validated biological threat agents including bacteria, toxins, viruses and other agents of biological origin. By employing biotechnology, medical systems will be designed to rapidly identify, diagnose, prevent and treat disease due to exposure to biological threat agents.

FY 1994 Accomplishments: Funded under Army PE 62787.871

FY 1995 Planned Program: Funded under Army PE 62787.871

FY 1996 Planned Program:

- Evaluate the immunological response of bio-engineered vaccines for *Brucella* sp. and anthrax in animal models. (3187)
- Evaluate the safety and efficacy of candidate vaccines for viral agents such as Venezuelan equine encephalitis. (593)
- Evaluate the safety and efficacy of candidate drugs for the treatment of biological toxins, including botulium and ricin. (7464)

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BUDGET ACTIVITY 2 - Exploratory Development	PE NUMBER AND TITLE 0602384BP Chemical/Biological Defense (Exploratory Development)

FY 1997 Planned Program:
- Determine optimum vaccine formulations for bacterial vaccine candidates for *Brucella* and anthrax. (2947)
- Determine optimum vaccine formulations for viral vaccine candidates for encephalitis viruses. (570)
- Define drug treatment paradigms for biological toxins; evaluate drug candidates for treatment of exposure to sodium channel neurotoxins. (7315)
- Evaluate medical countermeasures against newly defined threat agents utilizing developed paradigms. (987)

Project 872 -Medical Chemical Defense: This project funds medical chemical defense exploratory development, and emphasizes the prevention of chemical casualties through application of pharmaceuticals for prevention and treatment of the toxic effects of nerve, blister, respiratory, and blood agents. This project supports exploratory development of prophylaxes, pretreatment, antidotes, decontaminants, and therapeutic compounds that will counteract the lethal, physical, and behavioral toxicity of chemical agents. It also supports development of medical chemical defense material that insures adequate patient care, field resuscitation, and patient procedures.

FY 1994 Accomplishments: Funded under Army PE 62787.875

FY 1995 Planned Program: Funded under Army PE 62787.875

FY 1996 Planned Program:
- Characterize and validate countermeasures against sulfur mustard; generate monoclonal antibodies to sulfur mustard; investigate reactive components for topical skin protectant. (6860)
- Characterize and validate countermeasures to nerve agent-induced seizures and pathology; refine methods to detect agents in biological fluids. (3157)
- Characterize and validate catalytic and immunological scavengers for nerve agents; employ biotechnological approaches to development of scavengers. (1947)
- Characterize and validate decontamination, diagnostic, prognostic, and treatment procedures directly applicable to patient management. (958)

FY 1997 Planned Program:
- Characterize and validate countermeasures against sulfur mustard; generate monoclonal antibodies to sulfur mustard; investigate reactive components for topical skin protectant. (7043)
- Characterize and validate countermeasures to nerve agent-induced seizures and pathology; refine methods to detect agents in biological fluids. (3328)
- Characterize and validate catalytic and immunological scavengers for nerve agents; employ biotechnological approaches to development of scavengers. (2117)
- Characterize and validate decontamination, diagnostic, prognostic, and treatment procedures directly applicable to patient management. (1109)

Project 313 - Shipboard Chemical/Biological Technology: This project funds technologies to improve protection to the fleet. This project funds technologies that will reduce the severe heat burden created by the protective overgarment; technologies to reduce the extensive and expensive carbon filter change out procedures and disposal

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BUDGET ACTIVITY 2 - Exploratory Development	PE NUMBER AND TITLE 0602384BP Chemical/Biological Defense (Exploratory Development)

required by the current collective system; technologies to reduce the size, complexity and false alarm rate of the current chemical detectors; and technologies for a creditable biological detector system; technologies to improve communications and operations in protective ensembles; technologies to define the interaction of an agent cloud with the complex structure of a ship and to incorporate the C/B impact on Flag/Fleet operations into realistic wargames. To create and build a creditable Navy response, the threat must be continuously reassembled, evaluated and disseminated to the operational commands.

FY 1994 Accomplishments: Funded under Navy PE RM33B313

FY 1995 Planned Program: Funded under Navy PE RM33B313

FY 1996 Planned Program:

- Continue efforts in Biological Particle sampler/sizer capable of discrimination between biological and non-biological particles. (104)
- Complete design of hood/blower mask for flight deck crew and initiate physiological testing and field trials. (250)
- Continue efforts in development of biosensors using OWG for shipboard use. (400)
- Continue modeling, simulation and wargaming of chemical and biological shipboard attack profiles with distribution of VLSTRACK version 2.0. (850)
- Micromachine and field trial of proximal probe device for shipboard use. (350)
- Modification of selected garments to include microencapsulated phase change material (MicroPCM). (200)
- Conduct laboratory demonstration of electroactive polymers for shipboard chemical detection. (200)
- Conduct shipboard demonstration of surface acoustic waveguide (SAW) chemical sensor. (100)
- Conduct joint US/UK helicopter pick-up trials. (150)

FY 1997 Planned Program

- Incorporate electroactive polymers into chemical protective overgarments. (205)
- Demonstrate particle sizer with discrimination between bio and non-bio particles for shipboard use. (125)
- Conduct field demo of proximal probe biosensor for shipboard use. (300)
- Continue modeling, simulation and wargaming of chemical and biological shipboard attack profiles with distribution of VLSTRACK version 2.0. (950)
- Continue efforts in development of biosensors using OWG for shipboard use. (400)
- Investigate SAW detector in a parachute, tube-launch or drone mounted mode. (175)
- Initiate catalyst-imbedded carbon program for filter systems on ships. (200)
- Conduct shipboard demo of MicroPCM benefits. (250)

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BUDGET ACTIVITY 2 - Exploratory Development	PE NUMBER AND TITLE 0602384BP Chemical/Biological Defense (Exploratory Development)

Project CP01 - Counterproliferation Support: This project funds exploratory development of technologies in support of the Counterproliferation program. There is concern over the growing proliferation of weapons of mass destruction. The May 1994 Report to Congress entitled "Report on Nonproliferation and Counterproliferation Activities and Programs" identified several areas for progress in which additional funding could significantly enhance projected capabilities. Technologies funded in this program element specifically address the passive defense shortfalls and are responsive to critical needs. The passive defense area is supported by technologies for BW agent standoff and point detection/characterization mounted on an Unmanned Aerial Vehicle (UAV), chemical detection, and decontamination. In FYs 95 and 96 technologies such as Ultra Violet (UV) laser and point technologies such as biorefractometer, fiber optic waveguide and nerve mounted on a UAV will be assessed for standoff biodetection. A downselect of the most promising technologies will be made for transition to Advanced Development.

FY 1994 Accomplishments: None

FY 1995 Planned Program:

- For the UV laser approach to standoff biodetection, measure spectral properties of simulants, interferents and backgrounds; measure background levels of fluorescing materials; initiate feasibility study of high power tunable source; initiate discrimination/pattern recognition algorithm development. Leverage efforts in PE62622.553 (5000)
- Conduct Phase I for laser biorefraction module and deliver breadboard for alternate standoff biodetection.; evaluate integation with other programs which address Joint Service automatic, point bioidentification requirements. (1000)
- Deliver and initiate test of prototype of automated fluid handling system for fiber optic waveguide (FOWG) as an alternative to standoff biodetection. (1000)
- Integrate established nerve sensor components into man-portable unit for alternative for standoff biodetection; establish test protocols and sensitivity to 10 chemical and biological agents; screen for effects of possible interferents. (1000)
- Develop miniature air sampler and conduct wind tunnel and flight test of sampler on research UAV. (100)
- Micro-fabricate and system check Micro surface acoustic waveguide (SAW) for chemical detection; transition to advanced development. (900)
- Initiate studies to determine the requirements for decontamination of biological agents on combat surfaces and of novel decontamination methods for sensitive equipment. (1000)

FY1996 Planned Program:

- For UV laser program, complete algorithm development and demonstrate capabilities at shorter ranges in field testing. Leverage efforts in PE62622.553 (4000)
- Conduct Phase II for laser biorefraction module and evaluate maturity. (1000)
- For FOWG, integrate fluid handling and biosensor system and test for reliability in handling dirty samples. (1000)
- Conduct off-site test of man-portable nerve unit with 10 additional candidate chemical and biological agents; design miniaturized unit using complementary technologies and conduct feasibility demo for miniaturized components. (1000)
- Design UAV optimized for chemical and biological mission and begin fabrication and subsystem testing. (300)
- Select technologies for transition to advanced development of standoff biodetection (0)

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BUDGET ACTIVITY 2 - Exploratory Development	PE NUMBER AND TITLE 0602384BP Chemical/Biological Defense (Exploratory Development)

- Conduct testing to determine reaerosolization hazard potential for biological agents and design sensitive equipment decontamination system prototype. (2000)

FY 1997 Planned Program:

- Complete testing to determine reaerosolization hazard potential for biological agents and down select most promising decontamination technologies for advanced development. (2500)

B. Program Change Summary

	FY 1994	FY 1995	FY 1996	FY 1997
Previous President's Budget		0	0	0
Appropriated Value				
Adjustments to Approp Value - Non-med CB Gen Inv			24595	24749
- Med Bio Def			11244	11819
- Med Chem Def			12922	13597
- Shipboard Chem/BioTech			2604	2605
- Counterproliferation		10000	9300	2500
Current Budget Submit/President's Budget		10000	60594	55175

NOTE: These projects were previously funded under PE/Projs 62622.553, 62787.871, 62787.875, RM33B313, respectively.

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DATE: February, 1995

BUDGET ACTIVITY: 2 - Exploratory Development

PE NUMBER AND TITLE: 0602384BP Chemical/Biological Defense (Exploratory Development)

PROJECT: 553

COST (*In Thousands*)	FY 1994 Actual	FY 1995 Estimate	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
553 Non-Medical Chem/Bio Defense & General Invest *	——	——	24595	24749	26000	27250	28106	30349	Continuing	Continuing

C. Other Program Funding Summary: See paragraph A for related efforts.

FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	To Compl	Total Cost

D. Schedule Profile: The efforts funded in these projects are non-system specific and represent continuing exploration development research in the area of CBD, therefore no milestones or events are provided.

FY 1994				FY 1995				FY 1996				FY 1997			
1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4

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BUDGET ACTIVITY: 2 - Exploratory Development

PE NUMBER AND TITLE: 0602384BP Chemical/Biological Defense (Exploratory Development)

PROJECT: 871

COST (*In Thousands*)	FY 1994 Actual	FY 1995 Estimate	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
871 Medical Biological Defense *	——	——	11244	11819	12478	13290	13263	13617	Continuing	Continuing

C. Other Program Funding Summary: See para A for related efforts.

	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	To Compl	Total Cost

D. Schedule Profile: The efforts in this project are non-system specific and represent continuing exploratory development research in the area of medical technology, therefore no milestones or events are provided.

FY 1994				FY 1995				FY 1996				FY 1997			
1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4

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BUDGET ACTIVITY: 2 - Exploratory Development

PE NUMBER AND TITLE: 0602384BP Chemical/Biological Defense (Exploratory Development)

PROJECT: 872

COST (*In Thousands*)	FY 1994 Actual	FY 1995 Estimate	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
872 Medical Chemical Defense *	——	——	12922	13597	14323	15257	15225	15630	Continuing	Continuing

C. Other Program Funding Summary: See para A for related efforts.

	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	To Compl	Total Cost

D. Schedule Profile: The efforts in this project are non-system specific and represent continuing exploratory development research in the area of medical technology, therefore no milestones or events are provided.

FY 1994				FY 1995				FY 1996				FY 1997			
1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4

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BUDGET ACTIVITY: 2 - Exploratory Development

PE NUMBER AND TITLE: 0602384BP Chemical/Biological Defense (Exploratory Development)

PROJECT: 313

COST (*In Thousands*)	FY 1994 Actual	FY 1995 Estimate	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
313 Shipboard Chem/Bio Technology *	——	——	2604	2605	2599	2603	2606	2604	Continuing	Continuing

C. Other Program Funding Summary: See para A for related efforts.

	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	To Compl	Total Cost

D. Schedule Profile: The efforts funded in these projects are non-system specific and represent continuing exploration development research in the area of CBD, therefore no milestones or events are provided.

FY 1994				FY 1995				FY 1996				FY 1997			
1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4

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BUDGET ACTIVITY: 2 - Exploratory Development

PE NUMBER AND TITLE: 0602384BP Chemical/Biological Defense (Exploratory Development)

PROJECT: CP01

COST (*In Thousands*)	FY 1994 Actual	FY 1995 Estimate	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
CP01 Counterproliferation Support Exp Dev	0	10000	9300	2500	0	0	0	0	Continuing	Continuing

C. Other Program Funding Summary: These funds supplement on-going efforts in Project 553, Chemical/Biological Defense General Investigations. See para A for related efforts.

FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	To Compl	Total Cost

D. Schedule Profile: The efforts funded in these projects are non-system specific and represent continuing exploration development research in the area of CBD, therefore no milestones or events are provided.

FY 1994				FY 1995				FY 1996				FY 1997			
1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4

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BUDGET ACTIVITY: 3 - Advanced Development

PE NUMBER AND TITLE: 0603384BP Chemical/Biological Defense (Advanced Development)

COST (*In Thousands*)	FY 1994 Actual	FY 1995 Estimate	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	0	0	25684	36644	45600	42400	36300	37100	Continuing	Continuing
807 Industrial Base/Medical Bio Def Vaccines & Drugs*			9878	10579	14487	15175	15369	15687	Continuing	Continuing
995 Medical Chemical Defense Life Support Material*			9406	9746	10578	10915	11018	11272	Continuing	Continuing
DE83 Chemical/Biological Defense Advanced Tech*			3998	6019	8835	9810	9913	10141	Continuing	Continuing
CP02 Counterproliferation Support Advanced Dev*	0	0	2400	10300	11700	6500	0	0	0	0

* These projects were previously funded under PE/Projs 63002.807, 63002.995, 63759.E83, 65160BP, respectively.

A. Mission Description and Budget Item Justification:

This program element funds advanced development for the DoD Core Vaccine and Drug Program as well as for development of field medical protective devices. The DoD Core Vaccine and Drug provides , in accordance with the Food and Drug Administration (FDA), regulations, drugs and vaccines for development which are effective protectants, treatments and antidotes against chemical and biological threat agents and military disease threats. Pilot and standard lots of candidate pharmaceutical-grade drugs, antidotes and vaccines are produced. Medical biological and chemical defense development consists of prophylaxes, pretreatment, antidotes and therapeutics; personnel and patient decontamination. The primary goal of this program is to provide, with minimum adverse effects, maximum soldier survivability and sustainability on the integrated battlefield as well as in miltary operations other than war. This program element funds demonstrations of technologies and materiel in support of deterrence and defense against chemical and biological warfare (Project Chem/Bio Def Adv Dev). The Army is the DoD Executive Agent for Chemical Warfare (CW) and Chemical and Biological Defense (CBD) research. These efforts comprise risk-reducing demonstrations conducted in an operational environment with active user and developer participation. These demonstrations integrate diverse technologies to improve DoD CW deterrence and CBD. This program element funds technology demonstrations in support of the Counterproliferation program in the areas of biological detection, chemical detection and decontamination. Work in this program element is consistent with the resource constrained Army Science and Technology Master Plan, the Joint Modernization Plan and Project Reliance. Efforts in this PE transition and provide risk reduction for Demonstration/Validation and Engineering Development programs supported by PE 0604384BP and 0605384BP, respectively. This program is dedicated to conducting proof of principal field demonstrations and tests of system-specific technologies to meet specific military needs and is therefore correctly placed in Budget Activity 3.

- **Project 807 - Industrial Base/Medical Biological Defense Vaccines and Drugs**: This project funds research on pre-clinical development of safe and effective prophylaxis and therapy (vaccines and drugs for exposure to biological threat agents). This project also supports the advanced development of kits to rapidly diagnose

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exposure to biological agents in clinical samples. To complete the defensive effort, a broad range of technologies involved in the targeting and delivery of prophylaxis and therapeutic medical countermeasures are evaluated to ensure the protection of U.S. Forces.

FY 1994 Accomplishments: Funded under Army PE 63002.807

FY 1995 Planned Program: Funded under Army PE 63002.807

FY 1996 Planned Program:
- Utilize developed animal models to evaluate candidate vaccines. (2615)
- Conduct demonstrations of candidate solutions for the treatment of biological toxins. (5508)
- Assess and validate models, assays and manufacturing technologies to support product development of diagnostic confirmation assays of biological threat agents. (1755)

FY 1997 Planned Program:
- Conduct demonstrations of candidate solutions for treatment of *Yersinia pestis* (1460)
- Demonstrate efficacy of candidate solutions for botulinum intoxication and conduct demonstrations of candidate solutions for other biological toxins. (6687)
- Develop improved diagnostic confirmation assays for biological threat agents. (2432)

Project 995 - Medical Chemical Defense Life Support Materiel: This project supports the investigation of new medical countermeasures to include antidotes,pretreatment drugs and topical skin protectants to protect U.S. Forces against known and emerging chemical warfare (CW) threats. Capabilities are maintained for reformulation, formulation and scale-up of candidate compounds using current good laboratory practices (CGLP). Analytical stability studies and safety and efficacy screening in addition to pre-clinical toxicology studies are performed prior to full scale development on promising pretreatment or treatment compounds.

