DEPARTMENT OF THE NAVY
FY 1997 BUDGET ESTIMATES

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JUSTIFICATION OF ESTIMATES
MARCH 1996

RESEARCH, DEVELOPMENT, TEST & EVALUATION
BUDGET ACTIVITIES 1-3
SCIENCE AND TECHNOLOGY (S&T)

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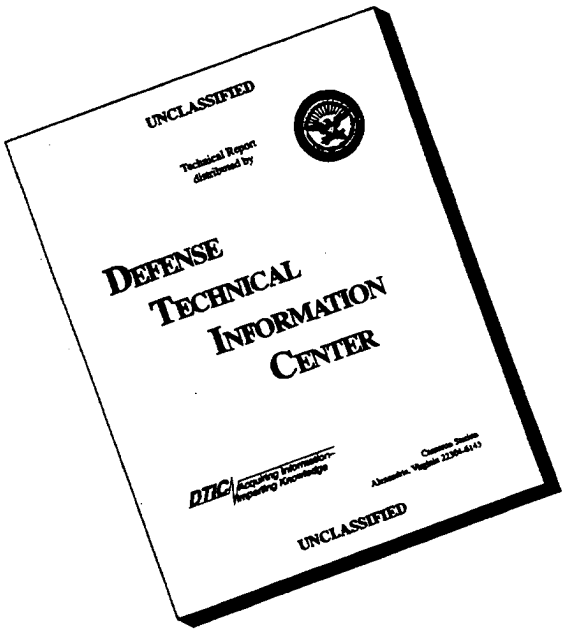

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Exhibit R-1

APPROPRIATION: 1319n

Department of the Navy

Research, Development, Test, and Evaluation, Navy

March 1996

In Thousands of Dollars

P-1 NUMBER	PROGRAM ELEMENT	PROGRAM NAME	BA	FY 1995	FY 1996	FY 1997	C
1	601152	In-House Independent Lab Research	1	16,970	15,390	15,309	U
2	601153	Defense Research Sciences	1	391,314	361,622	371,904	U
		Basic Research		408,284	377,012	387,213	
3	602111	Surface/Aerospace Surv. & Weapons Technology	2	34,213	42,313	26,312	U
4	602121	Surface Ship Technology	2	36,926	60,923	35,591	U
5	602122	Aircraft Technology	2	25,687	29,792	20,578	U
6	602131	Marine Corps Landing Force Technology	2	16,749	16,917	17,093	U
7	602232	C3 Technology	2	61,005	58,186	58,159	U
8	602233	Readiness Training & Env Quality Tech	2	47,890	47,676	40,828	U
9	602234	Materials, Electronics & Computer Technology	2	92,142	75,933	75,886	U
10	602270	EW Technology	2	16,866	17,776	22,454	U
11	602314	Undersea Surv. & Weapons Technology	2	49,128	55,226	49,580	U
12	602315	MCM, Mining & Special Warfare Technology	2	36,932	46,894	40,534	U
13	602435	Ocean & Atmospheric Technology	2	51,423	56,576	44,559	U
14	602633	Undersea Warfare Weapon Technology	2	32,640	33,158	33,891	U
		Applied Research		501,603	541,372	463,465	
15	603217	Air Systems & Weapons Advanced Technology	3	20,891	35,096	29,315	U
16	603238	Global Surv/Prec Strike/Air Defense Tech Demo	3	36,665	62,418	55,560	U
17	603270	Advanced EW Technology	3	14,079	13,865	15,085	U

Exhibit R-1 | Department of the Navy | March 1996

APPROPRIATION: 1319n | **Research, Development, Test, and Evaluation, Navy**

P-1 NUMBER	PROGRAM ELEMENT	PROGRAM NAME	BA	FY 1995	FY 1996	FY 1997	C
				In Thousands of Dollars			
18	603508	Ship Propulsion System	3	17,609	17,292	28,557	U
19	603640	MC Advanced Technology Demo	3	24,324	24,973	24,212	U
20	603706	Medical Development (Advanced)	3	55,820	60,660	37,342	U
21	603707	Manpower, Pers, & Training Adv Tech Demo	3	18,450	17,260	19,273	U
22	603712	Environmental Quality & Logistics Adv Tech	3	21,446	24,139	19,970	U
23	603747	Undersea Warfare Advanced Technology	3	60,887	45,794	43,583	U *
24	603771	Industrial Preparedness Man Tech Program	3	79,828			U
25	603782	Shallow Water MCM Demos	3	41,890	39,002	42,753	U
26	603792	Advanced Technology Transition	3	70,003	78,502	104,424	U
27	603794	C3 Advanced Technology	3	19,612	25,709	29,268	U
		Advanced Technology Development		481,104	444,730	449,342	

* = These programs contained classified materials and are printed in a separate justification back up book.

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Exhibit R-1 | Department of the Navy | March 1996

APPROPRIATION: 1319n | **Research, Development, Test, and Evaluation, Navy**

--- Alphabetic Listing ---

In Thousands of Dollars

P-1 NUMBER	PROGRAM ELEMENT	PROGRAM NAME	BA	FY 1995	FY 1996	FY 1997	C
17	603270	Advanced EW Technology	3	14,079	13,865	15,085	U
26	603792	Advanced Technology Transition	3	70,003	78,502	104,424	U
5	602122	Aircraft Technology	2	25,887	29,792	20,578	U
15	603217	Air Systems & Weapons Advanced Technology	3	20,891	35,096	29,315	U
27	603794	C3 Advanced Technology	3	19,612	25,709	29,268	U
7	602232	C3 Technology	2	61,005	58,186	58,159	U
2	601153	Defense Research Sciences	1	391,314	361,622	371,904	U
22	603712	Environmental Quality & Logistics Adv Tech	3	21,446	24,139	19,970	U
10	602270	EW Technology	2	16,866	17,776	22,454	U
16	603238	Global Surv/Prec Strike/Air Defense Tech Demo	3	36,665	62,418	55,560	U
24	603771	Industrial Preparedness Man Tech Program	3	79,628			U
1	601152	In-House Independent Lab Research	1	16,970	15,390	15,309	U
21	603707	Manpower, Pers, & Training Adv Tech Demo	3	16,450	17,260	19,273	U
6	602131	Marine Corps Landing Force Technology	2	16,749	16,917	17,093	U
9	602234	Materials, Electronics & Computer Technology	2	92,142	75,933	75,866	U
19	603640	MC Advanced Technology Demo	3	24,324	24,973	24,212	U
12	602315	MCM, Mining & Special Warfare Technology	2	36,932	46,894	40,534	U
20	603706	Medical Development (Advanced)	3	55,820	60,680	37,342	U
13	602435	Ocean & Atmospheric Technology	2	51,423	56,576	44,559	U

Exhibit R-1

APPROPRIATION: 1319n

Department of the Navy
Research, Development, Test, and Evaluation, Navy

March 1996

--- Alphabetic Listing ---

In Thousands of Dollars

P-1 NUMBER	PROGRAM ELEMENT	PROGRAM NAME	BA	FY 1995	FY 1996	FY 1997	C	
8	602233	Readiness Training & Env Quality Tech	2	47,890	47,876	40,828	U	
26	603782	Shallow Water MCM Demos	3	41,890	39,002	42,753	U	
16	603508	Ship Propulsion System	3	17,809	17,292	28,557	U	
3	602111	Surface/Aerospace Surv. & Weapons Technology	2	34,213	42,313	26,312	U	
4	602121	Surface Ship Technology	2	36,926	60,923	35,591	U	
11	602314	Undersea Surv. & Weapons Technology	2	49,126	55,226	49,580	U	*
23	603747	Undersea Warfare Advanced Technology	3	60,687	45,794	43,583	U	*
14	602633	Undersea Warfare Weapon Technology	2	32,640	33,158	33,891	U	*

* = These programs contained classified materials and are printed in a separate justification back up book.

Program and Financing [illegible]housands of dollars)

Identification code 17-1319-0-1-051	Budget Plan (amounts for RESEARCH, DEV, TEST & EVAL actions programed)			Obligations		
	1995 actual	1996 est.	1997 est.	1995 actual	1996 est.	1997 est.
Program by activities:						
Direct program:						
00.0101 Basic research	408,284	378,929	387,213	406,660	375,172	387,416
00.0201 Applied Research	501,603	543,779	463,465	473,049	570,544	467,424
00.0301 Advanced technology development	481,104	482,865	449,342	461,935	554,524	467,017
00.0401 Demonstration/validation	1,582,957	1,727,209	1,740,955	1,657,137	1,616,331	1,711,012
00.0501 Engineering and manufacturing development	2,213,031	2,405,727	2,048,657	2,270,420	2,425,974	2,091,636
00.0601 Management support	776,356	575,396	558,440	794,005	620,237	560,953
00.0701 Operational system development	2,642,982	2,380,629	1,686,662	2,717,856	2,383,169	1,718,864
00.9101 Total direct program	8,606,317	8,494,534	7,334,734	8,781,062	8,545,951	7,404,322
01.0101 Reimbursable program	111,669	110,000	110,000	122,142	113,659	110,000
10.0001 Total	8,717,986	8,604,534	7,444,734	8,903,204	8,659,610	7,514,322
Financing:						
Offsetting collections from:						
11.0001 Federal funds(-)	-109,801	-110,000	-110,000	-113,237	-110,000	-110,000
13.0001 Trust funds(-)	-128			-133		
14.0001 Non-Federal sources(-)	-1,740			-1,876		
17.0001 Recovery of prior year obligations				-3,023		
Unobligated balance available, start of year:						
21.4002 For completion of prior year budget plans				-758,455	-568,848	-516,272
21.4003 Available to finance new budget plans	-60,902	-11,600		-60,902	-11,600	
21.4009 Reprograming from/to prior year budget plan	-10,989	2,500				
22.0001 Unobligated balance transferred to other acco	18,202	-2,500		18,202	-2,500	
Unobligated balance available, end of year:						
24.4002 For completion of prior year budget plans				568,848	516,272	446,684
24.4003 Available to finance subsequent year budget	11,600			11,600		
25.0001 Unobligated balance expiring	9,489			9,489		
39.0001 Budget authority	8,573,717	8,482,934	7,334,734	8,573,717	8,482,934	7,334,734
Budget authority:						
40.0001 Appropriation	8,627,917	8,573,073	7,334,734	8,627,917	8,573,073	7,334,734
40.3601 Appropriation rescinded (unob bal)		-6,000			-6,000	
41.0001 Transferred to other accounts (-)	-54,200	-84,139		-54,200	-84,139	
43.0001 Appropriation (adjusted)	8,573,717	8,482,934	7,334,734	8,573,717	8,482,934	7,334,734

Identification code 17-1319-0-1-051	Budget Plan (amounts for RESEARCH, DEV, TEST & EVAL actions programed)			Obligations		
	1995 actual	1996 est.	1997 est.	1995 actual	1996 est.	1997 est.
Relation of obligations to outlays:						
71.0001 Obligations incurred				8,787,950	8,549,610	7,404,322
72.1001 Orders on hand, SOY				-169,602	-142,908	
72.4001 Obligated balance, start of year				5,751,294	5,155,440	5,165,061
74.1001 Orders on hand, EOY				142,908		
74.4001 Obligated balance, end of year				-5,155,440	-5,165,061	-4,805,235
77.0001 Adjustments in expired accounts (net)				-124,371		
78.0001 Adjustments in unexpired accounts				-3,023		
90.0001 Outlays (net)				9,229,644	8,397,081	7,764,148

Identification code 17-1319-0-1-051		1995 actual	1996 est.	1997 est.
	Direct obligations:			
	Personnel compensation:			
111.101	Full-time permanent	44,885	45,286	44,835
111.301	Other than full-time permanent	3,717	3,418	3,489
111.501	Other personnel compensation	1,646	1,574	1,558
111.901	Total personnel compensation	50,248	50,278	49,882
112.101	Personnel Benefits: Civilian personnel	9,205	10,176	10,146
113.001	Benefits for former personnel	698	150	150
121.001	Travel and transportation of persons	20,463	21,567	21,930
122.001	Transportation of things	2,136	2,131	2,097
123.301	Communications, utilities, and miscellaneous charges	8,619	8,878	9,144
124.001	Printing and reproduction	724	746	768
125.101	Advisory and assistance services	247,371	276,867	263,316
125.201	Other services with the private sector	5,490,346	5,440,405	4,358,087
	Purchases goods/services (inter/intra) Fed accounts			
125.301	Purchase of goods/services from other Fed agencies	252,858	236,570	226,565
125.302	Payments to foreign national indirect hire personnel	42	20	
125.303	Purchases from revolving funds	2,409,912	2,210,890	2,174,269
126.001	Supplies and materials	17,665	18,194	18,740
131.001	Equipment	15,794	16,268	16,756
132.001	Land and structures	2,905	2,900	2,900
141.001	Grants, subsidies, and contributions	252,076	249,911	249,564
199.001	Total Direct obligations	8,781,062	8,545,951	7,404,322
	Reimbursable obligations:			
	Personnel Compensation:			
211.101	Full-time permanent	32,453	33,454	41,583
211.301	Other than full-time permanent	2,738	868	2,698
211.501	Other personnel compensation	676	673	775
211.901	Total personnel compensation	35,867	34,995	45,056
212.101	Personnel Benefits: Civilian Personnel	6,835	7,138	8,624
221.001	Travel and transportation of persons	2,487	2,750	2,475
222.001	Transportation of things	101	100	100
223.301	Communications, utilities, and miscellaneous charges	1,637	1,635	1,630
224.001	Printing and reproduction	155	150	148
225.201	Other services with the private sector	37,959	26,766	15,882
	Purchases goods/services (inter/intra) Fed accounts			
225.303	Purchases from revolving funds	13,900	17,125	13,090
226.001	Supplies and materials	13,109	13,000	12,990
231.001	Equipment	8,592	8,490	8,480

Identification code 17-1319-0-1-051	1995 actual	1996 est.	1997 est.
241.001 Grants, subsidies, and contributions	1,500	1,510	1,525
299.001 Total Reimbursable obligations	122,142	113,659	110,000
999.901 Total obligations	8,903,204	8,659,610	7,514,322

Program and Financing ([illegible]housands of dollars) SUPPLEMENTAL

Identification code 17-1319-5-1-051	Budget Plan (amounts for RESEARCH, DEV, TEST & EVAL actions programed) 1995 actual	1996 est.	1997 est.	Obligations 1995 actual	1996 est.	1997 est.
Program by activities:						
Direct program:						
00.0101 Basic research		-1,917			-1,801	-116
00.0201 Applied Research		-2,407			-2,262	-145
00.0301 Advanced technology development		-38,135			-35,214	-2,921
00.0401 Demonstration/validation		-10,597			-10,597	
00.0501 Engineering and manufacturing development		-9,912			-9,317	-595
00.0601 Management support		-2,015			-1,894	-121
00.0701 Operational system development		-9,817			-9,227	-590
10.0001 Total		-74,800			-70,312	-4,488
Financing:						
Unobligated balance available, start of year:						
21.4002 For completion of prior year budget plans						4,488
Unobligated balance available, end of year:						
24.4002 For completion of prior year budget plans					-4,488	
40.3501 Budget authority (Appropriation rescinded) (		-74,800			-74,800	
Relation of obligations to outlays:						
71.0001 Obligations incurred					-70,312	-4,488
72.4001 Obligated balance, start of year						-28,499
74.4001 Obligated balance, end of year					28,499	9,425
90.0001 Outlays (net)					-41,813	-23,562

Identification code 17-1319-5-1-051	1995 actual	1996 est.	1997 est.
Direct obligations:			
125.201 Other services with the private sector		-70,312	-4,488
199.001 Total Direct obligations		-70,312	-4,488
999.901 Total obligations		-70,312	-4,488

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: March 1996

BUDGET ACTIVITY: 1

PROGRAM ELEMENT: 0601152N
PROGRAM ELEMENT TITLE: In-House Laboratory Independent Research

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 1995 ACTUAL	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
Ocean Sciences	584	571	587	602	620	639	658	CONT.	CONT.
Advanced Materials	1,893	1,850	1,883	1,916	2,010	2,070	2,132	CONT.	CONT.
Information Sciences	1,170	1,143	1,163	1,183	1,242	1,279	1,317	CONT.	CONT.
Sustained Programs	13,323	11,826	11,676	12,824	13,230	13,458	13,722	CONT.	CONT.
TOTAL	16,970	15,390	15,309	16,525	17,102	17,446	17,829	CONT.	CONT.

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This program supports the missions of the Naval Warfare Centers with high-risk/high-payoff research, responding as shown below to the Department of the Navy (DON) Joint Mission Areas/Support Areas (JMA/SA) and enabling the technologies that could significantly improve Joint Chiefs of Staff's Future Joint Warfighting Capabilities. The research addresses fundamental questions regarding existing and anticipated naval systems, and is supported within the Office of Naval Research (ONR) thrusts in Ocean Sciences, Advanced Materials, Information Sciences, and its Sustaining Program. This program reflects the integration of efforts both within Warfare Centers and among other research performers. Research efforts are proposed by the Warfare Centers, approved by ONR, and reviewed for the quality of science produced and for relevance to the naval mission.

(U) This program responds to the Joint Littoral JMA through ocean sciences research into the variability of the marine environment, such as acoustic shallow water (SW) models that incorporate wave-breaking sources, allowing superior signal processing in SW environments. Research advancing fundamental understanding of DON-essential materials and processes responds to operational capability requirements in the Maritime Support of Land Forces JMA, such as the recent development of an aluminum based, metal-matrix, high-temperature superconducting material that can be extruded into wires for significantly improved naval electrical power systems. The program responds to the Joint Surveillance JMA through thrusts in information sciences that address

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 1996

BUDGET ACTIVITY: 1 PROGRAM ELEMENT: 0601152N
PROGRAM ELEMENT TITLE: In-House Laboratory Independent Research

based, metal-matrix, high-temperature superconducting material that can be extruded into wires for significantly improved naval electrical power systems. The program responds to the Joint Surveillance JMA through thrusts in information sciences that address naval-relevant computing applications including software engineering, high performance computing, artificial intelligence, and the use of computers in manufacturing. For example, the development of an advanced signal processing technique for the analysis of real Anti-Submarine Warfare (ASW) broadband acoustic data provides detection performance which exceeds the conventional energy detector in high noise ASW applications. Research in other areas supports requirements of the Readiness JMA, such as discovering redox chemicals for use in "smart" coatings which alter color when degraded and serve as early warning systems for corrosion of naval systems. Due to the sheer volume of efforts included in this program element, the programs described in the Accomplishments and Plans sections are representative selections of the work included in this program element.

(U) JUSTIFICATION FOR BUDGET ACTIVITY: This program is funded under BASIC RESEARCH because it encompasses scientific study and experimentation directed towards increasing knowledge and understanding in broad fields directly related to long-term Department of the Navy (DON) needs.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1995 ACCOMPLISHMENTS:

- (U) ($584) Ocean Sciences responded to the Joint Littoral JMA by examining shallow water effects on high frequency sonar systems.
- (U) ($1,893) Advanced Materials responded to the Maritime Support of Land Forces JMA by investigating grain size and particle concentration in metals to gain understanding of the microstructural influences on flow and fracture, leading to improved models for predicting material response to impact and explosive attack; and by continuing work in property enhancement for advanced structural composites to improve damage tolerance.
- (U) ($1,170) Information Sciences responded to the Joint Surveillance JMA by investigating neural network wavelet processing for ASW, and developing nanotechnology for molecular computing resulting in electronic devices with greater computational power.
- (U) ($13,323) Sustaining Programs responded to the Joint Surveillance JMA through work to create thermally stable,

active optical wave-guiding materials such as nonlinear optical polymers for use in the development of high-speed optical switches and modulators to be used in future communications and avionics signal processing devices; and through the development of scattering theory for detection and classification of submerged objects such as mines.

2. (U) FY 1996 PLAN:

- (U) ($571) Ocean Sciences will respond to the Maritime Support of Land Forces JMA by studying remote sensing of water mass structures and currents, including surface fluxes and Langmuir circulation, small-scale Ocean-Atmosphere interaction, and current estimation from space, rain, and scattering.

- (U) ($1,850) Advanced Materials will respond to the Joint Littoral JMA by tailoring polymers at the molecular level to achieve reduced submarine acoustic signatures, and will respond to the Joint Strike JMA by enhancing the orientation stability in nonlinear optical polymers.

- (U) ($1,143) Information Sciences will respond to the Joint Strike and Surveillance JMA's by advancing the knowledge and skills of computational statistics as applied to image processing, and will respond to the Joint Littoral JMA by examining new classification techniques for threat neutralization.

- (U) ($11,826) Sustaining Programs will respond to the Joint Strike, Joint Littoral and Maritime Support of Land Forces JMA's by describing the underlying physics of the detonation process which will lead to new and novel warhead designs with desired degree of lethality, and will respond to the Readiness, Support and Infrastructure JMA by investigating biomedical preventions and treatments for operational injuries due to decompression and oxygen toxicity, heat and cold exposure, spatial disorientation, fatigue, hazardous materials, and radiation.

3. (U) FY 1997 PLAN:

- (U) ($587) Ocean Sciences will respond to the Joint Littoral JMA by investigating very-shallow-water (VSW) physics as it relates to the performance of mine countermeasure sensors.

- (U) ($1,883) Advanced Materials will respond to the Maritime Support of Land Forces and Joint Strike JMA's by investigating shock induced damage and failure mechanisms, at the atomic level, in metals used in warheads and i

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 1996

UDGET ACTIVITY: 1 PROGRAM ELEMENT: 0601152N
PROGRAM ELEMENT TITLE: In-House Laboratory Independent Research

armor.

- (U) ($1,163) Information Sciences (signal processing and statistical sciences) will respond to the Readiness JMA by using advanced time-frequency analysis techniques in conditioned based monitoring of shipboard machinery to better diagnose and maintain the surface and submarine fleet and will respond to Joint Strike JMA by developing new signal and imaging processing algorithms to improve effectiveness of autonomous target recognition/guidance.

- (U) ($11,676) Sustaining Program will respond to Joint Strike JMA by studying supersonic turbine engine combustion technology and improved energetic materials; will respond to the readiness, support and infrastructure JMA by researching biomedical methods for disease prevention and treatment, wound repair, blood loss, hemorrhagic and septic shock, transplantation, and musculoskeletal injury; and will respond to the Joint Littoral JMA by developing advanced processing technologies for mine countermeasure operations in SW and VSW.

(U) PROGRAM CHANGE SUMMARY:

	FY 1995	FY 1996	FY 1997
(U) FY 1996 President's Budget:	17,088	16,084	17,152
(U) Adjustments from FY 1996 PRESBUDG:	-118	-694	-1,843
(U) FY 1997 PRESBUDG Submit:	16,970	15,390	15,309

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: FY 1995 change reflects reduced program requirements. FY 1996 funding decreases include $.302 thousand for Congressional undistributed reductions, $.186 thousand for revised DoD inflation estimates, and $.206 thousand for minor program reductions. FY 1997 funding decreases include $.467 thousand for revised DoD inflation estimates and $1,376 thousand for other minor program reductions.

(U) Schedule: Not applicable.

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: March 1996

BUDGET ACTIVITY: 1

PROGRAM ELEMENT: 0601152N
PROGRAM ELEMENT TITLE: In-House Laboratory Independent Research

(U) Technical: Not applicable.

C. (U) OTHER PROGRAM FUNDING SUMMARY: Not applicable.

(U) RELATED RDT&E:

- PE 0601101A (In-House Laboratory Independent Research)
- PE 0601101F (In-House Laboratory Independent Research)
- PE 0601153N (Defense Research Sciences)
- PE 0602111N (Surface/Aerospace Surveillance & Weapons Technology)
- PE 0602234N (Materials, Electronics & Computer Technology)
- PE 0602314N (Undersea Surveillance & Weapons Technology)

D. (U) SCHEDULE PROFILE: Not applicable.

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: March 1996

UDGET ACTIVITY: 1

PROGRAM ELEMENT: 0601152N
PROGRAM ELEMENT TITLE: In-House Laboratory Independent Research

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FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: March 1996

BUDGET ACTIVITY: 1

PROGRAM ELEMENT: 0601153N
PROGRAM ELEMENT TITLE: Defense Research Sciences

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 1995 ACTUAL	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
Ocean Science	135,700	135,750	138,898	144,210	153,382	161,333	168,711	CONT.	CONT.
Advanced Meterials	54,084	56,247	59,652	62,038	67,001	69,681	72,468	CONT.	CONT.
Information Sciences	38,266	39,797	42,206	43,894	47,406	51,198	55,294	CONT.	CONT.
Sustained Programs	163,264	130,178	131,148	135,985	142,895	149,762	155,256	CONT.	CONT.
TOTAL	391,314	361,622	371,904	386,127	410,684	431,974	451,729	CONT.	CONT.

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This program sustains U.S. naval scientific and technological superiority, provides new concepts and technological options for the maintenance of naval power and national security, and provides the means to avoid scientific surprise, while exploiting scientific breakthroughs. The program responds as noted below to the science and technology (S&T) requirements from the Department of the Navy (DON) Joint Mission Areas/Joint Support Areas (JMA/JSA) and enables the technologies that could significantly improve Joint Chiefs of Staff's Future Joint Warfighting Capabilities. It also seeks to exploit new science opportunities relevant to long term naval requirements. The Office of Naval Research (ONR) responds to requirements through major research thrusts in Ocean Sciences, Advanced Materials, Information Sciences, and the Sustaining Program. These efforts are part of an integrated DON S&T process initiated in 1993.

(U) This program responds to the Joint Strike JMA through research leading to better structural materials to increase platform survivability; automated target recognition algorithms to improve identification of friend or foe (IFF), and to help improve real-time targeting under camouflage conditions; and physics and chemistry foundations for improved multispectral, all-weather sensors and electronics. Responses to the Forward Presence and Joint Littoral JMAs, which cover forward operations in high-threat coastal regions, involve knowledge of near-shore ocean and atmospheric circulation, remote sensing, acoustics, and optical transmission to improve mine detection and removal, special operations capabilities and submarine detection; novel

tructural materials for better ship damage tolerance; data fusion research to integrate environmental prediction products nto Command, Control, Communications, Computers and Intelligence (C4I) systems; and new concepts in batteries and propellants or improved torpedo performance. The program responds to requirements in the Joint Surveillance JMA with research into dvanced materials for improved sensors and electronics; and better signal processing for automated target recognition llowing rapid ship self-defense and identifying relocatable targets. Requirements of the Joint Space Electronic Warfare SEW)/Intelligence JMA are matched by research to extend our knowledge of ocean and atmospheric properties, allowing sensors o operate more effectively under highly variable (battlespace) environmental conditions; and by network and data studies to ddress real-time, all-weather surveillance and targeting, with short revisit times using multiple high capacity data links. esearch into improved aerodynamic shapes for high endurance surveillance responds directly to a requirement of the Strategic eterrence JMA. Research in response to the Readiness and Support & Infrastructure JSAs includes developing knowledge of coustic/boundary interactions for improved navigation capabilities in poorly charted areas; exploring longer service life aterials for reduced logistics; and investigating chemical and biological processes for clean handling of shipboard waste. inally, cognitive research leading to more efficient and cost-effective training, to more user-compatible decision support ystems, and to principles for the design of reconfigurable command and control structures responds to the Manpower & ersonnel and Shore Training JSAs.

(U) Program response to affordability requirements includes research on condition based maintenance, embedded training, anufacturing science, antifouling coatings, advanced materials and coatings, biosensors, and electro-optical and ultifunctional electronic devices and concepts that promise to greatly simplify future undersea surveillance arrays and radar ystems while reducing life cycle cost.

(U) Due to the sheer volume of efforts included in this program element, the programs described in the Accomplishments and lans sections are representative selections of the work included in this program element.

(U) JUSTIFICATION FOR BUDGET ACTIVITY: This program is funded under BASIC RESEARCH because it encompasses scientific study nd experimentation directed towards increasing knowledge and understanding in broad fields directly related to long-term epartment of the Navy (DON) needs.

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: March 1996

BUDGET ACTIVITY: 1

PROGRAM ELEMENT: 0601153N
PROGRAM ELEMENT TITLE: Defense Research Sciences

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1995 ACCOMPLISHMENTS:

- (U) ($135,700) Ocean Sciences responded to Joint Littoral and Forward Presence JMA requirements by development of numerical techniques for nested regional prediction models with assimilation of altimetry data; studies of nearshore wave/sediment processes for predicting beach morphology changes due to storms and mine dispersal/burial, improved tropical cyclone track predictions, predictions of acoustic range dependence on mode coupling/stripping, studies of acoustic ray chaos as a limitation of travel time inversion methods, algorithms for shipboard radar measurements of ocean surface currents over tactical ranges, internal wave and turbulent microstructure models for false alarm statistics, studies of benthic flourescence spectra, and exploration of bottom boundary layer dynamics, in support of reliable detection of targets, mines and obstacles in shallow water. Response to Strike and Surveillance JMAs included a 15% improvement in prediction capability for geomagnetic influence on high frequency communications and studies of coastally-trapped atmospheric disturbances that lead to extreme propagation/sensing/visibility variances.

- (U) ($54,084) Advanced Materials responded to the Joint Surveillance JMA by exploring thin film deposition of novel ferrite materials making possible the incorporation of magnetic circulators directly on solid-state devices used in radars, eliminating the weight and complexity of manually attached ferrite rings; to the Joint Littoral and Joint Strike JMAs through simulation and modeling of material flow and fracture to improve the design of torpedo warheads, welding and weld properties prediction, and the forming of aircraft metal structures, and through investigations into the structural and oxidation resistance of molybdenum disilicide, leading to its use in advanced military and commercial aircraft engines.

- (U) ($38,266) Information Sciences responded to the Readiness, Training and Manpower/Personnel JSAs through research on models and metrics for assessing and predicting readiness at various echelons. Research on non-linear dynamical systems was initiated to uncover principles for design of novel sensors and processors for system controllers to impact Precision Strike JMA. Cognitive process models of command decision makers in antiair warfare and antisubmarine warfare were developed to guide design of decision support systems in response to the Manpower/Personnel JSA.

- (U) ($163,264) Sustaining Programs responded to the Readiness JSA by investigating nonlinear resonances and nonlinear signal processing to detect signals below background noise, laser cooling of atoms for inexpensive precise atomic clocks for accurate targeting, and on-board thermoacoustic refrigeration to eliminate environmentally harmful gases; and to the Joint Littoral JMA requirements by investigating improved biosensor arrays for mine detection.

2. (U) FY 1996 PLAN:

- (U) ($135,750) Ocean Sciences will respond to Joint Strike JMA requirements by investigating on scene techniques for atmospheric nowcasts and forecasts of the battlespace environment for clutter reduction, improved tactical decision making and operational planning, and to Joint Littoral JMA requirements by developing coastal models and sensors leading to improved prediction of battlespace conditions for acoustic and electro-optical propagation and inversion to allow reliable detection of targets, mines and obstacles in shallow water environments. These and related efforts also respond to the Forward Presence JMA through improved mobility, awareness and sustainability.

- (U) ($56,247) Advanced Materials will respond to the Joint Strike and Joint Surveillance JMAs by investigating wide bandgap semiconduction materials for ultra-linear, wide bandwidth, low noise, high efficiency amplifiers and for power electronic building blocks; new electronic materials for processing massive amounts of information at high speeds; improved acoustic imaging materials for mine detection in turbulent water; and superconducting materials for superdirective antenna arrays and stable oscillators for radar. Materials will respond to Readiness and Support and Infrastructure JMAs by increasing research in corrosion-resistant materials and coatings that can survive in the marine environment and exceed requirements in environmental regulations.

- (U) ($39,797) Information Sciences will respond to Joint Strike JMA requirements by exploring algorithms using nonlinear inverse techniques to detect weak signals amid clutter and jamming, multi-spectral and wideband modulation algorithms to analyze the sensed field, and missile aimpoint selection algorithms to improve performance of multi-spectral seekers; science base for information management and tactical decision.

- (U) ($130,178) Sustaining Programs will respond to the Joint Strike and Joint Surveillance JMAs through exploring biological and machine vision to develop neural models supporting visual processing for real time retargeting and

rapid mission planning; biomimetics to develop unique enzymatic sensors for detecting hazardous chemicals; silicon-based neural networks for automated pattern recognition; and nonlinear control for seaborne crane operation for cargo transfer in sea state three.

- (U) ($1,935) Portion of extramural program reserved for Small Business Innovation Research assessment in accordance with 15 U.S.C. 638.

3. (U) FY 1997 PLAN:

- (U) ($138,898) Ocean Sciences will respond to Forward Presence, Joint Littoral and Joint Surveillance JMAs by advanced studies of littoral internal waves, shoaling surface waves, and benthic processes, and by exploring concepts and techniques for autonomous ocean sampling from unmanned platforms for improved undersea surveillance, mine detection, and countermeasures. It will respond to the Joint Strike JMA by applying a range of advanced techniques to assimilate data into complex environmental models so that actual environmental measurements can be reconciled with models in real time for improved system design and performance, an uncluttered tactical picture, realistic training, doctrine development, and tactical decision making.

- (U) ($59,652) Advanced Materials will respond to Joint Strike JMA requirements by investigating high temperature superconducting materials in magnetic anomaly detectors for enhanced mine countermeasures; advanced metals and ceramic composites for lightweight and unmanned underwater vehicles (UUV) used in sea-land assault; and lightweight structural materials for engines and missile frames to improve range and operational capabilities.

- (U) ($42,206) Information Sciences will respond to Joint Strike and Joint Littoral JMAs by exploring a variety of artificial intelligence approaches, including neural networks, knowledge-based systems, and pattern recognition methods, to help automate target identification and decision-making, to automate and enhance training/simulation technologies, and to facilitate man-machine interactions; by applying recent theories to achieve the capability to track many targets over long periods of time; by refining numerical and computational techniques using massively parallel processing/networked work stations for near real-time electromagnetic prediction, and by developing fast, nonlinear algorithms for complex mission planning. Manpower/Personnel and Training JSA requirements will be addressed by programs integrating intelligent computer assisted instruction techniques with virtual environment and multi-media interfaces to enable embedded training and enhance operational performance in a variety of

operational domains.

- (U) ($131,148) Sustaining Programs will respond to the Joint Strike and Joint Surveillance JMAs by investigating the principles required for high energy, high efficiency, high repetition rate, very short pulse, miniaturized lasers for rapid, wide area reconnaissance sensors essential for effective mine countermeasures; particle wave applications in high precision gyroscopes for navigation systems; and design of super-quantum well focal plane arrays for simultaneous multi-spectral infrared (IR) detection. Biomedical investigators will respond to Readiness SA requirements through new approaches to combat casualty care, improved immunophysiology, and enhanced military operational medicine.

B. (U) PROGRAM CHANGE SUMMARY:

	FY 1995	FY 1996	FY 1997
(U) FY 1996 President's Budget:	401,535	385,917	401,699
(U) Adjustments from FY 1996 PRESBUDG:	-10,221	-24,295	-29,795
(U) FY 1997 PRESBUDG Budget Submit:	391,314	361,622	371,904

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: FY 1995 adjustment reflects a Congressional S&T rescission (-$6,725) and an execution year adjustment (-$3,496). FY 1996 funding level reflects the following adjustments: Congressional undistributed (-$19,520); revised economic assumptions (-4,408); and other minor reprogrammings (-$367). FY 1997 reductions include revised DOD inflation estimates (-$12,183) and changes in program requirements (-$17,612).

(U) Schedule: Not applicable.

(U) Technical: Not applicable.

(U) OTHER PROGRAM FUNDING SUMMARY: Not applicable.

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: March 1996

BUDGET ACTIVITY: 1

PROGRAM ELEMENT: 0601153N
PROGRAM ELEMENT TITLE: Defense Research Sciences

(U) RELATED RDT&E:

(U) PE 0601102A (Army Defense Research Sciences)
(U) PE 0601102F (Air Force Defense Research Sciences)
(U) PE 0601152N (In House Laboratory Independent Research)
(U) PE 0602111N (Surface/Aerospace Surveillance & Weapons Technology)
(U) PE 0602121N (Surface Ship Technology)
(U) PE 0602122N (Aircraft Technology)
(U) PE 0602234N (Materials, Electronics & Computer Technology)
(U) PE 0602314N (Undersea Surveillance & Weapons Technology)
(U) PE 0603207N (Air/Ocean Tactical Applications)
(U) PE 0603785N (Combat Systems Oceanographic Performance Assessment)

Activities are coordinated through Tri-Service 6.1 Reliance Scientific Planning Groups.

D. (U) SCHEDULE PROFILE: Not applicable.

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: March 1996

UDGET ACTIVITY: 1

PROGRAM ELEMENT: 0601153N
PROGRAM ELEMENT TITLE: Defense Research Sciences

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FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: March 1996

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602111N
PROGRAM ELEMENT TITLE: Surface/Aerospace Surveillance & Weapons Technology

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 1995 ACTUAL	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
Surface/Aerospace Surveillance & Weapons Technology	34,213	42,313	26,312	34,680	37,490	38,327	39,067	CONT.	CONT.

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This program element (PE) has been restructured by transferring the Surface and Aerospace Surveillance Technology portion of this program element with the exception of the FY 1995 Congressional Plus-up to P.E. 0602232N, Information Warfare. This restructured P.E. will support future weapons systems for surface and air platforms for Naval Warfare relating to the Joint Mission Area of Joint Strike Warfare and Littoral Warfare. Specifically:

(U) The Joint Strike Mission Area includes technology issues in weapons disciplines relating to real-time targeting and retargeting, surgical lethality, platform survivability, and Battle Damage Indication. Programs include mission planning, missile and propulsion technology, advanced warheads, and precision targeting.

(U) The Joint Littoral Warfare Mission Area includes technology issues in air and surface battlespace dominance relating to ship defense, air superiority, Naval Surface Fire Support. Programs include low cost missile guidance and control, high firepower guns and guided projectiles, airborne and shipboard fire control, missile propulsion, and feasibility investigations of innovative weapon system concepts.

(U) Due to the sheer volume of efforts involved in this Program Element, the programs described in the accomplishments and plans section are representative selections of the work included in this Program Element.

(U) These efforts support the Joint Warfare Strategy "Forward...from the Sea". Programs in this PE are jointly planned in the Reliance process with the Air Force and Army through panels of the Joint Directors of Laboratories (JDL).

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 1996

BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602111N
PROGRAM ELEMENT TITLE: Surface/Aerospace Surveillance & Weapons Technology

1) JUSTIFICATION FOR BUDGET ACTIVITY: This program is budgeted within the APPLIED RESEARCH Budget Activity because it investigates technological advances with possible applications toward solution of specific Naval problems, short of a major development effort.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1995 ACCOMPLISHMENTS:

- (U) ($9,703) SHIP DEFENSE IN SUPPORT OF SURFACE BATTLESPACE:
  - (U) Continued:
    - -- (U) Hydro-code and small scale test lethality evaluation of explosively generated water columns for ship terminal defense with a determination of optimal water barrier timing and spacing requirements.
    - -- (U) Fabrication of breadboard low cost, light weight, Infrared Focal Plane Array (IRFPA) test-bed tracker for self-defense weapon fire control investigations.
    - -- (U) Fabrication and test of barrel and chamber sealing mechanism for multi-purpose composite launcher.
    - -- (U) Miniature Radio Frequency (RF) Guidance Technology Development; demonstration of miniature RF seeker guidance accuracy in multi-path/clutter via Hardware in-the-loop (HWIL) simulation.
    - -- (U) Training neural networks on sea surface data for a Low Altitude Fuze investigation.
    - -- (U) Reactive materials selection testing for potential lethality improvements for future anti-air weapon system.

- (U) ($10,012) AIR SUPERIORITY:
  - (U) Initiated:
    - -- (U) Investigation of coherent fiber bundle scene transformation technique for Infrared Infrared (IR) scene generation.
    - -- (U) Investigations to define requisite off-axis fire control architectures that will achieve Air Superiority against hostile aircraft beyond current forward looking sensor's field of regard.
  - (U) Continued:
    - -- (U) HWIL simulations of Guidance-integrated fuse (GIF) breadboard hardware for improved air-to-air missile lethality.
    - -- (U) Diamond IR dome efforts with fabrication, polishing and testing of a 2.5 inch diameter, 1mm thick dome with high optical, thermal and strength properties suitable for high speed missile operation.

- (U) Completed:
  -- (U) HWIL demonstration of Lock-on-after-Launch (LOAL) guidance components for improvement of air-to-air combat survivability.

- (U) ($11,464) STRIKE AND ANTI SURFACE WARFARE (ASUW) WEAPONRY:
  - (U) Initiated:
    -- (U) Feasibility investigations for long range gun launched rocket assisted guided projectile that will be compatible with acceleration levels (up to 20,000 g's) and muzzle pressures (up to 10,000 psi) of emerging new Electro-Thermo Chemical gun technologies.
  - (U) Continued:
    -- (U) Advanced Research Projects Agency (ARPA) WARBREAKER environment simulations of parallel processing algorithms for near real-time mission planning and adaptive in-flight mission replanning capabilities for future Navy smart weapons.
    -- (U) Application investigation of parallel distributed processing techniques for timely route and mission planning and adaptive mission control functions for cruise missile applications.
    -- (U) Solid Fuel Air Explosives (SFAE) warhead development.
    -- (U) Development of automatic image analysis and objective recognition, and near real time route and mission planning algorithms using parallel distributed processing techniques to provide in-flight real time retargeting capabilities for future cruise missiles.
    -- (U) Application of parallel distributed processing techniques for timely route, mission planning and adaptive mission control for future cruise missile applications.
  - (U) Completed:
    -- (U) Airborne testing and evaluation of real-time multi-sensor correlation algorithm for land attack targeting.

- (U) ($3,034) SURVEILLANCE: (Congressional Plus-up)
  -- (U) Multi-Spectral Shipboard Surveillance Technology; this increase was to significantly increase the scope of the effort to include large scale demonstrations and contractor proposed initiatives over and above the previously planned program which provided only for technology development. Specific efforts included design, fabrication, assembly, integration and testing of a multi-sensor suite consisting of radar, ladar, passive Radio Frequency, passive Infrared sensor, and data fusion processor.

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 1996

UDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602111N
PROGRAM ELEMENT TITLE: Surface/Aerospace Surveillance & Weapons Technology

2. (U) FY 1996 PLAN:

- (U) ($9,785) SHIP DEFENSE IN SUPPORT OF SURFACE BATTLESPACE:
  - (U) Initiate:
    -- (U) Precision track RF technology; Design and analysis of precision track concepts for targeting supersonic anti-ship threats.
    (U) Investigations into feasibility of gun weapon system based on the RAM Accelerator concept that can exceed 20MJ in muzzle energy while satisfying the constraint that the gun barrel not exceed 25 feet of length (length of 5" Mk 54 Gun Barrel).
  - (U) Continue:
    (U) Reactive material warhead efforts by designing baseline warhead.
    (U) Miniature RF Guidance Technology Development by designing and fabricating a breadboard millimeter wave receiver/antenna and developing processor and precision range resolution algorithms.
    (U) Fabrication, test & evaluation of breadboard low cost, lightweight, Infrared Focal Plane Array (IRFPA) test-bed tracker for self-defense weapon fire control investigation.
    (U) Low altitude IR Fuze development by conducting system integration tests over sea surface.
  - (U) Complete:
    -- (U) Fabrication and test of barrel and chamber sealing mechanism for multi-purpose composite launcher.
    -- (U) Hydro-code and small scale lethality test and evaluation of explosively generated water columns for water barrier Ship Based-defense.
    -- (U) Test plans for IRFPA testbed.
    -- (U) Validation of multipath and clutter model for miniature RF guidance effort.

- (U) ($8,550) FREE ELECTRON LASER: (Congessional plus-up)
  - (U) Initiate:
    -- (U) Design, fabricate, and activate a 1 Kilowatt average power Free Electron Laser (FEL) operating in the IR spectrum.
    -- (U) Evaluate the suitability of the FEL for Navy Anti-Ship Missile Defense.

- (U) ($7,637) AIR SUPERIORITY:
  - (U) Initiate:

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: March 1996

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602111N
PROGRAM ELEMENT TITLE: Surface/Aerospace Surveillance & Weapons Technology

-- (U) Development of aerodynamic prediction code techniques, including computational fluid dynamic code development and experimental wind tunnel experiments, that are needed to predict the aerodynamic performance of non-axisymmetric missile airframe shapes at high angles of attack flight conditions and over a speed regime from transonic up to Mach 3.5.
-- (U) Application of structural composites (fiber reinforced, resin-matrix composite materials) for developing lightweight, low cost missile airframe design concepts that will satisfy low-to-high temperature (1000 deg. F), high strength (>300ksi), and high stiffness requirements (for high gs:>60g) of future Air-to-Air tactical missiles.
-- (U) Development of improved combustion initability prediction model that can be used to reduce the likelihood of combustion initablity problems in solid rocket motor propulsion systmes.

- (U) Continue:
-- (U) HWIL simulations and system level tests of IR GIF breadboard hardware for improved air-to-air missile lethality.
-- (U) Investigation of coherent fiber bundle scene transformation technique for IR scene generation.
-- (U) Off Axis fire control architecture investigations.
-- (U) Diamond dome strength improvement and polishing demonstrations.

- (U) Complete:
-- (U) HWIL simulation of LOAL components for improved air-to-air combat survivability.
-- (U) Demonstration of tracker and image processor for IR GIF effort.
-- (U) Multisensor algorithm development for off axis fire control.
-- (U) Remote stabilization algorithm testing.

• (U) ($1,900) INTEGRATED HIGH PAYOFF ROCKET PROPULSION TECHNOLOGY (IHPRPT) (Congressional Plus-up):
- (U) Initiate:
-- (U) Develop candidate propellant formulations using ammonium dinitramide (ADN) oxidizer. Design and bench test high temperature, high strength composite rocket motor cases and a compact 3-axis thrust vector control system. Goal of efforts is to increase delivered energy by +3% and improve mass fractions by +10% (year 2000 IHPRPT goal).

• (U) ($10,465) STRIKE AND ASUW WEAPONRY:
- (U) Initiate:
-- (U) Feasibility studies for an adaptive warhead concept that will reduce the number of different

Exhibit R-2

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warhead types from three to one to address the wide spectrum of surface target types, thus alleviating a significant vertical launch system load out problem.

-- (U) Development of subsonic and supersonic, low drag, low Radar Cross Section (RCS), and blended body airframe concepts that provide 20% drag reduction and 50% range increase over conventional design.

-- (U) Precision weapon targeting and fire control investigations that assure 3 meter Circular Error of Probability (CEP) against fixed, relocatable, and moving targets.

-- (U) High speed, small, low power processors for automatic, near real time, high resolution image processing for real time retargeting and rapid mission planning for cruise missiles.

-- (U) Propulsion and Guidance and Control (G&C) technology feasibilty investigations for a future long range, Mach 6+, Vertical Launch System (VLS) compatible, quick response, and time critical counter force weapon.

- (U) Continue:

-- (U) Application of parallel distributed processing techniques for timely routing and adaptive mission planning and adaptive mission control for cruise missile application.

-- (U) SFAE warhead technology development.

- (U) Complete:

-- (U) ARPA WARBREAKER environment simulations of parallel processing algorithms for near real-time mission planning and adaptive in-flight mission re-planning capabilities for future Navy smart weapons.

-- (U) Adaptive Mission Control efforts in parallel processing task with transition of adaptive Strike Planner, target recognition processor, and mission database to Cruise Missile Real Time Retargeting Demonstration task under Project R0447, PE 0603217N.

• (U) ($1,903) NAVAL SURFACE FIRE SUPPORT:

- (U) Initiate:

-- (U) Development of a low cost, strapdown IR imaging seeker to provide terminal guidance for gun launched Naval Surface Fire Support (NSFS) Weapon System.

- (U) Continue:

-- (U) Efforts in long range gun launched rocket propulsion technology initiated in FY 1995 under Strike and ASUW weaponry by conducting rocket motor sub-system preliminary designs.

• (U) ($1,900) LONG RANGE PROJECTILE (Congressional Plus-up):

- (U) Initiate:

-- This increase, jointly planned with the Army,, is intended to significantly extend the range of gun-launched precision guided munitions by providing for developmental testing of new rocket motor propellants using nano-meter metal powders. New formulations in explosives will be tested which will lead to significant enhancements in projectile warhead lethalities and effectiveness. Additionally, projectile mating joint technologies will be demonstrated which will facilitate more efficient projectile designs.

- (U) ($173) Portion of external program reserved for Small Business Innovation Research assessment in in accordance with 15 U.S.C. 638.

3. (U) FY 1997 PLAN:

- (U) ($7,040) SHIP BASED DEFENSE IN SUPPORT OF SURFACE BATTLESPACE:
  - (U) Continue:
    -- (U) Test & evaluation of breadboard low cost, lightweight, IRFPA testbed tracker.
    -- (U) Precision track RF technology; Refine candidate system concepts, system simulation and modeling, and solid state transmiter/receiver module evaluation.
    -- (U) Low altitude fuze development by investigating applicability of high power short pulse laser Target Detection Device (TDD) for improved performance in low visibility aerosol and smoke conditions.
    -- (U) Ram Accelerator technology by conducting preliminary design studies for high pressure gas management and computational fluid dynamic modeling of in-bore high pressure combustion processes.
    -- (U) Reactive materials warhead investigation by testing baseline warhead design and conducting gas gun test to facilitate development of shock induced reaction models.
  - (U) Complete:
    -- (U) Demonstrate in simulation the terminal accuracy of a 60mm projectile attainable with low cost strapdown W-band seeker in a track-via-projectile mode.
    -- (U) Miniature RF Guidance technology development effort by demonstrating, via simulation, the terminal accuracy of a Strapdown W-band Seeker in a track via projectile mode, sized for a 60mm projectile.
    -- (U) IRFPA testbed tracker effort by field testing tracker and innovative non uniformity compensation technique.

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: March 1996

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602111N
PROGRAM ELEMENT TITLE: Surface/Aerospace Surveillance & Weapons Technology

- (U) ($4,317) AIR SUPERIORITY:
  - (U) Initiate:
    - (U) Development of insensitive, high performance solid rocket propulsion components from screening of emerging energetic materials, scaleup and propellant formulation, through characterization of subscale performance.
  - (U) Continue:
    - (U) Aerodynamic advanced prediction code development for transonic high angle of attack applications including non-axisymetric body configurations and nonlinear modes.
    - (U) Propellant formulation investigations expanding ingredients base to include CL-20 and poly gamma CDN.
  - (U) Complete:
    - (U) Investigation of coherent fiber bundle scene transformation techniques for IR scene generation by completing projector assembly and final testing.
    - (U) RF GIF investigation by demonstrating passive sensor processing algorithms to provide real time estimates of warhead firing commands under a range of air to air weapon encounters.

- (U) ($10,193) STRIKE AND ASUW WEAPONRY:
  - (U) Initiate:
    - (U) Affordable Seeker Concepts: Analysis of requirements and design for a strike seeker using concurrent engineering techniques to reduce design and prototype fabrication times.
    - (U) Affordable Seeker Concepts: Use concurrent engineering techniques to reduce time and cost; complete requirements analysis, design, develop and begin fabrication of a strike seeker for test and evaluation.
  - (U) Continue:
    - (U) Adaptive warhead concept studies by conducting scale evaluations of advanced explosive materials developed under PE 0602314N.
    - (U) Initial assessment of lifting body airframe technology for supersonic strike weapon applications.
    - (U) Emperical modeling of detonation process for reactive materials for solid fuel air explosive warhead.
  - (U) Complete:
    - (U) Parallel distributed processing techniques for routing and mission planning applications with transition to PE 0603217N, for captive flight test evaluations.

- (U) ($4,762) NAVAL SURFACE FIRE SUPPORT:
  - (U) Initiate:
    - -- (U) Incorporate results of Long Range projectile efforts in gun propellant, explosives, and advanced projectile concepts initiated with FY 1996 Congressional plus-ups.
    - -- (U) Feasibility assessment of high strength composite barrels for Naval gun applications.
    - -- (U) Feasibility assessment of advances relative GPS targeting concepts that will lead to increased target location accuracies.
  - (U) Continue:
    - -- (U) Feasibility assessment of strapdown IR imaging seeker technology for use as a terminal guidance technique for a low cost gun launched projectile.
    - -- (U) Gun launched rocket technology development by fabricating an advanced motor and conducting structural and performance evaluations.
    - -- (U) Investigation into high strength, long wearing, and light weight materials for future naval long life gun barrels.

B. (U) PROGRAM CHANGE SUMMARY:

	FY 1995	FY 1996	FY 1997
(U) FY 1996 President's Budget:	36,388	32,658	35,387
(U) Adjustments from PRESBUDG:	-2,175	+9,655	-9,075
(U) FY 1997 PRESBUDG Submit:	34,213	42,313	26,312

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: FY 1995 reduction reflects reduced requirements (-$2,175). FY 1996 overall increase due to Congressional plus-ups of (+$11,000); Congressional undistributed cuts (-$831), and revised DoD economic assumptions (-$514). FY 1997 changes include revised DoD inflation estimates (-$801); minor DoD repricings (-$873) and reduced program requirements (-$7,401).

(U) Schedule: Not applicable.

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 1996

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602111N
PROGRAM ELEMENT TITLE: Surface/Aerospace Surveillance & Weapons Technology

(U) Technical: Not applicable.

C. (U) OTHER PROGRAM FUNDING SUMMARY: Not Applicable

(U) RELATED RDT&E: This PE adheres to Tri-Service Reliance agreements with oversight provided by the JDL. This PE is related to and fully coordinated with efforts in the following:
(U) CONVENTIONAL AIR/SURFACE WEAPONRY:
(U) PE 0601153N (Defense Research Sciences)
(U) PE 0602203F (Aerospace Propulsion)
(U) PE 0602232N (C3 Technology)
(U) PE 0602234N (Materials, Electronics and Computer Technology)
(U) PE 0602302F (Rocket Propulsion and Astronautics Technology)
(U) PE 0602303A (Missile Technology)
(U) PE 0602601F (Advanced Weapons)
(U) PE 0602602F (Conventional Munitions)
(U) PE 0602618A (Ballistics Technology)
(U) PE 0602624A (Weapons and Munitions Technology)
(U) PE 0603004A (Weapons and Munitions Advanced Technology)
(U) PE 0603216F (Aerospace Propulsion and Power Technology)
(U) PE 0603609N (Conventional Munitions)
(U) PE 0603640M (Marine Corps Advanced Technology Demonstration)
(U) PE 0603790D (NATO Research and Development)
(U) This is in accordance with the ongoing Reliance joint planning processes.

D. (U) SCHEDULE PROFILE: Not applicable.

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: March 1996

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602121N
PROGRAM ELEMENT TITLE: SURFACE SHIP AND SUBMARINE HM&E TECHNOLOGY

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 1995 ACTUAL	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
Surface Ship and Submarine HM&E Technology	36,928*	60,923	35,591	41,591	48,563	50,069	50,937	CONT.	CONT.

* FY 1995 reflects FY 1996 S&T restructure. Funding moved to this P.E. from PE 0602323N.

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This program element (PE) provides for surface ship and submarine technology developments that contribute to meeting the top joint warfare capabilities established by the Joint Chiefs of Staff; namely to promptly engage regional forces in decisive combat on a global level, to employ a range of capabilities more suitable to actions at the lower end of the full range of military operations which allow achievement of military objectives with minimum casualties and collateral damage, and to counter the threat of weapons of mass destruction and future ballistic missile and cruise missiles to the United States and deployed forces.

(U) This PE develops affordable hull, mechanical, and electrical (HM&E) technology options for both surface ships and submarines. Starting in FY 1995 these options are organized within four technology thrusts: Structural Systems, Power and Automation, Signature Control, and Maneuvering and Seakeeping. They include electromagnetic and acoustic signature reduction, structural and weapon related survivability improvement, electrical and mechanical system efficiency, damage control, and hydrodynamic and propulsion alternatives. In addition, affordability for reduced acquisition and life-cycle costs is being pursued in all technology thrusts. Concepts that reduce the cost of design, fabrication, outfitting, maintenance, and operation are being developed. This HM&E technology spans various Joint Mission Areas and supports the Joint Warfare Strategy "Forward ...From the Sea."

(U) Due to the broad scope of technology included in this Program Element, the efforts described in the Accomplishments and Plans sections are representative selecions of work included in this program element.

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DATE: March 1996

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602121N
PROGRAM ELEMENT TITLE: SURFACE SHIP AND SUBMARINE HM&E TECHNOLOGY

(U) JUSTIFICATION FOR BUDGET ACTIVITY: This program is budgeted within the APPLIED RESEARCH Budget Activity because it investigates technological advances with possible applications toward solution of specific Naval problems, short of a major development effort.

B. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1995 ACOMPLISHMENTS

- (U) ($7,424) SURFACE SHIP STRUCTURAL SYSTEMS:
- (U) INITIATED:
- (U) Development of hull monitoring and assessment system to determine structural integrity of ships at sea. (Reliability Based Ship Structural Design Guidelines)
- (U) Investigation of underwater explosion response of composite primary hull structures. (Affordable Composite Ship Structural Systems)
- (U) Development of shipboard magazine protection and damage containment concepts. (Protection System Design Guidelines)
- (U) CONTINUED:
- (U) Development of improved analytical codes for slamming load predictions on ship hulls. (Reliability Based Ship Structural Design Guidelines)
- (U) Development of guidelines for design of unidirectional double hull ships. (Affordable Metallic Ship Structural Systems)
- (U) Evaluation of low cost fabrication techniques for a sub-scale composite primary hull midship section. (Affordable Composite Ship Structural Systems)

- (U) ($10,640) SURFACE SHIP POWER AND AUTOMATION:
- (U) INITIATED:
- (U) Development of first generation of Power Electronic Building Blocks (PEBB) (Advance Concept Electrical Systems)
- (U) Development of hatch closure fiber optic sensor. (Integrated Damage Control System)
- (U) Development of horizontal heat transfer algorithm for fire/smoke spread model. (Integrated Damage Control System)

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: March 1996

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602121N
PROGRAM ELEMENT TITLE: SURFACE SHIP AND SUBMARINE HM&E TECHNOLOGY

- (U) Development of spray geometry sub-model for global watermist fire suppression model. (Integrated Damage Control System)
- (U) Improvements in stability calculations and rate of flooding calculations for shipboard environments. (Integrated Damage Control System)
- (U) CONTINUED:
- (U) Development of simulation model for powering future electric gun. (Power Conversion Systems).
- (U) Demonstration of autothermal diesel fuel reformer for high power density fuel cell (Power Conversion Systems).
- (U) COMPLETED:
- (U) Performance testing of cryogenic turbo expander for low-temperature superconducting systems. (Electric Propulsion Concepts)
- (U) Performance testing of low-temperature superconducting wire alloys. (Electric Propulsion Concepts) Electrical Systems)
- (U) Demonstration of solid-state switching components for zonal electrical power distribution system. (Advanced Concept Electrical Systems)
- (U) Laboratory validation of limited duty cycle generator for pulse power networks. (Advanced Concept Electrical Systems)
- (U) Scale model loading demonstrations of zonal electrical power distribution system. (Advanced Concept Electrical Systems)
- (U) Diesel engine noise signature simulation model development. (Power Conversion Systems)

- (U) ($4,798) SURFACE SHIP SIGNATURE CONTROL:
- (U) INITIATED:
- (U) Development of cost-effective radar and compatible infrared (IR) signature control concepts for low observable ship designs. (Topside Low-Signature Concepts)
- (U) Development of active noise control techniques for quieting shipboard liquid systems. (Underwater Low-Signature Concepts)
- (U) Development of concepts for cavitation reducing rudders and appendages. (Underwater Low-Signature Concepts)
- (U) Development of improved magnetic sensors for closed loop degaussing systems. (Underwater Low-Signature Concepts)

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: March 1996

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602121N
PROGRAM ELEMENT TITLE: SURFACE SHIP AND SUBMARINE HM&E TECHNOLOGY

- (U) COMPLETED:
- (U) Transition of lightweight, low-observable, electromagnetically-compatible glass-reinforced plastic mast concept to Advanced Technology Development. (PE 0603792N) (Topside Low-Signature Concepts)
- (U) Development and transition of an electro-optic electromagnetic environment monitoring system to NAVSEA (PE 0603792N). (Electromagnetic Compatibility Design Guidelines)

- (U) ($600) SURFACE SHIP MANEUVERING AND SEAKEEPING:
- (U) INITIATED:
- (U) Performance testing of vertical axis propulsor (Innovative Hull Form and Propulsion Concepts)

- (U) ($3,415) SUBMARINE SIGNATURE CONTROL:
- (U) INITIATED:
- (U) Feasibility study of using large-scale acoustic holography imaging technology for acoustic signature reduction concept evaluations. (Signature Assessment)
- (U) Development of quiet, environmentally safe, small-device launcher to support littoral operations and environmental regulations. (Payload Launch Quieting)
- (U) CONTINUED:
- (U) Demonstration of electromagnetic signature quieting technology for global operations. (EM Signature Reduction)
- (U) Verification of target strength simulation tool. (Acoustic Silencing Concepts)
- (U) Evaluation of sensor technology for active noise control of machinery truss. (Acoustic Silencing Concepts)
- (U) Evaluation of forcing function models for development of a low self-noise sonar bow dome. (Self Noise)
- (U) Quantitative assessment of the transient flow noise generated by slot flow geometry in weapons launcher systems. (Payload Launch Quieting)
- (U) COMPLETED:
- (U) Demonstration and documentation of concept to control low-frequency structural acoustic phenomena. (Acoustic Silencing Concepts)

- (U) (3,813) SUBMARINE STRUCTURAL SYSTEMS:
- (U) INITIATED:

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BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602121N
PROGRAM ELEMENT TITLE: SURFACE SHIP AND SUBMARINE HM&E TECHNOLOGY

(U) Verification of model dynamic response of coatings subjected to shock loading. (Shock Coatings)

- (U) CONTINUED:
- (U) Development of analytic models for shock isolation components for shock resistant machinery mounting trusses. (Machinery Truss Support System)
- (U) Evaluation of structural concepts for composite sail integrated acoustic and non-acoustic technology. (Composite Sail)
- (U) Utilization of new transducer technologies to enhance the quality of deep submergence test data to support verification of analytic models. (Hull Shock Strength)
- (U) Development of comprehensive fluid-structure interaction predictive models. (Hull Shock Strength)
- (U) Collection of rupture data on full-scale hull weld materials. (Hull Rupture)
- (U) COMPLETED:
- (U) Transitioned to NAVSEA validated damage prediction methods for stiffened cylindrical hull sections, subjected to shock loading. (Hull Shock Strength)

- (U) ($2,962) SUBMARINE POWER AND AUTOMATION:
- (U) CONTINUED:
- (U) Evaluation of mechanical performance of hypocyclic speed reducer for electromechanical actuators for zone distributed hydraulic systems. (Distributed Hydraulics)
- (U) Development of simulation models of advanced electric distribution system components for an electric submarine. (Electric Power Distribution)
- (U) Laboratory demonstration of 2 Hp permanent magnet motor to validate design tools for enhanced acoustic performance in permanent magnet motors. (Electric Drive)
- (U) Demonstration of active quieting of pump tonal noise by magnetic bearings. (Machinery Quieting)
- (U) COMPLETED:
- (U) Demonstration of shaftless main seawater pump technology and transition to NAVSEA. (Pump Technology)
- (U) ($3,276) SUBMARINE MANEUVERING AND SEAKEEPING:
- (U) INITIATED:
- (U) Concept studies for technologies to provide current state-of-art propulsor performance in simple reduced cost units. (Low Cost Propulsor)
- (U) CONTINUED:
- (U) Development and implementation of techniques for computing flows around the stern with various

propulsor/appendage configurations. (Maneuvering Predictions)
- (U) Development and construction of a scale model, first-generation full stern/integrated propulsor concept. (Full Stern/Integrated Propulsor)
- (U) Development of models to predict near-field downstream flow features from hull feature inflow conditions. (Wakes)
- (U) COMPLETED:
- (U) Development of semi-empirical maneuvering models; transition results for conversion into design tools at the Hydrodynamics/Hydroacoustics Technology Center. (Maneuvering Predictions)
- (U) Validation of broadband vibration noise methodology for early stage propulsor design predictions; transition model to the Hydrodynamics/Hydroacoustics Technology Center. (Propulsor Quieting)

2. (U) FY 1996 PLAN:

- (U) ($18,922) SURFACE SHIP STRUCTURAL SYSTEMS:
- (U) INITIATE:
- (U) Development of fully probabilistic reliability based design procedure. (Reliability Based Ship Structural Design Guidelines)
- (U) Exploration of the multi-use capabilities (protection/signature reduction) of topside composite armor to increase survivability. (Protection System Design Guidelines)
- (U) CONTINUE:
- (U) Evaluation of structural alternatives for economical installation of distributive systems modules. (Affordable Metallic Ship Structural Systems)
- (U) Evaluation of coupled finite-element/finite-difference analytic methods for predicting the response of ship structures to weapons. (Protection System Design Guidelines)

- (U) ($5,117) SURFACE SHIP POWER AND AUTOMATION:
- (U) INITIATE:
- (U) Development of integrated time-progressive flooding sensors and software. (Integrated Damage Control System)
- (U) CONTINUE:
- (U) Demonstration of feasibility of a contra-rotating scale model homopolar motor. (Electric Propulsion

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DATE: March 1996

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602121N
PROGRAM ELEMENT TITLE: SURFACE SHIP AND SUBMARINE HM&E TECHNOLOGY

Concepts)
- (U) Demonstration of a single zone of the Advanced Concept Electrical System architecture and validate simulations. (Advanced Concept Electrical Systems)
- (U) Demonstration of diesel structural components fabricated from non-ferous and composite materials (Power Conversion Systems)
- (U) Demonstration of high power density fuel cell with diesel desulfurization and reformer. (Power Conversion Systems)
- (U) Demonstration of hull integrity fiber optic sensor. (Integrated Damage Control System)
- (U) COMPLETE:
- (U) Assessment of fuel cells on non-combatants (Power Conversion Systems).
- (U) Conceptual design for a new family of shock hardened air-circuit breakers.

- (U) ($5,161) SURFACE SHIP SIGNATURE CONTROL:
- (U) CONTINUE:
- (U) Development of analytical techniques for prediction of the Radar Cross Section (RCS) due to 2nd and 3rd order scattering phenomena such as cavities and surface traveling waves. (Topside Low-Signature Concepts)
- (U) Development of guidelines for ship topside shaping for IR signature control. (Topside Low-Signature Concepts)
- (U) Development of advanced quiet rudder design concept. (Underwater Low-Signature Concepts)
- (U) Development of fluid system quieting techniques using active control technology. (Underwater Low-Signature Concepts)
- (U) Development of improved magnetic sensors to support advanced degaussing systems. (Underwater Low-Signature Concepts)
- (U) COMPLETE:
- (U) Transition of broadband high-frequency embedded antenna concept for the Advanced Enclosed Mast/Sensor System (PE 0603792N). (Topside Low-Signature Concepts)

- (U) ($1,162) SURFACE SHIP MANEUVERING AND SEAKEEPING:
- (U) INITIATE:

Cooperative U.S. and Netherlands project on Propeller Tip Vortex Cavitation reduction. (Hydrodynamic

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PROGRAM ELEMENT: 0602121N
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Analytical Methods)
- (U) CONTINUE:
Development of methods to predict the motions of damaged ships and ships in deep water. (Hydrodynamic Analytical Methods)

- (U) ($5,621) SUBMARINE SIGNATURE CONTROL:
- (U) INITIATE:
- (U) Development of design tools to predict far-field acoustic signatures. (Signature Assessment)
- (U) Development of methods for in-situ characterization and evaluation of acoustic materials. (Acoustic Materials)
- (U) CONTINUE:
- (U) Demonstration of concept for control of electromagnetic signatures at depth. (EM Signature Reduction)
- (U) Validate analysis models for development of a low self-noise sonar bow dome and design quarter-scale acoustically transparent dome. (Self Noise)
- (U) Demonstration of accurate, cost effective methods for evaluating weapons launcher systems noise. (Payload Launch Quieting)
- (U) COMPLETE:
- (U) Feasibility assessment of acoustic holography imaging technology for evaluation signature reduction concepts. (Signature Assessment)
- (U) Transition sensor technology for active control of machinery truss and rafts. (Acoustic Silencing)
- (U) Demonstration and validation of target strength simulation capability; transition design tool development to the Hydrodynamics/Hydroacoustics Technology Center. (Acoustic Silencing)

- (U) ($4,170) SUBMARINE STRUCTURAL SYSTEMS:
- (U) INITIATE:
- (U) Development and evaluation of machinery cradle for shock. (Machinery Truss Support System)
- (U) Development of integrated shock/acoustic equipment mount concepts for decks and machinery support trusses. (Machinery Truss Support System)
- (U) CONTINUE:
- (U) Large-scale experimental verification of shock isolation models for shock resistant machinery

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mounting trusses. (Machinery Truss Support System)
- (U) Demonstration and validation of models to assess dynamic response of acoustically-coated structures subjected to dynamic loads. (Hull Shock Strength)
- (U) Development of criteria for hull/frame failure model for steel pressure hulls under dynamic loads. (Hull Rupture)

- (U) ($5,340) SUBMARINE POWER AND AUTOMATION:
- (U) INITIATE:
- (U) Development of quiet environmentally safe, small-device (payload) launcher to support littoral operations and environmental regulations. (Payload Launch)
- (U) Development and demonstration of power modulation and other technologies to actively control electric motor noise. (Electric Drive)
- (U) Development of seawater-based hydraulic system components for zone distributed hydraulic systems. (Distributed Hydraulics)
- (U) Development of adaptive magnetic bearings for increased bearing life and noise control (Machinery Reliability)
- (U) CONTINUE:
- (U) Verification of electric motor analysis tools in development of intermediate-scale (300 Hp) permanent magnet motor. (Electric Drive)
- (U) Demonstration of quieting multiple pump noise tonals by magnetic bearings. (Machinery Quieting)
- (U) COMPLETE:
- (U) Evaluation of acoustic performance of hypocyclic speed reducer in zone distributed hydraulic systems. (Distributed Hydraulics)

- (U) ($5,406) SUBMARINE MANEUVERING AND SEAKEEPING:
- (U) INITIATE:
- (U) Evaluation of physics-based maneuvering tools for prediction of submarine trajectory. (Maneuvering Predictions)
- (U) Concept development of control systems and appendages having improved control authority. (Maneuvering Systems)
- (U) CONTINUE:
- (U) Selection of technologies to provide for a low cost propulsor concept. (Low Cost Propulsor)
- (U) Evaluation of hydrodynamic and hydroacoustic performance at small-scale of first generation full-

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PROGRAM ELEMENT: 0602121N
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stern/integrated propulsor concept. (Full Stern/Integrated Propulsor)
- (U) Assess maneuvering characteristics of first generation full stern concept for verfication of maneuvering analytical predictions. (Full Stern/Integrated Propulsor)
- (U) Development of models to predict near-field downstream flow features from hull feature inflow conditions. (Wakes)

- (U) ($8,024) POWER ELECTRONIC BUILDING BLOCKS:
- (U) INITIATE:
- (U) Development of computational testbed for advanced concept electrical system simulation. (Advanced Concept Electrical Systems)
- (U) Development of second-generation demonstration modules for form and fit of power electronic building blocks. (Advanced Concept Electrical Systems)
- (U) COMPLETE:
- (U) Design of first-generation demonstration modules for form of Power Electronic building blocks (Advanced Concept Electrical System)

- (U) ($1,916) INTERACTIVE ELECTRONIC TECHNICAL MANUALS:
- (U) COMPLETE:
- (U) Demonstration of weapons systems Interactive Electronic Technical Manuals for Embedded Test Procedures.
- (U) Demonstration of weapons systems Interactive Electronic Technical Manual for Advanced Maintenance.

- (U) ($ 84) SMALL BUSINESS INNOVATION RESEARCH:
- (U) Portion of extramural program reserved for Small Business Innovation Research assessment in accordance with 15 U.S.C.638.