FY 1994 Accomplishments: Funded under Army PE 63002.995

FY 1995 Planned Program: Funded under Army PE 63002.995

FY 1996 Planned Program:
- Validate countermeasures to sulfur mustard; produce reactive components for topical skin protectant; validate tests for vesicants in biological fluids. (7323)
- Develop antibodies to specific biochemical stages of the nerve agent poisoning process; validate methods to detect agents in biological fluids. (447)
- Validate advance biotechnological approaches to development of catalytic and immunological scavengers for nerve agents. (529)
- Validate decontamination, diagnostic, prognostic and treatment procedures directly applicable to patient management. (1109)

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FY 1997 Planned Program:
- Validate countermeasures to sulfur mustard; produce reactive components for topical skin protectant; validate tests for vesicants in biological fluids. (7423)
- Develop antibodies to specific biochemical stages of the nerve agent poisoning process; validate methods to detect agents in biological fluids. (516)
- Validate advance biotechnological approaches to development of catalytic and immunological scavengers for nerve agents. (598)
- Validate decontamination, diagnostic, prognostic and treatment procedures directly applicable to patient management. (1209)

Project DE83 - Chemical Biological Defense Systems Advanced Development: This project demonstrates technology advancements in the areas of agent detection and identification; decontamination,and individual/collective protection which will speed maturing of advanced technologies to reduce risk in system-oriented Demonstration and Validation. This project funds the Integrated Biodetection Advanced Technology Demonstration (ATD). This ATD will fabricate, demonstrate and integrate advanced point and standoff biodetection technologies.

FY 1994 Accomplishments: Funded under Army PE 63759.DE83

FY 1995 Planned Program: Funded under Army PE 63759.DE83

FY 1996 Planned Program:
- Prepare Integrated Biodetection ATD plan. (500)
- Fabricate point biosensor prototypes for the Integrated Biodetection ATD. (2000)
- Initiate testing of breadboard point biosensors for the Integrated Biodetection ATD. (1498)

FY 1997 Planned Program:
- Complete user test of point prototypes for Integrated Biodetection ATD. (2000)
- Fabricate standoff detector prototypes for the Integrated Biodetection ATD. (4019)

Project CP02 - Counterproliferation Support: This project funds advanced development of technologies in support of the Counterproliferation program. There is concern over the growing proliferation of weapons of mass destruction. The May 1994 Report to Congress entitled "Report on Nonproliferation and Counterproliferation Activities and Programs" identified several areas for progress in which additional funding could significantly enhance projected capabilities. Demonstrations funded in this program element specifically address the passive defense shortfalls and are responsive to critical needs. The passive defense area is supported by demonstrations in BW agent standoff and point detection/characterization mounted on an Unmanned Aerial Vehicle (UAV), chemical detection, and decontamination. Technologies such as Ultra Violet (UV) laser and point technologies such as biorefractometer, fiber optic waveguide and nerve mounter on a UAV will be demonstrated for short range biodetection.

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FY 1994 Accomplishments: None

FY 1995 Planned Program: None

FY 1996 Planned Program:

- Conduct technology demonstration of and transition to Service application Micro-Surface Acoustic Waveguide for chemical detection. (2400)

FY 1997 Planned Program:

- Conduct technology demonstration of selected standoff biological detection technologies to include UltraViolet laser, Biorefractometer, Fiber Optic Waveguide and/or Nerve mounted on an Unmanned Aerial Vehicle. (10300)

B. Program Change Summary

	FY 1994	FY 1995	FY 1996	FY 1997
Previous President's Budget			0	0
Appropriated Value			9878	10579
Adjustments to Approp Value-Ind Base/Med Bio V&D			9408	9746
-Med Chem Def Life Spt Mat			3998	6019
-Chem/Bio Def Adv Tech			2400	10300
-Counterproliferation				
Current Budget Submit/President's Budget			25684	36644

NOTE: These projects were previously funded under PE/Projs 63002.807, 63002.995, 63759.DE83, 65160BP, respectively.

Change Summary Explanation:

Funding:

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Schedule:

Technical:

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PE NUMBER AND TITLE: 0603384BP Chemical/Biological Defense (Advanced Development)

PROJECT: 807

COST (*In Thousands*)	FY 1994 Actual	FY 1995 Estimate	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
807 Industrial Base/Medical Bio Def Vaccines & Drugs*	——	——	9878	10579	14487	15175	15369	15687	Continuing	Continuing

C. Other Program Funding Summary: See para A for related efforts.

FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	To Compl	Total Cost

D. Schedule Profile: This project contains efforts on multiple countermeasures. Each countermeasure must meet product safety and efficacy requirements for MS0/I transition to ensure full compliance with DoD 5001 and FDA regulations.

FY 1994				FY 1995				FY 1996				FY 1997			
1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4

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BUDGET ACTIVITY: 3 - Advanced Development

PE NUMBER AND TITLE: 0603384BP Chemical/Biological Defense (Advanced Development)

PROJECT: 995

COST (*In Thousands*)	FY 1994 Actual	FY 1995 Estimate	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
995 Medical Chemical Defense Life Support Material*	——	——	9408	9746	10578	10915	11018	11272	Continuing	Continuing

C. Other Program Funding Summary: See para A for related efforts.

	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	To Compl	Total Cost

D. Schedule Profile This project contains efforts on multiple countermeasures. Each countermeasure must meet product safety and efficacy requirements for MS0/I transition to ensure full compliance with DoD 5001 and FDA regulations.

FY 1994				FY 1995				FY 1996				FY 1997			
1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4

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BUDGET ACTIVITY: 3 - Advanced Development

PE NUMBER AND TITLE: 0603384BP Chemical/Biological Defense (Advanced Development)

PROJECT: DE83

COST (*In Thousands*)	FY 1994 Actual	FY 1995 Estimate	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
DE83 Chemical/Biological Defense Advanced Tech*	——	——	3998	6019	8835	9810	9913	10141	Continuing	Continuing

C. Other Program Funding Summary: See para A for related efforts.

	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	To Compl	Total Cost

D. Schedule Profile

	FY 1994				FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Conduct Integrated Biodetection ATD									x							

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BUDGET ACTIVITY: 3 - Advanced Development

PE NUMBER AND TITLE: 0603384BP Chemical/Biological Defense (Advanced Development)

PROJECT: CP02

COST (*In Thousands*)	FY 1994 Actual	FY 1995 Estimate	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
CP02 Counterproliferation Support Advanced Dev	0	0	2400	10300	11700	6500	0	0	0	0

C. Other Program Funding Summary: See para A for related efforts. These funds supplement on-going efforts in Project DE83, Chem/Bio Def Systems Adv Dev.

	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	To Compl	Total Cost

D. Schedule Profile

	FY 1994				FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Fabricate SAW devices									x							
Conduct SAW Demo										x						
Determine performance of operation in different environments											x					
Prepare reports												x				
Conduct standoff biodetection demo using multiple approaches															x	
Integrate with Integrated Biodetection Adv Tech Demo																

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BUDGET ACTIVITY: 4 - Demonstration And Validation

PE NUMBER AND TITLE: 0603884BP Chemical/Biological Defense

COST (*In Thousands*)	FY 1994 Actual	FY 1995 Estimate	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	0	0	32461	42755	53900	52100	30500	39800	Continuing	Continuing
D601 NBC Contamination Avoidance Systems	0	0	7429	9621	10205	10059	0	1499	Continuing	Continuing
D604 NBC Protection Systems	0	0	9593	9199	7183	4024	8190	16206	Continuing	Continuing
DE81 NBC Decontamination Systems	0	0	6870	6989	5134	4851	6293	5995	Continuing	Continuing
D669 Joint Service Lightweight Integrated Suit Technology(JSLIST)	0	0	0	0	0	201	0	799	Continuing	Continuing
D993 Medical Chemical Defense	0	0	4311	4294	4271	4242	3845	3663	Continuing	Continuing
S205 Navy Shipboard Chem/Bio Defense	0	0	2060	1702	1392	1254	1313	1289	Continuing	Continuing
W059 Naval Aircraft Chem/Bio Defense	0	0	178	150	153	151	157	150	Continuing	Continuing
C159 Marine NBC Equipment	0	0	2000	2000	3062	3018	2202	999	Continuing	Continuing
CP04 Counterproliferation Support Dem/Val	0	0	0	8800	22500	24300	8500	9000	Continuing	Continuing

NOTE: FY94/FY95 Funding executed under Program Elements controlled by individual Services. See individual Project descriptions for audit to FY94/95 Programs.

A. **Mission Description and Budget Item Justification:** Operational forces across the continuum of global, contingency, special operations/low intensity conflict, counternarcotics, and other high risk missions have an immediate need to safely operate, survive and sustain operations in a nuclear, biological and chemical agent threat environment. Operating forces have a critical need for defense against worldwide proliferation of NBC warfare capabilities and for medical treatment of casualties in medical treatment facilities. Congress directed centralized management of DoD NBC Defense initiatives, both medical and non-medical This program element supports the Demonstration/Validation (DEMVAL) of NBC defensive equipment, both medical and non-medical, and addresses various shortcomings identified in Conduct of the Persian Gulf War: Final Report to Congress, April 1992. These projects provide for development and demonstration testing of equipment across all Services and represents the first effort of the Department to consolidate and integrate all NBC defense efforts in this Budget Activity. This program is enhanced using Counterproliferation Support funding.

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This DEMVAL program funds for individual and collective protection equipment such as the Advanced Integrated Collective Protection System (AICPS), the Joint Service Lightweight Integrated Suit Technology (JSLIST) and Naval shipboard collective protection; an array of chemical/biological/toxin detection and warning systems to include the lightweight Nuclear Biological and Chemical Reconnaissance System, the Lightweight Standoff Chemical Agent Detector (LSCAD), the next generation Chemical Biological Mass Spectrometer (CBMS) and the HAZWARN chemical reporting system; and, finally, the Modular Decontamination System (MDS) and sorbent decontamination technology and equipment to replace currently logistically burdensome and time consuming decon methods. In the medical chemical defense area this DEMVAL program funds improved medical equipment and drugs essential to counteracting lethal and human performance degrading effects of chemical threats. Specific items include improvements to nerve agent antidotes, topical skin protectants and anticonvulsants.

This program element focuses on efforts associated with advanced technology development used to demonstrate general military utility to include demonstration and validation in the area of chemical/biological defense equipment advance development and is correctly placed in Budget Activity 4.

D601 NBC Contamination Avoidance Systems: This project provides Demonstration Validation (DEMVAL) of Reconnaissance, Detection, and Identification (RDI) equipment. Items of equipment included in this project are: (1) Lightweight Standoff Chemical Agent Detector (LSCAD) which provides chemical agent detection and mapping for chemical agent clouds; (2) Chemical Biological Mass Spectrometer (CBMS) which identifies all chemical and biological agents collected and is a component of the Nuclear, Biological and Chemical Reconnaissance System (NBCRS) and the Biological Integrated Detection System (BIDS); and (3) Biological Detector (BD), a point detector for threat biological agents which is also a component of the BIDS and is under management of the Joint Program Office for Biological Defense (JPO-BIO). All of these systems increase existing chemical and biological war fighting capabilities by providing more complete, accurate, and current battlefield data.

FY 1994 Planned Program:

- Program executed under PE# 0603806A/D601

FY 1995 Planned Program:

- Program executed under PE# 0603806A/D601

FY 1996 Planned Program:

- CBMS - Design NBCRS-Integrated Prototype (1000)
- CBMS - Fabrication NBCRS Integration Components (2500)
- CBMS - Conduct Technical Feasibility Test (TFT) (1500)
- CBMS - Conduct Limited User Test (LUT) (1500)
- CBMS - Complete Technical Documentation (429)
- LSCAD - Complete Milestone I IPR (500)

FY 1997 Planned Program:

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- LSCAD - Initiate DEMVAL (2000)
- LSCAD - Complete DEMVAL Hardware Development (2640)
- LSCAD - Complete DEMVAL Software Development (2350)
- LSCAD - Fabrication of PPT Systems (1680)
- LSCAD - Initiate Developmental Testing II (951)

D604 NBC Protection Systems: The project provides for development of the Advanced Integrated Collective Protective System (AICPS). The AICPS will integrate NBC filtration environmental controls and power source components for tactical and combat systems and exploit new filtration technology (regenerable filtration, catalytic oxidation or deep bed chromium-free carbon). The effort extends vehicular collective protection applications providing for reductions in system size, weight, energy and in filter change logistics burden. The AICPS can be integrated into multiple configurations to provide protection to different tactical systems. Additionally, the effort provides a system solution for countering future threat agents and alleviating the disposal problems associated with hazardous material chromium impregnated carbon filters. Funding for AICPS is supported by the Counterproliferation initiative.

FY 1994 Planned Program:
- Program executed under PE# 0603806A/D604.

FY 1995 Planned Program:
- No Planned Program

FY 1996 Planned Program:
- AICPS - Complete Engineering Design Review (2500) (1700)[1]
- AICPS - Initiate Prototype Resign and Fabrication for PPQT and IOT&E (6093)
- AICPS - Plan and conduct Milestone I/II IPR (500)
- AICPS - Continue User Interface and System Integration (500)
- AICPS - Environmental Control and Power Unit Testing (700)[1]

[1] Counterproliferation support funding.

FY 1997 Planned Program:
- AICPS - Complete Prototype Redesign and Fabrication for PPQT and IOT&E (4699)
- AICPS - Initiate PPQT and IOT&E (4000)
- AICPS - Continue User Interface and System Integration (500)

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DE81 NBC Decontamination System: Funding supports the Modular Decontaminating System (MDS), a more transportable, less labor intensive, and more effective system for applying decontaminating solutions to vehicle and equipment surfaces. Lessons learned from Desert Storm validated the need for a deployable and efficient decontamination system. The MDS reduces water usage and equipment processing time with increased water pressure and variable water temperature. The MDS consists of the XM21 Decontaminant Pumper Module and the XM22 High Pressure Washer Module. A Milestone I/II Decision was approved in Dec 93. Funding also supports the Sorbent Technology program which provides a reactive Sorbent for immediate decontamination. It will replace the M295 Kit, for personal wipedown procedures and Decontaminating Solution 2 (DS-2) in operator spraydown procedures. The Sorbent will be more reactive towards Chemical Warfare (CW) agents than the M295 Kit, therefore, the hazard associated with the spent decontaminant will be reduced. The Sorbent will be more compatible with Mission Oriented Protective Posture (MOPP) and other materials that currently use DS2.

FY 1994 Planned Program:
- Program executed under PE# 0603806A/DE81

FY 1995 Planned Program:
- Program executed under PE# 0603806A/DE81

FY 1996 Planned Program:
- MDS - Complete PPQT (2400)
- MDS - Conduct Initial Operational Test and Evaluation (IOT&E) (565)
- MDS - Complete initial TDP (988)
- MDS - Conduct Milestone III/TC IPR (47)
- Sorbent - Award Advanced Development Contract (1970)
- Sorbent - Award applicator Contract (900)

FY 1997 Planned Program:
- MDS - Complete final TDP (2000)
- Sorbent - Conduct Health Hazard Assessment (300)
- Sorbent - Conduct Environmental Assessment (300)
- Sorbent - Conduct Field Testing (4389)

Project D669 -Joint Service Lightweight Integrated Suit Technology (JSLIST): The JSLIST II Program will invite contractors to submit untested protective clothing for test and evaluation in the quest for the next generation of advanced material chemical protective clothing technology. Candidates will undergo technical testing similar to the testing planned for the current generation JSLIST I candidates. Funding for JSLIST II is supported by the four services as well as Counterproliferation support.

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FY 1994 Planned Program:
- No Planned Program

FY 1995 Planned Program:
- No Planned Program

FY 1996 Planned Program:
- No Planned Program

FY 1997 Planned Program:
- Conduct Development Testing (DT) on JSLIST II candidates (3700)[1]
- Conduct Milestone I/II IPR

[1] Counterproliferation support funding.

Project D993-Medical Chemical Defense Life Support Materiel: This project funds advanced development of countermeasures for chemical agents including life support equipment, pretreatment and therapeutic drugs, and individual/casualty decontamination compounds. A system of medical defense against chemical agents is required to provide individual soldiers protection, to sustain their performance in a chemical environment, and to provide for self-aid and medical treatment of chemical casualties.

FY 1994 Planned Program:
- Program executed under PE#0603807A/D993.

FY 1995 Planned Program:
- Program executed under PE#0603807A/D993.

FY 1996 Planned Program:
- Evaluate human safety and technical performance of the nerve agent antidote system (HI-6), cyanide pretreatment, and multichambered autoinjector. (4311)

FY 1997 Planned Program:
- Evaluate human safety and technical performance of the nerve agent antidote system (HI-6), cyanide pretreatment, and advanced anticonvulsant. (4294)

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Project S2053 - Shipboard Chem/Bio Defense: Conduct advanced development of Nuclear, Biological and Chemical (NBC) defensive systems for surface ships to support the requirement to sustain operations in a NBC (weapons of mass destruction) threat environment. Systems developed will counter predicted new and novel threats into the next century as validated by Office of Naval Intelligence CBR Threat Assessment (TA# 004-94)

FY 1994 Planned Program:
- Program executed under PE# 0603514N/S2053

FY 1995 Planned Program:
- Program executed under PE# 0603514N/S2053

FY 1996 Planned Program:
- Continue Chemical Agent Remote Detection System (CARDS) Advanced Development Model (ADM) design, testing and acquisition documentation preparation; achieve MS I approval. Continue development of design specifications and other technical data. (1294)
- Support shipboard (DDG-51 and LPD-17 ship classes) testing of advanced high pressure Collective Protection System (CPS) fans. (150)
- Initiate program for next generation Chemical and Biological (C/B) Individual Protection Ensemble (IPE), to include suit, boots, gloves and mask.(200)
- Complete Improved Chemical Protection System (ICPS) shipboard evaluations and technical data package. (436)

FY 1997 Planned Program:
- Continue CARDS ADM design, testing and acquisition and development documentation preparation. (950)
- Continue acquisition program for next generation Chemical and Biological (C/B) Protection IPE. (450)
- Initiate acquisition program for next generation C/B Shipboard Collective Protection System (CPS). (302)

Project WO59 - Naval Aircraft Chem/Bio Defense: This project investigates possible naval aircraft concepts of operations in a chemical and biological contaminated environment. The project includes development of chemical biological research methodology to define the chemical warfare environment for aircraft and the resulting hazard to aircrews. This project also develops concepts for aircraft decontamination and detection methods. Additionally, this project includes preparation of modifications to naval air technical manuals detailing the most current methods for countering a chemical and biological attack.