3. (U) FY 1997 PLAN:

- (U) ($3,553) SURFACE SHIP STRUCTURAL SYSTEMS:
- (U) CONTINUE:
- (U) Validation testing of hull integrity monitoring and assessment system. (Reliability Based Ship Structural Design Guidelines)

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PROGRAM ELEMENT: 0602121N
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- (U) Development of code to model fatigue behavior of large composite structures. (Affordable Composite Ship Structural Systems)
- (U) Demonstration of a model for reactive gas flow in non-burst compartments following an explosion. (Protection System Design Guidelines)
- (U) COMPLETE:
- (U) Transition of probabilistic hull strength design method to NAVSEA. (Affordable Metallic Ship Structural Systems)
- (U) Evaluation of low cost/high quality composite hull structures for mine hunters and small combatants. (Affordable Composite Ship Structural Systems)
- (U) Development of analytically-based design tool to predict weapons loading and structural response of hulls to non-contact underwater explosions. (Protection System Design Guidelines)
- (U) Total ship design options for destroyer/cruiser survivability which account for passive hardening and equipment architectures. (Protection System Design Guidelines)

- (U) ($6,426) SURFACE SHIP POWER AND AUTOMATION:
- (U) CONTINUE:
- (U) Evaluation of advanced cooling system concepts for pulse power and other high power density applications (Advanced Auxiliary Systems).
- (U) Development of advanced damage control sensors to measure flow rates of air and water. (Integrated Damage Control Systems)
- (U) Demonstration of non-chemical acting alternative to HALON 1301 with zero ozone depletion potential (Integrated Damage Control System)
- (U) COMPLETE:
- (U) First functional demonstration of power electronic building blocks. (Advanced Concept Electrical Systems)
- (U) Development of a lightweight, non-magnetic diesel, using composite components (Power Conversion Systems).
- (U) Validation of simulation model for powering future electric gun. (Power Conversion Systems).
- (U) Development of damage control algorithms that will predict fire and smoke movement. (Integrated Damage Control Systems)
- (U) Demonstration of permanent magnet propulsion system on a patrol craft. (Electric Propulsion

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Concepts).

- (U) ($4,657) SURFACE SHIP SIGNATURE CONTROL:
- (U) Initiate evaluation of high-performance ship hull concepts which meet low-observable requirements. (Topside Low-Signature Concepts)
- (U) CONTINUE:
- (U) Development of Radar Diffuse Surface (RDS) Concepts as alternatives to traditional Radar Absorbing Material (RAM). (Topside Low-Signature Concepts)
- (U) Development of exhaust air system quieting technique utilizing active control. (Topside Low-Signature Concepts)
- (U) Development of Low RCS and IR signature stack suppression system. (Topside Low-Signature Concepts)
- (U) Development of performance prediction algorithms for IR coatings. (Topside Low-Signature Concepts)
- (U) Development of propeller quieting techniques for operating in littoral areas. (Underwater Low-Signature Concepts)
- (U) COMPLETE:
- (U) Development of electromagnetic compatibility analysis models and interference reduction techniques for ultra-wide band and wide band radio frequency systems. (Electromagnetic Compatibility Design Guidelines)
- (U) Development of improved magnetic sensors for advanced degaussing systems. (Underwater Low-Signature Concepts)
- (U) Transition of advanced rudder design to NAVSEA for full-scale evaluation. (Underwater Low-Signature Concepts)

- (U) ($955) SURFACE SHIP MANEUVERING AND SEAKEEPING:
- (U) CONTINUE:
- (U) Conducting parametric design studies on Tip Vortex Cavitation reduction cooperative US/Netherlands project. (Hydrodynamic Analytical Methods)
- (U) Development and assessment of point design of a Vertical Axis Propulsor. (Innovative Hull Form and Propulsion Concepts)
- (U) COMPLETE:
- (U) Powering tests of Vertical Axix Propulsor. (Innovative Hull Form and Propulsion Concepts)

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- (U) ($3,436) SUBMARINE SIGNATURE CONTROL:
- (U) INITIATE:
- (U) Development of acoustic technology to provide sumbarine hull structures with intrinsic acoustic performance benefit. (Advanced Hull Concepts)
- (U) CONTINUE:
- (U) Development of design tools to predict far-field acoustic signatures. (Signature Assessment)
- (U) Assessment of in-situ methods to characterize acoustic coatings. (Acoustic Materials)
- (U) Demonstration of proof-of-concept for control of far-field electromagnetic signatures. (EM Signature Reduction)
- (U) Fabrication and testing of quarter-scale acoustically transparent sonar bow dome. (Self-noise)

- (U) ($3,604) SUBMARINE STRUCTURAL SYSTEMS:
- (U) INITITATE:
- (U) Structural assessment and development of hull modification concepts that provide intrinsic acoustic advantage. (Hull Modifications)
- (U) CONTINUE:
- (U) Development and evaluation of machinery cradle for shock. (Machinery Truss Support System)
- (U) Development of integrated shock/acoustic mount concepts for trusses and rafts. (Machinery Truss Support System)
- (U) Demonstration of analysis of pressure hull rupture/toughness of internally stiffened hulls. (Hull Rupture)
- (U) Validate analysis capabilities to evaluate reponse of acoustically coated hull to shock loading. (Hull Shock Strength)
- (U) COMPLETE:
- (U) Transtion of capability to evaluate response of acoustically coated hull to shock loading. (Hull Shock Strength)

- (U) ($3,507) SUBMARINE POWER AND AUTOMATION:
- (U) Initiate development of automated machinery monitoring system technology for machinery compartment. (Automation)
- (U) CONTINUE:
- (U) Demonstrate technologies for active quieting of electric motor noise. (Electric Drive)

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- (U) Commence prototype development of quiet environmentally safe small-device launcher. (Launch Concepts)
- (U) Development of seawater-based hydraulic system components for zone distributed hydraulic systems. (Distributed Hydraulics)
- (U) Demonstrate broadband pump active quieting using magnetic bearings. (Machinery Quieting)

- (U) ($2,953) SUBMARINE MANEUVERING AND SEAKEEPING:
- (U) INITIATE:
- (U) Concept development of submarine control appendages having improved control authority and minimal signatures. (Maneuvering Concepts)
- (U) CONTINUE
- (U) Demonstration of low cost propulsor concept feasibility in small-scale laboratory experiments. (Low Cost Propulsor)
- (U) Radio controlled model experimentation to validate physics-based maneuvering tools. (Maneuvering Predictions)
- (U) Develop full-stern/integrated propulsor second generation concept, based upon first generation design performance. (Full Stern/Integrated Propulsor)
- (U) Development of models to predict near-field downstream flow features from hull feature inflow conditions. (Wakes)
- (U) COMPLETE:
- (U) Transition unsteady flow analysis for evaluating non-acoustic wake signatures to Hydrodynamic/ Hydroacoustic Technology Center. (Wakes)

- (U) ($6,500) PEBB:
- (U) INITIATE:
- (U) Development of third generation demonstration modules for form, fit, and function of PEBB. (Advanced Concept Electronics Systems)
- (U) CONTINUE:
- (U) Evaluation of second generation demonstration modules for form and fit of PEBB. (Advanced Concept Electronic Systems)
- (U) COMPLETE:
- (U) Design of second generation demonstration modules for form and fit of PEBB. (Advanced Concept Electronic

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Systems)

- (U) COMPLETE:
  Transition unsteady flow analysis for evaluating non-acoustic wake signatures to Hydrodynamic/Hyrdroacoustic Technology Center (Wakes)

B. (U) PROGRAM CHANGE SUMMARY:

	FY 1995	FY 1996	FY 1997
(U) FY 1996 President's Budget	35,059	36,786	42,430
(U) Adjustments from FY96 PRESBUDG:	+1,869	+24,137	-6,839
(U) FY 1997 PRESBUD Submit:	36,928	60,923	35,591

(U) CHANGE SUMMARY EXPLANATION:
(U) Funding: FY 1995 change reflects increase in program requirements. FY 1996 Adjustments reflect Congressional Plus-ups for Curved Plate (+$15,000), Submarine Technology (+$10,000), Submarine Technology (-$4,926), PEBB (+$6,000), Congressional undistributed cuts (-$1,196), and Revised DoD inflation estimates (-$741). FY 1997 changes include revised DoD inflation estimates (-$1,089), minor repricing adjustments (-$1,402) and reduced program requirements (-$4,348).

(U) Schedule: Not applicable.

(U) Technical: Not applicable.

C. (U) OTHER PROGRAM FUNDING SUMMARY:

(U) OTHER APPROPRIATION FUNDS: Not applicable.

(U) RELATED RDT&E:

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PROGRAM ELEMENT: 0602121N
PROGRAM ELEMENT TITLE: SURFACE SHIP AND SUBMARINE HM&E TECHNOLOGY

- (U) PE 0601153N (Defense Research Sciences)
- (U) PE 0602131M (Marine Corps Landing Force Technology)
- (U) PE 0602233N (Readiness, Training and Environmental Quality Technology)
- (U) PE 0602234N (Materials, Electronics, and Computer Technology)
- (U) PE 0602314N (Undersea Warfare Surveillance Technology)
- (U) PE 0602315N (Mine Countermeasures, Mining and Special Warfare Technology)
- (U) PE 0603502N (Surface and Shallow Water MCM)
- (U) PE 0603508N (Ship and Submarine HM&E Advanced Technology)
- (U) PE 0603513N (Shipboard System Component Development)
- (U) PE 0603514N (Personnel/Ship Survivability)
- (U) PE 0603553N (Surface Anti-Submarine Warfare)
- (U) PE 0603561N (Advanced Submarine Systems Development)
- (U) PE 0603563N (Ship Concept Advanced Design)
- (U) PE 0603564N (Ship Preliminary Design and Feasibility Studies)
- (U) PE 0603569E (ARPA S&T Program)
- (U) PE 0603573N (Advanced Surface Machinery Systems)
- (U) PE 0603792N (Advanced Technology Transition)
- (U) PE 0604558N (New Design SSN Development)
- (U) PE 0604561N (SSN-21 Development Program)
- Under the Tri-Service Reliance Agreement, the Navy has the lead for this Navy-unique program.

D. (U) SCHEDULE PROFILE: Not applicable

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEETDATE: March 1996

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602122N
PROGRAM ELEMENT TITLE: Aircraft Technology

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 1995 ACTUAL	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL
Aircraft Technology	25,687	29,792	20,578	26,554	31,215	31,229	32,700	CONT.	CONT.

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This program develops technology for naval aviation, with emphasis on the demands imposed by aircraft carrier flight operations and Marine Corps amphibious and field operations relating to the Joint Mission Areas of Joint Strike Warfare and Joint Littoral Warfare. This program exploits the emerging technologies of: (a) composite and matrix materials for structures to reduce airframe and propulsion plant weight and the effects of saltwater corrosion; (b) reduced observables, (c) aerodynamic designs of Navy-unique aircraft components; (d) advanced gas turbine engine component designs for extended range/endurance; and (e) predicting safer, more reliable at-sea operating envelopes. The program provides mission area analysis and concept definition required for the Applied Research phase of air vehicle and weapon system programs.

(U) Aircraft Technology develops the manned airborne platform future joint warfighting capabilities to promptly engage regional forces in decisive combat on a global basis and to employ a range of capabilities more suitable to actions at the lower end of the full range of military operations, which allow achievement of military objectives with minimum casualties and collateral damage. This element adheres to Tri-Service Reliance Agreements and supports the Department of Defense Science and Technology Strategy, which coordinates and minimizes duplication of aircraft technology efforts. The individual Navy aircraft technology exploratory efforts are selected to fill technology gaps that are in the United States Air Force, Army, National Aeronautics and Space administration, Advanced Research Projects Agency and industry programs, which if successfully demonstrated, would meet Navy aviation needs.

(U) Aircraft Technology addresses the Fixed Wing Vehicle Technology Development Approach (FWVTDA), which

develops goals and payoffs from both the operational user's and system & technology developer's perspective. The FWVTDA is a joint Service, Agency and industry process. At the Project Reliance Joint Director of Laboratories (JDL) airframe fixed wing component taxonomy level, goals include Aerodynamics, Flight Control, Subsystems, Structures and Maritime Aircraft Unique. The following reflects the Joint Subsystem Level goals for fighter/attack aircraft for the year 2000 (baseline F-22 & F-18E/F), incorporating technology integration: 20% reduction in development costs; 30% reduction in support costs; 30% reduction in signature; 10% increase in lift-to-drag; 25% reduction in weight fraction; 33% increase in component service life; 40% increase in reliability; 10% reduction in seabased support volume; 10% increase in the safety of launch & recovery operations

(U) Aircraft Technology also addresses the Rotary Wing Vehicle Technology Development Approach (RWVTDA). At the Project Reliance JDL rotary wing component taxonomy level, goals include Aeromechanics, Flight Control, Subsystems and Structures. The following reflects the joint Subsystem Level goals for cargo/utility rotary wing air vehicles for the year 2000 (baseline V-22 & UH-60): 13% reduction in structural weight/Hover-Out-of-Ground Effect weight ratio; 8% increase in rotorcraft maximum lift/drag ratio; 25% reduction in radar cross section; 35% reduction in infrared signature; 35% reduction in visual/electro-optical signature; 4dB reduction in acoustic radiation; 40% reduction in vibration; 20% reduction in development time; 25% reduction in procurement cost/pound structural weight; 25% reduction in maintenance costs/flight hour/installed shaft horsepower; Improvement in handling qualities (Cooper-Harper Rating 4); 30% reduction in number of flight safety components; 20% increased hardening to threats.

(U) Other Joint Subsystem Level quantified goals are addressed under specific Defense Technology Area Plans (TAPs): Aeropropulsion (by year 2003; baseline engine FY 119 for fighter/attack aircraft, T700/T406 for patrol/transport/rotary wing aircraft, and F107 for missiles/UAVs): 100% increase in thrust-to-weight, 35% reduction in acquisition & maintenance cost, 40% reduction in fuel consumption, and 120% increase in specific thrust. Aircraft Power (by year 2000; baseline F-18E/F & F-22): Eliminate hydraulic system; 250% increase in reliability; 50% reduction in engine bleed air. Integrated Avionics (by year 2005): 50% reduction in cost for multifunciton RF avionics. Cockpit/Displays (by year 2000; baseline F-18E/F & F-22): Achieve crew safe escape to 700 KEAS; Increase G-protection to 12 Gs; Achieve 300 sq.in. flyable flat panel display; Achieve ejection-safe Helmet Display for off-boresight targeting.

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEETDATE: March 1996

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602122N
PROGRAM ELEMENT TITLE: Aircraft Technology

(U) Due to the sheer volume of efforts included in this Program Element, the programs described in the Accomplishment Plans sections are representative selections of the work included in this program element.

(U) JUSTIFICATION FOR BUDGET ACTIVITY: This program is budgeted within the APPLIED RESEARCH Budget Activity because it investigates technological advances with possible applications toward solution of specific Naval problems, short of a major development effort.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1995 ACCOMPLISHMENTS:

- (U) ($6,310) PROPULSION:
  - (U) Completed:
    - (U) The development and transition of advanced technology low spool components for fighter/attack aircraft technology demonstrator engines that meet the Integrated High Performance Turbine Engine Technology (IHPTET) goals and highlight increased performance, life, reliability and maintainability goals with respect to improving the capabilities of advanced Navy carrier-based aircraft.
    - (U) Testing of the Navy Subsonic Core compressor and the axially staged, high stability combustor in the 6.3 Advanced Turbine Engine Gas Generator. A 25% increase in stage loading, 3% increase in efficiency and +600 F increase in combustor exit temperature over the YF-119 baseline were demonstrated.
    - (U) Testing of the IHPTET Phase II aft swept fan in a rig facility. A 4% increase in efficiency was demonstrated.
    - (U) Demonstration testing of Opto-Electronic Control system. This sensor and control system reduces engine weight by 50 pounds and provides electromagnetic interference protection for carrier suitability.

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEETDATE: March 1996

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602122N
PROGRAM ELEMENT TITLE: Aircraft Technology

- (U) ($7,232) AIR VEHICLE:
  - (U) Completed:
    - -- (U) Development of advanced crew station concepts and performance evaluation metrics.
    - -- (U) Development of the Smart Aircraft Vehicle Management prototyping system and demonstrated its use with selected architectures and smart components.
    - -- (U) Development of metal matrix aircraft arresting tail hook to reduce weight and extend life.
    - -- (U) Demonstration of the ability to calculate the radar cross section of a full scale aircraft at 1 GHZ.

- (U) ($5,684) DYNAMICS OF FLIGHT:
  - (U) Completed:
    - -- (U) New design/analysis methodologies in aerodynamics for better performance through vortex flow control and increased correlation of wind tunnel models, computational fluid dynamic models, and actual aircraft testing.

- (U) ($2,292) SEABASED AIRCRAFT ADVANCED SUPPORT (formerly Seabased Aircraft Support):
  - (U) Completed:
    - -- (U) Development and demonstration of an Advanced Aircraft Tracking System that will provide accurate aircraft tracking, identification and position/rate information under all seabased environmental conditions.
    - -- (U) Detailed design of Remote Light Detection and Ranging (LIDAR) software for measuring the turbulent wind flow fields which adversely affect seabased aircraft launch and recovery operations aboard all aviation capable ships.

- (U) ($4,169) OXIDE PURPLE:
  - (U) Classified.

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEETDATE: March 1996

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602122N
PROGRAM ELEMENT TITLE: Aircraft Technology

2. (U) FY 1996 PLAN:

- (U) ($6,489) PROPULSION:
  - (U) Initiate:
    - (U) Development of moderate bypass ratio fan to meet Phase III goals.
    - (U) Design of a reduced part count Phase III advanced combustor with an integral fuel nozzle/diffuser concept.
    - (U) Development of a reduced parts, simplistic design engine fuel metering system that will reduce shipboard maintenance and reduce engine weight by 50 pounds.
  - (U) Continue to:
    - (U) Test the Phase II forward swept Joint Technology Demonstrator fan in a rig facility. The fan will eliminate a fan stage to improve logistics of parts supply. It will increase efficiency by 4% as compared to the F414 fan.
  - (U) Complete:
    - (U) Fabrication of high pressure turbine rotor system with a dual alloy disk. The design will provide turbine temperature capability improvement of 600 F, cooling flow reduction of 35% and weight reduction of 10%.
    - (U) Fabrication and test of a full set of first-stage, vaneless, counterrotating low-pressure turbine blades, yielding a reduction in weight and cooling requirements over current technology.
    - (U) Rig test and final design of fan, low pressure turbine, augmentor and controls components in preparation for 1997 IHPTET Phase II demonstration.
    - (U) Testing of a turbine blade and vane in an advanced gas generator. A 600 F increase in turbine inlet temperature will be demonstrated. The fabrication utilized advanced manufacturing techniques that reduced costs by 20%. The turbine system will provide increased capability for Navy Patrol/Transport aircraft applications.

- (U) ($7,862) AIR VEHICLE:
  - (U) Initiate:
    - (U) Development of an Intelligent Vehicle Management System for vehicle diagnostics, mediation, and

pilot aiding in response to aircraft damage and subsystems failures.

-- (U) Development of Electric Power Generating System hardware which incorporates superconductivity technology.

-- (U) Design, fabricate and test an advanced programmable image warping capability within the context of an ongoing, minature flat panel display.

- (U) Continue to:

-- (U) Develop composite low cost integral stiffener concept with improved load carrying capability.

-- (U) Demonstrate Voice Recognition & Synthesis and helmet-mounted display/head tracker technology integration. Full-mission flight simulators will be used to validate the performance benefits.

-- (U) Demonstrate multi-function programmable display pad designs, including high definition technology flat panel displays.

-- (U) Demonstrate through lab & flight testing, sensor, display, avionics architecture, and image processing integration, the Cyborg Eye concept of pilot visual/display system enhancement.

-- (U) Develop new thermal management approaches to economically cool next generation avionics.

- (U) Complete:

-- (U) Testing and evaluation of a damped composite aircraft centerbody structure, started in FY91, to demonstrate vibration and dynamic effects alleviation. The lifetime and safety margin of this structure increased, while the combined weight and volume of the active control and redesigned structure was reduced.

-- (U) Demonstration of Smart Metallic Structures to perform real-time assessments and monitoring of damage and fatigue life.

-- (U) Demonstration of the ability to perform post repair, non-destructive inspection of aircraft composite structures that would be suitable for use aboard aircraft carriers.

-- (U) Testing of the Power Management & Distribution for a More Electric Aircraft and the Integrated Power Unit in coordination with U.S. Air Force Wright Labs.

-- (U) Design feasibility testing & documentation of prototype self-regulating cartridges for advanced escape systems.

- (U) ($8,710) DYNAMICS OF FLIGHT:
  - (U) Initiate:
    - (U) Development and demonstration of advanced outer loop flight control algorithms to substantially improve the mission effectiveness, survivability, and lethality for both current and future Naval aircraft.
    - (U) Development of cost sensitivity and Life Cycle cost prediction models for system level component integration in maritime aircraft.
    - (U) Design, fabrication, and risk reduction ground testing of a near-flight quality Vectored Thrust Ducted Propeller Concept.
  - (U) Continue to:
    - (U) Integrate and test an intelligent (learning augmented) flight control system on a real-time piloted flight simulation.
    - (U) Develop and evaluate control laws to assist the pilot in outer-loop control functions.
    - (U) Develop On-Board Expert Diagnostic Systems for reduced maintenance and increased aircraft availability.
    - (U) Evaluate improved weapon carriage techniques for application to advanced tactical aircraft.
  - (U) Complete:
    - (U) Wind tunnel tests of a small scale model to investigate the aerodynamic performance and the rotor dynamics in hover and in wing-borne flight, to determine the feasibility of the Canard/Rotor Wing concept.
    - (U) Application of artificial intelligence techniques for evaluating aircraft handling qualities.

- (U) ($1,200) SEABASED AIRCRAFT ADVANCED SUPPORT (formerly Seabased Aircraft Support):
  - (U) Initiate:
    - (U) Development of high fidelity analysis models which accurately simulate the dynamic interaction between the airwakes of small ships and the flight dynamics of helicopters during launch & recovery operations. These models will be used to expand the safe launch & recovery envelopes for a wide range of environmental conditions (wind velocities, sea states, etc.).
  - (U) Continue to:

- (U) Develop Remote LIDAR Sensor for measuring turbulent wind flow fields. Included will be a landbased sensor performance evaluation.

• (U) ($5,250) OXIDE PURPLE:
- (U) Classified.

(U) ($ 281) SMALL BUSINESS INNOVATION RESEARCH (SBIR)
(U) Portion of extramural program reserved for small business inovation research assessment in accordance with 15 U.S.C.368.

3. (U) FY 1997 PLAN:
• (U) ($6,807) PROPULSION:
- (U) Initiate:
  - (U) Development of Phase III compressor, turbine, and control components for integration into an 6.3 Advanced Turbine Engine Gas Generator demonstrator.
  - (U) Design of Phase III components that will increase the affordability and reliability of Navy subsonic support aircraft.
- (U) Continue to:
  - (U) Test Phase III Joint Technology Demonstrator Engine fan.
  - (U) Design the Phase III Advanced Gas Generator/Joint Technology Demonstrator Engine combustor.
  - (U) Design advanced corrosion resistant mechanical components to reduce dynamic seal leakage and increase rotor speed capability to meet Phase III goals.
- (U) Complete:
  - (U) Design for Phase III Joint Technology Demonstrator Engine combustor.
  - (U) Flight testing of electronic engine control system with Wright Labs. The system design, will utilize ruggedized optic connectors and combine optics and electronics on one chip to minimize size and weight.
  - (U) Fabrication, assembly and testing in a 6.3 demonstrator engine of additional IHPTET Phase II advanced fan, compressor, combustor, high/low turbine, augmentor, bearings, and controls technologies.

This will be transferred to the 6.3 engine demonstration of 60% improvement on thrust/weight and 30% reduction in fuel consumption over a YF-119 engine.

- (U) ($5,689) AIR VEHICLE:
  - (U) Initiate:
    - (U) Development of Smart Composite Structures which incorporate health monitoring capabilities for accurate damage identification and assessment to develop a condition based diagnostic system.
    - (U) Development of repair techniques for highly curved, composite aircraft structures applicable to aircraft inlet duct and exhaust nozzle structures.
  - (U) Continue to:
    - (U) Demonstrate hardware and software for advanced high definition Visually-Coupled Displays for sensor fusion and precision real time retargeting, threat warning, and extended aircraft/aircrew vision under adverse attitude, maneuvering, and environmental conditions.
    - (U) Demonstrate new thermal management approaches to economically cool next generation avionics.
    - (U) Develop a robust composite sandwich structure. This is a joint program with the US Air Force; the Navy is developing the analysis methodology for the structural joints.
    - (U) Develop an intelligent fault tolerant Vehicle Management System.
    - (U) Evaluate health monitoring concepts for composite structure, using innovative sensors and techniques such as neural networks for damage identification and assessment to develop a condition based diagnostic system.
    - (U) Develop visual/electro-optical signature prediction and detection tool for fixed wing tactical aircraft.
    - (U) Continue design, fabrication and test of advanced programmable image warping capability within the context of an ongoing minature flat panel display.
  - (U) Complete:
    - (U) Demonstration of composite low cost integral stiffener concept with improved load carrying capability.

- (U) ($4,000) DYNAMICS OF FLIGHT:

- (U) Continue to:
  - -- (U) Demonstrate artificial intelligence Cooper-Harper Ratings System for flying qualities evaluations on a high fidelity man-in-the-loop simulation.
  - -- (U) Perform real-time demonstrations of integrated environment and aircraft models for shipboard dynamic interface to be correlated with LIDAR turbulent ship wind flow data.
  - -- (U) Develop and evaluate control laws to assist the pilot in outer-loop control functions (i.e., control of acceleration, as well as other dynamic aspects of the air vehicle).
  - -- (U) Develop techniques for performing detailed two-dimensional and three-dimensional analyses for evaluating high lift aerodynamic concepts.
  - -- (U) Develop a combined Computational Fluid Dynamics/Finite Element Method (CFD/FEM) design/analysis tool for accurately predicting aerodynamic loads of and designing the structure for aircraft empennages.
  - -- (U) Improve capability, during Exploratory Development, in the evaluation of the life cycle cost and affordability impact of technology advances for use in the development of future aircraft concepts. Efforts to be coordinated with JAST, F/A-18E/F, V-22, other Services and industry.

- (U) ($0) SEABASED AIRCRAFT ADVANCED SUPPORT:
  - (U) Cessation of efforts for one year as a result of OSD funding cut.

- (U) ($ 4,082) OXIDE PURPLE:
  - (U) Classified.

B. (U) PROGRAM CHANGE SUMMARY:

	FY 1995	FY 1996	FY 1997
(U) FY 1996 President's Budget:	28,622	22,238	26,328

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEETDATE: March 1996

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602122N
PROGRAM ELEMENT TITLE: Aircraft Technology

(U) Adjustments from FY 1996 PRESBUDG:	-2,935	7,554	-5,750
(U) FY 1997 PRES Budget Submit:	25,687	29,792	20,578

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: FY 1995 reduction includes a combination of a Congressional S & T rescission (-$2,682) and program adjustments (-$253). FY 1996 reflects Congressional increase (+$8,500) and Congressional undistributed reductions (-$585) and revised DoD inflation estimates (-361). FY 1997 changes include; pricing adjustments (-$165); reduced program requirements (-$4,963); and revised DoD inflation estimates (-$622).

(U) Schedule: FY 97 - Reduction in initiation & scope of efforts in all areas.

(U) Technical: FY 97 - Loss of technology efforts under seabased aircraft support due to one year delay of all technology supporting this program.

C. (U) OTHER PROGRAM FUNDING SUMMARY: Not applicable.

(U) RELATED RDT&E: This program adheres to Tri-Service Reliance Agreements on Air Vehicles (Fixed), Air Vehicles (Rotary), Integrated Avionics, and Aeropropulsion with oversight provided by the Joint Directors of Laboratories.

(U) Work in this Program Element (PE) is related to and fully coordinated with efforts in the following PEs:
- (U) PE 0601101F (Geophysics)
- (U) PE 0601102F (Materials)
- (U) PE 0601153N (Defense Research Sciences)
- (U) PE 0602201F (Aerospace Flight Dynamics)
- (U) PE 0602202F (Human Systems Technology)
- (U) PE 0602203F (Aerospace Propulsion)

(U) PE 0602204F (Aerospace Avionics)
(U) PE 0602233N (Readiness, Training and Environmental Quality Technology)
(U) PE 0602234N (Materials, Electronic and Computer Technology)
(U) PE 0602708E (Cockpit Autonomous Landing)
(U) PE 0603003A (Rotary Wing Aircraft Technology)
(U) PE 0603106F (Logistics Systems Technology)
(U) PE 0603112F (Advanced Materials)
(U) PE 0603202F (Aerospace Propulsion Subsystems Integration)
(U) PE 0603205F (Flight Vehicle Technology)
(U) PE 0603211F (Aerospace Structures)
(U) PE 0603216F (Aerospace Propulsion and Power Technology)
(U) PE 0603217N (Air Systems and Weapons Advanced Technology)
(U) PE 0603231F (Crew Systems and Personnel)
(U) PE 0603245F (Advanced Flight Technology Integration)
(U) PE 0603706N (Medical Development(Advanced))
(U) PE 0603792N (Advanced Technology Demonstrations)

(U) Advanced Technology Transition in accordance with the ongoing Reliance joint planning process and contains no unwarranted duplication of effort among the Military Departments.

D. (U) SCHEDULE PROFILE: Not applicable.

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: March 1996

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602131M
PROGRAM ELEMENT TITLE: Marine Corps Landing Force Technology

(U) COST (Dollars in thousands)

PROJECT NUMBER & TITLE	FY 1995 ACTUAL	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
Marine Corps Landing Force Technology	16,749	16,917	17,093	19,049	20,809	20,832	21,390	CONT.	CONT.

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This program is the only Department of Defense APPLIED RESEARCH program that develops the technologies needed to support Marine Corps expeditionary forces warfighting requirements, which are unique for land combat forces due to the amphibious/littoral entry into the battlespace. The primary focus of this program is Landing Force Technology in direct support of Marine Corps needs as defined in pertinent documents. It also collaterally supports the following Joint Mission Areas: Strike, Littoral Warfare, and Surveillance. This is a continuing program based on an annual review of progress, needs, and emerging technology opportunities.

(U) By law, the National Security Act of 1947, the Marine Corps is tasked to develop those phases of amphibious operations that pertain to doctrine, tactics, techniques, and equipment used by the landing force, and which are of common interest to the Army. This Program Element (PE) and its associated Technology Program Plan MQ1A cover eight major technology thrusts that will lead to new or improved capabilities in a variety of functional areas.

(U) Affordability has always been an important aspect of the Marine Corps' investment strategy. The Marine Corps Science and Technology (S&T) program makes every effort to assess the affordability of its technology projects and to optimize investment opportunities. Under the Operational Maneuver From The Sea (OMFTS) scenario, supplies need to be moved from a sea-base offshore (up to 200 nm) to multiple delivery points (up to 60 miles inland) in potentially difficult sea-state conditions. OMFTS demands for a given operation far exceed the current Marine Corps Combat Service Support (CSS) capabilities. Technologies being developed will reduce the demand on shore and/or increase the CSS system capabilities by increasing material transport capabilities, reducing tare weight, developing lightweight and more productive engineer and material handling equipment, transferring maximum service support capability from shore to sea-base, and improving ship to shore transfer efficiency. Capabilities to provide In-Transit Visibility and Total Asset Visibility of supplies and equipment

orldwide are being developed to operate in conjunction with Very Low Frequency satellites. Cost effective efforts are nderway to minimize or eliminate the corrosion related degradation of current and future Marine Corps systems, therefore, ncreasing system life.

U) Due to the sheer volume of efforts included in this PE, the programs described in the Accomplishments and Plans sections re representative selections of the work included in this PE.

U) JUSTIFICATION FOR BUDGET ACTIVITY: This program is budgeted within the APPLIED RESEARCH Budget Activity because it nvestigates technological advances with possible applications toward solution of specific Naval problems, short of a major levelopment effort.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1995 PLAN:

- (U) ($2,610) Surface Mobility: Completed fabrication of the Joint Tactical Electric Vehicle. Conducted initial performance testing and demonstrations. Completed evaluation of Articulated Electric Drive Trailer. Completed fabrication and testing of Inductive Coupler technology. Continued Corrosion Prevention and Control development, procurement, and testing. Developed system level concepts and technology roadmap of future surface mobility assets supporting OMFTS. Awarded Broad Agency Announcement (BAA) contracts.

- (U) ($2,600) Mine Detection: Continued Automatic Target Recognition effort. Transitioned program to Coastal Battlefield Reconnaissance and Analysis (COBRA) Advanced Technology Development (ATD), PE 0603640M. Completed design and fabrication of a tunable filter multi-spectral camera. Initiated investigation of alternate sensor technologies for mine detection, especially in adverse environments (rain, fog, turbid water). Initiated multi-spectral visible/thermal infrared camera image fusion investigation for cued mine detection. Received and evaluated BAA responses.

- (U) ($2,512) Mine Countermeasures: Executed selected BAAs to emulate threat capabilities. Conducted full scale tests in mechanical mine neutralization. Completed definition of surrogate mine countermeasures systems requirements. Evaluated countermeasures techniques. Completed modelling and simulation and conducted system demonstration.

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: March 1996

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602131M
PROGRAM ELEMENT TITLE: Marine Corps Landing Force Technology

- (U) ($2,074) Marine Air-Ground Task Force (MAGTF) Command, Control, Communications, Computers and Intelligence (C4I): Demonstrated Tactical Cellular System. Completed Phase I contracts for Over The Horizon (OTH) Communications hardware/software specification and design. Expanded artificial intelligence and transitioned Amphibious Assault Planner to the Program Manager for MAGTF C4I. Demonstrated a prototype battalion level, field-capable, tactical simulator and decision aid. Demonstrated a prototype field Korean/English language translator system for tactical reporting and air/ground support request.

- (U) ($1,318) Survivability: Completed source selection for false target generator effort. Continued joint participation with Advanced Applied Research Agency in Advanced Land Concepts Systems Generation II, Phase II. Continued work in evaluating new materials for armor system applications. Initiated development of Electro-Armor Systems for Marine Corps specific applications. Continued optimization of ceramic-metal armor technologies. Defined Tactical Decal specification and vehicle integration.

- (U) ($3,015) Advanced Amphibious Logistics: Completed system concept for Recording and Tracking. Proposed first concept for system configuration integration for Recording, Tagging, and Tracking. Developed Expeditionary Engineering Technologies concepts. Developed Bulk Liquid system concept. Initiated sea-basing cargo transfer technologies support efforts. Awarded selected BAAs in support of roadmap. Demonstrated 3 Kilowatt generator.

- (U) ($1,920) Targeting Sensors: Demonstrated Integrated Fire Control (IFC) System. Conducted "all-up" demonstration of Expendable Acoustic Remote Sensor. Completed Gated Laser Video System proof of concept and prepare for transition to Marine Corps ATD, PE 0603640M. Awarded selected BAAs.

- (U) ($700) Weaponry: Demonstrated Mobile Automatic Fire Support System auto-loader mortar and transitioned to the Program Manager for Ground Weapons. Demonstrated advanced concepts in point recognition projectile jointly with the Army. Evaluated and awarded BAAs.

2. (U) FY 1996 PLAN:

- (U) ($2,709) Surface Mobility: Complete testing of the Joint Tactical Electric Vehicle and transition technology to Marine Corps ATD, PE 0603640M. Complete Inductive Coupler tests and transition technology to Marine Corps ATD. Continue development and execution of Surface Mobility Program Plan and technology roadmap. Refine system concepts for supporting power projection and sustainment by

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conducting performance, cost and technological risk trade-offs. Continue Corrosion Control investigations and tests.

- (U) ($2,000) Mine Detection: Complete Automatic Target Recognition efforts. Procure experimental prototype tunable filter multi-spectral camera. Assess passive millimeter wave technology shortfalls and solicit BAA responses to correct. Initiate transition to Marine Corps ATD's, PE 0603640M, to start in FY 1997. Design and fabricate feasibility demonstration sensor device for mine detection in adverse environments (rain, fog, turbid water); begin laboratory tests. Solicit BAA responses to extend the standoff range for multi-spectral mine detection and improved buried mine detection. Demonstrate visible/thermal image fusion technologies; transition to Demonstration/Validation COBRA follow-on program, PE 0603635M, Marine Corps Ground Combat/Support Arms System, Project C2247, as a product improvement.