FY 1994 Planned Program:
- Program executed under PE# 0603514N

FY 1995 Planned Program:
- Program executed under PE# 0603514N

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FY 1996 Planned Program:
- Continue development of the Naval Air Chemical/Biological defense concept of operations. (178)

FY 1997 Planned Program:
- Continue development of the Naval Air Chemical/Biological defense concept of operations. (150)

Project C159 - Marine NBC Equipment: The purpose of this project is to complete advanced development of USMC specific NBC equipment. This equipment consists of four categories: individual protection; detection, decontamination; and collective protection. Individual protection consists of the items necessary to protect the individual Marine, such as NBC suits, gloves, boots, and field protective mask. Detection provides the Marine and /or the unit with the ability to detect NBC agents in concentrations that are sub-lethal. Decontamination is the capability to remove NBC agents from personnel and /or equipment. Collective protection is the ability to provide filtered air to specified areas that will allow Marines inside to be free of contamination, thus not having to wear special NBC equipment for protection. The work in this project allows for continued improvement of the Marine Corps NBC defensive posture.

FY 1994 Planned Program:
- Program executed under PE#060363M/C1598.

FY 1995 Planned Program:
- Program executed under PE#060363M/C1598.

FY 1996 Planned Program:
- Conduct Developmental Test for Lightweight Nuclear Biological Chemical Reconnaissance System (LNBCRS). (1500)
- Continue LNBCRS Systems Integration (400)
- Support JSLIST I Program (100)

FY 1997 Planned Program:
- Continue LNBCRS Integration (700)
- Plan and conduct Developmental Test II for LNBCRS. (1300)

Project CP04 - Counterproliferation Support - DEM/VAL: Weapons of mass destruction (WMD) may directly threaten US forces in the field or threaten effective employment of those forces. Potential adversaries may use WMD to deter US power projection abroad. As required by the National Defense Authorization Act of 1994, an interagency review committee chaired by Dr. John Deutch performed a comprehensive review of US nonproliferation and counterproliferation activities and programs, and provided a report to Congress in May 1994. The report provides an overview of existing, planned, and proposed capabilities and technologies, as well as a description of

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priorities, programmatic options, and other issues. It identifies areas where improvements could be made in current programs. It also identifies high priority shortfalls in operational capability needed to implement US non/counterproliferation policy.

The Counterproliferation Program support in this area of passive defense is focused on accelerating the delivery of high priority technology and capability in the areas of chemical and biological detection, individual protection and collective protection.

CHEMICAL AND BIOLOGICAL (CB) DETECTION - Provides CB warfare agent detection in a contaminated environment. This area accelerates the development of chemical or biological detectors. Developmental items will be compatible with future software/communications interfaces increasing the accuracy and speed of NBC warning and reporting.

INDIVIDUAL PROTECTION - Counterproliferation support provides acceleration in non-respiratory protection to the individual soldier, sailor, airman, or marine in a NBC contaminated environment.

FY 1994 Planned Program:
- No planned program.

FY 1995 Planned Program:
- No planned program.

FY 1996 Planned Program:
- No planned program.

FY 1997 Planned Program:
- Chemical Agent Detection Program. Modify surface acoustic wave (SAW) technology to fit in Unmanned Aerial Vehicle (UAV). (500)
- Chemical Agent Detection Program. Initiate engineering development effort to put SAW technology in shipboard chemical detectors (4600)
- Supports Non-Respiratory Protection Program. See Project D669 (Joint Lightweight Integrated Suit Technology JSLIST). (3700)

B. Program Change Summary:

	FY 1994	FY 1995	FY 1996	FY 1997
Previous President's Budget		0	0	0
Appropriated Value	0	0	0	0

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	FY 1994	FY 1995	FY 1996	FY 1997
Adjustments to Appropriated Value	0	0	0	0
Current Budget Submit/President's Budget	0	0	32461	42755

Change Summary Explanation: Starting in FY96 this program represents a consolidation of all Chemical/Biological defense programs Department wide into a single DOD program element for each Budget Activity in accordance with the FY94 Authorization Act. See individual project descriptions for audit of FY94/FY95 funding.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: FEBRUARY 1995

BUDGET ACTIVITY: 4 - Demonstration And Validation

PE NUMBER AND TITLE: 0603884BP Chemical/Biological Defense

PROJECT: D601

COST (In Thousands)	FY 1994 Actual	FY 1995 Estimate	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
D601 NBC Contamination Avoidance Systems	0	0	7429	9621	10205	10059	0	1499	Continuing	Continuing

C. Other Program Funding Summary:

	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	To Compl	Total Cost
RDTE,A Budget Activity 4 PE 0603806A, Project D601 NBC Contamination Avoidance Systems	21277	8623	0	0	0	0	0	0	0	29900
RDTE,A Budget Activity 5 PE 0604806A, Project D020 NBC Contamination Avoidance Systems	42285	9469	0	0	0	0	0	0	0	51754
RDTE,D Budget Activity 2, PE 0602384BP, Proj A553 CB Defense & General Investigation			24595	24749	26000	27250	28106	30349	Cont'd	Cont'd
RDTE,D Budget Activity 5 PE 0604384BP, Proj D020 NBC Contamination Avoidance Systems			7950	34890	32128	29915	40483	19733	Cont'd	Cont'd
RDTE, D Budget Activity 5, PE 0604384BP, Project DBD-3, Joint Biological Defense Program - BIDS			30199	26122	41094	35944	49191	44000	Cont'd	Cont'd
Procurement, Defensewide, BA3, Chem/Bio Def								16327	92250	108577
LSCAD								13914	25100	39014
CBMS										

D. Schedule Profile:

	FY 1994	FY 1995	FY 1996	FY 1997
CBMS Award Contract	X*			
CBMS Bioprofiling		X		
CBMS Engineering Design Test			X	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: FEBRUARY 1995

BUDGET ACTIVITY: 4 - Demonstration And Validation

PE NUMBER AND TITLE: 0603884BP Chemical/Biological Defense

PROJECT: D601

	FY 1994	FY 1995	FY 1996	FY 1997
CBMS Fabrication for TFT/LUT		X	X	
CBMS TFT/LUT			X	
CBMS Documentation			X	
CBMS Production Decision (for BIDS)			X	
CBMS Milestone I/II for NBCRS		X		
LSCAD Milestone I Review			X	
LSCAD Contract Award			X	
LSCAD Critical Design Review				X
LSCAD System Delivery				X
LSCAD Engineering Tests				X
LSCAD Milestone II Review				

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: FEBRUARY 1995

BUDGET ACTIVITY: 4 - Demonstration And Validation

PE NUMBER AND TITLE: 0603884BP Chemical/Biological Defense

PROJECT: D601

A. Project Cost Breakdown:

	FY 1994	FY 1995	FY 1996	FY 1997
CBMS Design			1000	
CBMS Fabrication			2500	
CBMS Test (including Bioprofiling)			3000	
CBMS Document			429	
LSCAD Initiate DEMVAL				2000
LSCAD Hardware Development				2640
LSCAD Software Development				1680
LSCAD Software Development				2350
LSCAD Development Test & Support			500	951
Total			7429	9621

B. Budget Acquisition History and Planning Information:

Performing Organizations

Contractor or Government Performing Activity	Contract Method/Type or Funding Vehicle	Award or Obligation Date	Performing Activity EAC	Project Office EAC	Total Prior to FY 1994	FY 1994	FY 1995	FY 1996	FY 1997	Budget to Complete	Total Program
Product Development Organizations								3000	5100	8600	16700
Bruker	C/CPFF	Nov 95	16700	16700				500	1800		2300
Unknown	C/CPFF	Dec 95	2300	2300							
Support and Management Organizations								1429	0	3170	4599
Govt CBDCOM	PO	Oct 95	4599	4599				2500	2721		5221
Govt ERDEC	PO	Oct 95	5221	5221							
Test and Evaluation Organizations											

Government Furnished Property: None

	Total Prior to FY 1994	FY 1994	FY 1995	FY 1996	FY 1997	Budget to Complete	Total Program
Subtotal Product Development				3500	6900	8600	1900

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)				DATE FEBRUARY 1995
BUDGET ACTIVITY 4 - Demonstration And Validation	PE NUMBER AND TITLE 0603884BP Chemical/Biological Defense			PROJECT D601
Subtotal Support and Management	3929	2721	3170	9820
Subtotal Test and Evaluation	0	0	3800	3800
Total Project	7429	9621	15570	32620

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: FEBRUARY 1995

BUDGET ACTIVITY: 4 - Demonstration And Validation

PE NUMBER AND TITLE: 0603884BP Chemical/Biological Defense

PROJECT: D604

COST (*In Thousands*)	FY 1994 Actual	FY 1995 Estimate	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
D604 NBC Protection Systems	0	0	9593	9199	7183	4024	8190	16206	Continuing	Continuing

C. Other Program Funding Summary:

	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	To Compl	Total Cost
RDTE,D Budget Activity 2, PE 0602384BP, Project A553 CB Defense & General Investigation			24595	24749	26000	27250	28106	30349	Cont'd	Cont'd
RDTE,A Budget Activity 4 PE 0603806A Project D604 NBC Protection Systems	6318	1480	0	0	0	0	0	0	0	7798
RDTE,A Budget Activity 5 PE 0604806A Project D017 NBC Protection Systems	170	9050	0	0	0	0	0	0	0	9220
RDTE,D Budget Activity 5 PE 0604384BP Project D017 NBC Protection Systems			4529	0	0	0	0	0	Cont'd	Cont'd

D. Schedule Profile:

	FY 1994				FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
AICPS Awarded Development Contract			X*													
AICPS Developed Design Concept				X*												
AICPS Initiate Prototype Fabrication						X										
AICPS Initiate Engineering Design Test (EDT)								X								
AICPS Complete EDT											X					

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: FEBRUARY 1995

BUDGET ACTIVITY: 4 - Demonstration And Validation

PE NUMBER AND TITLE: 0603884BP Chemical/Biological Defense

PROJECT: D604

	FY 1994				FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
AICPS Initiate Prototype Fabrication for PPQT and IOT&E											X					
AICPS Conduct Milestone I/II IPR											X					

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: FEBRUARY 1995

BUDGET ACTIVITY: 4 - Demonstration And Validation

PE NUMBER AND TITLE: 0603884BP Chemical/Biological Defense

PROJECT: D604

A. Project Cost Breakdown:

	FY 1994	FY 1995	FY 1996	FY 1997
Hardware Development			3000	2000
Producability			400	400
System Engineering			2563	1819
Training Development			50	50
Integrated Logistics Support			300	100
Quality Assurance			300	250
Reliability, Maintainability, and Availability			100	100
Configuration Management			80	80
Technical Data			300	400
EDT			2500	
PPQT				4000
Total			9593	9199

B. Budget Acquisition History and Planning Information: Not Applicable

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: FEBRUARY 1995

BUDGET ACTIVITY: 4 - Demonstration And Validation

PE NUMBER AND TITLE: 0603884BP Chemical/Biological Defense

PROJECT: DE81

COST (*In Thousands*)	FY 1994 Actual	FY 1995 Estimate	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
DE81 NBC Decontamination Systems	0	0	6870	6969	5134	4851	6293	5995	Continuing	Continuing

C. Other Program Funding Summary:

	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	To Compl	Total Cost
RDTE,A Budget Activity 4, PE 0603806A, Project DE81 NBC Decontamination Systems	3000	4969	0	0	0	0	0	0	0	7969
RDTE,D Budget Activity 2, PE 0602384BP, Proj A553 CB Defense & General Investigation			24595	24749	26000	27250	28106	30349	Cont'd	Cont'd
Procurement, Defensewide, BA3, Chem/Bio Def Modular Decontamination System (MDS)				9009	13752	12997	7222			42964

D. Schedule Profile:

	FY 1994				FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Sorbent Prepare Engineering Support Document									X							
Sorbent Award AD Contract											X					
Sorbent Award Applicator Contract											X					
Sorbent Conduct Health Hazard Assessment																X
Sorbent Conduct Environmental Assessment																X
Sorbent Conduct Field Testing																X
MDS Conduct Milestone I/II	X*															
MDS Design Test		X*														
MDS Award XM22 Contract				X												

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: FEBRUARY 1995

BUDGET ACTIVITY: 4 - Demonstration And Validation

PE NUMBER AND TITLE: 0603884BP Chemical/Biological Defense

PROJECT: DE81

	FY 1994				FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
MDS Start EDT				X												
MDS Complete EDT							X									
MDS Start PPQT								X								
MDS Complete PPQT											X					
MDS Conduct IOT&E												X				
MDS Conduct MS III/TC (LP)																

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: FEBRUARY 1995

BUDGET ACTIVITY: 4 - Demonstration And Validation

PE NUMBER AND TITLE: 0603884BP Chemical/Biological Defense

PROJECT: DE81

A. Project Cost Breakdown:

	FY 1994	FY 1995	FY 1996	FY 1997
Sorbent System Engineering			820	200
Sorbent Technical Data				1900
Sorbent Contractor Engineering Support			2050	2889
MDS Development Engineering			2040	1118
MDS Producability Engineering			411	438
MDS Prototype Manufacturing			160	0
MDS Systems Test & Evaluation			555	182
MDS Training			46	92
MDS Technical Data Package			788	170
MDS Critical Design Review				
Total			6870	6989

B. Budget Acquisition History and Planning Information: Not Applicable

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: FEBRUARY 1995

BUDGET ACTIVITY: 4 - Demonstration And Validation

PE NUMBER AND TITLE: 0603884BP Chemical/Biological Defense

PROJECT: D669

COST (*In Thousands*)	FY 1994 Actual	FY 1995 Estimate	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
D669 Joint Service Lightweight Integrated Suit Technology(JSLIST)	0	0	0	0	0	201	0	799	Continuing	Continuing

C. Other Program Funding Summary:

	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	To Compl	Total Cost
RDTE,D Budget Activity 5, PE 0604384BP, Proj L40 JSLIST	0	0	2264	987	590	197	981	0	Cont'd	Cont'd
RDTE,D Budget Activity 4 PE 0603884BP Proj CP04 - Counterproliferation Support	0	0	0	8800	22500	24300	8500	9000		

D. Schedule Profile:

	FY 1994				FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Development Test													X			
Milestone I/II IPR															X	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: FEBRUARY 1995

BUDGET ACTIVITY: 4 - Demonstration And Validation

PE NUMBER AND TITLE: 0603884BP Chemical/Biological Defense

PROJECT: D993

COST (*In Thousands*)	FY 1994 Actual	FY 1995 Estimate	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
D993 Medical Chemical Defense	0	0	4311	4294	4271	4242	3845	3663	Continuing	Continuing

C. **Other Program Funding Summary:** There are no other Appropriation efforts.

D. **Schedule Profile:**

	FY 1994				FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Topical Skin Protectant IND Submission		X											X			X
Multichambered Autoinjector NDA Filing																
Multichambered Autoinjector MS III						X										
Nerve Agent Antidote System (HI-6) MSI	X*															
Cyanide Pretreatment MS 0			X													
Cyanide Pretreatment MS I										X						
Advanced Anticonvulsant MS I																

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: FEBRUARY 1995

BUDGET ACTIVITY: 4 - Demonstration And Validation

PE NUMBER AND TITLE: 0603884BP Chemical/Biological Defense

PROJECT: D993

A. **Project Cost Breakdown:**

	FY 1994	FY 1995	FY 1996	FY 1997
Contract Support			2892	2498
Developmental Costs			403	720
Project Management			1016	1076
Total			4311	4294

B. **Budget Acquisition History and Planning Information:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: FEBRUARY 1995

BUDGET ACTIVITY: 4 - Demonstration And Validation

PE NUMBER AND TITLE: 0603884BP Chemical/Biological Defense

PROJECT: S205

COST (*In Thousands*)	FY 1994 Actual	FY 1995 Estimate	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
S205 Navy Shipboard Chem/Bio Defense	0	0	2080	1702	1392	1254	1313	1289	Continuing	Continuing

C. **Other Program Funding Summary:**

	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	To Compl	Total Cost
RDTE,D Budget Activity 5, PE 0604384BP, Proj SO41 Shipboard BR/CW Countermeasures	0	0	2103	2006	2029	2151	2165	2242	Cont	Cont
Procurement, Defensewide, BA3, Chem/Bio Def										
Chemical Warfare Detectors	0	0	5455	7390	6620	11695	11752	12222	Cont	Cont
Shipboard Outfitting of C/B equipment	0	0	498	6467	13257	10438	10467	0	Cont	Cont
Port Facility Decontamination equipment	0	0	0	0	1012	994	997	996	Cont	Cont
Operations and Maintenance, USN (4B5N)	0	0	300	310	320	320	330	340	Cont	Cont

	FY 1994				FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Program Milestone ACPG MS III													X			
Program Milestone CARDS MS I																
Program Milestone IPE SRR											X					
Engineering Milestone CARDS SRR															X	
Engineering Milestone CPS SRR											X					
T&E Milestone CARDS DT I																

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: FEBRUARY 1995

BUDGET ACTIVITY: 4 - Demonstration And Validation

PE NUMBER AND TITLE: 0603884BP Chemical/Biological Defense

PROJECT: S205

A. Project Cost Breakdown:

	FY 1994	FY 1995	FY 1996	FY 1997
Subtotal Product Development			2080	1702
Subtotal Support and Management			0	0
Subtotal Test and Evaluation			0	0
Total			2080	1702

B. Budget Acquisition History and Planning Information: Not Applicable

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: FEBRUARY 1995

BUDGET ACTIVITY: 4 - Demonstration And Validation

PE NUMBER AND TITLE: 0603884BP Chemical/Biological Defense

PROJECT: W059

COST (*In Thousands*)	FY 1994 Actual	FY 1995 Estimate	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
W059 Naval Aircraft Chem/Bio Defense	0	0	178	150	153	151	157	150	Continuing	Continuing

C. Other Program Funding Summary:

	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	To Compl	Total Cost
RDTE,D Budget Activity 5, PE 0604384BP, Proj WO60 Naval Aircrew Chemical/Biological Defense	0	0	1083	494	0	0	0	0	Cont	Cont

D. Schedule Profile: Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE FEBRUARY 1995
BUDGET ACTIVITY 4 - Demonstration And Validation	PE NUMBER AND TITLE 0603884BP Chemical/Biological Defense PROJECT W059

A. Project Cost Breakdown:

	FY 1994	FY 1995	FY 1996	FY 1997
Product Development			178	150
Total			178	150

B. Budget Acquisition History and Planning Information: Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: FEBRUARY 1995

BUDGET ACTIVITY: 4 - Demonstration And Validation

PE NUMBER AND TITLE: 0603884BP Chemical/Biological Defense

PROJECT: C159

COST (*In Thousands*)	FY 1994 Actual	FY 1995 Estimate	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
C159 Marine NBC Equipment	0	0	2000	2000	3062	3018	2202	999	Continuing	Continuing

C. **Other Program Funding Summary:**

	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	To Compl	Total Cost
Procurement, Defensewide, BA3, Chem/Bio Def										
LNBCRS		0	0	0	0	0	0	70037	0	70037

D. **Schedule Profile:**

	FY 1994				FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Program Milestones LNBCRS MS I								X								
LNBCRS DT I												X				
LNBCRS MS II														X		
LNBCRS OT																

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: FEBRUARY 1995

BUDGET ACTIVITY: 4 - Demonstration And Validation

PE NUMBER AND TITLE: 0603884BP Chemical/Biological Defense

PROJECT: C159

A. Project Cost Breakdown:

	FY 1994	FY 1995	FY 1996	FY 1997
Systems Integration			1000	1000
Project Management Support			610	530
Development Test & Evaluation			390	470
Total			2000	2000

B. Budget Acquisition History and Planning Information: Not applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: FEBRUARY 1995

BUDGET ACTIVITY: 4 - Demonstration And Validation

PE NUMBER AND TITLE: 0603884BP Chemical/Biological Defense

PROJECT: CP04

COST (*In Thousands*)	FY 1994 Actual	FY 1995 Estimate	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
CP04 Counterproliferation Support Dem/Val	0	0	0	8800	22500	24300	8500	9000	Continuing	Continuing

C. **Other Program Funding Summary:**

	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	To Compl	Total Cost
RDTE,D Budget Activity 4 PE 0603884BP Project D669 - JSLIST	0	0	0	0	0	201	0	799	Cont'd	Cont'd

D. **Schedule Profile:** See Project D669 (JSLIST) for supported system schedule profile.

	FY 1994				FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Prototype UAV/SAW Detector													X			
Initiate SAW Engineering Development													X			
Fabricate SCAD/SAW Prototype																X

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: FEBRUARY 1995

BUDGET ACTIVITY: 4 - Demonstration And Validation

PE NUMBER AND TITLE: 0603884BP Chemical/Biological Defense

PROJECT: CP04

A. Project Cost Breakdown:

	FY 1994	FY 1995	FY 1996	FY 1997
Technical Data				400
Systems Engineering				4700
Logistics Support				200
Test and Evaluation				3500
Total				8800

B. Budget Acquisition History and Planning Information:

Performing Organizations

Contractor or Government Performing Activity	Contract Method/Type or Funding Vehicle	Award or Obligation Date	Performing Activity EAC	Project Office EAC	Total Prior to FY 1994	FY 1994	FY 1995	FY 1996	FY 1997	Budget to Complete	Total Program
Product Development Organizations									500		500
NRL	MIPR	JAN 97	500	500					4600		4600
NSWC - Dahlgren	MIPR	JAN 97	4600	4600							
Support and Management Organizations									700		700
Govt PM Soldier	MIPR	JAN 97	700	700							
Test and Evaluation Organizations									1000		1000
Govt NATICK	MIPR	JAN 97	1000	1000					2000		2000
DPG	MIPR	JAN 97	2000	2000							

Government Furnished Property: None.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: FEBRUARY 1995

BUDGET ACTIVITY: 4 - Demonstration And Validation

PE NUMBER AND TITLE: 0603884BP Chemical/Biological Defense

PROJECT: CP04

	Total Prior to FY 1994	FY 1994	FY 1995	FY 1996	FY 1997	Budget to Complete	Total Program
Subtotal Product Development					5100		5100
Subtotal Support and Management					700		700
Subtotal Test and Evaluation					3000		3000
Total Project					8800		8800

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RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: February 1995

BUDGET ACTIVITY: 5 - Engineering And Manufacturing Development

PE NUMBER AND TITLE: 0604384BP Chemical/Biological Defense

COST (*In Thousands*)	FY 1994 Actual	FY 1995 Estimate	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	0	15200	95324	102938	122200	124900	173800	137600	Continuing	Continuing
D020 NBC Contamination Avoidance Systems	0	0	7950	34890	32128	29915	40483	19733	Continuing	Continuing
D017 NBC Protection Systems	0	0	4529	0	0	0	0	0	Continuing	Continuing
DF97 NBC Decontamination Systems	0	0	0	0	0	0	0	0	Continuing	Continuing
D848 Medical Chemical Defense Life Support Materiel	0	0	341	224	213	164	161	162	Continuing	Continuing
L40 Joint Service Lightweight Integrated Suit Technology (JSLIST)	0	0	2264	967	590	197	981	0	Continuing	Continuing
DBD2 Joint Biological Defense - Medical	0	0	6746	6719	6725	6790	6849	7161	Continuing	Continuing
DBD3 Joint Biological Defense - Biological Integrated Detection System (BIDS)	0	0	30199	26122	41094	35944	49191	44000	0	226548
DBD4 Joint Biological Defense - Interim Biological Agent Detector/Biological Agent Detector System (IBAD/BADS)	0	0	2422	2320	1926	1435	1433	1441	Continuing	Continuing
DBD5 Joint Biological Defense - Stand-Off Detection	0	0	14768	12438	23581	28496	28460	25653	15000	148396
S041 Shipboard BR/CW Countermeasures	0	0	2103	2006	2029	2151	2165	2242	Continuing	Continuing
W060 Naval Aircrew Chemical/Biological Defense	0	0	1083	494	0	0	0	0	Continuing	Continuing
AF21 Air Force Chemical/Biological Agent Detection and Warning and Decontamination	0	0	537	474	369	739	3451	5521	Continuing	Continuing
AF37 Air Force Individual Protection	0	0	3582	5564	5045	6569	4126	2187	Continuing	Continuing

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: February 1995

BUDGET ACTIVITY: 5 - Engineering And Manufacturing Development

PE NUMBER AND TITLE: 0604384BP Chemical/Biological Defense

COST (*In Thousands*)	FY 1994 Actual	FY 1995 Estimate	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
CP05 Counterproliferation Support - EMD	0	15200	18800	10700	8500	12500	36500	29500	Continuing	Continuing

NOTE: FY94/FY95 Funding executed under Program Elements controlled by individual Services. See individual Project descriptions for audit to FY94/95 Programs.

A. Mission Description and Budget Item Justification: Operational forces across the continuum of global, contingency, special operations/low intensity conflict, counternarcotics, and other high risk missions have an immediate need to safely operate, survive and sustain operations in a nuclear, biological and chemical agent threat environment. Operating forces have a critical need for defense against worldwide proliferation of NBC warfare capabilities and for medical treatment of casualties in medical treatment facilities. Congress directed centralized management of DoD NBC Defense initiatives, both medical and non-medical This program element supports the Engineering and Manufacturing Development (EMD) of NBC defensive equipment, both medical and non-medical, and addresses various shortcomings identified in Conduct of the Persian Gulf War: Final Report to Congress, April 1992. These projects provide for development and demonstration testing of equipment across all Services and represents the first effort of the Department to consolidate and integrate all NBC defense efforts in this Budget Activity. This program is enhanced using Counterproliferation Support funding.

This engineering and manufacturing development program funds for individual and collective protection equipment such as the XM45 Aircrew Protective Mask (ACPM), the Joint Service Lightweight Integrated Suit Technology (JSLIST), Naval shipboard collective protection, a Disposable Eye/Respiratory Protection (DERP) for pilots and a CB respirator system for use by aircrews in Navy and Marine Corps tactical, rotary wing, and land based fixed wing aircraft; radiological detection and monitoring equipment; an array of chemical/biological/toxin detection and warning systems to include the Multi-Purpose Integrated Chemical Agent Detector (MICAD), the XM22 Automatic Chemical Agent Alarm (ACADA), the CB Mass Spectrometer (CBMS), Naval shipboard Improved (Chemical Agent) Point Detector System (IPDS)Chemical Agent Remote Detector System (CARDS), the In Line Water Chemical Biological Detector, the Aircraft Interior Detector, the Shipboard Automatic Liquid Agent Detector (SALAD), the Shipboard Chemical Agent Monitor (SCAMP) and the XM93E1 Fox NBC Reconnaissance Systems (NBCRS); and, finally, decontamination solutions and equipment to replace currently logistically burdensome and time consuming decon methods.

In the medical chemical defense area this engineering and manufacturing development program funds improved medical equipment and drugs essential to counteracting lethal and human performance degrading effects of chemical threats, and medical equipment essential to meeting medical requirements on the integrated battlefield with emphasis on decreased size/weight and high mobility, yet supporting large numbers of combat casualties. Additionally, foreign medical materiel may be procured for exploitation of advanced technology and development to meet Army medical defense goals. This program element supports the full-scale development of prophylactic and therapeutic drugs and rapid identification and diagnostic systems.

The Joint Program Office for Biological Defense (JPO-BD) was established to provide centralized management of the Services' Biological Defense Acquisition Programs. DoD Biological Warfare Defense mission area needs require the detection of validated biological threat agents to provide early warning capabilities on mobile and fixed platforms. This program element will provide theater protection through the development of point and stand-off detection systems. The detection system concept will

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provide detection, identification, warning and sample collection for verification that a biological agent attack has occurred. This program element also provides for the development of biological defense medical programs. DoD Biological Defense medical mission will address: (1) protective vaccines - vaccination capability against the most probable biological threat agents; (2) identification - clinical identification of biological threat agents through medical evaluation and laboratory analysis to augment early warning capabilities.

The projects in this Program Element support research efforts in the engineering and manufacturing development phases of the acquisition strategy and are therefore correctly placed in Budget Activity 5

Project D020 - NBC Contamination Avoidance Systems: This project provides for the Engineering and Manufacturing Development (EMD) of advanced nuclear and chemical defensive equipment to enhance U. S. capability to detect and identify threat agents on the battlefield. The project supports: (1) Automatic Chemical Agent Alarm (ACADA), which is more sensitive and responsive than current detectors and is capable of concurrent nerve and blister agent detection; (2) Multipurpose Integrated Chemical Agent Detector (MICAD) which automates NBC warning and reporting throughout the battlefield and links digital data into the Army's command, control and communications systems; (3) the XM93E1 FOX NBC Reconnaissance System (NBCRS), which is a dedicated system of NBC detection, warning, and sampling equipment integrated into a high speed, wheeled, high mobility armored carrier capable of performing NBC reconnaissance on primary, secondary, or cross country routes throughout the battlefield; (4) AN/UDR-13 Pocket Radiac Set which provides ground troops with a lightweight, user-friendly tactical device for measuring and detecting radiation; (5) Advanced Airborne Radiac System (AARS) to provide rapid, accurate, and safe measurement of radiation from the air and for correlating airborne readings to ground radiation readings and positions; and (6) CB Mass Spectrometer (CBMS) which identifies all chemical and biological agents collected and is a component of the NBCRS and Biological Integrated Detection System (BIDS); and (7) Biological Detector (BD), a point detector for threat biological agents which is also a component of the BIDS and is under management of the Joint Program Office for Biological Defense (JPO-BIO).

FY 1994 Planned Program:
- Program executed under PE# 0604806A/DO20

FY 1995 Planned Program:
- Program executed under PE# 0604806A/DO20

FY 1996 Planned Program:
- MICAD - Fabricate and inspect test systems (3770)
- MICAD - Fabricate and inspect installation kits (800)
- MICAD - System Integration (780)
- MICAD - Build Prototype Hardware (2600)

FY 1997 Planned Program:

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- MICAD-Build test hardware (7297)
- MICAD - Fabricate and inspect installation kits (750)
- MICAD - System Integration (507)
- MICAD-Conduct PPQT (2814)
- MICAD-Conduct PPT (2275)
- MICAD-Conduct IOT&E (1500)
- CBMS - Design Modifications for Objective BIDS and NBCRS (12000)
- CBMS - Conduct Bioprofiling for Objective BIDS (2000)
- CBMS - Software Documentation/ADA (Military style software) Development (5747)

Project D017 - NBC Protection Systems: Provides EMD of equipment to protect soldiers on NBC contaminated battlefields. The project resources development of the XM45 Aircrew Protective Mask (ACPM) which provides rotary-wing air crewmen with a less burdensome respiratory protection system. The ACPM eliminates the air crew dependence on forced air and is compatible with helicopter weapon sights and night vision system. This project also supports the Advanced Integrated Collective Protection System (AICPS) which integrates NBC filtration environmental controls and power source components for combat systems and exploits new filtration technology. The AICPS can be integrated into multiple configurations to provide protection to several different tactical systems. Also supports the M40 Mask Pre-Planned Product Improvement and the M20 Collective Protection System Pre-Planned Product Improvement.

FY 1994 Planned Program:
- Program executed under PE# 0604806A/DO17

FY 1995 Planned Program:
- Program executed under PE# 0604806A/DO17

FY 1996 Planned Program:
- ACPM - Resolve design issues, complete TDP, build Initial Operational Test and Evaluation (IOT&E) hardware, and complete logistics support (1913)
- ACPM - Conduct and support PPQT, and IOT&E (2087)
- ACPM - Prepare for and conduct Milestone III IPR (529)

FY 1997 Planned Program:
- No planned program.

Project DF97 - NBC Decontamination Systems: Provides EMD of new NBC decontamination solutions and equipment.

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FY 1994 Planned Program:
- No planned program

FY 1995 Planned Program:
- Program executed under PE# 0604806A/DF97

FY 1996 Planned Program:
- No planned program

FY1997 Planned Program:
- No planned program

Project D848-Medical chemical Defense Life Support Materiel: This project funds the development of medical materiel necessary to field an effective capability for medical dense against chemical agent threats facing U.S. forces in the field.

FY 1994 Planned Program:
- Program executed under PE#0604807/D848.

FY 1995 Planned Program:
- Program executed under PE#0604807/D848.

FY 1996 Planned Program:
- Conduct extended stability testing of the medical aerosolized nerve agent antidote; validate production/manufacturing capability for the topical skin protectant. (341)

FY 1997 Planned Program:
- Conduct extended stability testing of the medical aerosolized nerve agent antidote and submit New Drug Application for topical skin protectant. (224)

Project L40 - Joint Service Lightweight Integrated Suit Technology: This program has identified, for all four services, a design and several fabric alternatives which may satisfy the entirety of armed services requirements for individual protection against the worldwide chemical and biological threat. This program is the premier effort in and is an example for consolidation of Service research and development efforts into a true joint chemical and biological defense program. This project is supported by the Counterproliferation initiative.

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FY 1994 Planned Program:
- Program executed under PE#0604713A/L40, PE#0603635M/C1598, PE#0603514N/S2953, PE#0604516N/S0410, PE#0604601F, PE#06027593F.

FY 1995 Planned Program:
- Program executed under PE#0604713A/L40, PE#0603635M/C1598, PE#0603514N/S2953, PE#0604516N/S0410, PE#0604601F, PE#06027593F. (6700) [2]
- Conduct Integrated Developmental and Operational testing of prototype ensembles (4000) [1]
- Achieve Milestone I/II and conduct In Process Review

[2] Program funding provided for and justified by individual Services
[1] Counterproliferation funding support

FY 1996 Planned Program:
- Continue and complete Integrated Developmental and Operational testing of prototype ensembles. (6883) [1]

[1] Program funding includes Counterproliferation funding support (3600) and funding from Project SO41 (919) and PE#0603884BP/C159 (100).

FY 1997 Planned Program:
- Plan and conduct Milestone III Type Classification In Process Review (987)

Project DBD2 - Joint Biological Defense - Medical: This project funds advanced research and development of protective vaccines, antitoxins, and pharmacological mediators which can safely be administered to combatants and provide effective protection against validated biological threat agents to include: microbes (viruses, bacteria, etc.) and toxins of biological origin (microbial, plant or animal). Advanced development of these products involves studies which demonstrate product safety and efficacy and which are required for product licenser by the Food and Drug Administration. This project also funds advanced research and development into kits/equipment used in a medical environment for diagnosing and identifying biological warfare agents from patient samples, and other products which reduce casualty morbidity and mortality and protect medical personnel from secondary exposure to threat agents. International Cooperative Agreements - A Memorandum of Understanding with the United Kingdom is being developed and is currently in staffing.