- (U) ($2,200) Mine Countermeasures: Continue technology search for advanced mine kill mechanisms through BAA solicitation and award with the goal of reducing weight and volume and increasing effectiveness over more difficult surfaces and barriers. Complete full scale testing of mechanical mine neutralization. Complete Off/Route Smart Mine breadboard and key countermeasures concept testing. Complete evaluation of countermeasures techniques and transition activities to the Army (joint effort with Belvoir Research and Development Center (BRDEC), Ft. Belvoir, Virginia) and Program Manager. Complete vehicle landmine survivability system demonstrations and transition activities to the Army (joint effort with BRDEC) and Program Manager. Continue execution of selected BAAs to develop countermeasures techniques. Test countermeasures breadboard systems versus emulator. Model countermeasures effectiveness.

- (U) ($2,894) MAGTF C4I: Complete Phase II contracts for OTH Communications and provide demonstration of Block I prototypes. Demonstrate intelligent automated landing plan generator. Provide complete order of battle capability for battalion level, tactical simulator and demonstrate. Expand field language translator system to provide briefing capability. Perform Phase I technology application for collaborative planning and decision aids. Exercise cellular communications in support of joint operations. Expand joint countermeasures C4I architecture to support OMFTS.

- (U) ($1,361) Survivability: Continue development of Electro-Armor systems. Continue ceramic-metal development and integration into Marine Corps specific vehicles and systems. Continue Low Observable efforts. Continue false target generator efforts. Continue Advanced Land Concepts Systems Generation II efforts, Phase II. Continue work

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in evaluating new materials for armor system applications.

- (U) ($2,566) Advanced Amphibious Logistics: Select and award BAA contracts in support of technology roadmap. Complete Recording and Tracking system configuration integration. Complete Expeditionary Engineering Technologies system concepts. Begin concept validation. Complete validation of Amphibious Bulk Liquid Technology system configuration. Continue developing technology concepts for sea-basing cargo transfer technologies. Initiate technology support efforts for Maritime Prepositioning Force operations technology. Solicit BAA responses for demonstratable system components to support concepts and follow-on Marine Corps ATD efforts in PE 0603640M.

- (U) ($2,306) Targeting Sensors: Complete advanced testbed development. Transition Gated Laser Video System to Marine Corps ATD, PE 0603640M. Start development of sensor registration, sensor orientation, multiple sensor data fusion, and sensor communications and tactical target tracking in near perfect real-time tactical IFC System. Continue to exploit emerging technology through the BAA process.

- (U) ($714) Weaponry: Complete autoloader and transition technology to Program Manager, develope concepts for inexpensive, autonomous and guided, mortar rounds for the auto-load system. Analyze technology deficiencies, and continue to nullify those deficiencies through the BAA process.

- (U) ($82) Modeling and Simulation: Continue definition and development of environmental features of the littoral battlespace (land, air, sea) for applications in virtual prototyping and the advanced training device. The environmental features will include the various sensor media being exploited in other Applied Research efforts. Explore new concepts using legacy and emerging Navy and Marine Corps communications assets to support at sea construction and virtual training.

- (U) ($85) Portion of extrammural program reserved for Small Business Innovation Research assessment in accordance with 15 U.S.C.638.

3. (U) FY 1997 PLAN:

- (U) ($2,823) Surface Mobility: From technology roadmap of future surface mobility assets, select and award BAA contracts for high pay-off thrust areas. Continue detailing sustainment concept of integrating advanced development systems and components. Analyze synergistic effect of the high technologies and determine operational

suitability. Transition new systems and demonstrate in Marine Corps ATD PE 0603640M. Continue Corrosion Control and transition promising materials and processes to Marine Corps ATD.

- (U) ($1,492) Mine Detection: Complete tests of alternate sensor device for mine detection in adverse environments to quantify performance; analyze remaining technology shortfalls and solicit BAA responses to correct. Initiate transition to Marine Corps ATD, PE 0603640M to start in FY 1998/FY 1999. Continue development of technologies to extend the standoff range for multi-spectral mine detection and improved performance for buried mine detection.

- (U) ($1,750) Mine Countermeasures: Complete development and testing of countermeasures techniques. Demonstrate countermeasures capability in field environment. Complete modeling and simulation efforts directly related to Mine Countermeasures.

- (U) ($3,207) MAGTF C4I: Continue efforts in developing OTH Communications capability for landing forces. Complete prototype tactical simulator and demonstrate. Develop C4I information transfer and management architectural specification based on Marine Corps requirements and technology search. Initiate Phase II collaborative planning and decision making effort. Identify computer hardware technology and investigate ability of improving speak-easy radio technology for man-portable scenarios.

- (U) ($1,200) Survivability: Continue development and integration of Electro-Magnetic Armor systems. Continue tactical decal work with specific application, test and evaluation. Continue false target generator efforts with system integration into overall vehicle system. Continue Advanced Land Concepts System Generation II, Phase II participation. Continue new material armor evaluation and optimization.

- (U) ($2,981) Advanced Amphibious Logistics: Complete configuration integration for Amphibious Bulk Liquid technologies and Expeditionary Engineering technologies. Complete technology system concepts and begin concept validation for sea-basing cargo transfer technologies. Develop technology concepts for Maritime Prepositioning Force operations technology.

- (U) ($2,600) Targeting Sensors: Continue to demonstrate sensor registration, sensor orientation, multiple sensor fusion, and communication links components for real-time tactical IFC System. Develop concepts for remotely programmable adaptive sensors. Continue to exploit technology through the BAA process.

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: March 1996

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602131M
PROGRAM ELEMENT TITLE: Marine Corps Landing Force Technology

- (U) ($772) Weaponry: Demonstrate components of lightweight, close-in Air Defense Systems. Demonstrate components of autonomous-guided, auto-loader mortar rounds. Continue to exploit emerging lightweight weapons technology through the BAA process.

- (U) ($268) Modeling and Simulation: Continue development of environment features of the littoral battlespace. Explore new concepts using legacy and emerging Navy and Marine Corps communications assets to support at sea construction and virtual training.

B. (U) PROGRAM CHANGE SUMMARY:

	FY 1995	FY 1996	FY 1997
(U) FY 1996 President's Budget:	16,774	17,623	18,040
(U) Adjustments from 1996 PRESBUDG:	-25	-706	-947
(U) FY 1997 PRESBUDG Submit:	16,749	16,917	17,093

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: FY 1995 reduction (-25K) due to Execution Adjustment. FY 1996 reduction consists of (-335K) for Undistributed Congressional Reductions, and (-371K) for revised DOD inflation rates. FY 1997 reduction consists of (-518K) revised DOD inflation estimates and (-429K) for minor pricing adjustments.

(U) Schedule: Not applicable.

(U) Technical: Not applicable.

C. (U) OTHER PROGRAM FUNDING SUMMARY: Not applicable.

(U) RELATED RDT&E:

000069

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: March 1996

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602131M
PROGRAM ELEMENT TITLE: Marine Corps Landing Force Technology

(U) This program adheres to Tri-Service Reliance Agreements in Chemical/Biological Defense; Command, Control and Communications; Conventional Air/Surface Weaponry; Electronic Devices; Ground Vehicles; Ships and Watercraft; Manpower and Personnel; and Training Systems.
(U) PE 0603606A (Improved Dispersed Explosives Technology)
(U) PE 0603619A (Improved Dispersed Explosives Technology)
(U) PE 0603611M (Marine Corps Assault Vehicles)
(U) PE 0603635M (Marine Corps Ground Combat/Support System)
(U) PE 0603640M (Marine Corps Advanced Technology Demonstrations)
(U) PE 0602232N (Space and Electronic Warfare Technology)
(U) PE 0603782N (Shallow Water Mine Countermeasures Demonstrations)
(U) The Army, Air Force, and Navy Technology Base Programs are monitored by Marine Corps Project Officers through their counterparts in those organizations to ensure that no unwarranted duplication exists.

D. (U) SCHEDULE PROFILE: Not applicable.

000070

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: March 1996

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602232N
PROGRAM ELEMENT TITLE: Space & Electronic Warfare (SEW) C3 Technology

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 1995 ACTUAL	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
Space & Electronic Warfare (SEW) Technology	61,005	58,186	56,159	62,920	69,697	71,036	72,922	CONT.	CONT.

(U) Mission Description and Budget Item Justification: This PE supports future command, control, communications (C^3) and surveillance systems for surface, air, and space platforms for Naval Warfare. This program develops C^3 technologies necessary for the delivery of critical tactical information to decision makers in a timely manner and for the transmission, fusion, and management of information between the warrior, the command center, and National Command Authorities. Technology developments include: connectivity, networking, distributed computer processing, multilevel security, information management, information warfare, decision support and navigation. The major goal is to provide the Navy with the capacity to interconnect government and commercial telecommunication assets in a worldwide network that is responsive to regional theater challenges and the National interest. Surface/Aerospace Surveillance technology development supports theater surveillance, Battle group area surveillance, ship self defense, air battle space surveillance and surveillance to support strike missions. Both C^3 technology and surveillance technology are related to the Joint Mission Areas of Joint Strike Warfare, Littoral Warfare, Joint Surveillance, and Space-Electronic Warfare-Intelligence (SEW/I). Specifically: Joint Strike efforts address technology issues in real-time targeting and Battle Damage Assessment (BDA). Programs include mission planning, en route C^3, precision targeting and BDA. Littoral Warfare efforts address issues in air and surface battlespace and develops technology for ship self-defense, cooperative engagement and power projection systems including ship-based and off-ship radar and electro-optic/infrared, Electro Optical/Infrared (EO/IR) sensors, connectivity and robust enduring communications. Joint Surveillance efforts address issues of real-time targeting, connectivity, counter-jamming and deception. Program includes multi-platform radar and IR sensors for detection, identification, tracking, BDA, and timely distribution of surveillance information to all levels of command. SEW/I efforts address information warfare Common Tactical Picture, battle management and connectivity. Programs include sensors

and C^3 to provide timely situation awareness of the total battlespace and indications and warning of threat operations and intentions.

(U) These efforts support the Joint Warfare Strategy "Forward... From the Sea". Programs are jointly planned in the Reliance process with the United States Air Force (USAF), Army and other agencies through technology panels of the Joint Directors of Laboratories (JDL).

(U) Due to the sheer volume of efforts included in this Program Element, the programs described in the Accomplishments and Plans sections are representative selections of the work included in this program element.

(U) JUSTIFICATION FOR BUDGET ACTIVITY: This program is budgeted within the Applied Research Budget Activity because it investigates technological advances with possible application towards solution of specific Naval problems short of a major development effort.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1995 ACCOMPLISHMENTS:

- (U) ($22,742) RADAR TECHNOLOGY

(U) Developed radar survivability waveforms and power management technology to reduce radar vulnerability to anti-radiation missiles. DoD coordination is via Joint Active System Survivability Working Group.
(U) Developed system architecture for compact multi-mode radar (Synthetic Aperture/Inverse Synthetic Aperture/Moving Target Indicator) for airborne surveillance and identification of both land and ocean surface targets in the littoral environment.
(U) Designed ultra-wideband space fed phased array for multi-target tracking while scanning and to overcome radar multi-path problems.
(U) Signal processing and algorithms that enabled fleet AN/APS-137 radars to automatically identify ship targets.
(U) Designed voltage controlled diode affordable phased array. The goal is a 70% reduction in cost.

(U) Developed Space-Time-Adaptive-Processing (STAP) for Mountain Top Phase II experiments. Cost is a major issue in phased arrays. STAP technology will significantly reduce effects of jamming and clutter on radar performance in detecting low altitude targets in land and sea background environments.
(U) Fabricated and completed acceptance testing of brassboard multi-channel coherent wideband radar for ship self-defense evaluation.
(U) Transitioned high frequency (HF) radar technology to HF Surface Wave Radar Advanced Technology Demonstration (ATD). The ATD will quantify the over-the-horizon detection and tracking capability of HF radar in an at-sea shipboard operational environment.

- (U) ($13,770) EO/IR TECHNOLOGY

(U) Designed and conducted performance assessment of signal processor architecture and algorithms for Multi-Color shipboard Infrared Search and Track (IRST) sensor to enable rapid, low false alarm rate, detection and tracking of low altitude, low contrast targets at the sensor horizon (Joint with Army).
(U) Developed Shared aperture (Television (TV), Forward Looking Infrared (FLIR), IRST) EO Sensor for surveillance and targeting of air and surface targets from fighter/attack multi-mission aircraft. Coordinated with USAF and Army.
(U) IR background measurement and modeling program emphasized multi-nation assessment and validation of environmental effects models. Database is widely used by U.S. and International infrared sensor designers.
(U) Developed multi-hyper spectral EO sensor for airborne surveillance of land targets (Joint with Air Force).
(U) Developed system concept and architecture for integrated active/passive IR sensor for surveillance, precision track and IR target recognition.
(U) Conducted IR measurement and analysis of cloud wake phenomonology from National Oceanographic Atmospheric Administration (NOAA) space platforms to determine detectability of surface ships transiting beneath cloud cover (Joint with United Kingdom (UK), Advanced Research Projects Agency (ARPA), and National Aeronautics and Space Administration (NASA) participation.)
(U) Conducted initial performance testing of precision EO interferometer, including imaging of stellar and orbiting objects from Lowell observatory in Flagstaff, Arizona.
(U) Completed contract effort with Societie De Applications Generales Electro-Magnetic (SAGEM) of France for development of stabilized multi-aperture optical director for ship IRST applications.

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 1996

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602232N
PROGRAM ELEMENT TITLE: Space & Electronic Warfare (SEW) C3 Technology

(U) Installed second generation mid and long wave focal plane arrays in ship IRST brassboard.
(U) Developed IR Sensor Performance Prediction Decision Aid Workstation.

- (U) ($4,244) MULTI-SENSOR TECHNOLOGY

(U) Designed compact multi-sensor surveillance system for airborne surveillance and targeting with emphasis on multi-platform utility. Multi-sensor data fusion should yield improved target detection and recognition.
(U) Developed architecture for sensor integration, adaptive resource management and data fusion.
(U) Conducted assessment of Commercial Off-The-Shelf (COTS) signal processors for military sensor applications.

- (U) ($3,140) C^3 SYSTEM ARCHITECTURE:

(U) Because of the unique features of military communications networks, there are no commercial networks that can be procured and installed directly into battlegroup networks. The Navy needs to develop military communications networks that will be compatible and allow for connectivity to fixed commercial networks. A major objective is much higher data rates than are available in current narrow band Navy communications systems. The plan is to demonstrate the capability to communicate at T3 rates (45 Mbps) over the Tri-Service Testbed. Further downstream, investigations will be conducted into extending the data rate to OC-3 rates (155 Mbps).
(U) The key technology is Asychronous Transfer Mode (ATM), initially developed for commercial, optical fiber, telecommunications networks. ATM technology for RF networks have been investigated and the first successful use of ATM over military satellite links (Defense Satellite Communications System, or DSCS) was achieved.
(U) Multicast is the transmission of messages from one to many addresses. It is used extensively by the Navy. Present standard protocol suites such as Transmitter Control Protocol/Internet Protocol (TCP/IP) do not support multicast, and there is no standard protocol package being developed for commercial application. The plan therefore has been to develop an enhanced standard multicast protocol for military networks and demonstrate it over the Tri-Service Testbed. Preliminary discussions have been held with France for developing a transport protocol for high speed networks that would support multicast services.
(U) Applied the submarine network simulation model to the Navy Submarine Communications Support System (SCSS) architecture, which is the eventual transition program.

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FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: March 1996

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602232N
PROGRAM ELEMENT TITLE: Space & Electronic Warfare (SEW) C3 Technology

- (U) ($9,345) COMMUNICATIONS:

(U) Significant improvements in military communications capabilities need to be developed to exploit commercial communications advances, particularly in boosting the data-rate capability to the commercial T1 rate, and in developing more capable antennas appropriate for military aircraft, ships and submarines. Antenna development must address the proliferation of antennas on military platforms and the potential for mutual interference. Additionally, antennas must be developed to cover the Super High Frequency (SHF) band (nominally 2-20 GHz) which previously has not been used for military communications. Not to be overlooked is the need to develop counter-communications capability that would deny or disrupt enemy communications.
(U) Continued development of key communications technologies for air, ship and submarine platforms.
(U) Conducted at-sea measurements and demonstration of the submarine on-hull Extremely Low Frequency (ELF) antenna, perform two-antenna field tests of the ELF corona antenna array, and initiate field tests of a submarine SHF antenna that has potential for achieving a significant increase in data rates and an associated reduction in time required for transfer of Tomahawk mission data updates for joint strike operations.
(U) Demonstrated a laboratory model of a reconfigurable feed network for the 3x3 aircraft antenna array panel, investigate Microwave Monolithic Integrated Circuit (MMIC) and silicon integrated circuit designs for the advanced miniaturized airborne communications relay, and adapt network protocols developed for the ship community to the air platform to accommodate a strongly connected transient network user that would make battlegroup networks interoperable with tactical data links for joint strike operations.
(U) Completed testing of the SHF multifunction antenna array and conducted tests of optical control for the antenna array, conducted on-air tests of the higher data rate Ultra High Frequency (UHF) algorithms to acquire over-water propagation statistics and establish baseline performance using simple modulation techniques, and created a more advanced high data rate LAMPS Mark III capability that would allow line-of-sight, full duplex capability up to the T3 (45 Mbps) rate.
(U) Made the HF jamming techniques data base compatible with the standard Navy TAC III computer, developed an automatic device to identify foreign languages, and transitioned the High Frequency Electronic Beam Semi-Conductor (HF EBS) power amplifier to a shipboard communications/counter-communications system.

- (U) ($6,118) COMMAND SUPPORT:

(U) Demonstrated Express Transport Protocol (XTP) integration with the real-time MACH distributed operating system.
(U) Integrated the THETA distributed operating system with the High Grade Security (HIGS) Testbed for test and evaluation.
(U) Completed and transitioned Anti-Submarine Warfare (ASW) Quality Monitoring System which allows Joint Maritime Command Information System (JMCIS) to determine data quality and relevance of tactical messages and target tracks to speed up and facilitate decision making.
(U) Developed jointly with the Air Force, based on an evolving national standard, a Common Object Request Broker Architecture (CORBA) technology allowing military implementation of distributed object-oriented data bases.
(U) Continued development of optimized multiple interdependent routing algorithms for strike warfare that incorporate joint strike/weapon capability against non-mobile targets and demonstrate graphical user interface (GUI) for routing module.
(U) Demonstrated 3-node distributed planning algorithm over a network using weapon-target algorithm to determine proper target assignments.
(U) Demonstrated intelligent object oriented image and text retrieval tools and active database to support collaborative information management.
(U) Demonstrated tools for monitoring mission plan - execution in JWID-95 exercise.

- (U) ($1,646) NAVIGATION:

(U) Completed the shipboard fiber optic gyro development and transitioned to the Naval Sea Systems Command 6.3 ship gyrocompass program, developed the design concept for a shipboard infrared stellar-inertial navigation system, tested and evaluated the superconducting gyro design for improved accuracy over conventional ring-laser gyros, and conducted simulation of video-compression algorithms with encoding for high noise environments typical of military operations as compared with the commercial environment.

2. (U) FY 1996 PLAN:

- (U) ($21,276) RADAR TECHNOLOGY:

(U) Continue:

(U) Field test of Radar Survivability/Counter Anti-Radiation Missile (ARM) Waveforms in a Low Probability of Intercept Radar testbed to assess level of immunity to anti-radiation homing seekers. This continuing multi-year effort is coordinated under Joint Service Active Systems Survivability Working Group.
(U) Development of a Testbed System for Compact-Multi-Mode Radar Synthetic Aperture Radar/Moving Target Indicator/Inverse Synthetic Aperture Radar (SAR)/(MTI)/(ISAR) for manned and unmanned aircraft surveillance of sea and land targets in littoral environments.
(U) Development of ISAR improvements for automatic ship classification for fleet AN/APS-137 radar upgrade. Coordinated with PMA-290.
(U) Development of Voltage Controlled Diode Affordable Phased Array. Continuing program is attacking the high cost of phased arrays. Technology is planned for transition to shipboard multi-function, next generation radar. Coordinated with PEO(TAD).
(U) Field test of Ultra-Wideband Radar System for ship self defense against high speed low observable missiles. This effort is coordinated with PEO(TAD).
(U) Integration and testing of Horizon Search, Track and Engagement Radar with Ship Self Defense Combat System to enable rapid engagement of anti-ship missiles. Coordinated with PEO(TAD).

(U) Complete:
(U) Mountain Top Phase II experiment for STAP for Airborne Early Warning (AEW) Radar to provide effective operation in dense clutter and jamming.
(U) Laboratory Testing of Two Dimensional Air Target Identification Algorithms. To be integrated with USAF and Navy/Airborne Platform radar for flight testing. F-14D, APG/71 is a candidate radar for flight testing.
(U) Wideband AEW Radar Testbed integration to enable evaluation of concepts for next generation AEW Radar.

(U) Initiate:
(U) Design concept for ultra wideband space fed phased array for multi-function (search, track, engage) radar.
(U) Roof Top Testing of Wideband AEW Testbed Radar to assess wideband performance against real targets.
(U) Integration of Two Dimensional Air Target Identification Algorithms in AN/APG-71 Radar Signal Processor for subsequent flight tests (Joint with USAF).
(U) Concept development for UHF electronically steered phased array for carrier based AEW aircraft.

- (U) ($12,034) EO/IR TECHNOLOGY:

(U) Continue:
(U) Real-Time Signal Processor and Algorithm development for Multi-Color IRST to enable rapid, low false alarm rate detection, track of low altitude targets at the sensor horizon (Joint with Army).
(U) Field and Flight Testing of Shared Aperture (TV, FLIR, IRST) EO Sensor for fighter/attack aircraft surveillance and targeting. Multiple transitions are planned to USAF, Army and Navy systems.
(U) IR background measurements and modeling program including IR Background Model(s) Validation with North Atlantic Treaty Organization (NATO) and The Technology Cooperative Program (TTCP) Nation Participation.
(U) Development and test of Multi-Hyper Spectral EO Sensor for Airborne Surveillance of Land targets (Joint with USAF).
(U) Development of integrated active/passive IR sensor for surveillance, ranging and target recognition.
(U) IR measurement and analysis of cloud wake phenomenology from Hi-altitude platforms to determine detectability of surface (ship) targets, transitioning beneath cloud cover. (Joint US, UK, ARPA and NASA participation).

(U) Complete:
(U) EO Interferometer at Lowell Observatory for precision imaging of aircraft and orbiting objects.
(U) Laboratory/land testing of ship Multi-Color IRST to quantify performance in a Marine environment prior to at sea trials.
(U) IR Sensor Performance Prediction Decision Aid Workstation for fleet use.
(U) Analysis of Initial Cloud Wake phenomenology experiments (Joint with U.K.)

(U) Initiate:
(U) Joint US/UK sea trials of ship Multi-Color IRST (British Frigate).
(U) Development of flyable calibrated Multi-Spectral Radiometer IR Sensor for IR background and target measurements.
(U) Surveillance IRST for AEW aircraft Theater Ballistic Missile (TBM) discrimination and tracking, endorsed by PMA-231.

- (U) ($3,127) MULTI-SENSOR TECHNOLOGY:

(U) Continue:
(U) Development of Compact Multi-Sensor (Multi-Mode Radar, EO, Electronic Warfare Support Measures (ESM)) System for Unmanned Aerial Vehicle (UAV) and manned aircraft surveillance and targeting to facilitate multi-sensor data fusion. Per Congressional direction and increased funding in late FY95, initiated contract efforts for development of integrated multi-sensor fusion. This supports Sensor Integration and Data Fusion Technology for Airborne Surveillance of land areas. This effort is coordinated with Defense Area Reconnaissance Office (DARO).
(U) Validation of sensor integration, adaptive resource management and data fusion architecture.

(U) Initiate:
(U) Accelerated capabilities initiative in Integrated Air Deployed Strike Surveillance (IADSS)

- (U) ($2,308) C3 SYSTEM ARCHITECTURE:

(U) Develop the capability to increase data rates over the Tri-Service Testbed to OC-3(155Mbps).
(U) Apply the submarine network simulation model to specific network protocol suites, such as the Minimum Coverage Approximation/Handoff Assigned Multiple Access (MINCAP/HAMA) and Enhanced Link 16, to establish a performance baseline for submarine participation in battlegroup networks, a capability nonexistent today.

- (U) ($9,412) COMMUNICATIONS:

(U) Continue development of key communications technologies for air, ship and submarines.
(U) Complete at-sea measurements of the on-hull ELF submarine antenna, continue field tests of the corona-mode ELF antenna, refine design of submarine low-profile antennas to minimize sea-water washover effects as a means of increasing data rates, and assess the suitability of novel as well as known SHF antenna, taking into consideration link analysis requirements, electrical and mechanical performance, and housing and deployment requirements.
(U) Perform analysis to extend the aircraft antenna array design to a conformal array for curved surfaces, considering both slots and dipole antenna elements, fabricate breadboards of the miniaturized airborne communications relay to provide a high data-rate UHF capability, and determine high data-rate SATCOM requirements for Naval aircraft.

(U) Complete testing of the optically controlled antenna and explore transition potential to aircraft platforms, investigate the feasibility of employing Frequency Selective Surfaces (FSS) for composite masts in order to reduce the number of antennas aboard ships, assess alternative bandwidth efficient modulation formats for use in maritime UHF line-of-sight communications, and explore the use of existing commercial modems that incorporate bandwidth efficient modulations and adaptive signal processing techniques.
(U) Develop an HF jammer processor to aid the operator in making timely decisions concerning optimum frequencies for jamming specific targets, interference effects with own communications, propagation conditions etc., and test/evaluate language identification algorithms developed by the USAF.

- (U) ($6,358) COMMAND SUPPORT:

(U) Demonstrate and transition Optical Strike Routing Algorithms into 6.3 Real-time Support program (PE 0603794N).
(U) Verify and report results of tests performing fast, complex simulations of mission force/unit level planning.
(U) Initiate requirements analysis for establishing a virtual environment laboratory Testbed that utilizes existing network infrastructure to provide Navy and Joint Service a distributed environment for rapid prototyping of collaborative technologies and demonstrations.
(U) Initiate work on crises action planning tools that automatically generates Joint Tactical Force (JTF) or Theater Level plans in response to crises.
(U) Complete and transition image/text exploitation and retrieval tools, CORBA-compliant distributed computing to 6.3 ATD or Portable C4I for the JTF, and demonstrate distributed security system tools to a selected operational command site for evaluation.
(U) Integrate and model high-performance computing infrastructure and resource management software into a heterogeneous distributed computing environment for command and control applications.
(U) Investigate information warfare techniques for intrusion detection and information recovery of command and control systems.
(U) Initiate development of a virtual reality display that provides strike planners a 3D view and interaction with targets on and around the battlefield.
(U) Initiate analysis and investigate methods to assess quality of data and identify levels of uncertainty associated with inconsistent and ambiguous data from distributed information specialist.

(U) Initiate development of multi-user environment collaborative software using object oriented technology for use in collaborative planning.
(U) Continue development of intelligent software agents for common tactical picture.
(U) Continue development of force level execution and monitoring tools and plan repair when primary plan fails.
(U) Continue development of intelligent software agents for information retrieval techniques for object oriented databases and image/text exploitation.

- (U) ($1,491) NAVIGATION:

(U) Develop improved algorithms for passive submarine terrain avoidance, investigate feasibility of quantum-well gyros to avoid mechanical dithering, fabricate and test a model of superconducting gyro and develop specifications for a high performance fiber-optic gyro suited for submarine applications.

- (U) ($ 2,180) SMALL BUSINESS INNOVATIVE RESEARCH
Portion of extramural program reserved for Small Business Innovative Research assessments in accordance with 15 U.S.C.638.

3. (U) FY 1997 PLAN:

- (U) ($21,363) RADAR TECHNOLOGY:

(U) Continue:
(U) Field testing of Radar Survivability/Counter ARM waveforms in Low Probability of Interception (LPI) Testbed.
(U) Development and field test of compact multi-mode radar (SAR/MTI/ISAR) for Ocean and Land Surveillance from manned aircraft and UAVs.
(U) Fabricate and test an Ultra-Wideband space fed phased array (Scale Model of 8x8 elements) in support of ultra-wideband radar technology development.
(U) Performance testing of horizon search, track and engagement radar integrated with ship self defense combat system in a high speed low altitude target environment.

(U) Develop scale model of voltage controlled diode affordable phased array.
(U) Integration and validation of two dimensional Air Target Identification technology in AN/APG-71 radar.

(U) Complete:
(U) Concept development for UHF electronically steered phased array for carrier based AEW aircraft.
(U) Field Test of Ultra-Wideband radar system against targets of varying cross section and flight regimes.
(U) Transition automatic ship classification technology to Naval Air Systems Command for AN/APS-137 upgrade.

(U) Initiate:
(U) Joint Program with USAF to add Terrestrial Inverse Synthetic Aperture Mode and moving target image processing to existing Synthetic Aperture Radar (SAR) Radar System (JSTARS and AN/APG-76).
(U) Development of breadboard hardware Very High Frequency (VHF)/UHF stepped frequency Ultra Wideband Radar Technology for concealed or buried target detection and exploitation.
(U) Design and fabrication of scale model UHF Electronically Steered phased array.

- (U) ($12,279) EO/IR TECHNOLOGY:

(U) Continue:
(U) Development of real-time signal processor for ship Multi-Color shipboard IRST.
(U) IR background measurement, analysis and modeling program. Validation of modeling techniques with NATO and TTCP Nation participation.
(U) Field testing of Multi-Hyper Spectral Airborne EO Sensor for Surveillance of airspace and land targets for integrated air defense and strike missions.
(U) Development of integrated active/passive IR Sensor for surveillance, ranging and target recognition.
(U) Development of surveillance IRST for AEW aircraft TBM discrimination and tracking.

(U) Complete:
(U) Joint US/UK sea trials of ship Multi-Color IRST.
(U) Validation of IR background models. Transition to fleet for use in decision aids use and to Government, academic and industrial R&D facilities to aid in development of IR sensor and signal processing developments.
(U) Shared Aperture (TV, FLIR, IRST) for fighter/attack aircraft.

(U) IR measurement and analysis of cloud ship wake phenology from high altitude platforms.

(U) Initiate:
(U) Development of shared aperture (TV, FLIR,IRST) EO Sensor to facilitate two color IRST and active laser for E-2 AEW and Theater Missile Defense (TMD) missions.
(U) Development of Distributed Aperture Infrared Imaging/Search and Track Sensor for high-resolution target detection and passive ranging.
(U) Exploitation of EO discriminates for non-imaging, unresolved target detection and recognition.

- (U) ($2,861) MULTI-SENSOR TECHNOLOGY:

(U) Continue:
(U) Development of Compact Integrated Multi-Sensor System for UAV and manned aircraft surveillance, targeting and BDA.
(U) Development of Data/Sensor fusion technology emphasizing integration and fusion of EO and passive ESM sensors for integrated air defense and strike surveillance missions.

(U) Complete:
(U) Data/Sensor Fusion Architecture and Processor Design.

(U) Initiate:
(U) Procurement of COTS sensors for integrated multi-sensor system Testbed.

- (U) ($1,920) C3 SYSTEM ARCHITECTURE:

(U) Conduct tests of the Tri-Service Testbed employing the most important emerging high-speed technology in the commercial sector, ATM. Develop the ATM tactical network architecture and investigate link error control algorithms for appropriate ATM over RF transmission media.
(U) Develop modifications to protocols specifically suited to the submarine as a disadvantaged node. Employ the submarine network simulation model to assess the modifications.

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: March 1996

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602232N
PROGRAM ELEMENT TITLE: Space & Electronic Warfare (SEW) C3 Technology

- (U) ($10,148) COMMUNICATIONS:

(U) Continue development of key communications technologies for air, ship and submarines.
(U) Transition the on-hull ELF antenna to the Submarine Integrated Antenna System engineering development program, fabricate the more promising low-profile submarine antenna for at-sea testing and demonstration, demonstrate the corona-mode ELF antenna in a dual antenna configuration, and assess the more promising submarine SHF antenna and develop brassboard for testing.
(U) Complete analyses of conformal antenna arrays on curved surface and transition an automated message distribution system to naval C3 aircraft.
(U) Complete analysis of alternative bandwidth-efficient modulations for UHF communications and select/implement an efficient design and investigate chaotic synchronization of nonlinear circuits for improved covert communications.
(U) Conduct at-sea experiments of high data-rate ship/air communications employing the NASA Advanced Communications Technology Satellite (ACTS).
(U) Develop enhancements to commercial ATM adaptation protocols to meet military ATM requirements.
(U) Develop a laboratory demonstration breadboard of a reconfigurable slot antenna array and measure performance.

- (U) ($5,888) COMMAND SUPPORT:

(U) Continue work on crises action planning decision aid for use at Theater Level for responding to crises.
(U) Continue work on virtual laboratory that supports interaction and prototyping of Joint Service collaborative mission planning and targeting.
(U) Continue development of software agents for intelligent retrieval of data.
(U) Continue work on defensive information warfare using pattern recognition techniques for detecting unauthorized intrusions into C^2 systems and predicting and isolating damage to information systems. Investigate use of Counter C^2 Anti-Processor techniques.
(U) Develop architectural concepts, software and hardware components and evaluation tools that will improve information sharing by connecting system high enclaves of COTS components and increasing security by using high assurance components for security critical functions.

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FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: March 1996

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602232N
PROGRAM ELEMENT TITLE: Space & Electronic Warfare (SEW) C3 Technology

(U) Continue development of architecture and algorithms that identify computer security threats and vulnerabilities and develop high assurance components for increasing security for security critical functions.
(U) Continue work on the virtual reality display workbench for use in tactical mission planning with collaborative group software in a multi-user environment.
(U) Continue development of end-to-end design tools for assessing real-time, distributed command and central algorithms and protocols.
(U) Continue effort for interpreting tactical situations for recognition of activities, tactics and intent through distributed situation assessment specialist and develop decision aids for monitoring of plan execution.
(U) Continue development of distributed hybrid data architecture that includes ability to access flat files, relational databases and object oriented data bases including map storage and retrieval.

- (U) ($1,700) NAVIGATION:

(U) Conduct at-sea tests of the passive submarine terrain avoidance system that make possible Global Positioning System (GPS)-independent underwater navigation, fabricate and conduct lab tests of quantum-well lattice, and design/fabricate/test high performance fiber-optic gyros.

B. (U) PROGRAM CHANGE SUMMARY:

	FY 1995	FY 1996	FY 1997
(U) FY 1996 President's Budget:	60,546	60,090	65,540
(U) Adjustments from PRESBUDG:	+459	-1,904	-9,381
(U) 1997 PRESBUDG Submit:	61,005	58,186	56,159

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: FY 1995 increase reflects an increase in program requirements. FY 1996 adjustment reflects: Congressional Undistributed (-$1,143); revised economic assumptions (-$707); and a minor program reduction (-$54). FY 1997 adjustments reflects revised DoD inflation estimates (-$1,722) and reduced program requirements

Exhibit R-2

006085

(-7,659).

(U) Schedule: Infrared analysis measurement and modeling program will be reduced to background model assessment and validation. Two year delay incurred against multi-spectial radiometric IR sensor development efforts.

(U) Technical: Not applicable.