FY 1994 Planned Program:
- Program executed under PE#0603807A/DB809 and PE#0604807A/D847.

FY 1995 Planned Program:
- Program executed under PE#0603724D/DBD2.

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FY 1996 Planned Program:

- Conduct Phase I safety, immunogenicity and Phase II optimal dosing and scheduling studies for improved anthrax, smallpox recombinant Venezuelan Equine Encephalitis vaccines and toxoids for Ricin and Staph enterotoxin B. (2488)
- Conduct Phase I safety, immunogenicity and Phase II optimal dosing and scheduling studies for Botulinum toxoids, types A-G. (799)
- Conduct expanded Phase II studies of a Botulism Immune Globulin F(ab')2 Heptavalent (Equine), submit a Product License application for a Q-Fever vaccine and field a Tularemia vaccine. (3459)

FY 1997 Planned Program:

- Conduct Phase I safety, immunogenicity and Phase II optimal dosing and scheduling studies for a recombinant Venezuelan Equine Encephalitis vaccine and a toxoid for Staph enterotoxin B. (1179)
- Conduct Phase I safety, immunogenicity and Phase II optimal dosing and scheduling studies for Botulinum toxoids, types A-G. (2245)
- Conduct expanded Phase II studies for improved anthrax, smallpox, and recombinant Venezuelan Equine Encephalitis vaccines and Ricin Toxoid and submit a Product License application for a Botulism Immune Globulin F(ab')2 Heptavalent (Equine). (3295)

Project DBD3 - Joint Biological Defense - Biological Integration Detection System (BIDS): DoD Biological Warfare Defense mission area requires the detection of biological threat agents to provide early warning capabilities at mobile and fixed locations. The detection system concept will provide detection, identification, warning and sample collection for verification that a large area biological agent attack has occurred. This program will provide a core non-developmental item (NDI), fixed/mobile platform based, point Biological Integrated Detection System (BIDS). The BIDS will consist of a shelter-configured detection suite (comprised of complementary generic, non-specific and specific detectors and supporting communication and meteorological equipment) mounted on a dedicated vehicle. The BIDS program is part of a biological defense "system of systems" architecture for detecting biological warfare agents on the battlefield. The BIDS will identify the agent type. International Cooperative Agreements - Annex A6 (Bio-Chemical Detector Demonstration and Validation Program) to the Memorandum of Understanding with Canada and the United Kingdom signed in 1980, for research, development, production and procurement of chemical and biological defense materiel. This project also contains funds for the Air Force detection program.

FY 1994 Planned Program:

- No planned program. Related work previously performed in DoD PE#0603724D (Biological Defense Development), Army PE#0603806A/Project Number D601 (NBC Contamination Avoidance Systems), PE#0604806A/Project Number D020 (NBC Defense Systems) and Air Force PE#0604601F/Project Number 3321 (Nuclear, Biological, Chemical Defense Equipment).

FY 1995 Planned Program:

- Program executed under PE#0603724D/DBD1.

FY 1996 Planned Program:

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- Fabricate candidate technology P3I BIDS detection components. (4600)
- Evaluate candidate technologies for the P3I BIDS. (1300)
- Continue antibody, reagent, and detector kit development and testing. (5000)
- Complete biological detector (BD) prototype fabrication. (6200)
- Conduct Production Proveout Test (PPT) and Evaluation (BD). (2800)
- Initiate P3I BIDS integration. (2200)
- Initiate P3I BIDS prototype fabrication. (5899)
- Initiate P3I BIDS prototype engineering test. (2000)
- Continue Air Force biological detector studies. (200)

- **FY 1997 Planned Program:**
- Complete P3I BIDS prototype fabrication and engineering test. (2800)
- Conduct P3I BIDS Pre-Production Qualification Testing (PPQT). (3600)
- Conduct P3I BIDS Initial Operational Test and Evaluation (IOT&E). (2400)
- Develop P3I BIDS Technical Data Package (TDP). (5000)
- Evaluate P3I BIDS TDP. (1222)
- Develop and evaluate BD TDP. (2700)
- Complete antibody investigations. (3000)
- Continue Air Force biological detector studies. (200)
- Initiate Engineering and Manufacturing Development (EMD) of BD as objective BIDS component. (5200)

Project DBD4 - Joint Biological Defense - Interim Biological Agent Detector (IBAD)/Biological Agent Detector System (BADS): Conduct development of biological defensive systems for surface ships to support the requirement to sustain operations in a biological threat environment. IBAD will provide an interim point detection capability onboard ships at sea, which will be part of the theater protection strategy. BADS will provide the objective system, a fully automated, shipboard, point detection and standoff capability to be integrated into the detection strategy. BADS will also provide monitoring capability for decontamination assessment.

FY 1994 Planned Program:
- No planned program. Related work was previously performed in Navy PE#0603514N/Project Number S2053 (Ship Combat Survivability) and PE#0604516N/Project Number S0410 (Ship Survivability).

FY 1995 Planned Program:
- Program executed under PE#0603724D/DBD1.

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FY 1996 Planned Program:

- Complete IBAD follow-on operational testing and begin shipboard installations, system check-outs, and hands-on training. (550)
- Continue BADS-Point Detector advanced development model design, testing, documentation (design specifications and other technical data) preparation. (1460)
- Continue BADS-Portable Detector and Monitor. Initiate development of documentation and cost and operational effectiveness analysis. (412)

FY 1997 Planned Program:

- Continue IBAD shipboard installations, system check-outs, and hands-on training. (250)
- Continue BADS-Point Detector program. Initiate engineering development models, component testing and advancement of design specifications and other technical data. (1450)
- Continue BADS-Portable Detector and Monitor development to include test and evaluation of candidate technologies. Continue development of documentation and completion of initial cost and operational effectiveness analysis. Achieve MS II approval. (620)

Project DBD5 - Joint Biological Defense - Stand-Off Detection: This program will provide core Long Range Biological Stand-off Detection System (LR-BSDS), air platform based, for ranges out to 50 Km. The LR-BSDS will use Laser Infrared Detection and Ranging (LIDAR) technology whereby a laser transmits pulses of infrared light and collects backscatter from the aerosol clouds. This program has a concurrent development effort to provide technology-driven upgraded capabilities to core systems as well as developing a Short Range Biological Stand-Off Detection System (SR-BSDS) for fixed/mobile platforms for ranges out to 5 Km. The SR-BSDS uses ultra-violet (UV) laser and Laser Induced Fluorescence (LIF) technologies. The Stand-Off Program is part of a biological defense "system of systems" architecture for detecting and identifying biological warfare agents on the battlefield. The architecture has an LR-BSDS, which will identify the presence of biological aerosols at long range but cannot tell whether it contains biological agents. The SR-BSDS operates at much shorter ranges and can further identify the presence of a biological agent but not which specific agent is within the cloud. The architecture is complementary in nature, without the duplication of detection technologies. This project funds the advanced development of biological stand-off detection system technologies which can be used for the detection and communication of biological aerosols to indicate the presence of biological warfare agents on the battlefield. The early warning approach of LR-BSDS will enable the commander to posture other detection systems to confirm the presence of biological agents, and what type they are in order to properly react to minimize or prevent casualties. The technologies used in each of these detection systems are different and designed to complement each other in the total system architecture. This program is supported by the Counterproliferation initiative which will provide standardized point and stand-off detection. The objectives are to reduce weight, bulk and power requirements while increasing sensitivity. Further software/communications interfaces will increase the accuracy and speed of NBC warning.

FY 1994 Planned Program:

- No planned program. Related work previously performed in DoD PE#0603724D (Biological Defense Development).

FY 1995 Planned Program:

- Program executed under PE#0603724D/DBD1.
- Initiate system design for LR-BSDS (3500)[1]

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- Initiate laser design for LR-BSDS (1200)[1]
- Initiate fabrication of brassboards for LR-BSDS Engineering Design Testing (EDT) (2300)[1]

[1] Counterproliferation funding support

FY 1996 Planned Program:
- Complete design, conduct Critical Design Review and prepare preliminary Technical Data Package (TDP) for P3I LR-BSDS. (1700)
- Complete system design of LR-BSDS. (2500)[1]
- Complete laser design for LR-BSDS. (1200)[1]
- Initiate prototype fabrication of LR-BSDS. (5100) (5700)[1]
- Initiate Engineering Design Test (EDT) of LR-BSDS. (300)
- Conduct EDT of LR-BSDS using brassboards (3400)[1]
- Complete design, conduct Critical Design Review and prepare preliminary Technical Data Package (TDP) for SR-BSDS. (1700)
- Fabricate SR-BSDS prototypes. (5668)
- Initiate EDT of SR-BSDS. (300)

[1] Counterproliferation funding support

FY 1997 Planned Program:
- Complete Demonstration/Validation development of LR-BSDS.(5100)
- Complete fabrication of LR-BSDS prototypes (1400)[1]
- Conduct acceptance testing on LR-BSDS (1200)[1]
- Conduct technical feasibility testing and early user test and evaluation for LR-BSDS (2600)[1]
- Retrofit technical demonstration prototypes (5500)[1]
- Complete Demonstration/Validation development of SR-BSDS. (5838)
- Conduct Technical Feasibility Test on SR-BSDS. (1500)

[1] Counterproliferation funding support

Project S041 - Shipboard BR/CW Countermeasures: Develops Chemical and Biological (CB) defensive systems for surface ships to support the requirement to sustain operations in a CB threat environment. Systems developed will counter threats in the near term and predicted emerging threats to Naval forces as validated by Office of Naval Intelligence (ONI) CB Threat Assessment (TA# 004-94).

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FY 1994 Planned Program:

- Program executed under PE# 0604516N/SO410

FY 1995 Planned Program:

- Program executed under PE# 0604516N/SO410

FY 1996 Planned Program:

- Initiate fabrication of Shipboard Chemical Agent Monitor Portable (SCAMP)Engineering Development Models (EDM) and start Technical Evaluation (TECHEVAL). (384)
- Support Improved Point Detector System Follow-on Test and Evaluation (FOT&E). (200)
- Complete Shipboard Automatic Liquid Agent Detector (SALAD) Technical Evaluation (TECHEVAL) and support shipboard Operational Evaluation (OPEVAL). Continue development of technical data package and requisite acquisition documentation in preparation for FY97 MS III. (600)
- Complete Advanced Chemical Protective Garment (ACPG) TECHEVAL and OPEVAL and finalize technical data package and requisite acquisition documentation in preparation for MS III. This task represents support to JSLIST I (Project L40) (919)

FY 1997 Planned Program:

- Complete SCAMP TECHEVAL and support shipboard OPEVAL. Continue development of technical data package and requisite acquisition documentation in preparation for FY98 MS III. (532)
- Complete SALAD OPEVAL and technical data package and requisite acquisition documentation in preparation for 2Q FY97 MS III decision. (300)
- Support ACPG Milestone III IPR. (200)
- Initiate Chemical Agent Remote Detector System (CARDS) engineering and manufacturing development phase. Procure EDMs, initiate technical testing and refinement of technical documentation including specifications and technical drawings. (974)

Project W060 - Naval Aircrew Chemical/Biological Defense: This project funds upgrading existing individual protective equipment for Marine Corps helicopter and Marine Corps Tactical Air crews. This project is also tests and develops support packages for Non Developmental Item (NDI) mask assemblies for Naval helicopter and tactical air crews.

FY 1994 Planned Program:

- Program executed under PE 0604264N/W0606.

FY 1995 Planned Program:

- Program executed under PE 0604264N/W0606

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FY 1996 Planned Program:
- Prepare ILS and programmatic documentation, and conduct TECHEVAL for NDI Mask Assembly. (1083)

FY 1997 Planned Program:
- Conduct OPEVAL and obtain Milestone III decision for NDI Mask Assembly. (494)

Project AF21 - Air Force Chemical and Biological Agent Detection and Warning, and Decontamination: Develops decontamination equipment and detectors to warn personnel of nuclear, biological and chemical contamination.

FY 1994 Planned Program:
- Program executed under PE#0604601F/3321.

FY 1995 Planned Program:
- Program executed under PE#0604601F/3321.

FY 1996 Planned Program:
- Perform doctrine/policy CONOPS analysis for In-Line Water Chemical-Biological Detector. (140)
- Perform studies on effects of AF doctrine on the development of deployment of Aircraft Interior Detector. (160)
- Perform studies on effects of AF doctrine on the development of Equipment Contamination Sensor (ECOS) and Stand-Off Detection. (180)
- Perform studies/analysis of Equipment Contamination Sensor (ECOS) and Stand-Off Detection. (180)
- Provide support for Automatic Vapor Agent Detector (AVAD) and Multi-Function Radiac (MFR) production efforts. (57)

FY 1997 Planned Program:
- Perform studies to validate specifications for Body Cooling. (100)
- Conduct C-17 ventilation trials. (138)
- Initiate analysis to validate specifications and establish detection times for cargo aircraft interior detectors. (178)
- Continue support for AVAD and MFR production efforts (58)

Project AF37 - Air Force Individual Protection: Based upon changing world conditions chemical/biological weapons have emerged as a major threat to our forces. Because of this, the using commands have issued operational requirements to protect personnel against agents while minimizing the impact to their performance. The Air Force is developing clothing and equipment (both aircrew and ground crew) to protect personnel in chemical/biological environments.

FY 1994 Planned Program:
- Program executed under PE#0604601F/3337.

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FY 1995 Planned Program:

- Program executed under PE#0604601F/3337.

FY 1996 Planned Program:

- Continue EMD for the chemically protected Explosive Ordnance Disposal (EOD) ensemble. (1305)
- Conduct EMD for the chemically protected Fire Fighter's Ensemble (FFE). (1150)
- Support AERP aircraft modifications and chemical surety test analysis; provide engineering management support, scientific, engineering and technical assistance, Human System Center assessments, and System Program Office operating support. (773)
- Initiate a technology survey for Body Cooling. (110)
- Perform study for development of doctrine/policy for CONOPS of Automatic Nuclear Biological Chemical Reporting System. (142)
- Automatic Cost & Operational Effectiveness Assessment (COEA) capability for Chem-Bio programs. (102)

FY 1997 Planned Program:

- Continue EMD for EOD ensemble. (1985)
- Continue FFE EMD. (1970)
- Support AERP aircraft modifications and chemical surety test analysis; provide engineering management support, scientific, engineering and technical assistance, Human System Center assessments, and System Program Office operating support. (1096)
- Conduct analyses of C-17 ventilation trails. (513)

Project CP05 - Counterproliferation Support (EMD): Weapons of mass destruction (WMD) may directly threaten US forces in the field or threaten effective employment of those forces. Potential adversaries may use WMD to deter US power projection abroad. As required by the National Defense Authorization Act of 1994, an interagency review committee chaired by Dr. John Deutch performed a comprehensive review of US nonproliferation and counterproliferation activities and programs, and provided a report to Congress in May 1994. The report provides an overview of existing, planned, and proposed capabilities and technologies, as well as a description of priorities, programmatic options, and other issues. It identifies areas where improvements could be made in current programs. It also identifies high priority shortfalls in operational capability needed to implement US non/counterproliferation policy.

The Counterproliferation Program support in the area of passive defense is focused on accelerating the delivery of high priority technology and capability in the areas of chemical and biological detection, individual protection and collective protection.

CHEMICAL AND BIOLOGICAL(CB) DETECTION - Provides Chemical or Biological warfare agent detection in a contaminated environment. This area accelerates the development of chemical or biological detectors. Developmental items will be compatible with future software/communications interfaces increasing the accuracy and speed of NBC warnings. Executed under Project DBD5 (Joint Biological Defense - Stand-Off Detection).

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INDIVIDUAL PROTECTION - Counterproliferation support provides acceleration of non-respiratory protection to the individual soldier, sailor, marine, or airman in a Chemical or Biological (CB) contaminated environment. Executed under Project L40 (JSLIST).

COLLECTIVE PROTECTION - Provides a contamination free area for operations in a NBC contaminated area. Executed under PE#0604806A/Project DO17 (NBC Protection Systems).

FY 1994 Planned Program:
- No planned program.

FY 1995 Planned Program:
- Supports Stand-Off Biological Detection Program. See Project DBD5 (Joint Biological Defense - Stand-Off Detection). (7000)
- Supports Non-Respiratory Protection Program. See Project L40 (JSLIST). (4000)
- Supports Advanced Integrated Collective Protection System. See PE#0604806A/Project DO17 (NBC Protection Systems). (4200).

FY 1996 Planned Program:
- Supports Stand-Off Biological Detection Program. See Project DBD5 (Joint Biological Defense - Stand-Off Detection). (12800)
- Supports Non-Respiratory Protection Program. See Project L40 (Joint Service Lightweight Integrated Suit Technology - JSLIST). (3600)
- Supports Advanced Integrated Collective Protection System. See PE#0603884D/D604 (NBC Protection Systems). (2400)

FY 1997 Planned Program:
- Supports Stand-Off Biological Detection Program. See Project DBD5 (Joint Biological Defense - Stand-Off Detection). (10700)

B. Program Change Summary:

	FY 1994	FY 1995	FY 1996	FY 1997
Previous President's Budget	0	0	0	0
Appropriated Value	0	0	0	0
Adjustments to Appropriated Value	0	0	0	0
Current Budget Submit/President's Budget	0	15200	95324	102938

Change Summary Explanation: Starting in FY96 this program represents a consolidation of all Chemical/Biological defense programs Department wide into a single DOD program element for each Budget Activity in accordance with the FY94 Authorization Act. See individual project descriptions for audit of FY94/FY95 funding.