C. (U) OTHER PROGRAM FUNDING SUMMARY: Not applicable.

(U) RELATED RDT&E: This program adheres to Tri-Service Reliance Agreements with oversight provided by the JDL. Work in this PE is related to and fully coordinated with efforts in the following PEs:

(U) PE 0601153N (Defense Research Science)
(U) PE 0601102F (Defense Research Science)
(U) PE 0602101F (Geophysics)
(U) PE 0602102F (Materials)
(U) PE 0602702F (Command, Control and Communications)
(U) PE 0603428F (Space Subsystems Technology)
(U) PE 0603741D (Air Defense Initiative)
(U) PE 0603789F (C3I Technology Development)
(U) PE 0601101F (In-House Laboratory Independent Research)
(U) PE 0602204F (Aerospace Avionics)
(U) PE 0602712E (Materials and Electronics Technology)
(U) PE 0602782A (Command, Control and Communications (C3) Technology)
(U) PE 0603109F (Integrated Aircraft Avionics)
(U) PE 0603203F (Advanced Avionics for Aerospace Vehicles)
(U) PE 0603217N (Air Systems and Weapons Advanced Technology)
(U) PE 0603253F (Advanced Avionics Integration)
(U) PE 0605502F (Small Business Innovation Research) (U) PE 0602204F (Aerospace Avionics)
(U) PE 0602709A (Night Vision Technology)
(U) PE 0603203F (Advanced Avionics for Aerospace Vehicles)

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 1996

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602232N
PROGRAM ELEMENT TITLE: Space & Electronic Warfare (SEW) C3 Technology

(U) PE 0603253F (Advanced Avionics Integration)
(U) PE 0603270F (Electronic Combat Technology)
(U) PE 0603710A (Night Vision Advanced Technology)
(U) PE 0602782A (Command, Control and Communications Technology)
(U) PE 0602702F (Command, Control Communications)
(U) PE 0603792N (Advanced Technology Transition)
(U) PE 0603794N (C^3 Advanced Technology)
(U) Advanced Technology Transition is in accordance with the on-going Reliance joint planning process and contains no unwarranted duplication of effort among the Military Departments.

D. (U) SCHEDULE PROFILE: Not applicable.

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: March 1996

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602232N
PROGRAM ELEMENT TITLE: Space & Electronic Warfare (SEW) C3 Technology

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FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: March 1996

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602233N
PROGRAM ELEMENT TITLE: Readiness, Training and Environmental Quality Technology

(U) COST: (Dollars in thousands)

PROJECT NUMBER & TITLE	FY 1995 ACTUAL	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
Readiness, Training and Environmental Quality Technology	47,890	47,676	40,828	43,320	47,212	48,126	49,152	CONT.	CONT.

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This program element (PE) provides generic affordable technologies in support of all Joint Mission Areas/Joint Support Areas (JSA), in particular the JSAs for Readiness; Manpower & Personnel; Support and Infrastructure; and Training. These JSAs encompass requirements for manning, operating, and maintaining fleet assets, and for providing the necessary training, facilities, and equipment to maintain operating forces in a high state of readiness. The PE also supports the Joint Warfare Strategy "Forward...From the Sea" as well as three of the "Top Five" Future Joint Warfighting Capabilities identified by the Joint Chiefs of Staff--in particular, capabilities related to: (a) conducting limited-objective warfare (e.g., technology for enhancing the performance of special forces personnel, aiding decision makers in highly ambiguous situations, and improving casualty care); (b) promptly engaging regional forces worldwide (e.g., technology for deployable training and mission rehearsal, and for logistics support of amphibious landings); and (c) countering weapons of mass destruction (e.g., technology for responding to chemical and biological threats). This PE encompasses the following areas:

(U) Personnel, Training, and Human Factors technologies enhance the Navy's ability to select, assign, and manage its people; to train effectively and affordably in classroom settings, in simulated environments, and while deployed; and to operate effectively in the complex, high-stress, information-rich and ambiguous environments of modern warfare. Technology development in these areas responds to a variety of requirements, including: providing more affordable approaches to training and skill maintenance; managing the force efficiently and maintaining readiness with fewer people and smaller budgets; providing warfighting capabilities optimized for low-intensity conflict and littoral warfare; and operating and maintaining increasingly sophisticated weapons systems.

(U) Medical technologies increase cost savings; improve safety and enhance personnel performance capabilities under adverse conditions; enhance diagnosis of medical emergencies and treatment of casualties; and prevent costly occupational injury and disease in hazardous environments. Requirements which support technology development in these areas include:

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 1996

DGET ACTIVITY: 2 PROGRAM ELEMENT: 0602233N
PROGRAM ELEMENT TITLE: Readiness, Training and Environmental Quality Technology

proving warfighting capabilities through enhanced supply and long-term storage of prepositioned medical supplies such as ood; providing better stress endurance/control for key personnel; and providing enhanced casualty care onboard amphibious sualty receiving ships.

(U) Logistics technologies increase operational readiness through effective management and movement of supplies ashore and -sea, and advanced techniques for more cost-effective construction and maintenance of shore and off-shore facilities. chnology development in these areas responds to a variety of requirements, including: providing the logistic support needed support amphibious landing; providing the diagnostic technologies that will enable the implementation of a condition-based . time-based maintenance philosophy; and providing a long distance logistics supply chain with short reaction time.

(U) Environmental quality technologies enable sustained Navy opeartions, world wide, in compliance with all national and nternational laws, regulations and agreements. Technology development in this area is in direct support of CNO's prioritized avy user and S&T requirements and will lead to systems and processes that will provide the Fleet with the capabilities for nvironmentally compliant forward presence both ashore and afloat. Specific requirements that support this area include: inimizing the curtailment of military operations due to ship, shore and aircraft compliance requirements; and providing the apability to sustain Naval forces anywhere in a timely and environmentally compliant manner.

(U) Due to the sheer volume of efforts included in this PE, the programs described in the Accomplishments and Plans ections are representative selections of work included in this PE.

(U) This PE also seeks to strengthen the educational pipeline vital for maintaining a strong technology development apability, by supporting programs at a wide range of educational institutions, including Historically Black Colleges & niversities, and other Minority Institutions. In addition, the PE provides funding for the Navy Science Assistance Program, he purpose of which is to improve the ability of the Navy's science and technology community to respond rapidly to urgent leet needs. Programs in this PE are jointly planned in the Reliance process with the Air Force and Army via panels of the oint Directors of Laboratories, the Joint Engineers, the Training & Personnel Systems Science & Technology Evaluation and anagement Committee, and the Armed Services Biomedical Research Evaluation and Management Committee.

U) JUSTIFICATION FOR BUDGET ACTIVITY: This program is budgeted within the APPLIED RESEARCH Budget Activity because it nvestigates technological advances with possible applications toward solution of specific Naval problems, short of a major evelopment effort.

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: March 1996

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602233N
PROGRAM ELEMENT TITLE: Readiness, Training and Environmental Quality Technology

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1995 ACCOMPLISHMENTS:

- (U) ($18,163) PERSONNEL, TRAINING AND HUMAN FACTORS TECHNOLOGY:
  - (U) Initiated:
    - -- (U) development of enhanced measures of effectiveness sufficiently sensitive for use in determining how training interventions affect operational readiness.
    - -- (U) development of mathematical modeling techniques for training resource allocation, to optimize the scheduling and management of finite Navy training assets.
  - (U) Continued:
    - -- (U) evaluation of decision support technology and advanced team training strategies for tactical decision making in ship air defense, limited-objective warfare scenarios.
    - -- (U) development of computer-based dynamic visual-spatial tests that can result in improved job performance, fewer training failures, and less equipment downtime.
    - -- (U) evaluation of 3-dimensional audio and visual displays for improved air combat maneuvering and ASW training.
  - (U) Completed:
    - -- (U) development of algorithms to simulate multi-element/beam sonar processing for more cost-effecive air and surface ASW training systems.
    - -- (U) development of techniques to identify, measure and train aircrew coordination skills in order to enhance mission effectiveness and safety.

- (U) ($16,413) MEDICAL AND CBD TECHNOLOGY:
  - (U) Initiated:
    - -- (U) development of abzyme for removal of Rh(D) antigen from red blood cells along with scale-up and limited clinical testing of enzymatically converted type A red blood cells to ultimately contribute to improved prepositioned blood supplies.
    - -- (U) development of recombinant growth factors and cytokines to enhance recovery of injured blood forming and immune systems to improve casualty care.
    - -- (U) development of data to revise over-conservative standards for safe microwave radiation exposures which currently put all weather decks off limits, to improve operational readiness without risking

occupational injury.
-- (U) development of dual-use biosensors with medical applications.
-- (U) development of prototype aircrew life support system.
-- (U) development of a therapeutic resuscitation fluid to enhance recovery of organ function in hemorrhagic shock.
-- (U) development of a chemical that enhances delivery of oxygen by blood and blood substitutes.

- (U) Continued:
  -- (U) Naval Battle Analyses including CB Warfare and Post-attack Shipboard Chemical Hazard Analysis which will improve operational capabilities in CBD environment.
- (U) Completed:
  -- (U) hardware development of micromachined chemical, biological sensor for detection of single molecule for improved fleet CBD detectors.
  -- (U) simulant agent destruction by Microwave Plasma device to be installed in ship CBD collective protection systems.
  -- (U) documentation, validation, and revision of VSLTRACK 1.5/2.0 which will be installed in joint service CBD hazard prediction models and Navy Mobile Operational Support System.
  -- (U) determination of mechanisms whereby sepsis and/or endotoxemia induces vascular tissue contractile dysfunction for improved casualty care.
  -- (U) definition of intracellular targets for growth factor modulation in hematopoietic cells for improved casualty care.
  -- (U) determination of effects of freeze-dried platelet transfusion which will ultimately contribute to improved prepositioned blood supplies.

• (U) ($13,314) LOGISTICS AND ENVIRONMENTAL QUALITY TECHNOLOGY:
- (U) Initiated:
  -- (U) development of an obstacle clearing vehicle that can more rapidly prepare amphibious landing sites.
  -- (U) development of the capability to predict maintenance requirements based on equipment condition, instead of time-based criteria.
  -- (U) development of non-invasive level sensor technology for shipboard wastewater systems.
  -- (U) development of biosonar for operations to clear littoral areas.
  -- (U) development of Marine Environmental Research and Training Station.
- (U) Continued:

-- (U) development of capability to examine real-time images of debris in oil lubricating systems and make decisions regarding wear or failure condition of the machinery.
-- (U) diagnostic and modeling technology for the prediction of pier structural capacity.
-- (U) development of NOx emissions technology for existing small marine diesels.
-- (U) technology development for environmentally benign underwater hull cleaning.
-- (U) development of affordable treatment technologies for harbor spoils.
-- (U) plasma arc technology development for shipboard solid waste destruction.
-- (U) advanced fire fighter training facility wastewater and air emissions treatment technology development.
-- (U) development of treatment technologies for advanced "zero discharge" industrial wastewater treatment facilities.

- (U) Completed:
-- (U) development of a fire retardant, foam-in-place dispensing system for shipboard use to aid in protecting expensive repair parts.
-- (U) equipment design of a faster, more capable underway replenishment system for shipboard use.
-- (U) diagnostic technology to assess more accurately the structural safety of Navy heavy lift cranes.
-- (U) ship test of non-invasive level sensor for ship wastewater systems; transition to advanced development for full scale ship demonstration.
-- (U) development of bioemulsifier process for in-situ cleaning of shipboard oil/water separators; transition to advanced development for ship test and implementation.
-- (U) development of underwater hull cleaning technologies; transition to advanced technology program for integration and demonstration.

2. (U) FY 1996 PLAN:

• (U) ($18,723) PERSONNEL, TRAINING AND HUMAN FACTORS TECHNOLOGY:
- Initiate:
-- (U) development of human systems interface techniques to manage the presentation of information concerning impending system failures.
-- (U) development of training concepts and principles unique to virtual environment based training systems.

- Continue:
  -- (U) development of generative adaptive testing techniques which permit computer generation of new test items.
- Complete:
  -- (U) operational evaluations of team training strategies that will minimize the adverse effects of stress on decision-making performance.
  -- (U) development and evaluation of a multi-criteria network model for optimizing assignments in the face of complex and conflicting assignment policies.

• (U) ($15,011) MEDICAL TECHNOLOGY:
- Initiate:
  -- (U) testing of liposome encapsulated hemoglobin in combination with therapeutic agents that prevent/correct reperfusion injury in hemorrhagic models.
  -- (U) evaluation of dinitromed as a cellular cryoprotectant that eliminates the need for washing frozen blood components.
  -- (U) evaluation of therapeutic drugs/hormones that modulate body temperature in a sub-freezing cold injury model.
  -- (U) development of amiloride formula for improved perfusion of organs for transplant.
  -- (U) testing of freeze-dried platelets in small animal hemorrhage model.
- Continue:
  -- (U) development of antibody-based enzymes for removing Rh determinant from red cells.
  -- (U) development of a therapeutic resuscitation fluid to enhance recovery of organ function in hemorrhagic shock.
  -- (U) development of bacterial endo-beta-galactosidase as a more efficient enzyme for removing A determinant from red cells.
  -- (U) development of oxygen delivery enhancer (crocetin) as resuscitation fluid additive.
  -- (U) evaluation of immunoregulatory monoclonal antibodies as adjuvants in inflammatory diseases.
- Complete:
  -- (U) transition to industry of LToral adjuvant for prevention of mucosal infections.
  -- (U) transition to industry of DHEA immunoprotectant for use in surgery patients and casualties to prevent sepsis and promote wound healing.
  -- (U) transition to industry of a monoclonal antibody that neutralizes an immunosuppressive factor

produced by casualties.

- (U) ($13,788) LOGISTICS AND ENVIRONMENTAL QUALITY TECHNOLOGY:
  - Initiate:
    - -- (U) proof-of-concept test and demonstration of best material handling and stowage concepts for ships.
    - -- (U) development of methods to exploit the combined use of future state predictors and failure progression models in mechanical diagnostics.
    - -- (U) development of a standard stability assessment procedure for pontoon facilities and prepare an operational guideline for open ocean use.
    - -- (U) development of technology for real time, in-situ identification and characterization of contaminated marine sediments.
    - -- (U) development of fuel additive technology for gas turbines and diesel engines to reduce NOx emissions.
  - Continue:
    - -- (U) treatment technologies for advanced industrial wastewater treatment facilities.
    - -- (U) advanced fire fighter training facility wastewater and air emissions treatment technology development.
  - Complete:
    - -- (U) design of at sea rearming capability for vertical launch capable ships.
    - -- (U) development of improved logistic strikedown capability for underway ships.
    - -- (U) exhaust treatment technology for reducing NOx emissions from small diesel engines in current Navy inventory.
    - -- (U) plasma arc technology development for shipboard solid waste treatment; transition to FY97 ATD start.
    - -- (U) conceptual treatment train technologies for contaminated harbor spoils.
    - -- (U) copper paint capture technology development for underwater hull maintenance vehicle.

- (U) ($154) Portion of extramural program reserved for Small Business Innovation Research assessment in accordance with 15 U.S.C. 638

3. (U) FY 1997 PLAN:

- (U) ($19,318) PERSONNEL, TRAINING AND HUMAN FACTORS TECHNOLOGY:
  - Initiate:

-- (U) development of an integrated decision support and onboard training system to enhance command tactical decision making during shipboard air defense operations.

- Continue:
  -- (U) development and evaluation of unconventional visual, auditory and haptic cuing techniques to enhance learning of complex perceptual-motor skills.
  -- (U) development of interfaces for a decision-centered Combat Opeartions Center, to provide Marine Corps commanders flexible access to information that is tailored for specific situations, and which can support both analytical and intuitive decision making.
- Complete:
  -- (U) evaluations in operational environments of experimental tools to assist decision-makers in rapid situation assessment under conditions of high uncertainty.
  -- (U) development and evaluation of visual-spatial tests to improve the validity of selection and assignment batteries by using computer-based, dynamic tests in addition to traditional verbal, multiple choice tests.
  -- (U) development and demonstration of dynamic ocean display graphics optimized for instruction in Distributed Interactive Simulations involving dissimilar training devices and shallow water scenarios.

• (U) ($11,663) MEDICAL TECHNOLOGY:
- Initiate:
  -- (U) development of supportive based resuscitation fluid.
  -- (U) development of field-portable ultrasonic imager to detect radiolucent shrapnel.
- Continue:
  -- (U) development of antibody-based enzymes for removing Rh determinant from red cells.
  -- (U) development of bacterial endo-beta-galactosidase as a more efficient enzyme for removing A determinant from red cells.
  -- (U) evaluation of immunoregulatory monoclonal antibodies as adjuvants in inflammatory diseases.
  -- (U) development of therapeutic resuscitation fluid to enhance recovery of organ function in hemorrhagic shock.
- Complete:
  -- (U) evaluation of liposome encapsulated hemoglobin in combination with therapeutic agents that prevent/correct reperfusion injury in hemorrhagic models.

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: March 1996

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602233N
PROGRAM ELEMENT TITLE: Readiness, Training and Environmental Quality Technology

-- (U) evaluation of dinitromed as a cellular cryoprotectant that eliminates the need for washing frozen blood components.

- (U) ($9,847) LOGISTICS AND ENVIRONMENTAL QUALITY TECHNOLOGY:
  - Initiate:
    -- (U) development of pulsed power technology for shipboard wastewater effluent polishing.
    -- (U) electrochemical technology development for pretreatment of shipboard liquid wastes.
    -- (U) development of microwave assisted paint removal for composite materials in aircraft structures and sytems.
    -- (U) development of shipboard rag cleaning technology to prevent pollution.
  - Continue:
    -- (U) bench scale testing and developing design parameters required for Industrial Waste Treatment Plant to meet future Navy requirements.
    -- (U) development of fuel additive technology for NOx reduction in gas turbine and diesel engines.
    -- (U) development of device for rapid, in-situ identification and characterization of contaminated marine sediments.
  - Complete:
    -- (U) model testing of pier fendering system to enable accurate prediction of forces exerted upon piers during berthing operations.
    -- (U) feasibility study and design criteria for advanced modular lighterage system in discharging cargo during amphibious operations.
    -- (U) design of advanced, environmentally compliant fire fighter training facilities.

B. (U) PROGRAM CHANGE SUMMARY:

	FY 1995	FY 1996	FY 1997
(U) FY 1996 President's Budget:	50,089	40,511	42,122
(U) Adjustments from PRESBUDG:	-2,199	+7,165	-1,294
(U) FY 1997 PRESBUDG Submit:	47,890	47,676	40,828

00097

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: March 1996

DGET ACTIVITY: 2

PROGRAM ELEMENT: 0602233N
PROGRAM ELEMENT TITLE: Readiness, Training and Environmental Quality Technology

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: Net FY 1995 reduction results from a S & T rescission (-5,151K) and a program requirements increase of (+2,952K). FY 1996 changes due to (+8,700) Chem-Bio Warfare and MERTS Congressional plus-up, Congressional Undistributed reductions (-936K), revised DOD inflation estimates (-580K), and minor repricing (-19K). FY 1997 reduction for revised DOD inflation estimates (-1,238K) and minor pricing adjustments (-614K), offset by new initiatives to effect long term system life cycle cost savings (+1,500K).

(U) Schedule: Not applicable.

(U) Technical: Not applicable.

(U) OTHER PROGRAM FUNDING SUMMARY: Not applicable.

(U) RELATED RDT&E:
(U) PE 0601152N (In-House Laboratory Independent Research)
(U) PE 0601153N (Defense Research Sciences)
(U) PE 0602232N (Space and Electronic Warfare (SEW) Technology)
(U) PE 0603706N (Medical Development (Advanced))
(U) PE 0603707N (Manpower, Personnel and Training Advanced Technology Development)
(U) PE 0603712N (Environmental Quality and Logistics Advanced Technology)
(U) PE 0602202F (Human Systems Technology)
(U) PE 0602205F (Personnel, Training and Simulation)
(U) PE 0602716A (Human Factors Engineering Technology)
(U) PE 0602727A (Non-System Training Device Technology)
(U) PE 0602785A (Manpower, Personnel and Training Technology)
(U) PE 0602787A (Medical Technology)
This PE adheres to Tri-Service Reliance Agreements on Training Systems, Manpower & Personnel, Human Systems Interface, Medical, CBD, Civil Engineering, and Environmental Quality. Oversight is provided by the JDL, TAPSTEM, ASBREM, and Joint Engineers.

(U) SCHEDULE PROFILE: Not applicable.

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: March 1996

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602234N
PROGRAM ELEMENT TITLE: MATERIALS, ELECTRONICS, AND COMPUTER TECHNOLOGY

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 1995 ACTUAL	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
Materials, Electronics, and Computer Technology	92,142	75,933	75,886	85,791	95,641	97,190	98,691	CONT.	CONT.

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This Program Element (PE) provides exploratory development to support all Navy advanced weapon and platform system concepts and needs in the areas of materials, electronics, and computer technology. Developmental tasks address significant improvements in terms of affordability, performance, reliability, environmental impact, advanced distributed manufacturing to effect transition of advanced technology to the Navy fleet. Development efforts are part of an integrated Department of Navy Science and Technology process managed by the Office of Naval Research.

- (U) This PE develops enabling technologies to support most Joint Mission Areas, for example:
  -- (U) Joint Strike: advanced thermal management materials for most platforms to reduce weight and cost.
  -- (U) Littoral Warfare: acoustic signature reducing materials, torpedo warhead materials, fiber optic sensors, vacuum electronics, solid state low noise amplifiers, complex systems engineering, and high performance computing.
  -- (U) Joint Surveillance: real-time targeting, connectivity, counter-jamming and deception. Programs include infrared sensors, broadband adaptive transmitter/receiver modules, and control components, fiber optics technology, high performance computing, and artificial intelligence.
  -- (U) Space and Electronics Warfare/Intelligence (SEW/I): lightweight and radiation-hard satellite materials, radio frequency (RF) solid state devices, high performance computing, complex systems reengineering and reuse, software engineering environments, secure computing, human computer interaction, security and assured computing approaches, and expert system technology.
  -- (U) Strategic Deterrence: advanced ballistic missile launcher materials, raido frequency (RF) solid state devices for secure communications, engineering of complex systems, and high performance computing.
  -- (U) Forward Presence issues: high temperature pavements for advanced aircraft, Radio Frequency (RF) solid state devices

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: March 1996

BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602234N
PROGRAM ELEMENT TITLE: MATERIALS, ELECTRONICS, AND COMPUTER TECHNOLOGY

for secure communications, high power transmitters for precision strike, high performance computing, and decision aids.
-- (U) Maritime Support of Land Forces: development of advanced distributed manufacturing capabilities and advanced long-life materials for repair of aircraft at sea.
-- (U) In addition, this PE directly underpins the Readiness Joint Support Area and Support and Infrastructure Joint Support Area especially in the domains of affordability, environmental quality, and logistics. Programs include environmentally acceptable coatings for both aircraft and ships and the maintenance of the Navy pier and wharf infrastructure for surge capacity.
-- (U) This PE supports the Office of the Secretary of Defense (OSD) Science and Technology (S&T) Investment Strategy in the following Future Joint Warfighting Capabilities: Real-Time Knowledge of the Enemy, Prompt Engagement of Regional Forces on Global Basis, Lower-End Actions, Space Control, and Countering Threat of Weapons of Mass Destruction; materials projects support affordable performance increases in radomes, infrared windows, advanced engines, and platform signature reduction to allow achievement of military objectives with minimum casualties and collateral damage; materials programs directly support lightweight, survivable satellite and spacecraft thermal control materials to positively affect the U.S. ability to control space usage. The PE is an integral part of the following Department of Defense Key Technology Areas: Materials, Processes and Structures, Electronic Devices, and Computers. As a foundational technology area it has impact in most other DoD Key Technology areas as well.
-- (U) Due to the sheer volume of efforts included in the Program Element, the programs described in the Accemplishments and Plans sections are representative selection of the work included in the program.

(U) JUSTIFICATION FOR BUDGET ACTIVITY: This program is budgeted within the EXPLORATORY DEVELOPMENT Budget Activity because it investigates technological advances with possible applications towards solution of specific Naval problems, short of a major developmental effort.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1995 ACCOMPLISHMENTS:

- (U) ($908) SHORE FACILITIES MATERIALS.
  -- (U) Completed evaluation of failure mechanisms in Navy piers and wharves and established repair procedures. The Navy must maintain a large infrastructure for surge shipping capacity. Understanding of failure will permit development of

repair and life-extension technologies to structures.

- (U) ($9,571) AIRBORNE MATERIALS.
-- (U) Developed environmentally compliant aircraft coating system including a non-chromate (non-toxic) pretreatment process and a low volatile organic (less than 200 gram per liter) water-borne urethane coating; coatings are needed to meet future environmental restrictions for both air quality and waste disposal.
-- (U) Completed demonstration of higher efficiency thermal barrier coatings for turbine engines with 100° C temperature increase and improved resistance to mechanical shedding under load. This temperature increase is equivalent to approximately a 25% increase in thermodynamic efficiency in aircraft engines while still using traditional superalloys for turbine blades.

- (U) ($10,046) SEABORNE MATERIALS.
-- (U) Demonstrated an anti-fouling release system for biomolecularly derived antifoulants or other antifoulant materials and continued development of silicone-based self-cleaning hull coatings. Release capsules based on self-assembling micro-tubules provide the necessary release rate and long life for fouling resistance.
-- (U) Completed demonstration of a lower cost (versus tantalum) tungsten shaped charge liner material for use against multiple threats without degradation in performance.
-- (U) Demonstrated a preceramic polymer blast resistant material for vertical-launch systems in quarter scale with the capability to provide multiple launch of the Standard Missile Block 4.

- (U) ($3,379) MISSILE/SPACE MATERIALS.
-- (U) Completed qualification of a flexible graphite/copper thermal strap, used to conduct heat from internal satellite components to exterior heat radiators, for use on Navy GEOSAT satellite and its commercial derivative for weight savings and reliability.

- (U) ($20,081) MULTI-MISSION MATERIALS.
-- (U) Completed development of laser protection materials for known wavelengths and initiated development of materials that can respond fast enough (<one microsecond) to laser energy to protect the human eye from agile (tunable) lasers.
-- (U) Completed design studies for high thermal conductivity electronic packaging and initiated development of advanced composites for aircraft avionics and sea-based electronic systems based on high-thermal conductivity carbon fibers.

-- (U) Demonstrated the first high temperature superconducting coil magnet in a motor of greater than 100 horsepower.

- (U) ($6,478) RF SOLID STATE DEVICE AND CONTROL COMPONENTS.
  -- (U) Completed development of the 400-1400 MHz adaptive Transmit/Receive (T/R) module for Airborne Early Warning (AEW) radar applications. The adaptive capability provides for improved interference rejection and enhances target detection and track of low observable targets.
  -- (U) Completed development of L-band monolithic receiver that utilizes Semiconductor Bulk Acoustic Resonators to reduce filter size and permit use in airborne applications.
  -- (U) Initiated the development of high dynamic range wide band Low Noise Amplifier (LNA) with very high second and third order intermodulation intercepts to minimize false alarm rate.

- (U) ($16,506) VACUUM ELECTRONICS.
  -- (U) Continued development of Microwave Power Module (MPM) capable of producing in excess of 100 watts CW (within C-band) at extremely high efficiencies for use in an airborne antenna conformal to an E-2C.
  -- (U) Initiated development of the Millimeter Wave Power Module (MMPM) to extend the capability of the MPM.
  -- (U) Initiated the development of a high power microwave window technology using man-made diamond to increase the power handling capability and bandwidth of microwave power tubes.
  -- (U) Completed final testing of high-duty, reduced noise cross field amplifier (CFA) for AN/SPY-1. These improvements will increase radar performance in high clutter environments.

- (U) ($5,334) ELECTRO-OPTICS TECHNOLOGY.
  -- (U) Demonstrated optical control of 8-element linear array with bandwidth from 2 to 18 GHz.
  -- (U) Transitioned development of 128 x 128 dual-band (3 to 5um and 8 to 12um) infrared focal plane array (IRFPA) with simultaneous coincident signal integration to Ballistic Missile Defense Organization (BMDO) and initiated development of a color discriminating IRFPA that will have a spectral response in two mid-wave bands to detect dim or camouflaged targets in clutter.
  -- (U) Continued development of GaInSb/InAs superlattice-based detectors as an alternative to HgCdTe-based detectors for higher temperature operation at longer wavelengths.

- (U) ($6,118) MICROELECTRONICS.

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DATE: March 1996

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602234N
PROGRAM ELEMENT TITLE: MATERIALS, ELECTRONICS, AND COMPUTER TECHNOLOGY

-- (U) Continued development of 3 dimensional Silicon-on-Insulator (SOI) complimentary metal oxide semi-conductor circuits to implement high density signal processors.
-- (U) Completed design of high resolution (16 bit), low speed (100 Kilosamples/sec), low power (1 mW) Analog-to-Digital (A/D) converter implemented in thin-film silicon-on-sapphire for low-cost, low power deployable sensor systems and Signal Intelligence.

- (U) ($2,101) ELECTRONIC AND E/O MATERIALS.
-- (U) Continued growth and characterization of InAs/GaSb materials for III-V superlattice infrared focal plane array detectors.
-- (U) Demonstrated resist materials sensitive to 193 nm wavelength light for sub 0.25 micrometer lithography. This effort, combined with an Advanced Research Projects Agency (ARPA) effort to develop sub 0.25 um steppers, should ensure that the U.S. will be able to meet the requirements of fine line lithography through the year 2005.

- (U) ($2,344) HIGH PERFORMANCE COMPUTING (HPC).
-- (U) Performed laboratory testing prior to at-sea evaluation of HPC sources for submarine detection operations using long-line towed-arrays (TB-29); parallel algorithms include focused beamforming, automated detection and tracking, and automated acoustic-contact correlation.
-- (U) Demonstrated the capability of Processing Graph Method Tool (PGMT) to place Single Instruction Multiple Data (SISD) parallel computers under PGM.

- (U) ($2,637) ARTIFICIAL INTELLIGENCE AND HUMAN COMPUTER INTERACTION.
-- (U) Demonstrated machine learning of team tactics in simulated tactical air combat, and assess utility for transition to ARPA 6.3 projects in advanced simulation.
-- (U) Extended the Eucalyptus multi-modal (natural language, speech, graphics) interface to operate in a distributed environment, and developed response capabilities with natural language generation.
-- (U) Demonstrated object modeling using innovative range image operators for machine vision, and initiate exploratory development of behavior-based control on Nomadic robots (transitioning results of ONR-sponsored 6.1 research at Massachusetts Institute of Technology (MIT)).
-- (U) Integrated modules for case based reasoning functions in an advanced testbed.

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DATE: March 1996

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602234N
PROGRAM ELEMENT TITLE: MATERIALS, ELECTRONICS, AND COMPUTER TECHNOLOGY

- (U) ($4,639) ENGINEERING OF COMPLEX SYSTEMS.
  -- (U) Continued development of the DESTINATION prototype with emphasis on refining system design structuring and resource allocation capabilities and building the library of objective functions for design optimization.
  -- (U) Released the initial version of the Systems Reengineering Environment (SRE) with automated capabilities to translate CMS-2 tactical software programs to Ada. Merged into ARPA environments for engineering.
  -- (U) Initiated Software Development Infostructure and Reuse testbed and investigated emerging commercial standards including the Portable Common Tools Environment (PCTE) and the Common Object Request Broker (CORBA).

- (U) ($2,000) ADVANCED DISTRIBUTED MANUFACTURING DEMONSTRATION
  -- (U) Enhanced and continued measurement of the virtual manufacturing project demonstrator using a networked distributed manufacturing testbed, showing functional correctness and measured economies that can be gained in building mechanical and electrical subsystems; determined the framework applicability to software reuse.

2. (U) FY 1996 PLAN:

- (U) ($753) SHORE FACILITIES MATERIALS.
  -- (U) Complete field trials of high temperature pavements that are resistant to AV-8B exhaust temperatures and velocities which should eliminate costly procurement and engine foreign object damage repair.
  -- (U) Continue pier/wharf reinforcement protection via materials substitution and cathodic protection.

- (U) ($7,933) AIRBORNE MATERIALS.
  -- (U) Continue diamond material development for infrared domes with a successful 1 mm thick polished 3 in. diameter dome for supersonic missiles.
  -- (U) Continue development of nickel superalloys and ingot processing of orthorhombic titanium aluminide materials for engine rotors and turbine shrouds capitalizing on the high temperature capabilities and enhanced ductility of the orthorhombic crystal structure and the 40% lower density versus conventional superalloys. Complete demonstration of cast and wrought gamma titanium aluminide in aircraft engine high pressure compressor blades and vanes to replace superalloys for a 40% component weight savings.
  -- (U) Continue development of repair adhesives and conductive polymers for advanced aircraft polymer composites.

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BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602234N
PROGRAM ELEMENT TITLE: MATERIALS, ELECTRONICS, AND COMPUTER TECHNOLOGY

- (U) ($8,556) SEABORNE MATERIALS.
  -- (U) Continue development of anti-fouling, environmentally compliant hull coatings.
  -- (U) Continue evaluation of continuous cooling transformation diagrams for 100,000 pound yield strength high strength low alloy hull steels needed to control metallurgy and hydgrogen cracking of welds in hulls.
  -- (U) Complete development of low strength (65,000 lb/sq-in tensile strength) low alloy steel to lower the cost of aircraft carrier construction by elimination of needs for welding preheat and post-welding heat treatment.
  -- (U) Complete development of advanced liner material for shipboard vertical launch systems.

- (U) ($2,139) MISSILE/SPACE MATERIALS.
  -- (U) Complete qualification of oxidation (atomic oxygen) resistant carbon-carbon composite thermal doublers for Navy Ultra-high frequency UHF satellites appropriate to low-earth orbit for a weight savings of 58%.

- (U) ($9,065) MULTI-MISSION MATERIALS.
  -- (U) Complete concept validation of the remotely addressable, embedded sensor concept using RF energy to energize sensors in resin-matrix composite materials and transmit sensor information to external receivers eliminating the need for wire attachment to external systems and initiate phase II project to develop sensors and detectors.
  -- (U) Complete development of high temperature superconductor wire for motor magnet windings and test in a superconducting motor. High temperature superconductors will permit motor application at liquid nitrogen rather than liquid helium temperatures (77 K (-196° C) vs. 20 K (-253° C)).
  -- (U) Continue laser protection materials development and development of specialized ceramic materials for thermal barrier coatings and high speed missile radomes.
  -- (U) Initiate Phase II remote addressable embedded sensors development to evaluate strain and pressures in thick carbon fiber composites for noninvasive health monitoring of structures and process control.

- (U) ($6,959) RF SOLID STATE DEVICE AND CONTROL COMPONENTS.
  -- (U) Continue development of InGaAs/InP heterostructure power High Electron Mobility Transistors (HEMTs) (including power and power combining components) for use in Wide-band active aperture phased array component development.
  -- (U) Continue development of silicon carbide static induction transistor devices and structures that exhibit 10 Watts (W) of continuous power and air-bridged static induction transistors that exhibit 160 watts of continuous power at Short-band frequencies for Navy systems applications such as AEGIS.

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BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602234N
PROGRAM ELEMENT TITLE: MATERIALS, ELECTRONICS, AND COMPUTER TECHNOLOGY

-- (U) Initiate development of high power (20KW) UHF circulators for shipboard communications applications, especially for integrating multiple systems within a common aperture.
-- (U) Continue development of 18-40 GHz Monolithic Microwave Integrated Circuit (MMIC) Driver for Millimeter Wave (MMW) Power Module for use in decoys and extending frequency range of the SLQ-32.
-- (U) Complete demonstration of fixed frequency superdirective array for improved direction finding for small diameter anti-radiation missile seeker applications.
-- (U) Continue development of high dynamic range, wide band Low Noise Amplifier (LNA) with very high second and third order intermodulation intercepts.

• (U) ($12,644) VACUUM ELECTRONICS.
-- (U) Continue extension of MPM concept to higher frequencies with the development of MMW (20-40 GHz, 50-W) power modules.
-- (U) Complete development of MPM capable of producing in excess of 100 watts CW (within C-band) at extremely high efficiencies for use in an airborne antenna conformal to an E-2C.
-- (U) Complete and distribute beta test version of the Millimeter Wave Advanced Computational Environment (MMACE) 2-dimensional Research and Engineering Framework (REF) with a preliminary design tool set selected for the design of a helix traveling wave tube (TWT).
-- (U) Initiate development of selected elements of an advanced design tool set for implementation in consort with the 2-dimensional REF.
-- (U) Continue development of high power density Microwave (MW) window technology using man-made diamond. This technology is central to needed performance improvements in several Navy systems

• (U) ($6,351) ELECTRO-OPTICS TECHNOLOGY.
-- (U) Continue development of fiber optic beamformer for phased array radar systems with emphasis on fast wavelength tuning of source, large dynamic range, and field testing of system, especially as related to the Advanced Technology Development (ATD) on shipboard Electronic Counter Measures (ECM) transmitter for ship defense.
-- (U) Continue mid-Infrared fiber development to reduce impurity loss to <.5 dB/m, total loss <1.0 dB/m, and increase mechanical strength to >75 ksi to support Electronic Warfare and hazardous waste detection applications.
-- (U) Continue development of 128 x 128 adaptive IRFPA with on-chip electronics to enhance the dynamic range 120 dB and to implement offset nonuniformity correction.

-- (U) Continue development of color-discriminating IRFPA
-- (U) Continue development of GaInSb/InAs superlattice based detectors as an alternative to HgCdTe-based detectors for higher temperature operation at longer wavelengths.

- (U) ($6,107) MICROELECTRONICS.
-- (U) Continue development of 3D circuits on SOI with emphasis on Reduced Instruction Set (RISC) processor.
-- (U) Complete demonstration of analog front-end of 16 bit, 125 megasample/sec analog-digital converter for Anti Submarine Warfare (ASW) applications.
-- (U) Continue development of 100x100 synapse, 100 neuron analog self-learning artificial neural network.
-- (U) Initiate development of sub 500nm - 250nm p-channel silicon germanium devices with T-gate structures in 50nm thick thin-film silicon-on-sapphire for improved transistor performance up to 50 GHz.
-- (U) Continue development of analog Very Large Scale Integrated (VLSI) circuits for co-site interference cancellation applications.

- (U) ($1,826) ELECTRONIC AND E/O MATERIALS.
-- (U) Continue development of wide bandgap III-V semiconductors such as GaN and AlN which will involve a combination of materials growth, device structure fabrication, and characterization to produce blue lasers and high power, high temperature operation of RF devices.
-- (U) Complete development of techniques for growth of unstrained InGaAs/InAlAs heterostructures on GaAs substrates by means of compositionally graded layers acting as dislocation filters. The devices will be used for secure communications with applications to military and civilian users.
-- (U) Complete contractual activity to demonstrate narrow band (less than 1 percent) high temperature superconducting bandpass filters capable of handling more than ten watts of incident microwave power and initiate program to fabricate and characterize high temperature superconducting thin films optimized for high power microwave components.
-- (U) Initiate single-precursor growth of cubic silicon carbide substrates. The goal is to provide a method for producing low defect density substrates used in Navy high power RF electronics.

- (U) ($3,167) HIGH PERFORMANCE COMPUTING (HPC).
-- (U) Complete sea trial (TB-29) with laboratory hardened submarine towed array algorithms using Commercial-Off-the Shelf (COTS) hardware.

-- (U) Demonstrate the capability of PGMT to place MIMD parallel computers using static scheduling under PGM.
-- (U) Initiate the design of a Digital Library for the Warrior using parallel computers and demonstrate parallel image/video servers. Installed and worked with early research products from the ARPA/National Science Foundation (NSF)/National Aeronautics and Space Agency (NASA) Digital Library program.

- (U) ($2,700) ARTIFICIAL INTELLIGENCE AND HUMAN COMPUTER INTERACTION.
-- (U) Demonstrate the application of machine learning techniques for developing more reliable robotic software.
-- (U) Redesign multi-mode interfaces using new interaction techniques and conducted evaluation experiments.
-- (U) Apply speech understanding lessons learned from Eucalyptus to a model for speech control in virtual environments to enhance operator effectiveness.
-- (U) Demonstrate range-based sensing and control in mobile robots, suited to surveillance and other missions.
-- (U) Assess alternative approaches to the management of large and dynamic case-based memories, integrate model- and case-based reasoning; explore novel uses of cases viewed as active agents using a strict object-oriented model; these are key issues to making this approach effective in time constrained environments.

- (U) ($4,341) ENGINEERING OF COMPLEX SYSTEMS.
-- (U) Release DESTINATION prototype, a software tool for automated specification and exploration of complex processor-intensive systems, including advanced capabilities to perform system level design capture, design optimization, and structuring and restructuring in a coherent, seamless manner. Hierarchial capabilities will allow manipulation of various levels of system design, component, and environment representations. Included are proven tailorable objective functions based on different measures-of-effectiveness criteria to ensure that system requirements are affordable for the system's projected life. Transition to surface combatant SC21 program.
-- (U) Deliver prototype translator of CMS-2 (including embedded assembly language) to Ada. Complete and demonstrate test on actual Navy CMS-2 code.
-- (U) Develop Software Infostructure based on the Portable Common Interface Set (PCIS). Formulate CORBA reusable component development methodology. Develop and demonstrate World-Wide-Web(WWW) interfaces to Infostructure tools and CORBA components.

- (U) ($3,392) ADVANCED DISTRIBUTED MANUFACTURING DEMONSTRATION
-- (U) Continue development of measures of effectiveness for distributed manufacturing and virtual management of

distributed manufacturing, exploration of new manufacturing technologies for Navy application in distributed networks, application of virtual and distributed management to software development and software reuse in cooperation with government needs, documentation of military-related successful virtual management models for Virtual Management Workshop.

3. (U) FY 1997 PLAN:

- (U) ($1,000) SHORE FACILITIES MATERIALS.
-- (U) Complete establishment of criteria for the cathodic protection of Navy pier substructures in the marine splash zone using embedded anodes and metallized zinc systems for 50-75% longer pier life and lower maintenance cost and including ship protection from pier cathodic systems to avoid costly ship hull damage.

- (U) ($7,207) AIRBORNE MATERIALS
-- (U) Complete material and fabrication concept for a switchable (electrically conductive to non-conductive) missile radome to shield internal antennas from RF energy.
-- (U) Transition conductive polymer composite technology into F414 engine front frame for subsequent production qualification of the engine front frame eliminating the need for additional coatings and coating weight.
-- (U) Complete demonstration of 1500° F nickel superalloy disk and orthorhombic titanium capable of functioning with the higher cooling air temperatures of the Phase II Integrated High Performance Turbine Engine Technology demonstration engines.
-- (U) Complete development of an encapsulated, room-temperature storable adhesive for shipboard repair of aircraft, including higher temperature, bismaleimide composites to provide the Navy Fleet with an alternative to the short lived, costly, and logistically burdensome adhesives that require continuous cold storage.

- (U) ($9,730) SEABORNE MATERIALS.
-- (U) Complete development of hydrogen control methods in welding materials and processes to eliminate hydrogen cracking in ship/submarine welded structures for more affordable hulls and processes.
-- (U) Complete field testing of biofouling and repellents/fungicides/mildew-resists using controlled release from microtubules based on self-assembling biomolecular materials and silicone easy release fouling resistant hull coatings.

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BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602234N
PROGRAM ELEMENT TITLE: MATERIALS, ELECTRONICS, AND COMPUTER TECHNOLOGY

- (U) ($2,790) MISSILE/SPACE MATERIALS.
  -- (U) Complete Phase II of the Robust Processing Program in which high thermal conductivity carbon fibers are incorporated in metal thermal planes for a 50% increase in heat removal from electronic modules accompanied by a 30% decrease in thermal plane weight.

- (U) ($5,246) MULTI-MISSION MATERIALS.
  -- (U) Complete engine durability testing of stabilized zirconia thermal barrier coatings in marine turbine engines to provide at least 50% greater resistance to vanadate attack from lower grade oils than current zirconia coatings.
  -- (U) Complete Phase I of the remotely addressable embedded sensors development and demonstrate the system in a thick composite using radio frequency energy.
  -- (U) Continue laser protection materials development for both eye and sensor protection.
  -- (U) Initiate demonstration of controlled micro-structures based on self-assembling lipid systems.

- (U) ($6,959) RF SOLID STATE DEVICE AND CONTROL COMPONENTS.
  -- (U) Continue development of heterostructure power devices, switches and converters for use in the implementation of active aperture W-band phased arrays with efficient optical feeds. These radars are required in very high 'g' environments for hit-to-kill weapons, to reduce sidelobe jamming, and improve target tracking accuracy.
  -- (U) Demonstrate a 100 MHz to 10 GHz CW, high linearity GEISHA amplifier with 7-10 watts output.
  -- (U) Complete development of UHF high power circulator and provide to Multi-Functions Electomagnetic Readiating System (MERS) ATD.
  -- (U) Continue and expand high power SiC transistor structure development to encompass high linearity and high efficiency for fleet protection applications.
  -- (U) Complete development of high dynamic range wide band LNA with very high second and third order intermodulation intercepts and explore potential use of LNAs in JAST demonstration aircraft.
  -- (U) Complete 18-40 GHz MMIC Driver for MMW Power Module for use in decoys and extending frequency range of SLQ-32.

- (U) ($15,264) VACUUM ELECTRONICS.
  -- (U) Complete extension of MPM concept to higher frequency by development of MMW (20-40GHz, 50-W) power modules for Electronic warfare (EW) applications.
  -- (U) Complete development of selected elements of an advanced MMACE design tool set for implementation in consort with

the 2-dimensional REF.
-- (U) Complete development of high power density MW window technology using man-made diamond. This technology is central to needed performance improvements in several Navy systems.
-- (U) Initiate full-scale development of Twystrode to reduce size of MPM for radar and EW applications.

- (U) ($6,411) ELECTRO-OPTICS TECHNOLOGY.
-- (U) Complete demonstration of 128 x 128 adaptive IRFPA with on-chip electronics to enhance the dynamic range to 120 dB and to implement offset nonuniformity correction and initiate development of 256 x 256 adaptive IRFPA with high dynamic range on-chip electronics to implement on-chip nonuniformity correction and preliminary filtering functions.
-- (U) Continue demonstration of fiber optic beamformer for phased array radar with emphasis on a two-dimensional (4x4) array.
-- (U) Continue development of mid IR fibers to reduce impurity loss <0.1 dB/m and total loss <0.5 dB/m with emphasis on longer fibers (50m) and initiate development of IR fibers that transmit in the 8-12um region for Infrared Countermeasurers (IRCM) applications.
-- (U) Complete development of single color GaInSb/InAs superlattice detectors and initiate development of two-color superlattice detectors as an alternative to HgCdTe-based detectors for higher temperature operation at longer wavelengths.

- (U) ($8,900) MICROELECTRONICS.
-- (U) Complete development of 3D SOI RISC microprocessor to provide increased throughput to Navy signal processing systems.
-- (U) Demonstrate and manufacture planar Metal Oxide Semiconductor (MOS) Controlled Thyristers (MCTs) that operate at 1400 volts, 300A/cm^2 and 100 KHz switching speed for incorporation into Power Electronic Building Blocks (PEBBs).
-- (U) Demonstrate 16 bit, 20 MHz low temperature superconducting Analog-to-Digital (A/D) converter.
-- (U) Complete demonstration of collocated interference cancellation circuitry for communication systems.
-- (U) Complete development of 16 bit, 125 megasample/sec analog-digital converter for application to wide bandwidth digital ASW receiver to meet Navy multi-channel acoustic system requirements.
-- (U) Complete development of low power, low voltage sub 500nm - 250nm silicon germanium devices with T-gate structures in 50nm thick thin-film silicon-on-sapphire. These structures will allow the development of 4 bit, 10 gigasample/sec and 10 bit, 2.5 gigasample/sec analog-digital converters.

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BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602234N
PROGRAM ELEMENT TITLE: MATERIALS, ELECTRONICS, AND COMPUTER TECHNOLOGY

-- (U) Complete development of 100x100 synapse, 100 neuron analog self-learning artificial neural network and transition to 6.3 "Air Vehicle Diagnostic System" for the Time-Stressed Helicopter Rotor Gearbox.

- (U) ($2,123) ELECTRONIC AND E/O MATERIALS.
-- (U) Continue substrate development for wide bandgap materials that are lattice matched, semi-insulating as well as substrates that can be doped with n-type and p-type impurities. These substrates will form basis for high temperature/high power RF heterostructure devices for Navy EW and radar systems.
-- (U) Continue multi-disciplinary activity to optimize the properties of high temperature superconducting films for high power microwave applications and begin transition of improved materials to Air Force and Navy programs using passive high temperature superconducting components.
-- Complete development of growth techniques for single color detectors and initiate development of growth techniques for two-color detectors.
-- (U) Initiate nanometer-scale direct proximal probe patterning for fine-line (<0.05um) processing of metals and semiconductors to achieve the capability to realize sub-micrometer scale RF and microelectronic devices.
-- Continue single-precursor growth of cubic silicon carbide substrates. The goal is to provide a method for producing low defect density substrates used in Navy high power RF electronics.

- (U) ($2,976) HIGH PERFORMANCE COMPUTING (HPC).
-- (U) Demonstrate a software parallelization tool based on the PGM for mapping signal processing data flow diagrams into arbitrary sets of processors automatically.
-- (U) Demonstrate effective, customized digital library for information delivery to the warrior from multiple sources. Demonstrate knowbot, agent, mediator, and intelligent gatekeeper technology in a military application.

- (U) ($2,557) ARTIFICIAL INTELLIGENCE AND HUMAN COMPUTER INTERACTION.
-- (U) Demonstrate new capabilities for meteorological forecasting using machine learning.
-- (U) Demonstrate guidance of mobile robot tasks by utilizing a 3D range scanner, and advance the computational efficiency of machine vision through innovative use of data from tripod operators.
-- (U) Distribute an advanced Case Based Reasoning Shell which is useful for building decision aids with advanced capabilities in domains such as situation assessment and planning.
-- (U) Evaluate and extend multi-modal robotic interface and related tools.

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DATE: March 1996

BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602234N
PROGRAM ELEMENT TITLE: MATERIALS, ELECTRONICS, AND COMPUTER TECHNOLOGY

- (U) ($4,723) ENGINEERING OF COMPLEX SYSTEMS (ECS).
-- (U) Apply Destination and other ECS tools to the development of a sub-system of the AEGIS system using forward and reverse system composition methodology and prototype automation aids for specification and analysis of performance of at least three alternative designs. This will provide a fully integrated, automated environment to support affordable and evolutionary system design methodology for large complex computer-based systems.
-- (U) Demonstrate Software Infostructure and Portable Common Interface Set (PCIS) in a Navy project. Further develop affordable reusable component methodology using CORBA and other industry standards. Implement distributed interfaces using WWW technology.

B. (U) PROGRAM CHANGE SUMMARY:

	FY 1995	FY 1996	FY 1997
(U) FY 1997 President's Budget:	$94,259	$74,849	$86,515
(U) Adjustments from 1996 PRESBUDG:	-2,117	-1,084	-10,629
(U) FY 1997 PRESBUDG Submit:	$92,142	$75,933	$75,886

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: FY 1995 changes reflect increased program requirements (+$90) and S&T rescission (-$2,207). FY 1996 changes reflect increases for distributed manufacturing program (+$3,500), Congressional undistributed reductions (-$1,522), and revised DoD economic estimates (-$894). FY 1997 changes include revised DoD inflation estimates (-$2,336); minor pricing adjustments (-$793), and reduced program requirements (-$7,500).

(U) Schedule: The following thrust areas will see delays: Airborne Materials, Vacuum Electronics, and Engineering of Complex Systems. Specific areas which will see delays include research in the area of integration of electrically switchable radome materials into airborne systems and transitioning vacuum electronics research into industry. Efforts to transition automated translation tools for conversion of software source code from CMS-2 to ADA for all Navy legacy systems will be terminated.

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 1996

BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602234N
PROGRAM ELEMENT TITLE: MATERIALS, ELECTRONICS, AND COMPUTER TECHNOLOGY

(U) Technical: The thrust areas of Airborne Materials, Vacuum Electronics, and Engineering of Complex Systems will see an overall decrease that will increase the technical and transition risk for front frame technology for aircraft engines, especially F414 in the F/A-18E/F; increase the technical risk for size reduction of the microwave power module by use of new cathodes materials; eliminate refinement of the capability to convert software source code from CMS-2 to ADA.

C. (U) OTHER PROGRAM FUNDING SUMMARY: Not applicable.

(U) RELATED RDT&E:
(U) PEs 0601102A, 0601102F, 0601153N (Defense Research Sciences)
(U) PEs 0602105A, 0602102F (Materials Technology)
(U) PEs 0602705A, 0602709A, 0602204F,0602702F (Electronic Devices Technology)
(U) PEs 0602783A, 0602789A, 0602202F, 0602204F, 0602702F (Computer Technology)
(U) PE 0602303A (Missile Technology)
(U) PE 0602601A (Combat Vehicle and Automotive Technology)
(U) PEs 0602702F, 0602232N (Command, Control and Communications)
(U) PE 0602786A (Logistics Technology)
(U) PE 0602111N (Air and Surface Weapons Technology)
(U) PE 0602121N (Surface Ship & Submarine HM&E Technology)
(U) PE 0602122N (Aircraft Technology)
(U) PE 0602314N (Undersea Warfare Surveillance Technology)
(U) PE 0602323N (Submarine Technology)
(U) PE 0602270N (Electronic Warfare Technology)

(U) This PE adheres to Tri-Service Reliance Agreements on Advanced Materials, Electronic Devices and Computer Technology with oversight provided by the Joint Directors of Laboratories and Joint Engineers. This PE is integrated with the Navy's 6.1, 6.2, and 6.3A PE's shown above and is fully coordinated with efforts in DoD through JDL and TAP activities.

D. FUNDING PROFILE: Not applicable.

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: March 1996

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602270N
PROGRAM ELEMENT TITLE: Electronic Warfare Technology

PROJECT NUMBER & TITLE	FY 1995 ACTUAL	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
Electronic Warfare Technology	16,866	17,778	22,454	24,089	25,251	25,656	26,120	CONT.	CONT.

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: The Navy Electronic Warfare (EW) Science and Technology (S&T) Program addresses identified technology requirements for EW in cooperation with the other Services, placing special emphasis on Naval EW roles in Command and Control Warfare (C2W). This program develops technologies which support the effective utilization of naval force capabilities in the conduct of the Navy's Joint Mission Areas (JMAs) defined by OPNAV (i.e., Joint Strike, Littoral Warfare, Surveillance, Space and Electronic Warfare (SEW)/Intelligence, Deterrence, Maritime Support of Land Forces and Readiness and Shore Training). It is also vitally associated with future warfighting capabilities of "maintaining near perfect real-time knowledge of the enemy ..." and "to counter the threat of ... cruise missiles to the Continental United States (CONUS) and deployed forces". The Program is planned jointly in accordance with Tri-Service Reliance agreements which allocate various EW disciplines and their attendant technology development responsibilities between the Army, Air Force and the Navy. As part of the Integrated S&T EW Program, efforts are subject to review and execution oversight by the Joint Director of Laboratories (JDL) Technology Panel for Electronic Warfare (TPEW).

(U) The emergence of a polycentric strategic environment, the evolving and diversified nature of the threat, and the proliferation of arms and technology have contributed to shifting the focus of conflict to regional and littoral areas. Concurrently, the global arms industry continues to supply increasingly sophisticated sensors and weapons to the world-wide arms market. The heterogenous combination of military and commercial systems dictates the need to develop more advanced EW technologies which will be able to adequately exploit and counter the use of new threats.

(U) The structure and balance of this program are responsive to OPNAV guidance and the identified warfighting requirements and needs of the operational force. The program features the integration of 6.1 and 6.2 programs with 6.3 EW core programs and Advanced Technology Demonstrations (ATD) which can produce prototypes suitable for naval force

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deployments and demonstrations. Program integration is achieved through the transition and implementation of program products. The program continues to support work in Ship Self-Defense (SSD). It develops EW technologies to counter a range of threats (including multi-spectral/multi-modal sensors and seekers) and spans the entire electromagnetic spectrum by improving threat detection, identification, and location in the battle space. The program transitions new technologies to tactical aircraft (TACAIR), low observable aircraft, surface EW platforms, and Pre-Planned Product Improvement (P3I) programs through developmental upgrades and direct technology insertions.

(U) Due to the sheer volume of efforts included in this Program Element, the programs described are representative selections of the work included in this program element.

(U) JUSTIFICATION FOR BUDGET ACTIVITY: This program is budgeted within the APPLIED RESEARCH budget activity because it investigates technological advances with possible applications toward solution of specific Naval problems, short of a major development effort.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1995 ACCOMPLISHMENTS: Continued effort was made in developing techniques for transition into the Airborne Integrated Electronic Warfare System (AIEWS) SLQ-32 replacement system for surface combatants. Improvements and innovations for SSD technology were undertaken. Increased effort in the area of infrared countermeasures (IRCM) were initiated in response to the Tri-Service Infrared Countermeasures Program Plan which was developed under the direction of the Office of the Secretary of Defense.

- (U) ($2,879) THREAT WARNING - The objective is to develop small and inexpensive Radio Frequency (RF) receiver and demodulation techniques to recognize and characterize complex modern-modulation waveforms and to exploit both active and passive EO/IR technologies to provide early warning of hostile action, either surveillance or attack, to U.S. military platforms and to assist in identifying the threat and counter it.

(U) Integrated advanced technologies for a small arms counterfire direction funding system capable of detecting and

locating small arms muzzle flash.
(U) Completed Optical Augmentation (OA) and Infrared Search and Track (IRTS) susceptibility tests.
(U) Conducted final Tri-service demonstration of a digitally augmented receiver.
(U) Performed field testing of a full-up automatic Specific Emmitter Identification (SEI) system.
(U) Field tested Radar Warning Receiver/Infrared Warning Receiver (RWR/IRWR) full-up fusion demonstration.
(U) Integrated SEI techniques, Precision Electronic Support Measures (ESM), and Combat System Tracks for Littoral Warfare and Joint Strike missions. This is a new start focusing on improved situational awareness.

• (U) ($9,082) SELF PROTECTION - The objective is to provide a fundamental technology base, from components to systems, to support the prototype development of future onboard and offboard EW systems, to enhance Naval success in Littoral Warfare, Joint Strike, Sealift/Protection, Strategic Deterrence, and SEW Intelligence. The entire radar RF frequency band from High Frequency (HF) to Millimeter Wave (MMW) is covered under this project. It also includes the protection of U.S. Naval platforms against IR/EO guided weapons by the development of new IR materials for decoys and new deployment concepts and the development of technologies for laser based jammers.

(U) Incorporated a multiple tap delay line into the Van Atta Array modulation brassboard providing phase matched pulse stretching of four multiplexed optical signals.
(U) Fabricated and tested a large, planar array for the Advanced Multimode Active Electronic Counter Measures (ECM) system.
(U) Investigated the feasibility of using a low altitude decoy concept against advanced IR seekers (new start).
(U) Evaluated the Smart Towed IR Decoy for potential use in helicopters (new start).
(U) Performed ground test of a MMW jammer using an operational missile system.
(U) Optimized the IR Distraction Decoy design and investigated deployment parameters--demonstrated in over-water firings against anti-ship cruise missile simulators.
(U) Completed final design of the Rigid Inflatable RF/IR decoy and perform deployment tests using the MK36 launcher.
(U) Fabricated and tested an optimal demonstration vehicle and antenna isolation model for determining vehicle design compatibility.
(U) Demonstrated risk reduction of Long Duration Tethered Electronic Decoy for SSD (new start).

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• (U) ($4,905) MISSION SUPPORT - The objective is focused on improving the ability to assess EW performance ranging from individual system/platform through operations in Joint Mission and Support Areas such as training and the research infrastructure. A major goal of this research area is to explore development of Battle Management decision aids which fit within the established Navy C2 system deployed throughout the fleet. The focus is also on advanced surveillance techniques and jamming and deception of command and control systems and data links and the development of capabilities for strike, surveillance, ECM and other mission-support aircraft to improve situation awareness, to provide dependable combat identification and to determine the intent of enemy forces by passive means while disrupting their capability to obtain and disseminate tactical information.

(U) Evaluated Doppler difference hardware from received signals and estimate the seeker angle for a determination of ECM effectiveness in real time.
(U) Developed and tested real time data interfaces for multiple shipboard EW sensors and design a prototype sensor integration system.
(U) Refined the portable universal environment simulator design to meet fleet requirements for underway training and EW equipment checkout.
(U) Developed and tested technology for an embedded, at-sea training capability for EW C2 and the Navy Tactical Command System Afloat.
(U) Developed anti-ship missile real-time effectiveness measures that correlate RSM and integrated acceleration data from Doppler radar tracks.

2. (U) FY 1996 PLAN: The FY 1996 plan includes increased emphasis on technology addressing increased survivability for surface ships and tactical aircraft against the advancing IR threat. Efforts to increase shipboard sensor and weapons response to satisfy the reduced timelines associated with operations in littoral regions will continue. Programs in the areas of combat identification, precision strike and information dominance will receive added support to assist in the successful accomplishment of the Navy's JMA strategy.

• (U) ($2,945) THREAT WARNING - The objective is to develop small and inexpensive RF receiver and demodulation techniques to recognize and characterize complex modern-modulation waveforms and to exploit both active and passive EO/IR technologies to provide early warning of hostile action, either surveillance or attack, to U.S. military

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platforms and to assist in identifying the threat and counter it.

(U) Test multipath and navigation correction hardware for Electronic Stabilization.
(U) Field test initial prototype of small arms counterfire direction system.
(U) Perform final hardware configuration test of P-3 pod antenna system.
(U) Complete work necessary to transition the Digital Receiver to AIEWS, AN/ALR-67 Advanced Special Receiver (ASR) and AN/ALQ-99.
(U) Demonstrate capability of the Phase III EW/Micorwave Monolithic Integrated Circuit (MMIC) receiver.
(U) Develop miniature SEI extraction and processing hardware for integration into the full up automated SEI system.
(U) Perform analysis of passive emitter location using Doppler from helicopter rotors (new start).
(U) Field test compact URD-4 tactical system which is a significant enhancement to the Surveillance JMA.
(U) Characterize different antennas using a Polarimeter for identification of Non-Cooperative Target Recognition.

• (U) ($8,564) SELF PROTECTION - The objective is to provide a fundamental technology base, from components to systems, to support the prototype development of future onboard and offboard EW systems, to enhance Naval success in Littoral Warfare, Joint Strike, Sealift/Protection, Strategic Deterrence, and SEW Intelligence. The entire radar RF frequency band from HF to MMW is covered under this project. It also includes the protection of U.S. Naval platforms against IR/EO guided weapons by the development of new IR materials for decoys and new deployment concepts and the development of technologies for laser based jammers.

(U) Perform at-sea testing of optical amplifier jammer hardware.
(U) Develop and perform land based testing of an autonomous shipboard decoy launch and recovery system (new start).
(U) Initiate fabrication of a brassboard employing a linear array with a Photonic beam forming network.
(U) Test advanced IRCM false targets against foreign anti-ship cruise missiles (ASCM) seekers (new start).
(U) Complete Smart Towed IR Decoy flight and tether design.
(U) Demonstrate improved Kinematic-Special Material Decoy (SMD) against advanced seekers with discrimination capability.
(U) Test and analyze effectiveness results of the short pulse laser against the component response model(new start).
(U) Identify materials with potential for broadband applications, conduct a preliminary design of an active laser

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target and conduct Optical Augmentation (OA) measurements for Focal Plane Array (FPA) cameras at extended range to address the laser guided weapons problem (new start).
(U) Modification of IR Distraction Decoy design to include results of overwater tests.
(U) Complete MMW jammer design.
(U) Complete Lumped Line Towed Decoy test phase.

• (U) ($6,269) MISSION SUPPORT - The objective is focused on improving the ability to assess EW performance ranging from individual system/platform through operations in Joint Mission and Support Areas such as training and the research infrastructure. A major goal of this research area is to explore development of Battle Management decision aids which fit within the established Navy C2 system deployed throughout the fleet. The focus is also on advanced surveillance techniques and jamming and deception of C2 systems and data links and the development of capabilities for strike, surveillance, ECM and other mission-support aircraft to improve situation awareness, to provide dependable combat ID and to determine the intent of enemy forces by passive means while disrupting their capability to obtain and disseminate tactical information.

(U) Develop optimization algorithm for the soft-kill/hard-kill integration prototype for ship's on-board and off-board ECM techniques and assets employment.
(U) Demonstrate Optimum Resource Allocation algorithms for ship's on-board and off-board ECM techniques and asset employment.
(U) Assess requirements for captive carry hybrid simulation tests of advanced Anti-Ship Cruise Missile (ASCM) seekers (new start).
(U) Investigate navigation strategies using virtual reality (new start).
(U) Develop high speed algorithms and networks to link a detailed pulse-by-pulse CRUISE model with a high density signal level model such as the Full Engagement Decoy Simulator (FEDS).
(U) Incorporate cloud cover model to the IR predictive code in the CRUISE model.
(U) Fabricate and perform tri-service test of a cellular communications countermeasures system.
(U) Assess isolation improvement techniques and analysis methods.

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3. (U) FY 1997 PLAN: FY 1997 increased funding reflects an increase to enhance IRCM technology. Work continues on shipboard sensor and weapons response involved in operations in littoral regions. Programs concerning combat identification, precision strike and information dominance will continue and development of micro/Unmanned Aerial Vehicle (UAV) designs for small Radar Cross Section (RCS) platforms will be initiated.

• (U) ($3,407) THREAT WARNING - The objective is to develop small and inexpensive RF receiver and demodulation techniques to recognize and characterize complex modern-modulation waveforms and to exploit both active and passive EO/IR technologies to provide early warning of hostile action, either surveillance or attack, to U.S. military platforms and to assist in identifying the threat and counter it.

(U) Demonstrate MMIC Phase III hardware in a MK-36 compatible decoy.
(U) Initiate development of micro/UAV designs for protection of small radar cross section (RCS) platforms (new start).
(U) Transition EW/MMIC Receiver to AIEWS, ALR-67 ASR.
(U) Conduct anechoic chamber tests of integrated miniature SEI with MMIC receiver and antenna.
(U) Fabricate 16-channel optical brassboard for use in follow-up receiver testing.
(U) Develop passive emitter location hardware for helicopters.

• (U) ($10,850) SELF PROTECTION - The objective is to provide a fundamental technology base, from components to systems, to support the prototype development of future onboard and offboard EW systems, to enhance Naval success in Littoral Warfare, Joint Strike, Sealift/Protection, Strategic Deterrence, and SEW Intelligence. The entire radar RF frequency band from HF to MMW is covered under this project. It also includes the protection of U.S. Naval platforms against IR/EO guided weapons by the development of new IR materials for decoys and new deployment concepts and the development of technologies for laser based jammers.

(U) Develop design requirements for incorporating advanced active multimode countermeasure into AIEWS.
(U) Fabricate and test onboard MMW jammer breadboard.
(U) Develop a method of launching a shipboard decoy using non-pyrotechnic means (new start).
(U) Flight test High Range Resolution (HRR)/Inverse Synthetic Aperture Radar (ISAR) countermeasures hardware.

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(U) Fabricate Millimeter Wave Power Module (MMPM) electronically steered array for testing in airborne ECM systems (new start).
(U) Develop final IR Distraction Decoy design.
(U) Flight certify a Smart Towed IR Decoy with tethered interface.
(U) Evaluate effects of a short pulse laser against IR seekers.
(U) Develop 7 channel fiber-optic antenna remoting system (new start).
(U) Define and procure candidate broadboard materials for use in offboard devices against laser guided weapons.
(U) Characterize FPA cameras and implement design of OA receiver and laser jamming of FPA cameras for onboard systems against laser guided weapons.
(U) Design and develop optical chaff round (new start).
(U) Establish fuze vulnerabilities and evaluate techniques to address EO/IR fuze (new start).
(U) Evaluate IRCM false target tests and modify false target generator.

• (U) ($8,197) MISSION SUPPORT - The objective is focused on improving the ability to assess EW performance ranging from individual system/platform through operations in Joint Mission and Support Areas such as training and the research infrastructure. A major goal of this research area is to explore development of Battle Management decision aids which fit within the established Navy C2 system deployed throughout the fleet. The focus is also on advanced surveillance techniques and jamming and deception of command and control systems and data links and the development of capabilities for strike, surveillance, ECM and other mission-support aircraft to improve situation awareness, to provide dependable combat ID and to determine the intent of enemy forces by passive means while disrupting their capability to obtain and disseminate tactical information.

(U) Develop and test a prototype shipboard sensor integration system with real-time interfaces.
(U) Develop high speed algorithms to attempt real-time simulation of IR/RF scenarios.
(U) Develop enhanced detailed sea surface model for use in clutter simulation and modeling tests (new start).
(U) Continue evaluation of Navy operational strategies by incorporating Virtual Reality concepts.

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B. (U) PROGRAM CHANGE SUMMARY:

	FY 1995	FY 1996	FY 1997
(U) FY 1996 President's Budget:	$17,176	$18,341	$20,836
(U) Adjustments from FY 1996 PRESBUDG:	-310	-563	+1,618
(U) FY 1997 PRESBUDG Submit:	$16,866	$17,778	$22,454

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: FY 1995 change reflects a reduction in program requirements. FY 1996 change reflects: Congresional undistributed (-$348); revised DoD inflation estimates (-$215). FY 1997 change reflects combination of revised DoD inflation estimates (-$705), minor pricing adjustments (-$177) and an increase in program requirements (+$2,500).

(U) Schedule: FY 1996 reflects a delay in the flight test of the High Range Resolution (HRR) hardware. FY 1997 reflects a change in the Polarimeter technology transition, transition of a Lumped Line Towed Decoy is delayed, transition of HRR is delayed, the Smart Towed IR Decoy will not be demonstrated, candidate offboard broadband materials will not be field tested and techniques will be evaluated to address the EO/IR fuze but a design will be delayed.

(U) Technical: FY 1997 P-3 SEI antenna integration will be funded from the Navy Technology Insertion Program.

C. (U) OTHER PROGRAM FUNDING SUMMARY:

(U) RELATED RDT&E PROGRAMS:
This PE adheres to Tri-Service Reliance Agreements on EW with oversight and coordination provided by the JDL and is

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associated with efforts that are being pursued under the following Army and Air Force PEs:

(U) PE 0602204F (Aerospace Avionics)
(U) PE 0603270F (Electronic Combat Technology)
(U) PE 0602270A (Electronic Warfare Technology)
(U) PE 0603270A (Electronic Warfare Technology)
(U) PE 0605604A (Survivability and Lethality Analysis)

This program is also closely associated with the following Navy PEs:
(U) PE 0601153N (Defense Research Sciences)
(U) PE 0602315N (Mine Countermeasures, Mining and Special Warfare Technology)
(U) PE 0602234N (Materials, Electronics and Computer Technology)
(U) PE 0602232N (Space and Electronic Warfare (SEW) Technology)
(U) PE 0602111N (Air and Surface Weapons Technology)
(U) PE 0603270N (Advanced Electronic Warfare Technology)
(U) PE 0603792N (Advanced Technology Transition)
(U) PE 0604270N (EW Development)

D. (U) SCHEDULE PROFILE: Not applicable.

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DATE: March 1996

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602315N
PROGRAM ELEMENT TITLE: Mine Countermeasures, Mining and Special Warfare Technology

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 1995 ACTUAL	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
Mine Countermeasures, Mining and Special Warfare Technology	36,932	46,894	40,534	42,885	48,988	49,954	51,040	CONT.	CONT.

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This Navy program element (PE) provides technologies for naval Mine Countermeasures (MCM), U.S. naval mines, Naval Special Warfare, and Department of Defense (DOD) Explosive Ordnance Disposal (EOD). It is strongly aligned with the Joint Chiefs of Staff Joint Warfighting Capabilities through the development of technologies to achieve military objectives (Power Projection from the Sea) with minimal casualties and collateral damage.

The PE supports the Joint Littoral Warfare Mission Area by focusing on technologies that will provide the Naval Force with the capability to dominate the battlespace, project power from the sea, and support forces ashore with particular emphasis on rapid MCM operations. The MCM component concentrates on the development of technologies for clandestine minefield surveillance and reconnaisance, self-protection, minehunting, neutralization/breaching and clearance; the Mining component emphasizes offensive mining capabilities. The Special Warfare and EOD technology components concentrate on the development of technologies for near shore mine/obstacle detection and clearance, mobility and survivability, as well as explosive ordnance disposal.

(U) Due to the sheer volume of efforts included in this PE, the programs described in the Accomplishments and Plans sections are representative selections of the work included in this PE.

(U) MCM Technology: Third-world nations have the capability to procure, stockpile and rapidly deploy all types of naval mines, including new generation mines having sophisticated performance characteristics, throughout the littoral battlespace. "Desert Storm" demonstrated the U.S. Navy's needs to counter the projected third-world mine threat. Advanced technologies are required to rapidly detect and neutralize all mine types, from deep water to the beach. This PE has two major thrusts: (1) mine/obstacle detection and (2) mine/obstacle neutralization. The detection thrust includes: remote sensing techniques to survey threat mining activities and mine/obstacle field locations; advanced acoustic/non-acoustic sensors and processing technologies for rapid minefield reconnaissance and determination of the location of individual mines and obstacles. The

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majority of these sensors and techniques will be demonstrated in FY 1997 and FY 1998 as part of the Joint Countermine Advanced Concepts Technology Demonstration (ACTD). The neutralization thrust includes influence sweeping technologies for influence minefield clearance, explosive and non-explosive technologies for surf zone (SZ) mine/obstacle field breaching, and advanced technologies to rapidly neutralize shallow water (SW) sea mines.