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Counterproliferation Support funding was added to this program for FY95.

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PROJECT: D020

COST (*In Thousands*)	FY 1994 Actual	FY 1995 Estimate	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
D020 NBC Contamination Avoidance Systems	0	0	7950	34890	32128	29915	40483	19733	Continuing	Continuing

C. Other Program Funding Summary:

	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	To Compl	Total Cost
RDTE, D Budget Activity 4 PE 0603884BP Project D601 NBC Contamination Avoidance Systems			7429	9621	10205	10059	0	1499	Cont'd	Cont'd
RDTE, A Budget Activity 4 PE 0603806A Project D601 NBC Contamination Avoidance Systems	21277	8623							0	29900
Procurement, Defensewide, BA3, Chem/Bio Def			0	6566	13732	21623	40048	41320	27120	150409
ACADA XM22						11599	10587	10705	28000	60891
MICAD			46033	57150	27928	27379				158490
NBCRS XM93E1			3729	3700	5316					12745
Pocket Radiac								16327	92250	108577
LSCAD								13914	25100	39014
CBMS										

D. Schedule Profile:

	FY 1994				FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
MICAD-Preliminary Design Rev		X*														
MICAD-Hardware Critical Design Rev			X*													
MICAD-Software Design & Phase I Rev				X*												
MICAD - Initiate System Assembly						X										
MICAD-Sample Transfer System Design										X						

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: February 1995

BUDGET ACTIVITY: 5 - Engineering And Manufacturing Development

PE NUMBER AND TITLE: 0604384BP Chemical/Biological Defense

PROJECT: D020

	FY 1994				FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
MICAD-Build Prototype Hardware											X					
MICAD-Conduct PPT												X				
CBMS-Design																X
CBMS-Test																X
CBMS-Document																X

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)

DATE: February 1995

BUDGET ACTIVITY: 5 - Engineering And Manufacturing Development

PE NUMBER AND TITLE: 0604384BP Chemical/Biological Defense

PROJECT: D020

A. Project Cost Breakdown:

	FY 1994	FY 1995	FY 1996	FY 1997
Government Engineering Support			475	500
Contractor Engineering Support				
Project Management Office Support			4855	6657
Hardware Development			1500	450
Software Development			295	570
ILS			375	695
QA			450	575
Technical Data				7696
Testing				12000
Design				5747
Document			7950	34890
TOTAL				

B. Budget Acquisition History and Planning Information:

Performing Organizations

Contractor or Government Performing Activity	Contract Method/Type or Funding Vehicle	Award or Obligation Date	Performing Activity EAC	Project Office EAC	Total Prior to FY 1994	FY 1994	FY 1995	FY 1996	FY 1997	Budget to Complete	Total Program
Product Development Organizations											
CBDCOM	PO	Nov 95	5902	5902	0	0	0	1990	1925	1987	5902
LORAL-LIBRA	PO	Nov 95	33027	33027	0	0	0	5800	11146	16081	33027
MISC	PO/MIPR		1000	804	0	0	0	0	0	804	804
Contractor TBD	COMP/CPFF	Nov 96	38467	38467	0	0	0	0	14000	24467	38467
Support and Management Organizations											
CECOM		Oct 95	80	80	0	0	0	30	50	0	80
ARL		Oct 95	80	80	0	0	0	30	50	0	80

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)

DATE: February 1995

BUDGET ACTIVITY: 5 - Engineering And Manufacturing Development

PE NUMBER AND TITLE: 0604384BP Chemical/Biological Defense

PROJECT: D020

Contractor or Government Performing Activity	Contract Method/Type or Funding Vehicle	Award or Obligation Date	Performing Activity EAC	Project Office EAC	Total Prior to FY 1994	FY 1994	FY 1995	FY 1996	FY 1997	Budget to Complete	Total Program
CBDCOM	PO	Oct 96	14947	14947	0	0	0	0	3919	11028	14947
Test and Evaluation Organizations											
FT HOOD	MIPR	Oct 95		1750	0	0	0	0	0	1750	1750
TEXCOM	PO	Oct 95		20572	0	0	0	100	3800	16672	20572

Government Furnished Property: None

	Total Prior to FY 1994	FY 1994	FY 1995	FY 1996	FY 1997	Budget to Complete	Total Program
Subtotal Product Development				7790	27071	43339	78200
Subtotal Support and Management				60	4019	11028	15107
Subtotal Test and Evaluation				100	3800	18422	22322
Total Project				7950	34890	72789	115629

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: February 1995

BUDGET ACTIVITY: 5 - Engineering And Manufacturing Development

PE NUMBER AND TITLE: 0604384BP Chemical/Biological Defense

PROJECT: D017

COST (*In Thousands*)	FY 1994 Actual	FY 1995 Estimate	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
D017 NBC Protection Systems	0	0	4529	0	0	0	0	0	Continuing	Continuing

C. Other Program Funding Summary:

	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	To Compl	Total Cost
RDTE,D Budget Activity 4 PE 0603884BP Project D604 NBC Protection Systems			9593	9199	7183	4024	8190	16206	Cont'd	Cont'd
RDTE,A Budget Activity 4 PE 0603806A Project D604 NBC Protection Systems	6318	1480							0	7798
Procurement, Defensewide, BA3, Chem/Bio Def XM45 ACPM				7886	2024				Cont'd	Cont'd

D. Schedule Profile:

	FY 1994				FY 1995				FY 1996				FY 1997		
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Conduct MSII IPR for ACPM				X												
Conduct Mini- (EDT) for ACPM						X										
Build EDT Hardware for ACPM							X									
Conduct EDT for ACPM								X		X						
Start/Complete Preproduction Qualification Test (PPQT) for ACPM									X	X						
Start/Complete Initial Operational Test and Evaluation (IOT&E) for ACPM												X				
Conduct MSIII IPR for ACPM																

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)

DATE: February 1995

BUDGET ACTIVITY: 5 - Engineering And Manufacturing Development

PE NUMBER AND TITLE: 0604384BP Chemical/Biological Defense

PROJECT: D017

A. Project Cost Breakdown:

	FY 1994	FY 1995	FY 1996	FY 1997
Primary hardware development			1988	
Integrated Logistics Support (ILS) for ACPM			254	
Quality Assurance Support			250	
Configuration Management			215	
Technical Data			250	
PPQT			487	
OT&E			1000	
Travel			85	
Total			4529	

B. Budget Acquisition History and Planning Information:

Performing Organizations

Contractor or Government Performing Activity	Contract Method/Type or Funding Vehicle	Award or Obligation Date	Performing Activity EAC	Project Office EAC	Total Prior to FY 1994	FY 1994	FY 1995	FY 1996	FY 1997	Budget to Complete	Total Program
Product Development Organizations											
CBDCOM	PO	Oct 95	2282	2282	0	0	0	2282	0		2282
Support and Management Organizations											
CBDCOM	PO	Oct 95	760	760	0	0	0	760	0		760
Test and Evaluation Organizations											
TECOM	PO	Nov 95	487	487	0	0	0	487	0		487
TEXCOM		Nov 95	1000	1000	0	0	0	1000	0		1000

Government Furnished Property

Item Description	Award or Obligation Date	Delivery Date	Total Prior to FY 1994	FY 1994	FY 1995	FY 1996	FY 1997	Budget to Complete	Total Program

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)

DATE: February 1995

BUDGET ACTIVITY: 5 - Engineering And Manufacturing Development

PE NUMBER AND TITLE: 0604384BP Chemical/Biological Defense

PROJECT: D017

Item Description	Award or Obligation Date	Delivery Date	Total Prior to FY 1994	FY 1994	FY 1995	FY 1996	FY 1997	Budget to Complete	Total Program
N/A									
Support and Management Property									
N/A									
Test and Evaluation Property									
N/A									

	Total Prior to FY 1994	FY 1994	FY 1995	FY 1996	FY 1997	Budget to Complete	Total Program
Subtotal Product Development				2282	0		2282
Subtotal Support and Management				760	0		760
Subtotal Test and Evaluation				1487	0		1487
Total Project				4529	0		4529

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: February 1995

BUDGET ACTIVITY: 5 - Engineering And Manufacturing Development

PE NUMBER AND TITLE: 0604384BP Chemical/Biological Defense

PROJECT: DF97

COST (*In Thousands*)	FY 1994 Actual	FY 1995 Estimate	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
DF97 NBC Decontamination Systems	0	0	0	0	0	0	0	0	Continuing	Continuing

C. **Other Program Funding Summary:** None

D. **Schedule Profile:** Not Applicable

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: February 1995

BUDGET ACTIVITY: 5 - Engineering And Manufacturing Development

PE NUMBER AND TITLE: 0604384BP Chemical/Biological Defense

PROJECT: D848

COST (*In Thousands*)	FY 1994 Actual	FY 1995 Estimate	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
D848 Medical Chemical Defense Life Support Material	0	0	341	224	213	164	161	162	Continuing	Continuing

C. **Other Program Funding Summary:** There are no other Appropriation efforts.

D. **Schedule Profile:**

	FY 1994				FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Topical Skin Protectant MSII									X							
Nerve Agent Pretreatment NDA Filing		X														

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE February 1995
BUDGET ACTIVITY 5 - Engineering And Manufacturing Development	PE NUMBER AND TITLE 0604384BP Chemical/Biological Defense PROJECT D848

A. **Project Cost Breakdown:**

	FY 1994	FY 1995	FY 1996	FY 1997
Contract Support			257	102
Development Costs			14	14
Project Management			70	108
Total			341	224

B. **Budget Acquisition History and Planning Information:** Not applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: February 1995

BUDGET ACTIVITY: 5 - Engineering And Manufacturing Development

PE NUMBER AND TITLE: 0604384BP Chemical/Biological Defense

PROJECT: L40

COST (*In Thousands*)	FY 1994 Actual	FY 1995 Estimate	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
L40 Joint Service Lightweight Integrated Suit Technology (JSLIST)	0	0	2264	987	590	197	981	0	Continuing	Continuing

C. Other Program Funding Summary:

	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	To Compl	Total Cost
RDTE,D Budget Activity 4 PE 0603884BP Project D669 - JSLIST	0	0	0	0	0	201	0	799	Cont'd	Cont'd
RDTE,D Budget Activity 5 PE 0604384BP Project CP05 - Counterproliferation Support		15200	18800	10700	8500	12500	36500	29500	Cont'd	Cont'd
Procurement, Defensewide, BA3, Chem/Bio Def			498	6467	13257	10438	10467	0	Cont'd	Cont'd
CBR Equipment Shipborad			11049	13176	11727	18104	18744	19227	Cont'd	Cont'd
Chemical/Biological Defense Equipment (AF)				20000	20000	20000	20000		Cont'd	Cont'd
Operations and Maintenance, Army, 1140928.32				1500	1500	1500	1500	1500	7500	15000
Operations and Maintenance, USMC, 0206315M										

D. Schedule Profile:

	FY 1994				FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Milestone I/II						X										
DT/OT							X									
Milestone III														X		

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1995
BUDGET ACTIVITY 5 - Engineering And Manufacturing Development	PE NUMBER AND TITLE 0604384BP Chemical/Biological Defense PROJECT L40

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE February 1995
BUDGET ACTIVITY 5 - Engineering And Manufacturing Development	PE NUMBER AND TITLE 0604384BP Chemical/Biological Defense PROJECT L40

A. Project Cost Breakdown:

	FY 1994	FY 1995	FY 1996	FY 1997
Program Management Support			1100	987
Testing (DT/OT)			1164	
Total			2264	987

B. Budget Acquisition History and Planning Information: Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: February 1995

BUDGET ACTIVITY: 5 - Engineering And Manufacturing Development

PE NUMBER AND TITLE: 0604384BP Chemical/Biological Defense

PROJECT: DBD2

COST (*In Thousands*)	FY 1994 Actual	FY 1995 Estimate	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
DBD2 Joint Biological Defense - Medical	0	0	6746	6719	6725	6790	6849	7161	Continuing	Continuing

C. Other Program Funding Summary:

	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	To Compl	Total Cost
Operations and Maintenance, Army 112017	25300	17926	18587	32991	30009	30592	29855	29118	Cont'd	Cont'd
Military Construction, Army	15000	10000								

D. Schedule Profile:

	FY 1994				FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Venezuelan, Eastern/Western Equine Encephalitis Vaccine Product Validation							X									
Q-Fever CMR Extract Vaccine MS IIIA									X							
Submit Product License Application for Q-Fever Vaccine		X*														
Tularemia Live Vaccine MS IIIA									X							
Tularemia Live Vaccine MS III																X
Cell Culture Derived Smallpox Vaccine (Vaccinia) MS III																X
Submit Product License Application for Botulism Immune Globulin F(ab')2 Heptavalent (Equine) Vaccine																

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE February 1995
BUDGET ACTIVITY 5 - Engineering And Manufacturing Development	PE NUMBER AND TITLE 0604384BP Chemical/Biological Defense PROJECT DBD2

A. **Project Cost Breakdown:**

	FY 1994	FY 1995	FY 1996	FY 1997
Phase I & II Trials			6721	6694
Vaccine License Application			25	25
Total			6746	6719

B. **Budget Acquisition History and Planning Information:** Not Applicable

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: February 1995

BUDGET ACTIVITY: 5 - Engineering And Manufacturing Development

PE NUMBER AND TITLE: 0604384BP Chemical/Biological Defense

PROJECT: DBD3

COST (*In Thousands*)	FY 1994 Actual	FY 1995 Estimate	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
DBD3 Joint Biological Defense - Biological Integrated Detection System (BIDS)	0	0	30199	26122	41094	35944	49191	44000	0	226548

C. Other Program Funding Summary:

	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	To Compl	Total Cost
RDTE, D Budget Activity 4 PE 0603884BP Project D601 NBC Contamination Avoidance Systems			7429	9621	10205	10059	0	1499	Cont'd	Cont'd
RDTE, A Budget Activity 4 PE 0603806A Project D601 NBC Contamination Avoidance Systems	21277	8623							0	29900
RDTE, D Budget Activity 5 PE 0604384BP Project DO20 NBC Contamination Avoidance Systems			7950	34890	32128	29915	40483	19733	Cont'd	Cont'd
RDTE, A Budget Activity 4 PE 0604806A Project DO20 NBC Contamination Avoidance Systems	42285	9469							0	51750
Procurement, Defensewide, BA3, Chem/Bio Def Biological Integrated Detection System (BIDS)	0	0	19875	42734	27424	9742	68583	16924	110000	295282

D. Schedule Profile:

	FY 1994				FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Fabricate P3I Detection Components										X						
Evaluate Candidate P3I BIDS											X					

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: February 1995

BUDGET ACTIVITY: 5 - Engineering And Manufacturing Development

PE NUMBER AND TITLE: 0604384BP Chemical/Biological Defense

PROJECT: DBD3

	FY 1994				FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Production Prove-out Test (PPT) and Evaluation for Bio Detector Component												X		X		
Complete P3I Prototype Fabrication and Engineering Testing															X	
PPQT															X	
IOT&E																X
P3I BIDS TDP															X	
BIDS Objective System MS IV																

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)

DATE: February 1995

BUDGET ACTIVITY: 5 - Engineering And Manufacturing Development

PE NUMBER AND TITLE: 0604384BP Chemical/Biological Defense

PROJECT: DBD3

A. Project Cost Breakdown:

	FY 1994	FY 1995	FY 1996	FY 1997
Engineering Design			7200	5400
Fabrication			16699	3000
Test & Evaluation			4800	8800
Technical Data/Documentation			1500	8922
Total			30199	26122

B. Budget Acquisition History and Planning Information:

Performing Organizations

Contractor or Government Performing Activity	Contract Method/Type or Funding Vehicle	Award or Obligation Date	Performing Activity EAC	Project Office EAC	Total Prior to FY 1994	FY 1994	FY 1995	FY 1996	FY 1997	Budget to Complete	Total Program
Product Development Organizations											
ETG, Towson, MD	SS/CPFF	Oct 95	14400	14400	0	0	0	6200	8200	0	14400
Antibody Reagent Development	C/CPFF	Oct 95	8000	8000	0	0	0	5000	3000	0	8000
CBDC	MIPR	Oct 95	17600	17600	0	0	0	10925	6400	275	17600
TBD		Oct 97	145124	145124	0	0	0	0	0	145124	145124
Support and Management Organizations											
CBDC	MIPR	Oct 95	23335	23335	0	0	0	3074	2322	17939	23335
USAF	MIPR	Oct 95	400	400	0	0	0	200	200	0	400

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)

DATE: February 1995

BUDGET ACTIVITY: 5 - Engineering And Manufacturing Development

PE NUMBER AND TITLE: 0604384BP Chemical/Biological Defense

PROJECT: DBD3

Contractor or Government Performing Activity	Contract Method/Type or Funding Vehicle	Award or Obligation Date	Performing Activity EAC	Project Office EAC	Total Prior to FY 1994	FY 1994	FY 1995	FY 1996	FY 1997	Budget to Complete	Total Program
Test and Evaluation Organizations											
PPT			4800	4800	0	0	0	4800	0	0	4800
PPQT			3600	3600	0	0	0	0	3600	0	3600
IOTE			2400	2400	0	0	0	0	2400	0	2400
Future Testing			11000	11000	0	0	0	0	0	11000	11000

Government Furnished Property: None.