(U) Mine Technology: The need for improved mine technologies has diminished due to the reduced threat of the traditional modern submarines and surface ships. The elevated threats today are the third-world submarines and surface ships which may be encountered in the littoral waters of regional conflicts. Despite the diminished sophisticated threat, it is imperative that the Navy maintains its "critical mass" effort and capabilities in mine sensors, environment, and systems performance analysis technology. Emphasis will be placed on potentially high pay-off advanced target detection sensors and low cost mine system concepts with expanded weapon effectiveness for regional warfare.

(U) Special Warfare Technology: Naval Special Warfare (NSW) missions primarily support covert naval operations. The goal is to develop technology required to increase the combat range and effectiveness of Special Warfare units. A major current focus is to develop technologies to enhance the Sea-Air-Land (SEAL) mission of pre-invasion detection for clearance/avoidance of mines and obstacles in the very shallow water (VSW) and SZ approaches to the amphibious landing areas. Improvements to mission support equipment are needed to increase the probability of mission success, endurance and SEAL swimmer survivability.

(U) EOD Technology: Technology development for the EOD needs addresses the DOD Joint Service and interagency responsibilities in EOD, including that required to counter and neutralize Special Improvised Explosive Devices (SIED). The technologies developed are required for locating, rendering safe, and disposing of Unexploded Ordnance (UXO). These operations typically occur in deep, poor-visibility water, in areas of high background noise, and in strategic operating areas contaminated by a variety of UXO. Advanced technologies are needed for gaining access to areas contaminated by sophisticated area-denial sensors and/or booby traps and for contending with SIED incidents. These technologies are expected to transition to the Joint Services EOD Program or the DoD Technical Response Group.

(U) Affordability and life cycle cost considerations which are inherent to the technology issues addressed by this PE include: (1) reduced end-product costs; (2) improved maintainability and endurance; (3) efficient operational deployment and application, and (4) broader area or scope of impact for the resultant processes or mechanisms. In some cases, one or more of these attributes represent the primary purpose of the technology efforts. Specific examples within this program include: (1) a wide-swath omni-directional sonar array Toroidal Volume Search Sonar (TVSS) implemented with conformal polymer transducer

material for low-cost fabrication and light weight; (2) a high-sensitivity superconducting (SQUID) magnetic sensor, operating at temperatures compatible with the logistics and endurance of liquid nitrogen (vice helium) cooling; (3) the "Thunder Road" distributed explosive array deployment approach for efficient standoff area mine clearance; (4) shock mitigation techniques for high speed boats to reduce material and personnel attrition and enhance mission endurance; (5) technologies for a littoral sea mine capability with broader area coverage and significantly higher target threat reliability than presently available.

(U) JUSTIFICATION FOR BUDGET ACTIVITY: This program is budgeted within the APPLIED RESEARCH Budget Activity because it investigates technological advances with possible applications toward solution of specific Naval problems, short of a major development effort.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1995 ACCOMPLISHMENTS:

- (U) ($17,972) MINE/OBSTACLE DETECTION:
  - (U) Acoustic Sensors: Completed sea testing of the TVSS. Completed development and fabrication of the Side Looking Sonar (SLS). Completed fabrication and test pool measurements of high resolution, motion-compensated, side scan Synthetic Aperture Sonar (SAS) for detection, classification, and identification of bottom mines in very shallow water.
  - (U) Electro-Optic Sensors: Initiated sea tests of Unmanned Undersea Vehicle-compatible Laser Line Scan (LLS) prototype sensor to demonstrate mine identification capability.
  - (U) Elecro-Magnetic Sensors: Designed experimental Low Critical Temperature (Lo Tc) helium-cooled superconducting gradiometer (increased sensitivity and range) for detection and classification of buried mines.
  - (U) Image Processing and Classification Algorithms: Implemented a real-time LIDAR image processing algorithm capable of a 50% reduction in false alarms per target detected for anti-invasion minefield reconnaissance. Developed high-speed image processing algorithms for airborne anti-invasion mine detection and classification using passive and active optical sensors. Initiated effort to explore multisource data fusion methods to detect obstacles, mines and mine laying activities before hostilities.

- (U) ($9,580) MINE/OBSTACLE NEUTRALIZATION
  - (U) SW Mine Neutralization: Demonstrated stable Anti-Mine Projectile (AMP) dynamics through air, oblique water-

entry, and underwater. Continued surrogate mine detonation tests to quantify candidate AMP reactant materials. Initiated identification of key technical targeting and fire control system issues for RAMICS.

- (U) SZ Mine Neutralization: Investigated more accurate techniques to measure explosive shock pressures in wet sand to improve predictive capability of explosive performance. Developed a multi-phase model in a coupled hydrodynamic-structural code for simulation of explosive shock propagation through wet sand. Conducted mine vulnerability testing of available threat mines to update kill criteria and expand threat mine database. Conducted proof-of-concept tests for "Thunder Road" Distributed Explosive Technology (DET) array deployment concept, including a dynamic drop/deployment from a crane. Assessed effectiveness of Power Blade technology to clear anti-invasion mines on the beach.
- (U) Obstacle Breaching: Demonstrated single plate Explosively Formed Projectile (EFP) technology for destruction of SZ obstacles above water. Investigated concepts for in-stride deployment of EFP warheads against SZ obstacles. Conducted quantitative feasibility studies of alternative concepts for in-stride clearance including: linear shaped charge net, simultaneous detonation of bombs, high energy vortex rings, and obstacle vulnerability testing with dilute explosive tiles.

- (U) ($2,698) MINING:
  - (U) Mine Sensors: Completed Littoral Sea Mine (LSM) test vehicle and initiated lab testing of acoustic and electromagnetic sensors for LSM application. Deployed LSM test vehicle at sea and initiate background data collection. Developed advanced gradient influence sensor for detecting targets in shallow water high wave noise environments.
  - (U) Mine Support Technology: Continued testing reliability of underwater acoustic message transmissions techniques for Identify Friend or Foe (IFF). Evaluated neural network target classification algorithm for bottom mine target detecting devices. Developed advanced LSM classification and fire control techniques using fuzed acoustic and magnetic target influences.

- (U) ($6,682) SPECIAL WARFARE/EOD:
  - (U) Mission Mobility Technology: Conducted laboratory tests of shock mitigation technology components for NSW high speed boats. Tested and evaluated CO_2 and Oxygen sensor prototypes in MK 16 diver rebreather equipment.
  - (U) Mission Support Technology: Assessed echo backscatter technique to enhance hand held sonar's classification capability. Conducted operator evaluation/demonstration of detection performance of modified AN/PQS-2A hand

held sonar which incorporates spectral processing and a visual display. Fabricated test prototype of clandestine underwater near UV laser imager for mine identification.

- (U) Clearance of Conventional Ordnance: Tested and transitioned autonomous EOD work package containing controller, navigation, and "target" classification sections to a small, low weight autonomous underwater vehicle testbed. Demonstrated capability to acoustically image underwater targets at 3 frames per second. Developed high resolution simulation for assessing techniques to gather unexploded ordnance using multiple small robot agents.
- (U) Response to IED/SIED Incidents: Demonstrated significantly increased jet velocity of a linear shaped charge for UXO render safe procedures. Developed a controlled test bed for assessing robotic arm performance. Developed multiple suit/obscurants to circumvent detection by anti-intrusion sensors.

2. (U) FY 1996 PLAN:

- (U) ($21,691) MINE/OBSTACLE DETECTION
  - (U) Acoustic Sensors: Complete integration of the experimental SLS into the sonar testbed and conduct initial tow testing to evaluate towbody motion. Conduct very shallow water sea tests of low frequency (LF) and high frequency (HF) SAS and assess beamforming and motion compensation technology performance. Assess effectiveness of TVSS in a horizontal operating mode for wide-area mine detection/classification in shallow water.
  - (U) Electro-Optic Sensors: Complete sea tests of LLS prototype to identify sea mines in littoral waters. Investigate spectral imaging and analysis techniques for enhanced performance object classification and identification.
  - (U) Electro-Magnetic Sensors: Complete thin-film superconducting gradiometer down-selection process and begin fabrication of a field-deployable prototype sensor.
  - (U) Image Processing and Classification Algorithms: Demonstrate acoustic image processing algorithms for more automated mine classification in conjunction with the SAS sea test. Evaluate effectiveness of using resonance signal processing algorithms (using acoustic backscatter returns from mines) for long range mine classification without imaging. Refine airborne laser based image processing algorithms for detection of anti-invasion minefields in high clutter surf/beach zone environments, achieving further reduction in false alarm rates. Develop and evaluate algorithms which exploit multi-source data fusion methods to baseline the physics for submerged mine detection using remote imaging radar. Develop an artificial neural network target classifier for emulating a marine mammal's mine detection and classification capabilities.

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UDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602315N
PROGRAM ELEMENT TITLE: Mine Countermeasures, Mining and Special Warfare Technology

- (U) ($12,503) MINE/OBSTACLE NEUTRALIZATION:
  - (U) SW Mine Neutralization: Investigate technology issues associated with targeting and fire control for The Rapid Airborne Mine Clearance System (RAMICS) concept. Perform an integrated system-level evaluation and static demonstration of the RAMICS target acquisition, fire control, gun, and anti-mine projectile pergformance.Conduct technical analysis regarding feasibility and effectiveness of creating focused underwater shock waves to implement standoff mine destruction. Investigate hydrodynamic issues and approaches for pressure influence mine sweep concepts.
  - (U) SZ Mine Neutralization: Continue mine vulnerability testing of available mines to update kill criteria and develop analytical models to simulate effectiveness of buried mines in wet sand. Conduct critical component and initial full-scale testing of Thunder Road, providing an alternative approach to delivery which does not require a Naval craft. Continue survey and investigation of other alternative distributed explosive array deployment concepts.
  - (U) Obstacle Breaching: Continue testing of various warhead types against concrete obstacles to develop baseline damage rules. Initiate proof-of-concept testing of the best alternative breaching concepts as determined by the feasibility studies.

- (U) ($2,946) MINING:
  - (U) Mine Sensors: Complete LSM technology demonstration of acoustic and electro-magnetic sensors. Complete integrated acoustic, magnetic, electric and pressure LSM sensors data analysis. Update signal processing algorithms for SW diesel-electric submarines. Test advanced gradient influence sensor to determine the ability to detect targets in SW high wave noise environments.
  - (U) Mine Support Technology: Develop high reliability underwater message transmission techniques for Remote Control (RECO) applications. Transition advanced neural network classification and mine control firing algorithms using fuzed multiple influence sensor data to Mine Improvements program. Continue development of advanced LSM classification and fire control algorithms for detecting/localizing all surface targets, including fast patrol boats.

- (U) ($7,800) SPECIAL WARFARE/EOD:
  - (U) Mission Mobility Technology: Test and demonstrate a full-scale NSW high speed boat shock mitigation system. Transition the CO_2 and Oxygen sensor technology to EOD Fleet Diving System (Mk-16) Product Improvement Program. Develop and demonstrate capability to remove carbon dioxide from the breathing loop of closed circuit Underwater

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Breathing Apparatus (UBA) using membrane separation technique. Explore power source technologies for low signature diver propulsion vehicle application. Conduct phase change materials testing/evaluation for use in diver thermal protection.

- (U) Mission Support Technology: Evaluate feasibility of a portable multispectral reconnaissance imager for target (land mines,tanks, etc.) identification using a on-cooled optical parametric amplifier laser. Conduct laboratory testing of prototype ultrashort range-gated UV laser/camera. Conduct a technology assessment of underwater adhesives and non-metallic attaching technologies.
- (U) Clearance of Conventional Ordnance: Demonstrate capability of small robotic agent to detect and gather unexploded ordnance. Apply model based neural network processing technique to magnetometer and ground penetrating radar data from operational scenarios to reduce false alarms and increase detection rate.
- (U) Response to IED/SIED Incidents: Develop adaptive shielding technique to mask EOD Technician from anti-intrusion sensors.

• (U) ($1,954) Portion of extramural program reserved for Small Business Innovative Research assessment in accordance with 15 U.S.C. 638.

3. (U) FY 1997 PLAN:

• (U) ($20,679) MINE/OBSTACLE DETECTION:

- (U) Acoustic Sensors: Complete sea testing of the SLS. Demonstrate simultaneous signal processing of both the TVSS and SLS integrated into a small underwater towed vehicle. Based on analysis of at-sea tests, optimize the LF and HF SAS design for improved performance in shallow water.
- (U) Electro-Optic Sensors: Optimize electro-optic sensors based on analysis of at-sea performance. Conduct sea tests of next generation spectral imaging systems for power-efficient mine detection and identification.
- (U) Electro-Magnetic Sensors: Complete fabrication of field deployable superconducting gradiometer for the detection of buried mines. Conduct dock-side operability testing in small diameter underwater vehicle prior to at-sea tests.
- (U) Image Processing and Classification Algorithms: Conduct sea tests with integrated magnetic, SAS, and electro-optic sensors on an underwater platform in VSW to assess effectiveness of multi-sensor data fusion techniques. Demonstrate airborne image processing algorithms for detection of anti-invasion minefields in high clutter environments. Demonstrate capability to use multi-source data fusion algorithms to identify locations

of obstacles and mines. Evaluate and demonstrate the performance of the artificial neural network target classifier for incorporation into acoustic response monitor which collects a mammal's mine detecting characteristic activities and correlates them with the location of a minefield.

- (U) ($8,518) MINE/OBSTACLE NEUTRALIZATION:
  - (U) SW Mine Neutralization: Evaluate and demonstrate reliability of targeting and fire control for the AMP. Conduct at-sea experiments to verify assessment effectiveness of new mine destruction concept using focused underwater shock waves. Assess effectiveness of a candidate mine sweep concept using pressure influence.
  - (U) SZ Mine Neutralization: Validate multi-phase coupled code model for simulation of explosive shock propagation through wet sand and use results to update SZ mine neutralization analytical model. Update database of mine neutralization criteria (pressure, impulse, and energy) for threat mines through testing and analysis. Complete full-scale testing of Thunder Road for deploying distributed explosive arrays. Conduct proof-of-concept testing of promising alternative delivery concepts.
  - (U) Obstacle Breaching: Continue investigating alternatives for clearing obstacles in the SZ.

- (U) ($3,127) MINING:
  - (U) Mine Sensors: Develop Bi-Static active target motion analysis and motion compensation models for moored LSM with low cost mobile warheads. Complete measurement of target advanced gradient signatures, complete theory and performance model development, and arrive at feasibility decision for continuing this technology.
  - (U) Mine Support Technology: Demonstrate at sea reliable communications between a ship and mine, providing IFF and RECO capabilities. Verify in the lab advanced LSM processing techniques for detecting/localizing all surface targets. Assess applicability of intra-/inter-communication between mine nodes to achieve enhanced minefield effectiveness and flexibility in the form of Command, Control, Communication, Computer, and Intelligence (C4I), sensors fusion, and minefield adaptability.

- (U) ($8,210) SPECIAL WARFARE/EOD:
  - (U) Mission Mobility Technology: Complete and transition high speed boat shock mitigation system. Prototype and transition CO_2 membrane scrubber technology. Develop drive mechanism and propeller for low signature diver propulsion vehicle.
  - (U) Mission Support Technology: Integrate and demonstrate prototype UV imaging system for mine identification. Prototype and evaluate ensemble containing phase change materials for passive diver thermal protection. Design

and characterize optical parametric amplification laser for multispectral imaging.

- (U) Clearance of Conventional Ordnance: Conduct development of 2 kilo watt laser diode stack for the neutralization of surface unexploded ordnance. Begin testing of 10,000 element high frequency acoustic imaging array to provide centimeter resolution images in turbid water environment at a 20 frame per second rate. Complete experiments with a pulsed electro-magnetic induction technique for detecting and classifying buried and deeply buried unexploded ordnance.

- (U) Response to IED/SIED Incidents: Demonstrate a high velocity linear shaped charge for the disablement of SIEDs.

B. (U) PROGRAM CHANGE SUMMARY:

	FY 1995	FY 1996	FY 1997
(U) FY 1996 President's Budget:	37,475	43,384	44,303
(U) Adjustments from FY 1996 PRESBUDG:	-543	+3,510	-3,769
(U) FY 1997 PRESBUDG Submit:	36,932	46,894	40,534

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: FY 1995 decrease resulted from reduced program requirements. FY 1996 increase resulted from Congressional plus-up for RAMICS (+5,000K), offset by Congressional Undistributed (-921K) reductions amd revised DOD inflation estimates (-572K). FY 1997 reduction from revised DOD inflation estimates (-1,241K), minor pricing adjustments (-1,528K), and reduced program requirements (-1,000K).

(U) Schedule: Not applicable.

(U) Technical: Not applicable.

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 1996

BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602315N
PROGRAM ELEMENT TITLE: Mine Countermeasures, Mining and Special Warfare Technology

C. (U) OTHER PROGRAM FUNDING SUMMARY: Not applicable.

(U) RELATED RDT&E:

(U) This program has strong ties to the PE's listed below:
(U) PE 0601153N (Defense Research Sciences)
(U) PE 0602131M (Marine Corps Landing Force Technology)
(U) PE 0602233N (Readiness, Training and Environmental Quality Tech)
(U) PE 0602314N (Undersea Surveillance and Weapons Technology)
(U) PE 0602435N (Oceanographic and Atmospheric Technology)
(U) PE 0603502N (Undersea Warfare and MCM Development)
(U) PE 0603555N (Sea Control and Littoral Warfare Technology Demonstration)
(U) PE 0603654N (Joint Service EOD Development)
(U) PE 0604654N (Joint Service EOD Development)
(U) PE 1160401BB (Special Operation Technology Development)
(U) PE 1160402BB (Special Operation Advanced Technology Development)
(U) PE 0603782N (Shallow Water MCM Demonstrations)

(U) This program adheres to Tri-Service Reliance Agreements on EOD with coordination provided by the Joint Directors of Laboratories.

D. (U) SCHEDULE PROFILE: Not applicable

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FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: March 1996

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602435N
PROGRAM ELEMENT TITLE: Oceanographic and Atmospheric Technology

(U) COST (Dollars in thousands)

PROJECT NUMBER & TITLE	FY 1995 ACTUAL	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
N/A Oceanographic and Atmospheric Technology	51,423	56,576	44,559	47,254	53,011	55,083	57,833	CONT.	CONT.

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This Program Element (PE) provides the fundamental programmatic instrument by which basic environmental research is transformed into technology developments that provide new or enhanced warfare capabilities. This PE also provides environmental technologies that form the general environmental technical base on which all systems development and advanced technology depend. Efforts in this PE are fully supportive of the recent decision by the Chief of Naval Operations to "reinvigorate naval oceanography" as an essential core requirement and responsibility of the Navy.

(U) Due to the sheer volume of efforts included in this PE, the programs described in the Accomplishments and Plans sections are representative selections of the work included in this PE.

(U) This PE provides for ocean and atmospheric technology developments that contribute to meeting top joint warfare capabilities established by the Joint Chiefs of Staff. Major efforts of this PE are devoted to (1) gaining real-time knowledge of the battlefield environment, (2) environmental needs of regional warfare, (3)providing the on-scene commander the capability to exploit the environment to tactical advantage, and (4) atmospheric research related to detection of cruise missiles and weapons of mass destruction.

(U) This PE provides environmental support for fleet operations and for current or emerging systems. This PE supports virtually all the Joint Mission Areas/Support Areas with primary emphasis on Joint Littoral Warfare and Joint Strike Warfare. Specifically:

(U) Joint Littoral Warfare efforts address issues in undersea, surface, and air battlespace. Programs include ocean and atmospheric prediction for real-time description of the operational environment, shallow water (SW) acoustics and multiple-

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 1996

BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602435N
PROGRAM ELEMENT TITLE: Oceanographic and Atmospheric Technology

influence sensors for undersea surveillance and weapon systems, and environmental influences on mine countermeasure (MCM) systems.

(U) Joint Strike Warfare efforts address issues in air battlespace dominance. Programs include environmental influences on electromagnetic (EM)/electro-optic (EO) systems used in the targeting and detection of missile weapon systems as well as improvements in tactical environmental information management.

(U) These efforts support the Joint Warfare Strategy "Forward...From the Sea." This program adheres to Tri-Service Reliance Agreements on Environmental Sciences with oversight provided by the Joint Directors of Laboratories. Work in this PE is related to and fully coordinated with efforts in accordance with the ongoing Reliance joint planning process. There is close coordination with the U.S. Air Force under the Reliance program in the Environmental Sciences categories of Lower Atmospheric Sciences and Ocean Sciences.

(U) Program responses to affordability requirements include: low-cost, expendable ocean instrumentation, cost-effective data assimilation schemes for ocean and atmospheric prediction, cost-effective methods for numerical ocean and atmospheric prediction, and cost-effective techniques for incorporating real-time ocean/atmospheric conditions in environmental tactical decision aids for the on-scene commander.

(U) JUSTIFICATION FOR BUDGET ACTIVITY: This program is budgeted within the APPLIED RESEARCH Budget Activity because it investigates technological advances with possible applications toward solution of specific Naval problems, short of a major development effort.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1995 ACCOMPLISHMENTS:

- (U) ($15,112) ENVIRONMENTAL ISSUES IN UNDERSEA SURVEILLANCE AND WEAPONS:
  - (U) Constructed/validated empirical characterizations of bottom/volume and surface scattering to advance capabilities in low-frequency active acoustics; conducted tests of a low-frequency active acoustics model for SW regions to support undersea surveillance system design and performance estimates.
  - (U) Conducted preliminary investigation of the spatial/temporal nature of coastal ocean variability and assess the expected impact on acoustic variability and undersea surveillance acoustic systems; used as the

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basis for planning a FY 1996 experiment.
- (U) Evaluated the accuracy of computation of the non-adiabatic acoustic propagation terms (energy and time-spread) in strongly sloping environments.
- (U) Continued developments to construct a physics-based full-spectrum ambient noise predictive capability to permit noise cancellation/noise adaptation techniques in full-spectrum processing.
- (U) Focused on bottom aspects of SW scattering in torpedo guidance and control (G&C); used new data to increase the robustness of a feature model for classification of false-targets for improved torpedo performance assessment.

- (U) ($24,020) ENVIRONMENTAL INFLUENCES ON MCM SYSTEMS, INCLUDING LITTORAL OCEANOGRAPHY:
  - (U) Continued development of an optical data base using Coastal Zone Color Scanner data (and, if available, Sea-Viewing Wide-Field-of-View Sensor data) in coastal waters to support optical methods in MCM; fully instrumentd a towed-body in preparation for measurements to test high-resolution acoustic imaging algorithms for MCM in SW environments.
  - (U) Completed MCM Tactical Environmental Data System (MTEDS) prototype tactical decision aid software, system documentation and prototype assembly for at-sea demo in FY 1995; completed initial MCM environmental sensitivity analyses for determining tactical improvements attainable from improved environmental descriptions.
  - (U) Initiated hydrodynamical studies on the migration, scour, and burial of mines in the surf zone (SZ).
  - (U) Developed instrumentation to measure gas distribution within SZ sandy sediments, which is an environmental characteristic that significantly affects the acoustic interaction of acoustic waves with the bottom, especially the intense blast waves that offer a means of clearing buried mines.
  - (U) Characterized a coastal ocean site in terms of environmental factors that affect optical MCM systems as a basis for developing a general means of characterizing littoral optical environments.
  - (U) Developed semi-empirical acoustic and optical models to account for the effects of bubbles on acoustic and optical MCM systems.
  - (U) Conducted a high-frequency acoustic spatial/temporal coherence experiment in SW to gather data on environmental limitations to high-resolution MCM sonar systems, such as real and synthetic aperture sonar systems.
  - (U) Developed environmental sensors utilizing optical, acoustic, electromagnetic, and chemical technologies to provide a basis for remote semi-autonomous underwater oceanographic and environmental measurements, primarily with application to MCM.

- (U) Exploited remote-sensing techniques for all aspects of littoral warfare, especially MCM.

- (U) ($8,094) OCEAN AND ATMOSPHERIC PREDICTION:
  - (U) Continued development of methods aimed at a global ocean prediction system, including nested regional and tactical scale components;
    -- (U) developed models to take advantage of massively parallel computers
    -- (U) extended the Mediterranean Sea model to include air-sea interaction effects
    -- (U) developed a limited-area coastal modeling testbed to evaluate coastal models, which will be essential for real-time prediction of the operational environment in regional warfare settings.
  - (U) Increased emphasis on atmospheric prediction capability for coastal strike warfare through the incorporation of aerosols and other visibility parameters into the mesoscale system.
  - (U) Pursued development of a Coupled Ocean-Air Mesoscale Prediction System (COAMPS) that will allow sub-kilometer resolution and that will exploit the computer power expected in the mid-1990s; studies using COAMPS will provide better physical parameterizations for the Navy Operational Regional Atmospheric Prediction System (NORAPS).
  - (U) Applied artificial intelligence and neural network techniques to extract atmospheric parameters of tactical importance from remotely-sensed data.

- (U) ($4,197) ATMOSPHERIC INFLUENCES ON EM/EO SYSTEMS:
  - (U) Completed measurements on the variability of coastal atmospheric refractivity and evaluate its significance for EM systems used to detect sea-skimmers.
  - (U) Initiated electro-optical performance assessment in coastal environments through the measurement of atmospheric properties that influence EO transmission.

2. (U) FY 1996 PLAN:

- (U) ($13,699) ENVIRONMENTAL ISSUES IN UNDERSEA SURVEILLANCE AND WEAPONS:
  - (U) Validate a mid-frequency (1-10 kHz) state-of-the-art, bistatic active acoustic performance model for continental shelf and slope regions as a contribution to undersea acoustic surveillance.
  - (U) Transition a mid-frequency reverberation-suppression technique (Principal Components Inverse Method) to the Space and Naval Warfare Systems Command; this enables mathematical characterization of the acoustic components of the reverberation in near real-time.

- (U) Use measurements to assess ocean bottom influences on transient and broadband detection capabilities in SW regions; this directly supports efforts in detecting transients emitted by quiet targets.
- (U) Perform numerical testing and field testing of stochastic acoustic formalisms aimed at enabling complex SW environments to be treated without a complete deterministic description.
- (U) Conduct field measurements to provide a basis for linking acoustic variability with ocean variability.
- (U) Develop full-spectrum source models for surf, shrimp, fish and earthquake contributions and develop full-spectrum noise clutter statistics to advance the detection capabilities of full-spectrum processing.
- (U) Incorporate ocean focusing techniques using measured environmental data into signal processing algorithms to eliminate directional noise and other sources of interference to provide a robust tracking capability in the littoral environment.
- (U) Develop a detector/classifier which exploits the nonlinear character of broadband signals by simultaneously using nonlinear and chaotic methods to improve detection performance and increase detection/classification ranges, especially for the "quiet" submarine in littoral regions.
- (U) Conduct a joint oceanographic-acoustic field experiment to determine the significance of the variability of coastal oceans for undersea acoustic surveillance.
- (U) Revise the SW environmental false target model to include bottom features to advance torpedo G&C in SW; validate a bistatic bottom scattering strength model.

• (U) ($25,674) ENVIRONMENTAL INFLUENCES ON MCM SYSTEMS, INCLUDING LITTORAL OCEANOGRAPHY:
- (U) Transition bottom sediment scattering and penetration models and associated data bases to the MCM community to improve the capability to predict environmental effects on MCM acoustic systems.
- (U) Demonstrate the use of remotely-sensed optical properties in predicting the performance of MCM optical systems; conduct optical characterization of a second coastal ocean site for support of optical MCM systems.
- (U) Complete documentation of MTEDS and its transition to the MCM community; this system will enable the on-scene commander to have critical environmental data available for tactical improvements.
- (U) Continue development of hydrodynamical models that describe the migration, scour, and burial of mines in the SZ.
- (U) Develop a rapid, three-dimensional seismoacoustic scattering model in support of statistical algorithms to characterize littoral sediments for prediction of both geoacoustic and shock wave interaction with sediments.
- (U) Perform preliminary tests and modification of bubble and acoustic scattering measurement systems in SW to enable determination of the effect of bubbles on acoustic and optical MCM systems.

- (U) Analyze experimental data on high-frequency acoustic spatial/temporal coherence to determine the major environmental influences on high-resolution MCM sonar systems, such as real and synthetic aperture sonar systems.
- (U) Use the tactical oceanography simulation laboratory to provide environmental fields for amphibious warfare and special operations warfare simulations at Cherry Point, N.C.
- (U) Develop expendable, low-cost tide sensor technology and initiate development of sensor fusion procedures for littoral warfare applications.
- (U) Continue development of selected environmental sensor technologies that contribute to a remote semi-autonomous underwater oceanographic measurement capability.
- (U) Initiate development of a Portable Hyperspectral Imaging Low-Light Spectrometer (PHILLS) for use in the coastal zone to enable remote sensing of environmental characteristics and features of the coastal ocean.

(U) ($12,188) OCEAN AND ATMOSPHERIC PREDICTION:

- (U) Evaluate data assimilation techniques for the North Atlantic basin for inclusion in a large-scale ocean forecast system to be implemented by the year 2000.
- (U) Deliver an ocean forecast system for operational testing and subsequent use aboard Navy ships.
- (U) Demonstrate three-dimensional visualization methods applicable to real-time situations in shipboard environments as a means of improving the utility of ocean forecasts.
- (U) Demonstrate an ocean forecast model for the Yellow Sea - an area of operational interest.
- (U) Deliver a global ocean high-resolution eddy-resolving model for testing and operational evaluation; this represents a key step toward the goal of achieving a global ocean prediction system.
- (U) Develop new initialization methods for all atmospheric prediction models to enhance continuous assimilation of unconventional data.
- (U) Convert atmospheric prediction models to massively parallel processing machines to take advantage of their potential for greatly increased computational speed.
- (U) Continue atmospheric modeling of aerosols and improved non-hydrostatic model parameterization.
- (U) Further develop artificial intelligence and neural network techniques to extract atmospheric parameters of tactical importance from remotely-sensed data.
- (U) Initiate effort to determine utility of tactical radar systems for real-time, localized weather description as a means of contributing to ship self-defense and strike warfare.
- (U) Conduct development and integration of the Polar Ozone and Aerosal Measurement (POAM) sensor, which is scheduled for launch aboard a French satellite in FY97; POAM data will have significance for communications,

theatre defense, and surveillance.

- (U) ($4,722) ATMOSPHERIC INFLUENCES ON EM/EO SYSTEMS:
  - (U) Transition the full vertical extent version of the radio physical optics model that incorporates terrain effects; this model will enable better performance assessments in complex ocean-land coastal regions.
  - (U) Complete demonstration of the determination of atmospheric moisture profiles using Global Positioning Satellite signals of opportunity; this will be an important advance in the ability to easily determine atmospheric moisture, which influences the performance of all weapon and sensor systems using EM propagation.
  - (U) Deliver algorithm to estimate height of surface trapping layer above the ocean surface from remotely-sensed data; this will provide a breakthrough in the ability to estimate a critical environmental characteristic that affects the detection of sea-skimming missiles.

- (U) ($293) Portion of extramural program reserved for Small Business Innovative Research assessment in accordance with 15 U.S.C. 638.

3. (U) FY 1997 PLAN:

- (U) ($13,245) ENVIRONMENTAL ISSUES IN UNDERSEA SURVEILLANCE AND WEAPONS:
  - (U) Transition a bottom-scattering strength algorithm, good down to low grazing angles, that will enable bottom scattering to be accurately incorporated in Navy models that support undersea surveillance systems.
  - (U) Develop and validate an environmentally-based method for clutter control in SW to advance the capabilities of underwater active acoustic detection techniques.
  - (U) Evaluate deterministic acoustic predictions of the influence of ocean fronts and horizontal refraction on slopes to determine the significance of such features for underwater surveillance systems.
  - (U) Conduct a field test of predictions based on stochastic propagation formalisms to determine whether the stochastic approach can adequately represent acoustic conditions in harsh SW environments.
  - (U) Perform an assessment of the impact of noise on full-spectrum processors (frequencies up to 5 kHz), which offer a means of exploiting nontraditional signals emitted by submarines.
  - (U) Demonstrate in a littoral environment narrowband and broadband internode processing for a multi-node surveillance array that accounts for differential target Doppler; this capability will allow greater node

separation and a lower cost for a given area coverage.
- (U) Derive semi-empirical relationships linking acoustic variability with ocean variability.
- (U) Extend the SW scattering function model used in torpedo G&C to muddy bottoms; update the time, frequency and spatial coherence models using trial data.

• (U) ($16,684) ENVIRONMENTAL INFLUENCES ON MCM SYSTEMS, INCLUDING LITTORAL OCEANOGRAPHY:
- (U) Begin development of a semi-empirical formulation to predict lateral variability of high-frequency acoustic scattering in coastal areas and prepare to conduct further towed-body measurements to assess the spatial variability of high-frequency acoustic properties relevant to MCM operations in coastal areas.
- (U) Use remote-sensing techniques to extend optical characterizations for MCM systems to high interest areas outside the continental U.S.; evaluate surface effects on optical MCM system performance.
- (U) Conduct experiment to demonstrate the environmentally enhanced performance of magnetic MCM systems.
- (U) Make an identification of the fluid flow parameters critical to the surf/swash zone mine/sediment interaction and develop an initial empirical model for the interaction.
- (U) Complete the preliminary development of a three-phase constitutive model for sands to advance the environmental base on which explosive techniques of mine clearance will depend.
- (U) Analyze data from the previous measurements to determine the influence of bubbles on acoustical and optical MCM systems.
- (U) Transition tactical decision support functions to produce worldwide surf statistics, real-time surf data and amphibious vehicle operability data.
- (U) Provide an upgraded coherence model to the MCM development community for insertion into the synthetic aperture sonar system performance prediction model.
- (U) Continue use of simulations to determine environmental sensitivities of systems and sensors that support mine warfare and amphibious warfare.
- (U) Implement moored, low-cost mini-Acoustic Doppler Current Profiler technology to enable an affordable means of monitoring current structures in littoral regions.
- (U) Complete development of the PHILLS sensor and initiate characterization of the sensor capabilities in the coastal ocean.
- (U) Complete a littoral warfare environmental simulation capability including high-resolution circulation, wave, tidal and acoustic models in the tactical oceanographic simulation laboratory and support coastal simulations for joint undersea warfare.

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FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: March 1996

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602435N
PROGRAM ELEMENT TITLE: Oceanographic and Atmospheric Technology

- (U) ($10,038) OCEAN AND ATMOSPHERIC PREDICTION:
  - (U) Deliver ocean forecast models for the South China Sea and the Sea of Okhotsk, both areas of special operational interest, for operational testing and evaluation.
  - (U) Demonstrate a coastal tide prediction model capable of assimilating water level data and ocean current measurements; tide prediction is an essential environmental capability for successful littoral operations.
  - (U) Demonstrate the "nesting" of high-resolution coastal ocean models into regional ocean models; nesting of ocean prediction models is the central paradigm being followed in the creation of an ocean prediction scheme that will provide the necessary coverage and detail for military operations.
  - (U) Continue development of completely coupled air-ocean modeling schemes; such schemes are needed to account for the effect of the atmosphere on ocean characteristics and of ocean conditions on the atmosphere, particularly in coastal regions where complex interactions are possible.
  - (U) Demonstrate new ensemble forecasting methods for atmospheric prediction as a means of yielding not only a forecast but a likely range of possibilities.
  - (U) Provide standards for incorporation of atmospheric parameters in Navy simulators.
  - (U) Develop synthetic atmospheric environments for use in Navy training, systems testing, and tactical simulations.
  - (U) Continue effort aimed at utilization of tactical radar systems for real-time, localized weather description and as providing input to on-scene mesoscale prediction models.
- (U) ($4,592) ATMOSPHERIC INFLUENCES ON EM/EO SYSTEMS:
  - (U) Extend the Navy aerosol model into the ocean surface layer (below 10m) which plays a critical role in the detection of sea-skimming missiles.
  - (U) Develop a model of cloud edge effects to reduce false alarm rates in infra-red detection systems.
  - (U) Deliver an airborne hybrid radio propagation model to improve EM propagation prediction for airborne platforms.