	Total Prior to FY 1994	FY 1994	FY 1995	FY 1996	FY 1997	Budget to Complete	Total Program
Subtotal Product Development	0	0	0	22125	17600	145399	185124
Subtotal Support and Management	0	0	0	3274	2522	17939	23735
Subtotal Test and Evaluation	0	0	0	4800	6000	11000	21800
Total Project		0	0	30199	26122	174338	230659

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: February 1995

BUDGET ACTIVITY: 5 - Engineering And Manufacturing Development

PE NUMBER AND TITLE: 0604384BP Chemical/Biological Defense

PROJECT: DBD4

COST (*In Thousands*)	FY 1994 Actual	FY 1995 Estimate	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
DBD4 Joint Biological Defense - Interim Biological Agent Detector/Biological Agent Detector System (IBAD/BADS)	0	0	2422	2320	1926	1435	1433	1441	Continuing	Continuing

C. Other Program Funding Summary:

	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	To Compl	Total Cost
Procurement, Defensewide, BA3, Chem/ Bio Def Biological Agent Detector System (BADS)							1495	2987	Cont'd	Cont'd

D. Schedule Profile:

	FY 1994				FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
BADS Point Detector MS I								X						X		
BADS Point Detector MS II																X
BADS Portable Monitor MS I																

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE February 1995
BUDGET ACTIVITY 5 - Engineering And Manufacturing Development	PE NUMBER AND TITLE 0604384BP Chemical/Biological Defense PROJECT DBD4

A. Project Cost Breakdown:

	FY 1994	FY 1995	FY 1996	FY 1997
Primary Hardware Development			375	400
Systems Engineering			450	450
Integrated Logistics Support			175	175
Configuration Management			125	125
Technical Data			275	300
Developmental Test and Evaluation			250	200
Operational Test and Evaluation			150	0
Contractor Engineering Support			322	340
Government Engineering Support			300	330
Total			2422	2320

B. Budget Acquisition History and Planning Information: Not Applicable

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: February 1995

BUDGET ACTIVITY: 5 - Engineering And Manufacturing Development

PE NUMBER AND TITLE: 0604384BP Chemical/Biological Defense

PROJECT: DBD5

COST (*In Thousands*)	FY 1994 Actual	FY 1995 Estimate	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
DBD5 Joint Biological Defense - Stand-Off Detection	0	0	14768	12438	23581	28496	28460	25653	15000	148396

C. Other Program Funding Summary:

	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	To Compl	Total Cost
RDTE,D Budget Activity 5 PE 0604384BP Project CP05 - Counterproliferation Support		15200	18800	10700	8500	12500	36500	29500	Cont'd	Cont'd
Procurement, Defensewide, BA3, Chem/ Bio Def Stand-Off Biological Detection	0	0*	2985*	0	0	0	0	9995**	70000**	82980

* NDI LR-BSDS
** P3I LR & SR-BSDS

D. Schedule Profile:

	FY 1994				FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
LR-BSDS Development Contract Award					X*					X						
Complete LR-BSDS TDP											X					
Complete LR-BSDS Laser Design												X				
Prototype Fabrication of LR-BSDS												X				
Engineering Design Test of LR-BSDS															X	
Complete LR-BSDS TFT																X
Complete LR-BSDS EUTE																X
LR-BSDS MS I/II																X
LR-BSDS MS III											X					
Complete SR-BSDS TDP																

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: February 1995

BUDGET ACTIVITY: 5 - Engineering And Manufacturing Development

PE NUMBER AND TITLE: 0604384BP Chemical/Biological Defense

PROJECT: DBD5

	FY 1994				FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Fabricate Prototype SR-BSDS												X				
EDT of SR-BSDS												X				
Complete SR-BSDS TFT														X		
Complete SR-BSDS EUTE																X
SR-BSDS MS I/II																X

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)

DATE: February 1995

BUDGET ACTIVITY: 5 - Engineering And Manufacturing Development

PE NUMBER AND TITLE: 0604384BP Chemical/Biological Defense

PROJECT: DBD5

A. Project Cost Breakdown:

	FY 1994	FY 1995	FY 1996	FY 1997
Engineering Design			2400	0
Fabrication			8368	1000
Test and Evaluation			2400	8138
Technical Data/Documentation			1600	3300
Total			14768	12438

B. Budget Acquisition History and Planning Information:

Performing Organizations

Contractor or Government Performing Activity	Contract Method/Type or Funding Vehicle	Award or Obligation Date	Performing Activity EAC	Project Office EAC	Total Prior to FY 1994	FY 1994	FY 1995	FY 1996	FY 1997	Budget to Complete	Total Program
Product Development Organizations											
P3I LR-BSDS (TBD)	C/CPFF	Oct 95	9200	9200	0	0	0	5500	3600	100	9200
SR-BSDS (TBD)	C/CPFF	Oct 95	10000	10000	0	0	0	5568	4138	294	10000
LR & SR BSDS (TBD)	TBD	Oct 97	99700	99700	0	0	0	0	0	99700	99700
Support and Management Organizations											
CBDC/OGA	MIPR	Oct 95	22600	22600	0	0	0	3600	3200	15800	22600
Test and Evaluation Organizations											
TFT - TECOM		Oct 95	1600	1600	0	0	0	100	1500	0	1600
Future Testing	MIPR	Oct 97	7500	7500	0	0	0	0	0	7500	7500

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)

DATE: February 1995

BUDGET ACTIVITY: 5 - Engineering And Manufacturing Development

PE NUMBER AND TITLE: 0604384BP Chemical/Biological Defense

PROJECT: DBD5

Government Furnished Property: None.

	Total Prior to FY 1994	FY 1994	FY 1995	FY 1996	FY 1997	Budget to Complete	Total Program
Subtotal Product Development	0	0	0	11068	7738	100094	118900
Subtotal Support and Management	0	0	0	3600	3200	15800	22600
Subtotal Test and Evaluation	0	0	0	100	1500	7500	9100
Total Project	0	0	0	14768	12438	123394	150600

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: February 1995

BUDGET ACTIVITY: 5 - Engineering And Manufacturing Development

PE NUMBER AND TITLE: 0604384BP Chemical/Biological Defense

PROJECT: S041

COST (*In Thousands*)	FY 1994 Actual	FY 1995 Estimate	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
S041 Shipboard BR/CW Countermeasures	0	0	2103	2006	2029	2151	2165	2242	Continuing	Continuing

C. Other Program Funding Summary:

	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	To Compl	Total Cost
RDTE,D Budget Activity 4 PE 0603884BP Project S205 - Navy Shipboard Chem/Bio Defense	0	0	2080	1702	1392	1254	1313	1289	Cont'd	Cont'd
Procurement, Defensewide, BA3, Chem/Bio Def	0	0	5455	7390	6620	11695	11752	12222	Cont	Cont
Chemical Warfare Detectors	0	0	498	6467	13257	10438	10467	0	Cont	Cont
Shipboard Outfitting of C/B equipment	0	0	0	0	1012	994	997	996	Cont	Cont
Port Facility Decontamination equipment	0	0	300	310	320	320	330	340	Cont	Cont
Operations and Maintenance, USN, (4B5N)										

D. Schedule Profile:

	FY 1994				FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Program Milestone IPDS MS III							X						X			
Program Milestone ACPG MS III														X		
Program Milestone SALAD MS III						X										
Engineering Milestone SALAD CDR										X						
Engineering Milestone ACPG CDR					X											
T&E Milestone IPDS OT II												X				
T&E Milestone IPDS FOT&E														X		
T&E Milestone SCAMP DT II							X									
T&E Milestone ACPG DT II																

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: February 1995

BUDGET ACTIVITY: 5 - Engineering And Manufacturing Development

PE NUMBER AND TITLE: 0604384BP Chemical/Biological Defense

PROJECT: S041

	FY 1994				FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
T&E Milestone SCAMP OT II																X
T&E Milestone SALAD DT II										X						
T&E Milestone ACPG OT II												X				
T&E Milestone SALAD OT II						X										
Contract Milestone SCAMP NDI										X						
Contract Milestone IPDS Award																X
Contract Milestone CARDS Award						X										
Contract Milestone ACPG EDM Award														X		
Contract Milestone ACPG Award								X								
Contract Milestone SCAMP EDM Award						X										
Contract Milestone SALAD EDM Award																

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE February 1995
BUDGET ACTIVITY 5 - Engineering And Manufacturing Development	PE NUMBER AND TITLE 0604384BP Chemical/Biological Defense PROJECT S041

A. **Project Cost Breakdown:**

	FY 1994	FY 1995	FY 1996	FY 1997
Primary Hardware Development			100	440
Systems Engineering			0	80
Integrated Logistic Support			94	302
Technical Data			405	410
Developmental Test and Evaluation			580	240
Operational Test and Evaluation			280	170
Contractor Engineering Support			100	93
Government Engineering Support			519	246
Travel			25	25
Total			2103	2006

B. **Budget Acquisition History and Planning Information:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: February 1995

BUDGET ACTIVITY: 5 - Engineering And Manufacturing Development

PE NUMBER AND TITLE: 0604384BP Chemical/Biological Defense

PROJECT: W060

COST (*In Thousands*)	FY 1994 Actual	FY 1995 Estimate	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
W060 Naval Aircrew Chemical/Biological Defense	0	0	1083	494	0	0	0	0	Continuing	Continuing

C. Other Program Funding Summary:

	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	To Compl	Total Cost
RDTE,D Budget Activity 4 PE 0603884BP Project WO59 - Naval Aircraft Chem/Bio Defense	0	0	178	150	153	151	157	150	Cont'd	Cont'd
Procurement, Defensewide, BA3, Chem/Bio Def Chem/Bio Helicopter NDI Mask	0	0	0	7761	8096	8151	8473	100	0	32581

D. Schedule Profile:

	FY 1994				FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Program Milestones MS III											X					X
T & E Milestones TECHEVAL														X		
T & E Milestones OPEVAL								X								
Contract Milestones R&D Contract																X
Contract Milestones Production Option																

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE February 1995
BUDGET ACTIVITY 5 - Engineering And Manufacturing Development	PE NUMBER AND TITLE 0604384BP Chemical/Biological Defense PROJECT W060

A. Project Cost Breakdown:

	FY 1994	FY 1995	FY 1996	FY 1997
System Engineering			300	40
Developmental T&E			483	20
Operational T&E			0	394
ILS			300	40
Total			1083	494

B. Budget Acquisition History and Planning Information: Not Applicable

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: February 1995

BUDGET ACTIVITY: 5 - Engineering And Manufacturing Development

PE NUMBER AND TITLE: 0604384BP Chemical/Biological Defense

PROJECT: AF21

COST (*In Thousands*)	FY 1994 Actual	FY 1995 Estimate	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
AF21 Air Force Chemical/Biological Agent Detection and Warning and Decontamination	0	0	537	474	369	739	3451	5521	Continuing	Continuing

C. Other Program Funding Summary:

	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	To Compl	Total Cost
Procurement, Defensewide, BA3, Chem/Bio Def C/B Defense Program (AF)			11049	13176	11727	18104	18744	19227	Cont'd	Cont'd

D. Schedule Profile:

	FY 1994				FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Award AVAD Production Contract								X								
Award EMD Contract for MFR								X								
MFR IOC															X	

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE February 1995
BUDGET ACTIVITY 5 - Engineering And Manufacturing Development	PE NUMBER AND TITLE 0604384BP Chemical/Biological Defense PROJECT AF21

A. **Project Cost Breakdown:**

	FY 1994	FY 1995	FY 1996	FY 1997
AVAD/MFR Procurement Support			57	58
Foundation Analysis Studies			480	416
Total			537	474

B. **Budget Acquisition History and Planning Information:** Not applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: February 1995

BUDGET ACTIVITY: 5 - Engineering And Manufacturing Development

PE NUMBER AND TITLE: 0604384BP Chemical/Biological Defense

PROJECT: AF37

COST (*In Thousands*)	FY 1994 Actual	FY 1995 Estimate	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
AF37 Air Force Individual Protection	0	0	3582	5564	5045	6569	4126	2187	Continuing	Continuing

C. Other Program Funding Summary:

	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	To Compl	Total Cost
Procurement, Defensewide, BA3, Chem/Bio Def C/B Defense Program (AF)			11049	13176	11727	18104	18744	19227	Cont'd	Cont'd

D. Schedule Profile:

	FY 1994				FY 1995				FY 1996				FY 1997		
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
AERP FOC					X											
AERP F-16 Design						X										
AERP B-1B Design, Phase I											X					
AERP B-1B Design, Phase II								X								
DERP IOT&E								X								
DERP IOC								X								
GCE DT												X				
GCE OT																X
Exercise USAF Production Option																

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE February 1995
BUDGET ACTIVITY 5 - Engineering And Manufacturing Development	PE NUMBER AND TITLE 0604384BP Chemical/Biological Defense PROJECT AF37

A. Project Cost Breakdown:

	FY 1994	FY 1995	FY 1996	FY 1997
EOD Ensemble			1305	1985
FFE DT&E/OT&E			1150	1970
Contractual Support			298	431
Foundation Analyses/Studies			259	441
Assessments			322	457
TDY			248	280
Total			3582	5564

B. Budget Acquisition History and Planning Information: Not applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: February 1995

BUDGET ACTIVITY: 5 - Engineering And Manufacturing Development

PE NUMBER AND TITLE: 0604384BP Chemical/Biological Defense

PROJECT: CP05

COST (In Thousands)	FY 1994 Actual	FY 1995 Estimate	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
CP05 Counterproliferation Support - EMD	0	15200	18800	10700	8500	12500	36500	29500	Continuing	Continuing

C. Other Program Funding Summary:

	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	To Compl	Total Cost
RDTE,A Budget Activity 5 PE 0604806A Project D017 - NBC Protection Systems	170	9050	0	0	0	0	0	0	0	9220
RDTE,D Budget Activity 4 PE 0603884BP Project D604 - NBC Protection Systems	0	0	9593	9199	7183	4024	8190	16206	Cont'd	Cont'd
RDTE,D Budget Activity 5 PE 0604384BP Project L40 - JSLIST	0	0	2264	987	590	197	981	0	Cont'd	Cont'd
RDTE,D Budget Activity 5 PE 0604384BP Project DBD5 - Joint Biological Defense - Stand Off Detection	0	0	14768	12438	23581	28496	28460	25653	Cont'd	Cont'd
Procurement, Defensewide, BA3, Chem/Bio Def			498	6467	13257	10438	10467	0	Cont'd	Cont'd
CBR Equipment Shipborad			11049	13176	11727	18104	18744	19227	Cont'd	Cont'd
Chemical/Biological Defense Equipment (AF)	0	0*	2985*	0	0	0	0	9995**	70000**	82980
Stand-Off Biological Detection				20000	20000	20000	20000		Cont'd	Cont'd
Operations and Maintenance, Army, 1140928.32				1500	1500	1500	1500	1500	7500	15000
Operations and Maintenance, USMC, 0206315M										

* NDI LR-BSDS
** P3I LR & SR-BSDS

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1995
BUDGET ACTIVITY 5 - Engineering And Manufacturing Development	PE NUMBER AND TITLE 0604384BP Chemical/Biological Defense PROJECT CP05

D. Schedule Profile: See schedule profiles for supported programs.

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)

DATE: February 1995

BUDGET ACTIVITY: 5 - Engineering And Manufacturing Development

PE NUMBER AND TITLE: 0604384BP Chemical/Biological Defense

PROJECT: CP05

A. Project Cost Breakdown:

	FY 1994	FY 1995	FY 1996	FY 1997
Engineering Design/Development		8600	3700	0
Fabrication		1300	4700	1400
Testing and Evaluation		4300	8600	6700
Technical Data and Documentation		700	1000	2600
Engineering Support		300	800	
Total		15200	18800	10700

B. Budget Acquisition History and Planning Information:

Performing Organizations

Contractor or Government Performing Activity	Contract Method/Type or Funding Vehicle	Award or Obligation Date	Performing Activity EAC	Project Office EAC	Total Prior to FY 1994	FY 1994	FY 1995	FY 1996	FY 1997	Budget to Complete	Total Program
Product Development Organizations								500			500
Govt ERDEC	PO	APR 96	500	500			4200				4200
Loral Librascope	MIPR	FEB 95	4200	4200			5600	10800	3300	1400	21100
LANL/LLNL	MIPR	NOV 95	21100	21100					3100	4500	7600
Contractor TBD	FP	NOV 96	7600	7600							
Support and Management Organizations								300			300
Govt ERDEC	PO	OCT 95	300	300			1300	1600	2300	2400	7600
Govt CBDCOM	MIPR	JAN 95	7600	7600							
Test and Evaluation Organizations							4000				4000
TEXCOM	MIPR	APR 95	4000	4000				3600			3600
DPG		JAN 96	3600	3600							

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)

DATE: February 1995

BUDGET ACTIVITY: 5 - Engineering And Manufacturing Development

PE NUMBER AND TITLE: 0604384BP Chemical/Biological Defense

PROJECT: CP05

Contractor or Government Performing Activity	Contract Method/Type or Funding Vehicle	Award or Obligation Date	Performing Activity EAC	Project Office EAC	Total Prior to FY 1994	FY 1994	FY 1995	FY 1996	FY 1997	Budget to Complete	Total Program
Loral Librascope		OCT 95	1600	1600				1600			1600
TECOM	MIPR	JAN 95	4700	4700			100	400	2000	2200	4700

Government Furnished Property: None

	Total Prior to FY 1994	FY 1994	FY 1995	FY 1996	FY 1997	Budget to Complete	Total Program
Subtotal Product Development			9800	11300	6400	5900	33400
Subtotal Support and Management			1300	1900	2300	2400	7900
Subtotal Test and Evaluation			4100	5600	2000	2200	13900
Total Project			15200	18800	10700	10500	55200

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RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: February 1995

BUDGET ACTIVITY: 6 - Management Support

PE NUMBER AND TITLE: 0605384BP Chemical/Biological Defense

COST (*In Thousands*)	FY 1994 Actual	FY 1995 Estimate	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	0	1700	4936	5405	4900	4900	4900	4900	Continuing	Continuing
DO49 Joint Chemical/Biological Contact Point and Test	0	0	1736	1705	1700	1700	1700	1700	Continuing	Continuing
CP06 Counterproliferation Support RDTE/MGT	0	1700	3200	3700	3200	3200	3200	3200	Continuing	Continuing

A. **Mission Description and Budget Item Justification:** This program element includes the Joint Chemical/Biological (CB) Contact Point and Test and Counterproliferation Support in the passive defense area.

The objectives of the Joint Chemical/Biological (CB) Contact Point and Test (project DO49) program are to: (1) plan, conduct, evaluate, and report on joint tests (for other than developmental hardware) and accomplish operational research assessments in response to requirements received from the Services; (2) serve as the DoD joint contact point for chemical and biological defense test and technical data; and (3) publish and maintain the CB Technical Data Source Book. The purpose of the project is to provide input to the Services for development of doctrine, policy, training procedures, and feedback into the RDT&E cycle.

Weapons of mass destruction (WMD) may directly threaten US forces in the field or threaten effective employment of those forces. As required by the National Defense Authorization Act of 1994, an interagency review committee chaired by Dr. John Deutch performed a comprehensive review of US nonproliferation and counterproliferation activities and programs, and provided a report to Congress in May 1994. The report identified areas where improvements could be made in current programs and also identified high priority shortfalls in operational capability needed to implement US noncounterproliferation policy. The objective of this CP initiative project is two-fold; to enhance the NBC simulation capability that will provide realistic replication of the effects of NBC weapons of employment, and to develop Joint NBC defense doctrine requirements as a basis for the development of Joint NBC defense doctrine that will define sound tactics, techniques and procedures to facilitate Joint operations in an NBC environment.

This program includes research and development effort directed toward support of installations or operations required for general research and development use and therefore appropriate to Budget Activity 6.

Project DO49 - Joint Chemical/Biological Contact Point and Test: Conduct chemical/biological (CB) tests and maintains repository of CB information for multiple users.

FY 1994 Planned Program:

- Program Executed under PE#0605710A/DO49.

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BUDGET ACTIVITY 6 - Management Support	PE NUMBER AND TITLE 0605384BP Chemical/Biological Defense

FY 1995 Planned Program:

- Program Executed under PE#0605710A/DO49.

FY 1996 Planned Program:

- Initiate six assessments, three field trials and two laboratory tests evaluating performance and procedures in a chemical environment. (1356)
- Update VX Source Book. (80)
- Continue automation of Joint Technical Information Center. (300)

FY 1997 Planned Program:

- Initiate seven assessments, two field trials and two laboratory tests evaluating performance and procedures in a chemical environment. (1325)
- Update GB Source Book. (80)
- Continue automation of Joint Technical Information Center. (300)

Project CP06 - Counterproliferation Support: This counterproliferation initiative supports the following areas:

JOINT NBC DEFENSE SIMULATION AND TRAINING - Simulations are needed to improve the capability to assess realistic casualties and register "credit" for actions taken to mitigate the effects of these weapons, such as contamination avoidance, protection and decontamination. These simulations must be compatible with the most current conventional wargaming and planning programs used at all levels. The simulation must assess the development of responsive countermeasures and tactics that can be used to drive equipment design and doctrine development.

AUTOMATED NUCLEAR, BIOLOGICAL, AND CHEMICAL INFORMATION SYSTEM (ANBACIS) - This integrated software/computer system will (1) speed the flow of the NBC Warning and Reporting System (NBCWRS), (2) Assist in planning CB decontamination, and reconnaissance missions, and (3) provide a platform for training the unit NBC personnel in their mission. The system is being designed to run on both the Maneuver Control System (MCS) using the UNIX operating system and on desktop personal computers using UNIX or Microsoft's DOS.

JOINT NUCLEAR, BIOLOGICAL AND CHEMICAL(NBC) DEFENSE DOCTRINE DEVELOPMENT - Initiate development of Joint NBC defense doctrine requirements as a basis for the development of Joint NBC defense doctrine that will define sound tactics, techniques and procedures to facilitate Joint operations in an NBC environment. This doctrine can then be used to develop Joint training requirements for the Force and drive the NBC defense Joint professional training development.

COUNTERPROLIFERATION JOINT WARFIGHTING CAPABILITIES, MISSIONS, AND FUNCTIONS ASSESSMENT. - Provides capability for the Joint Staff to conduct critically needed analyses, analytic assessments which support policy, force structure, and budget deliberations tasked by both the Chairman of the JCS and the Vice Chairman of the JCS.

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BUDGET ACTIVITY 6 - Management Support	PE NUMBER AND TITLE 0605384BP Chemical/Biological Defense

NATIONAL DEFENSE UNIVERSITY DOCTRINE: Provides capability for the National Defense University to support the Counterproliferation Education Project by conducting critical assessments of impact on doctrine.

FY 1994 Planned Program:

- No planned program.

FY 1995 Planned Program:

- Conduct Army Warfighting Experiments, including modification of UNIX ANBACIS to run on B2C2, to accommodate theater Missile Defense warning and reporting requirements, and to update previously modified versions of UNIX ANBACIS used in JRTC 9602. (165)
- Continue update and modifications to the following modules: (1) Warning & Reporting Module, (2) Transport/Diffusion Module, (3) Integrated Meteorological System (IMETS) module, (4) Terrain Evaluation Module (TEM). (335).
- Analyze existing Service specific doctrine and extant Joint doctrine (150)
- Develop requirements list for doctrine programs that will be used to develop a strategy and timetable for the development of new doctrine capability. (100)
- Prepare a multi-year Joint Doctrine Development Action Plan (JDDAP) that will serve as the road map to ensure an orderly and logical production of doctrine, tactics, techniques, and procedures. The JDDAP is intended to develop Joint NBC defense doctrine under the auspices of Joint Pub 1-01, "Joint Publication System doctrine and Joint Tactics, Techniques, and Procedures Development Program. (200)
- Validate initial doctrine with new simulations. (100)
- Begin revising Joint Pub 3-11 to serve as the capstone document for Joint NBC defense doctrine and tactics, and techniques. (200)
- Identify operational requirements to successfully implement DOD Counterproliferation Policy guidance. (50)
- Formulate organizational (Service/SOCOM) responsibilities for implementing DOD CP policy guidance. (20)
- Identification of supported to supporting relationships for meeting future joint warfighting requirements primarily in the counter-employment of WMD mission area. (30)
- Identification and definition of Joint Staff responsibilities and actions that enable OSD CP Support Program Execution Plan. (20)
- Assessment of operational requirements at the regional contingency level, to include nuclear, chemical, and biological threats to US joint warfighting forces. (50)
- Formulation of programming integration processes to include CINCs and Services in joint long range planning efforts that support CP Policy. (40)
- Determine implications of WMD counteremployment operations to interceptor programs and what interceptor technology can do to enhance DOD CP objectives. (40)
- Development of supporting analytical material, including methodology definition and support to its use. (50)
- Conduct NBC Proliferation assessments by world regions. (60).
- Assess impact of NBC Proliferation on Service doctrine (60).
- Assess Counterproliferation education at Service Schools (30).

FY 1996 Planned Program:

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BUDGET ACTIVITY 6 - Management Support	PE NUMBER AND TITLE 0605384BP Chemical/Biological Defense

- Review and analyze existing simulation capability to determine key elements needed to provide the appropriate level of meaningful NBC realism to simulation and wargaming (450)
- Develop requirements list for simulation programs that will be used to develop a strategy and timetable for the development of new simulation capability. (250)
- Develop a Joint Simulation and Wargame Development Plan (JSWDP) which will be the road map to ensure an ordered and logical production of improved simulation capability (200)
- Begin development of training requirements for Joint NBC defense professional training. (250)
- Begin establishment of Distributive Interactive Simulation (DIS) systems at the Joint Service NBC Center, US Army Chemical School. (500)
- Integrate NBC defense planning and reporting into extant Battle Management systems to ensure connectivity of NBC defense considerations from tactical/operational level through the strategic level of war planning. (350).
- Complete effort to develop the JDDAP. (200)
- Integrate simulation efforts to ensure crosswalk between newly developed simulation and new doctrine development. (200)
- Complete rewrite of JP 3-11, coordinate and publish document. (75)
- Coordinate effort on the development of Joint tactics, techniques and procedures for nuclear and chemical contamination avoidance. (200)
- Conduct field testing of new chemical/nuclear contamination avoidance doctrine. (75)
- In response to new Defense Planning Guidance, Fiscal Guidance, changing budget priorities , results of previously conducted assessments, and Congressional direction provide an assessment capability to conduct, update and revise the following tasks:
- Identify operational requirements to successfully implement DOD Counterproliferation Policy guidance. (50)
- Formulate organizational (Service/SOCOM) responsibilities for implementing DOD CP policy guidance. (20)
- Identification of supported to supporting relationships for meeting future joint warfighting requirements primarily in the counter-employment of WMD mission area. (30)
- Identification and definition of Joint Staff responsibilities and actions that enable OSD CP Support Program Execution Plan. (20)
- Assessment of operational requirements at the regional contingency level, to include nuclear, chemical, and biological threats to US joint warfighting forces. (50)
- Formulation of programming integration processes to include CINCs and Services in joint long range planning efforts that support CP Policy. (40)
- Determine implications of WMD counteremployment operations to interceptor programs and what interceptor technology can do to enhance DOD CP objectives. (40)
- Development of supporting analytic material, including methodology definition and support to its use. (50)
- In response to changing world situations, results of previously conducted assessments, and new Congressional direction, provide an assessment capability to conduct, update and revise the following tasks:
- Conduct NBC Proliferation assessments by world regions. (60).
- Assess impact of NBC Proliferation on Service doctrine (60).
- Assess Counterproliferation education at Service Schools (30)

FY 1997 Planned Program:

- Procure hardware for the DIS and establish an instructional center for Services at the Chemical School. (900)

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- Refine Joint simulation requirements based on newly emerging Joint NBC defense doctrine (250).
- Refine/develop chemical and nuclear warfare simulation. (300)
- Integrate chemical and nuclear warfare simulation in to equipment models/wargames. (250)
- Develop improved simulations for biological warfare. (400)
- Integrate biological warfare simulation with equipment models/wargames. (250)
- Begin developing training requirements for the Joint NBC Defense Professional training at the Chemical School.(100)
- Begin coordination of Joint training requirements list for evaluation of NBC defense readiness with the CINCs and Services. (50)
- Complete Joint doctrine/tactics, techniques and procedures on chemical and nuclear contamination avoidance and coordinate and publish the document. (150)
- Coordinate effort on the development of Joint doctrine/tactics, techniques and procedures for biological contamination avoidance. (250)
- Integrate simulation efforts to ensure crosswalk between newly developed simulation and new doctrine development. (200)
- Conduct field testing of new biological contamination avoidance doctrine. (75)
- Coordinate new doctrine developments with existing Joint doctrine to ensure new information is reflected in these documents. (75)
- In response to new Defense Planning Guidance, Fiscal Guidance, changing budget priorities , results of previously conducted assessments, and Congressional direction provide an assessment capability to conduct, update and revise the following tasks:
- Identify operational requirements to successfully implement DOD Counterproliferation Policy guidance. (50)
- Formulate organizational (Service/SOCOM) responsibilities for implementing DOD CP policy guidance. (20)
- Identification of supported to supporting relationships for meeting future joint warfighting requirements primarily in the counter-employment of WMD mission area. (30)
- Identification and definition of Joint Staff responsibilities and actions that enable OSD CP Support Program Execution Plan. (20)
- Assessment of operational requirements at the regional contingency level, to include nuclear, chemical, and biological threats to US joint warfighting forces. (50)
- Formulation of programming integration processes to include CINCs and Services in joint long range planning efforts that support CP Policy. (40)
- Determine implications of WMD counteremployment operations to interceptor programs and what interceptor technology can do to enhance DOD CP objectives. (40)
- Development of supporting analytic material, including methodology definition and support to its use. (50)
- In response to changing world situations, results of previously conducted assessments, and new Congressional direction, provide an assessment capability to conduct, update and revise the following tasks:
- Conduct NBC Proliferation assessments by world regions. (60).
- Assess impact of NBC Proliferation on Service doctrine (60).
- Assess Counterproliferation education at Service Schools (30)

B. Program Change Summary:

	FY 1994	FY 1995	FY 1996	FY 1997

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: February 1995

BUDGET ACTIVITY: 6 - Management Support

PE NUMBER AND TITLE: 0605384BP Chemical/Biological Defense

	FY 1994	FY 1995	FY 1996	FY 1997
Previous President's Budget	0	0	0	0
Appropriated Value	0	0	0	0
Adjustments to Appropriated Value	0	1700*	0	0
Current Budget Submit/President's Budget	0	1700	4936	5405

Change Summary Explanation: This program represents a consolidation of all Chemical/Biological defense programs Department wide into a single DOD program element for each Budget Activity in accordance with the FY94 Authorization Act. See individual project descriptions for audit of FY94/FY95 funding.

Counterproliferation Support funding was added to this program for FY95.

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DATE: February 1995

BUDGET ACTIVITY: 6 - Management Support

PE NUMBER AND TITLE: 0605384BP Chemical/Biological Defense

PROJECT: DO49

COST (*In Thousands*)	FY 1994 Actual	FY 1995 Estimate	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
DO49 Joint Chemical/Biological Contact Point and Test	0	0	1736	1705	1700	1700	1700	1700	Continuing	Continuing

C. **Other Program Funding Summary:**

	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	To Compl	Total Cost
RDTE,D Budget Activity 1 PE 0601384BP - Chemical/Biological Defense (Basic Research)	0	0	23947	25676	26823	27594	28604	29498	Cont'd	Cont'd
RDTE,D Budget Activity 2 PE 0602384BP - Chemical/Biological Defense (ED)	0	0	60665	55270	55400	58400	59200	62200	Cont'd	Cont'd
RDTE,D Budget Activity 3 PE 0603384BP - Chemical/Biological Defense (AD)	0	0	25684	36644	45600	42400	36300	37100	Cont'd	Cont'd
RDTE,D Budget Activity 4 PE 0603884BP - Chemical/Biologcial Defense (DEMVAL)	0	0	32461	42755	53900	52100	30500	39600	Cont'd	Cont'd
RDTE,D Budget Activity 5 PE 0604384BP - Chemical/Biological Defense (EMD)	0	15200	95324	102938	122200	124900	173800	137600	Cont'd	Cont'd
Procurement, Defensewide, BA3, Chem/Bio Def	0	0	140524	197575	156440	148789	178368	214714	Cont'd	Cont'd

D. **Schedule Profile:** These efforts are continuous in nature, therefore no milestones or events are provided.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: February 1995

BUDGET ACTIVITY: 6 - Management Support

PE NUMBER AND TITLE: 0605384BP Chemical/Biological Defense

PROJECT: CP06

COST (*In Thousands*)	FY 1994 Actual	FY 1995 Estimate	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
CP06 Counterproliferation Support RDTE/MGT	0	1700	3200	3700	3200	3200	3200	3200	Continuing	Continuing

C. Other Program Funding Summary:

	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	To Compl	Total Cost
RDTE,D Budget Activity 1 PE 0601384BP - Chemical/Biological Defense (Basic Research)	0	0	23947	25676	26823	27594	28604	29498	Cont'd	Cont'd
RDTE,D Budget Activity 2 PE 0602384BP - Chemical/Biological Defense (ED)	0	0	60665	55270	55400	58400	59200	62200	Cont'd	Cont'd
RDTE,D Budget Activity 3 PE 0603384BP - Chemical/Biological Defense (AD)	0	0	25684	36644	45600	42400	36300	37100	Cont'd	Cont'd
RDTE,D Budget Activity 4 PE 0603884BP - Chemical/Biologcial Defense (DEMVAL)	0	0	32461	42755	53900	52100	30500	39600	Cont'd	Cont'd
RDTE,D Budget Activity 5 PE 0604384BP - Chemical/Biological Defense (EMD)	0	15200	95324	102938	122200	124900	173800	137600	Cont'd	Cont'd
Procurement, Defensewide, BA3, Chem/Bio Def	0	0	140524	197575	156440	148789	178368	214714	Cont'd	Cont'd

D. Schedule Profile:

	FY 1994				FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Joint NBC Defense Simulation and Training																

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	FY 1994				FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Complete NBC Defense simulation review												X				
Complete Joint Simulation & Wargame Development Plan												X				
Begin establishment of Distributive Interactive (DIS) System at Joint Service NBC Defense Center									X							
Complete establishment of DIS system														X		
Complete development of improved biological simulations															X	
Automated Nuclear, Biological and Chemical Information System (ANBACIS)																
Complete integration/testing of ANBACIS on B2C2							X									
Modify ANBACIS for Theater Missile Defense Warning and Reporting							X									
Complete update-ANBACIS Reporting/Warning Module							X									
Complete update- ANBACIS Transport/Diffusion Module							X									
Complete update-ANBACIS Integrated Meteorological and Terrain Evaluation Model								X								
Complete update ANBACIS software for new WINDOWS version																
Joint NBC Defense Doctrine Development																
Complete analysis of existing Service doctrine							X									

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	FY 1994				FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Start development of Joint Doctrine Development Action Plan (JDDAP)					X											
Start revision of Joint Pub 3-11						X										
Complete JDDAP									X							
Complete rewrite of JP 3-11									X							
Complete integration of simulation and new doctrine											X					
Complete Joint doctrine/tactics, techniques and procedures document for chem & nuc contamination														X		
Complete Joint doctrine/tactics, techniques and procedures document for biological contamination																X