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: March 1996

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602435N
PROGRAM ELEMENT TITLE: Oceanographic and Atmospheric Technology

1. (U) PROGRAM CHANGE SUMMARY:

	FY 1995	FY 1996	FY 1997
(U) FY 1996 President's Budget:	53,304	45,526	47,280
(U) Adjustments from PRESBUDG:	-1,881	+11,050	-2,721
(U) FY 1997 PRESBUDG Submit:	51,423	56,576	44,559

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: The FY 1995 reduction is due to updated 6.2 Applied Research rescission adjustment of (-1,166K) and reduced program requirements (-715K). The FY 1996 increase is composed of Congressional plus-ups (+12,850K) offset by Congressional undistributed reductions of (-1,111K), and revised DOD inflation estimates (-689K). FY 1997 reduction includes revised DOD inflation estimates (-1,387K), minor pricing adjustments (-334K) and a reduction in program requiremehts (-1,000K).

(U) Schedule: Not applicable.

(U) Technical: Not applicable.

2. (U) OTHER PROGRAM FUNDING SUMMARY: Not applicable

(U) RELATED RDT&E:
(U) PE 0601153N (Defense Research Sciences)
(U) PE 0602101F (Geophysics)
(U) PE 0602314N (Undersea Surveillance and Weapons Technology)
(U) PE 0602315N (Mine Countermeasures, Mining and Special Warfare Technology)
(U) PE 0602633N (Undersea Warfare Weapon Technology)
(U) PE 0602784A (Military Engineering Technology)
(U) PE 0603207N (Air/Ocean Tactical Applications)
(U) PE 0603785N (Combat Systems Oceanographic Performance Assessment)

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FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: March 1996

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602435N
PROGRAM ELEMENT TITLE: Oceanographic and Atmospheric Technology

(U) PE 0604218N (TESS ENG)

D. (U) SCHEDULE PROFILE: Not applicable.

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FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: March 1996

UDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602435N
PROGRAM ELEMENT TITLE: Oceanographic and Atmospheric Technology

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FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 199

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603217N
PROGRAM ELEMENT TITLE: Air Systems and Weapons Advanced Technology

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 1995 ACTUAL	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
R0446 Maritime Avionics Subsystems and Technology (MAST)	5,897	9,693	0	0	0	0	0	0	15,590
R0447 Weapons Advanced Technology	5,579	9,252	18,602	27,890	29,428	30,076	30,791	CONT.	CONT.
R2264 Air Systems Affordability	0	0	3,333	4,344	5,758	5,546	5,679	CONT.	CONT.
W2014 Integrated High Performance Turbine Engine Technology (IHPTET)	6,761	7,427	7,380	7,681	7,808	7,908	8,038	CONT.	CONT.
W2185 Advanced Anti-Radiation Guided Missile (AARGM)	2,654	0	0	0	0	0	0	0	24,597
R2282 Rapid Response Technologies	0	8,724	0	0	0	0	0	0	8,724
TOTAL	20,891	35,096	29,315	39,915	42,994	43,530	44,508	CONT.	CONT.

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This program element (PE) demonstrates concepts for future air platforms and surface/air weapons employed in Naval Warfare. The demonstrated concepts support the Joint Warfare Strategy "Forward...from the Sea" and relate to the Joint Mission Areas of Joint Strike Warfare, Littoral Warfare, and Joint Surveillance. Projects in this PE are jointly planned in the Reliance process with the Air Force and Army through panels of the Joint Directors of Laboratories.

(U) Joint Strike technology issues relevant to this PE include surgical lethality, platform survivability and affordability and increased Naval gunfire range and accuracy. Littoral Warfare technology issues relevant to this PE include air battlespace dominance, expeditionary forces air support, ship self-defense and increased Naval gunfire range and accuracy. Joint Surveillance technology issues relevant to this PE include platform mission endurance and survivability.

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FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: March 1996

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603217N
PROGRAM ELEMENT TITLE: Air Systems and Weapons Advanced Technology

Six projects are contained in the PE:

(U) Maritime Avionics Subsystems and Technology (MAST): A FY 95 short term new start, multi-faceted program maturing integrated modular avionics concepts and coordinated endeavors towards common avionics. Focused on scaleable, open, fault tolerant and common avionics architecture along with multifunction sensors and subsystems. Program thrusts addressed either Navy-specific applications or technological areas where the Tri-Services have agreed on a Navy lead.

(U) Weapons Advanced Technology: Demonstrates emerging sub-system/component level weapons concepts identified in PE 0602111N which promise affordable and significant performance improvements to both existing and next generation Naval air and surface launched weapons.

(U) Integrated High Performance Turbine Engine Technology (IHPTET): Provides experimental engine testing to demonstrate readiness for entering engineering development of new gas turbine engine technologies. IHPTET is a tri-service program in which each service contributes established shares of 6.2 and 6.3 funding and laboratory resources to meet specified goals of doubling thrust-to-weight ratio and halving fuel consumption by the year 2003 (relative to a 1987 baseline).

(U) Advanced Anti-Radiation Guided Missile (AARGM): Demonstrated advanced missile/seeker technologies to support a helicopter mounted missile with capabilities comparable to High Speed Anti-Radiation Missile/Sidearm.

(U) Air Systems Affordability: An FY 1997 new start, multi-faceted phased program to focus on improving the affordability of future major acquisition programs. This project will focus affordability research to support the delivered accuracy of future stand-off weapons.

(U) Rapid Response Technologies: An FY 1996, Congressionally directed increase geared to making emerging technologies more readily available to the fleet.

(U) JUSTIFICATION FOR BUDGET ACTIVITY: This program is budgeted within the ADVANCED TECHNOLOGY DEVELOPMENT Budget Activity because it encompasses design, development, simulation, experimental testing or prototype hardware. It is also necessary to validate technological feasibility and concept of operations to reduce technological risk prior to initiation of a new acquisition program or transition to an ongoing acquisition program.

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FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 199

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603217N
PROGRAM ELEMENT TITLE: Air Systems and Weapons Advanced Technology

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 1995 ACTUAL	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
R0447 Weapons Advanced Technology	5,579	9,252	18,602	27,890	29,428	30,076	30,791	CONT.	CONT.

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This project has been renamed and expanded. The project was originally named Electromagnetic Radiation Source Elimination (ERASE). This renamed project includes the elements contained in the original ERASE program while providing additional risk reducing demonstrations of emerging weapon guidance and control, ordnance, propulsion and airframe sub-system/component level technologies identified in Applied Research which promise affordable performance improvements to existing and next generation Navy air and surface launched weapons. The elements of this project address the Joint Mission Area (JMA) requirements for increased capabilities in the surgical lethality of weaponry (Strike JMA), increased ship self-defense capabilities (Littoral Warfare JMA) and increased accuracy and range for Naval gunfire support (Strike and Littoral JMAs). Included in this project is a focused thrust for both emitter location and defense suppression missile technologies, the requirements for which are documented in the Navy's Strike Warfare Master Plan and Conventional Munitions Plan.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1995 ACCOMPLISHMENTS:

- (U) ($3,075) Passive Radio Frequency (RF) targeting:
- (U) Completed:
  - -- (U) Low-frequency field tests, analyze data and document results.
  - -- (U) Fabrication of integrated low frequency system.
  - -- (U) Verification tests of passive ranging algorithms.
  - -- (U) Tests of candidate low band antennas.
  - -- (U) Integration of low frequency targeting system for test and evaluation.

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- (U) ($2,504) Advanced Anti-Radiation Missile (ARM) Guidance Demonstration (AAGD):
- (U) Initiated:
  - (U) Integration of digital signal processor with Anti-Radiation Homing (ARH) receiver.
  - (U) Procurement and fabrication of ARH processor.
  - (U) Terminal sensor processing design.
  - (U) Analysis of operational improvements (and risks) to be gained from the use of a narrow beam, high gain active antenna array to increase the sensitivity of current ARH missile seekers and potential new capabilities (i.e., an active Synthetic Aperture Array model).
- (U) Continued:
  - (U) Development of ARH digital processor and ADA software.
  - (U) Software design for terminal sensor processing.
  - (U) ARH receiver fabrication and testing.
- (U) Completed:
  - (U) Initial design of ARH receiver.
  - (U) Award of terminal sensor contract, Phase I (sensor hardware).

2. (U) FY 1996 PLAN:

- (U) ($3,289) AAGD:
- (U) Initiate:
  - (U) Study of low frequency antenna concepts.
  - (U) Development of aimpoint selection and sensor fusion processor specifications.
  - (U) Development of flight test plan.
  - (U) ARH Software Code Generation and Fabrication.
- (U) Continue:
  - (U) Integration of ARH and terminal sensor.
  - (U) Bench and Anechoic Chamber Testing of Integrated RF Receiver and Conformal Antenna.
  - (U) Design of ARH wideband active phased array.
  - (U) Integration of digital signal processor with ARH receiver.
- (U) Complete:
  - (U) ARH receiver fabrication and testing.

-- (U) Procurement and fabrication of ARH processor.
-- (U) Terminal sensor processing design.
-- (U) ARH processor ADA software development.
-- (U) Software design for terminal sensor processing.
-- (U) Active array trade study and limited demonstration.

- (U) ($4,470) Cruise Missile Real Time Retargeting Demonstration:
  - (U) This new task represents the Navy portion of a Joint Air Force/Navy effort to develop a flight weight brassboard real-time guidance and control system using a laser detection and ranging seeker under development by the Air Force and a mission planning system based on technologies developed under PE 0602111N, Air and Surface Weapons, to demonstrate the following capabilities for future cruise missiles: immediate launch on coordinates capability, inflight decision making, on-board target identification, precise aimpoint selection, battle damage indication and in-flight coordinated attack and targeting flexibility against fixed, relocated or mobile targets.

  - (U) Initiate:
    -- (U) Development of a data base of laser detection and ranging images.
    -- (U) Flight testing laser detection and ranging devices over typical cruise missile flight profiles.
    -- (U) Extending current solid state laser detection and ranging sensor capabilities by providing variable resolution for increased frame rates, direct control of field of view and increased device power.
    -- (U) Development of mission planning procedures and software for strike planning, targeting and neural network training.

- (U) ($1,493) Surgical Strike Adaptive Video and Data Communications System:
  - (U) This new task will demonstrate a platform to weapon system communication linkage to support joint strike operations involving real time retargeting and weapon control, inflight decision making, and battle damage indications. Characteristics of the desired system include a high degree of jam resistance, real time video via adaptive compression technology, and podless implementation to minimize impact on strike weapons loadout. Affordability is emphasized with compatibility with existing weapons and avionics, improved launch platform survivability and use of commercial design and production standards.
  - (U) Initiate:

-- (U) Performance prediction of adaptable data system and define demonstration.
-- (U) Design RF and embedded processor architecture and evaluate waveform approaches.
-- (U) Assess wavelet algorithms.

3. (U) FY 1997 PLAN:

• (U) ($1,641) AAGD:
- (U) Initiate:
-- (U) Analysis of integrated RF receiver and conformal antenna bench and anechoic chamber test data.
-- (U) Contract for development of low frequency antennas.
-- (U) Development of seeker simulation.
- (U) Continue:
-- (U) Design and develop an aimpoint selection processor to integrate multiple sensor inputs.
-- (U) Integration of ARH and terminal sensor.
- (U) Complete:
-- (U) Flight test plan.
-- (U) ARH Software Code Generation and Fabrication.
-- (U) Bench and Anechoic Chamber Testing of Integrated RF Receiver and Conformal Antenna.
-- (U) Integration of digital signal processor with ARH receiver.
-- (U) Delivery of terminal sensor (Imaging Infrared).

• (U) ($4,080) Cruise Missile Real Time Retargeting Demonstration:
- (U) Initiate:
-- (U) Design of common aperture for a dual mode laser detection and ranging/imaging IR seeker.
-- (U) Design and fabrication of a flight test hardware pod.
-- (U) Design and fabrication of the flight test hardware pod interface with the F/A-18 test aircraft to be used during flight test.
- (U) Continue:
-- (U) Development of the data base of laser detection and ranging images.
-- (U) Development of Mission Planning procedures and software for strike planning, targeting and neural network training.

-- (U) Flight testing of Laser Detection and Ranging Devices (LADAR) using the flight profile of potential transition weapons candidates. (Build '1' LADAR).
-- (U) Extending current solid state laser detection and ranging sensor capabilities by providing variable resolution for increased frame rates, direct control of field of view and increased device power.

• (U) ($2,544) Surgical Strike Adaptive Weapon Control Video and Data Communication System:
- (U) Initiate:
-- (U) Breadboard fabrication.
-- (U) Zero-free algorithms development for video compression.
-- (U) Omnidirectional antenna integration.
-- (U) Advanced modulation design and analysis.
-- (U) Platform/weapon integration.
-- (U) Environmental and lab testing of modules.
- (U) Continue:
-- (U) Podless system design.
-- (U) Design of RF and embedded processor architecture and evaluate waveforms.
-- (U) Assessment of wavelet algorithms for real time data compression.
- (U) Complete:
-- (U) Analysis of system performance requirements.
-- (U) Tradeoff studies of RF processing, digital processing and antennas.
-- (U) Antenna designs.
-- (U) Modem and submodule fabrication.

• (U) ($4,791) Concentric Canister Launcher (CCL):
- (U) This task is a transition/continuation of a project selected through the Advance Technology Demonstration process, started in PE 0603792N in FY 1996, transitioned to this PE for continued long term development and demonstration. This task will demonstrate a universal munitions launcher for Tomahawk, SM-2 Block IV, and Enhanced Sea Sparrow Missile (ESSM). The technologies to be demonstrated involve missile fly out from a full scale launcher tube; a fully stressed integral ship weapons module (ISWM); validation, verification, and possible redesign of developmental modeling and simulation tools; and the potential application of a new ablative material to full scale steel launchers. This program will address reduced Life Cycle Costs through reducing manning,

automated construction, and by utilizing a modular design.

- (U) Initiate:
  - -- (U) Restrained firing and fly out tests from CCLs on stands.
  - -- (U) Shock and vibration tests of loaded canisters.
  - -- (U) Manufacture full length ISWM.
  - -- (U) ISWM deck plate test.
  - -- (U) Computational Fluid Dynamics (CFD) simulations of the 3-D CFD internal ballistics simulation for Navy Tactical Missile System (NATACMS).
  - -- (U) Design and build full scale steel NATACMS launcher.
- (U) Complete:
  - -- (U) Building all full scale steel launchers.
  - -- (U) Fly out tests from CCLs on stands.
  - -- (U) Shock collar design and demonstration.
  - -- (U) Two missile types electro/optical interfaces with launcher and demonstrate same.
  - -- (U) ISWM deck plate test.

• (U) ($3,631) Concurrently Engineered Ball-Joint Gimbal for Joint Strike Weapon:

- (U) This task is a transition/continuation of a project selected through the ATD process, started in PE 0603792N in FY 1996, transitioned to this PE for continued long term development and demonstration. This advanced seeker effort has the potential of significantly reducing the cost of future strike weapon seekers without impacting their required performance capabilities. Specifically, this cost savings is achieved by reducing the number and complexity of mechanical parts, emphasizing software and electronics, maximizing the use of body-fixed components, and simplifying integration issues.
- (U) Initiate:
  - -- (U) System integration.
  - -- (U) Test platform integration.
  - -- (U) Subsystem lab and environmental testing.
- (U) Continue:
  - -- (U) Subsystem laboratory testing.
  - -- (U) Ball-Joint gimbal prototype fabrication.
  - -- (U) Large FOV sensor prototype fabrication.

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- (U) Complete:
  - -- (U) Ball-Joint design analysis.
  - -- (U) Large FOV sensor design analysis.
  - -- (U) Mechanical/electrical hardware design.

- (U) ($1,915) Shared Aperture:
- (U) This task is a new task which will demonstrate a shared RF aperture with the ability to simultaneously act as a common/shared antenna for multiple RF systems (such as: radar, communication, ESM, or Electronic Counter-counter Measures) for use on Navy platforms.
- (U) Initiate:
  - -- (U) Establishment of system requirements and performance specifications.
  - -- (U) Perform design studies for RF shared aperture array antennas.
  - -- (U) Conduct simulations and time-line analyses of each aperture type to verify combined sensor performance.

B. (U) PROGRAM CHANGE SUMMARY:

	FY 1995	FY 1996	FY 1997
(U) FY 1996 President's Budget:	3,986	9,300	14,579
(U) Adjustments from FY 1996 PRESBUDG:	+ 1,593	-48	+ 4,023
(U) FY 1997 PRESBUDG Submit:	5,579	9,252	18,602

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: FY 1995 increase reflects an increase in program requirements (+1,593). FY 1996 funding was reduced by Congressional undistributed reductions (-177) and other minor pricing adjustments (+129). FY 1997 funding increases are due to a combination of adjustments which combined all air weapons 6.3 core funds from PEs 0603217N & 0603238N into this one program element (+7,173), a reduction in program adjustments (-838), minor repricings (-$1,748) and a revised DoD Inflation estimates (-564).

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 1996

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603217N PROJECT NUMBER: R0447
PROGRAM ELEMENT TITLE: Air Systems and Weapons Advanced Technology PROJECT TITLE: Weapons Advanced Technology

(U) Schedule: Not applicable.

(U) Technical: Not applicable.

C. (U) OTHER PROGRAM FUNDING SUMMARY: Not applicable.

(U) RELATED RDT

(U) PE 0601152N (In House Lab Independent Research)
(U) PE 0601153N (Defense Research Sciences)
(U) PE 0602111N (Surface/Aerospace Surveillance and Weapons Technology)
(U) PE 0602122N (Aircraft Technology)
(U) PE 06 Materials, Electronics, and Computer Technology)
(U) PE 060 ventional Munitions)
(U) PE 0603238N (Precision Strike and Air Defense Technology Demonstrations)
(U) PE 0603609N (Conventional Munitions)
(U) PE 0603601F (Advanced Weapons)
(U) PE 0207133F (F-16 Squadrons)
(U) PE 0203730A (Chaparral Missile)

D. (U) SCHEDULE PROFILE: Not applicable.

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FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 199(

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603217N
PROGRAM ELEMENT TITLE: Air Systems and Weapons Advanced Technology

(U) COSTS: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 1995 ACTUAL	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 9999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
R2264 Air Systems Affordability	0	0	3,333	4,334	5,758	5,546	5,679	CONT.	CONT.

A. (U) PROGRAM ACCOMPLISHMENTS AND PLANS: This new project demonstrates affordability concepts for future air platforms and surface/air weapons employed in Naval Warfare. The demonstrated concepts will support the development and implementation of a phased program to focus a portion of the S&T programs on improving the affordability of future major acquisitions programs.

1. (U) FY 1995 ACCOMPLISHMENTS: Not applicable.

2. (U) FY 1996 PLAN: Not applicable.

3. (U) FY 1997 PLAN:

- (U) ($3,333) Precision Strike Navigator (PSN):
  - This task is a transition/continuation of a project selected through the Advance Technology Demonstration (ATD) process, started in Program Element (PE) 0603792N in FY 1996, and transitioned to this PE for continued long term development and demonstration. This task will develop a compact Inertial Management Unit (IMU) that will be capable of precision guidance even in a Global Positioning System (GPS) jamming environment. The PSN has the potential of replacing terminal seekers (Infrared and RF) by providing a substantial increase in terminal guidance accuracy with a concurrent order of magnitude reduction in cost. the PSN can be integrated into new weapons systems such as the Joint Stand-Off Weapon/Joint Direct Attack Munition and Tomahawk Block IV missiles.
  - (U) Initiate:
    - -- (U) Fabrication and testing of PSN IMU.
    - -- (U) Procurement and testing of accelerometers with electronics.
    - -- (U) System integration.
    - -- (U) Laboratory testing.

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 1996

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603217N PROJECT NUMBER: R2264
PROGRAM ELEMENT TITLE: Air Systems and Weapons Advanced Technology PROJECT TITLE: Air Systems Affordability

- (U) Continue:
  -- (U) Writing and verification of data reduction software.
- (U) Complete:
  -- (U) Design of polarizing and depolarizing polymer waveguide.
  -- (U) Fabrication of IMU's.

B. (U) PROGRAM CHANGE SUMMARY:

	FY 1995	FY 1996	FY 1997
(U) FY 1996 President's Budget:	0	0	0
(U) Adjustments from FY 1996 PRESBUDG	0	0	+3,333
(U) FY 1997 PRESBUDG Budget Submit:	0	0	3,333

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: FY 1997 increase due to program adjustment.

(U) Schedule: Not applicable.

(U) Technical: Not applicable.

C. (U) OTHER PROGRAM FUNDING SUMMARY: Not applicable.

(U) RELATED RDT&E:

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FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 199

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603217N PROJECT NUMBER: R2264
PROGRAM ELEMENT TITLE: Air Systems and Weapons Advanced Technology PROJECT TITLE: Air Systems Affordability

(U) PE 0601152N (In House Lab Independent Research)
(U) PE 0601153N (Defense Research Sciences)
(U) PE 0602111N (Surface/Aerospace Surveillance and Weapons Technology)
(U) PE 0602122N (Aircraft Technology)
(U) PE 0602234N (Materials, Electronics, and Computer Technology)
(U) PE 0602602F (Conventional Munitions)
(U) PE 0603238N (Precision Strike and Air Defense Technology Demonstrations)
(U) PE 0603609N (Conventional Munitions)
(U) PE 0603601F (Advanced Weapons)
(U) PE 0207133F (F-16 Squadrons)
(U) PE 0203730A (Chaparral Missile)

D. (U) SCHEDULE PROFILE: Not applicable.

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 1996

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603217N
PROGRAM ELEMENT TITLE: Air Systems and Weapons Advanced Technology

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 1995 ACTUAL	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
W2014 Integrated High Performance Turbine Engine Technology (IHPTET)	6,761	7,427	7,380	7,681	7,808	7,908	8,038	CONT.	CONT.

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This project covers the Navy's share of the demonstrator engine efforts under IHPTET, ensuring that Navy unique design and operational requirements are met. Full scale integrated technology demonstration is essential to transition technologies from exploratory development through advanced development and into system demonstration/validation. Without technology demonstrators, system acquisition cost/schedule risk would have an unacceptably higher level or programs would have to settle for less operational capability. The lack of technology demonstrator efforts could result in system development schedule increases of five or more years with the associated increase in cost. A strong and viable U.S. propulsion program also provides a dual-use benefit to country enhancing our competitiveness in the international commercial engine market. This long term project coordinated through Reliance, will provide for the future needs in air battlespace dominance and expeditionary forces support (Littoral Joint Mission Area (JMA)), increased platform mission endurance (Joint Surveillance JMA) and provide technology for increased affordability and platform survivability (Strike JMA). The program funds three demonstrator engine classes. Each engine class has specific performance goals that are divided into three phases with the ultimate goal of doubling propulsion capability by the year 2003. Phase I of the missile/expendable engines class has been completed. The phase goals of each engine class are listed as follows and are referenced to a 1987 baseline (additional affordability goals have been developed for fighter/attack and are being developed for turboprop/shaft classes):

(U) Fighter/attack (Joint Technology Demonstrator Engine JTDE):
- (U) Phase I - 1993: +30% thrust/weight (Fn/W), +100 °F combustor inlet temperature (CIT), +300 °F turbine inlet temperature (TIT).
- (U) Phase II - 1997: +60% Fn/W, +200 °F CIT, +600 °F TIT, -20% acquisition cost, -20% maintenance cost.
- (U) Phase III - 2003: +100% Fn/Wt, +400°F CIT, +900°F TIT, -35% acquisition cost, -35% maintenance cost.

(U) Turboprop/shaft (Joint Turbine Advanced Gas Generator JTAGG):

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FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 199

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603217N PROJECT NUMBER: W2014
PROGRAM ELEMENT TITLE: Air Systems and Weapons Advanced Technology PROJECT TITLE: IHPTET

- (U) Phase I - 1993: +40% shaft horsepower/weight (SHP/Wt), -20% specific fuel consumption (SFC), +300 °F TIT.
- (U) Phase II - 1993: +80% SHP/Wt, -30% SFC, +600 °F TIT.
- (U) Phase III - 2003: +120% SHP/Wt, -40% SFC, +1000 °F TIT.

(U) Missile/expendable engines (Joint Expendable Turbine Engine Concepts (JETEC)):
- (U) Phase I - 1991: +35% thrust/airflow (Fn/Wa), -20% SFC, +1100 °F CIT, +500 °F TIT, -30% Cost.
- (U) Phase II - 1997: +70% Fn/Wt, -30% SFC, +1200 °F CIT, +900 °F TIT, -45% Cost.
- (U) Phase III - 2003: +100% Fn/Wa, -40% SFC, +1400 °F CIT, +1400 °F TIT, -60% Cost.

(U) Each engine company utilizes at least two engine builds or demonstrator tests within each Phase to demonstrate the performance goals. The JETEC Phase II goals are divided into demonstrating SFC and Cost for a subsonic demonstrator and Fn/Wa, CIT, TIT and Cost for a supersonic demonstrator.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1995 ACCOMPLISHMENTS:
   - (U) ($500) Initiated:
     - (U) Phase II JTDE: Enhanced technologies design and fabrication.
   - (U) ($5,761) Continued:
     - (U) Phase II JTDE: Base programs design and fabrication.
     - (U) Phase II JTAGG: Design and component development of engine system.
     - (U) Phase II JETEC: Prop fan demonstration of Phase II subsonic goals. Allison Engine Company (AEC) supersonic demonstrator fabrication and assembly.
   - (U) ($500) Completed:
     - (U) Phase I JTAGG: Demonstrated goal performance for SFC (-20%). Exceeded goal perforamance for SHP/wt (+55%).
     - (U) Phase I JETEC: Testing of the Allied Signal XTL-35/2 at stoichiometric temperatures. The second build included an Advance Research Projects Agency carbon/carbon uncooled turbine.

2. (U) FY 1996 PLAN:

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 1996

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603217N PROJECT NUMBER: W2014
PROGRAM ELEMENT TITLE: Air Systems and Weapons PROJECT TITLE: IHPTET
Advanced Technology

- (U) ($7,271) Continue:
  - [illegible] II JTDE: Design, fabrication and assembly of demonstrator engines.
  - [illegible] II JTAGG: Design, component development and fabrication for demonstrator engine.
  - (U) [illegible]ase II JETEC: Fabrication and assembly of propfan engine core to demonstrate Phase III SFC goal.
- (U) ($156) Portion of extramural program reserved for Small Business Inovation Research assessment in accordance with 15 U.S.C. 638.

3. (U) FY 1997 PLAN:
   - (U) ($500) Initiate:
     - (U) Phase III JTDE: Source selection and contract award.
     - (U) Phase III JTAGG: Source selection and contract award.
     - (U) Phase III JETEC: Source selection and contract award.
   - (U) ($6,880) Continue:
     - (U) Phase II JTDE: General Electric/AEC and/or Pratt & Whitney demonstration of Phase II goals.
     - (U) Phase II JTAGG: Design, component development and fabrication for demonstrator engine and initiate preparation for demonstrator engine testing.
     - (U) Phase II JETEC: Supersonic Phase II demonstrator test. Phase III subsonic propfan demonstrator fabrication and assembly.

B. (U) PROGRAM CHANGE SUMMARY:

	FY 1995	FY 1996	FY 1997
(U) FY 1996 President's Budget:	7,949	7,782	9,798
(U) Adjustments from FY 1996 PRESBUDG:	-1,188	-355	-2,418
(U) FY 1997 PRESBUDG Budget Submit:	6,761	7,427	7,380

(U) CHANGE SUMMARY EXPLANATION:

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 1996

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603217N PROJECT NUMBER: W2014
PROGRAM ELEMENT TITLE: Air Systems and Weapons Advanced Technology PROJECT TITLE: IHPTET

(U) Funding: FY 1995 reduction includes ($519) due to a Congressional S & T rescission and (-$669) due to reduced program requirements. FY 1996 funding decreases is due to reduced program requirements (-$117), Congressional undistributed (-$150); and revised DoD economic assumptions (-$88). FY 1997 funding decreases reflect a reduction in program requirements (-$1,783); revised DoD inflation estimates (-$229) and minor repricing adjustments (-$406).

(U) Schedule: Not applicable.

(U) Technical: The funding decreases will delay the completion of IHPTET Phase II & III estimates engine technology demonstration goals from its original schedule.

C. (U) OTHER PROGRAM FUNDING SUMMARY: Not applicable.

(U) RELATED RDT&E:
- (U) PE 0601152N (In House Lab Independent Research)
- (U) PE 0601153N (Defense Research Sciences)
- (U) PE 0601102F (Defense Research Sciences)
- (U) PE 0601102A (Defense Research Sciences)
- (U) PE 0602122N (Aircraft Technology)
- (U) PE 0602234N (Materials, Electronics & Computer Technology)
- (U) PE 0602203F (Aerospace Propulsion)
- (U) PE 0602211A (Aviation Technology)
- (U) PE 0603202F (Aircraft Propulsion Subsystem Integration)
- (U) PE 0603216F (Advanced Turbine Engine Gas Generator)
- (U) PE 0603003A (Aviation Advanced Technology)

D. (U) SCHEDULE PROFILE: Not applicable.

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: March 1996

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603217N
PROGRAM ELEMENT TITLE: Air Systems and Weapons Advanced Technology

PROJECT NUMBER: W2014
PROJECT TITLE: IHPTET

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FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 1996

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603238N

PROGRAM ELEMENT TITLE: Precision Strike and Air Defense Advanced Technology

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 1995 ACTUAL	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
R2145 Cruise Missile Defense	36,665	48,525	46,311	31,559	12,334	0	0	0	214,352
R2266 Mobile Offshore Base	0	13,893	9,249	4,610	0	0	0	0	27,752
TOTAL	36,665	62,418	55,560	36,169	12,334	0	0	0	242,104

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This program focuses science and technology resources in the areas of Precision Strike and Air Superiority/Defense in support of the Joint Chiefs of Staff's (JCS's) top five Joint Warfighting Capabilities and the following Joint Mission Areas (JMAs): Joint Strike, Joint Littoral Warfare, Joint Surveillance, Strategic Deterrence and Strategic Sealift/Protection.

(U) The Global Surveillance and Communications area, transferred to Program Element (PE) 0603794N for FY 1995, developed and demonstrated the capability to provide the tactical user with theater of operations, near-real-time precision targeting information, sensor-to-shooter target updating, and Battle Damage Assessment generated from multiple existing high-altitude resources supporting all the referenced Joint Mission Areas with primary applicability to Joint Surveillance and Joint Littoral Warfare Mission Areas.

(U) Precision Strike integrates surveillance and targeting capabilities developed in the Global Surveillance area with high-speed processing and precision weapons for rapid response against high-value, short-dwell targets over extended ranges. The Navy Tactical Missile System provided a demonstration launch of a Navy variant of the Army Tactical Missile System from a ship in support of the Navy's Surface Fire Support mission.

(U) The Air Superiority and Defense area develops and demonstrates all-weather, day/night engagement capabilities against manned aircraft, cruise missiles (including supersonic sea-skimmers), helicopters and tactical ballistic

missiles that will be employing stealth and countermeasures. The Cruise Missile Defense (CMD) Advanced Technology effort includes: 1) an Advanced Concept Technology Demonstration (ACTD), Phase I, which demonstrates that an AEGIS ship (or other surface based missile launch platform) using one or more surrogate airborne sensor partners can provide greatly expanded air defense capabilities leading to a robust capability against overland cruise missiles beyond surface based radar line-of-sight; 2) and a CMD Phase II that accelerates and aligns E-2C Airborne Early Warning (AEW) aircraft and Standard Missile (SM-2) programs toward a fielded CMD capability and balances performance, cost, schedule and risk across multiple technology programs; and initiates advanced missile technology efforts to develop and demonstrate engagement capabilities against next generation overland cruise missiles. The Airship Demonstration assesses the potential contribution that airships could make to the airborne component of the ship self defense/cooperative engagement capability, over-the-horizon targeting and surveillance, and other relevant mission areas. Supporting the Strategic Deterrence and Strategic Sealift/Protection JMAs, the Mobile Offshore Base Project will demonstrate the feasibility of a forward positioned Strike Platform in geographical areas where surrounding non-aligned countries desire to maintain their sovereignty.

Beginning in FY 96, the PE will be divided into two projects, Cruise Missile Defense (R2145) and Mobile Offshore Base (R2266). These two projects were both previously tasks funded within project 2145.

(U) Cruise Missile Defense: This is a continuation of a program initiated in FY 94. The Cruise Missile Defense Advanced Technology effort includes: 1) an ACTD, Phase I, which demonstrates that an AEGIS ship (or other surface based missile launch platform) using one or more surrogate airborne sensor partners can provide greatly expanded air defense capabilities leading to a robust capability against overland cruise missiles beyond surface based radar line-of-sight; 2) and a CMD Phase II that accelerates and aligns E-2C AEW aircraft and Standard Missile (SM-2) programs toward a fielded CMD capability and balances performance, cost, schedule and risk across multiple technology programs; and initiates advanced missile technology efforts to develop and demonstrate engagement capabilities against next generation overland cruise missiles.

(U) Mobile Offshore Base (MOB): New project starting in FY 96 to develop a MOB concept to provide a means by which a long-term U.S. presence can be maintained. Technology issues associated with both semi-submersible and mono-hull modules connected into platforms between 1000 and 3000 meters in length will be explored. Technical challenges include mobility to get on station, as well as sea keeping and stability to support cargo transfer.

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 1996

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603238N

PROGRAM ELEMENT TITLE: Precision Strike and Air Defense Advanced Technology

(U) JUSTIFICATION FOR BUDGET ACTIVITY: This program is budgeted within the ADVANCED TECHNOLOGY DEVELOPMENT Budget Activity because it encompasses design, development, simulation, or experimental testing or prototype hardware to validate technological feasibility and concept of operations and reduce technological risk prior to initiation of a new acquisition program or transition to an ongoing acquisition program.

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FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 1996

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603238N
PROGRAM ELEMENT TITLE: Precision Strike and Air Defense Advanced Technology

PROJECT NUMBER & TITLE	FY 1995 ACTUAL	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
R2145 Cruise Missile Defense	36,665	48,525	46,311	31,559	12,334	0	0	0	214,352

(Note: In FY 1993-1995 this project also includes Studies & Simulations, Precision Signal Targeting System, Real Time Support Power Projection, NATACMS, Air Ship Demonstration. FY96 and out reflect on Cruise Missile Defense Efforts)

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This program focuses science and technology resources in the areas of Precision Strike and Air Superiority/Defense in support of the Joint Chiefs of Staff's (JCS's) top five Joint Warfighting Capabilities and the following Joint Mission Areas (JMAs): Joint Strike, Joint Littoral Warfare, Joint Surveillance, Strategic Deterrence and Strategic Sealift/Protection.

(U) The Global Surveillance and Communications area, transferred to Program Element (PE) 0603794N for FY 1995, developed and demonstrated the capability to provide the tactical user with theater of operations, near-real-time precision targeting information, sensor-to-shooter target updating, and Battle Damage Assessment generated from multiple existing high-altitude resources supporting all the referenced JMAs with primary applicability to Joint Surveillance and Joint Littoral Warfare Mission Areas.

(U) Precision Strike integrates surveillance and targeting capabilities developed in the Global Surveillance area with high-speed processing and precision weapons for rapid response against high-value, short-dwell targets over extended ranges. The Navy Tactical Missile System (NATACMS) provided a demonstration launch of a Navy variant of the Army Tactical Missile System from a ship in support of the Navy's Surface Fire Support mission.

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 1996

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603238N
PROGRAM ELEMENT TITLE: Precision Strike and Air Defense Advanced Technology

(U) The Air Superiority and Defense area develops and demonstrates all-weather, day/night engagement capabilities against manned aircraft, cruise missiles (including supersonic sea-skimmers), helicopters and tactical ballistic missiles that will be employing stealth and countermeasures. The Cruise Missile Defense (CMD) Advanced Technology effort includes: 1) an Advanced Concept Technology Demonstration (ACTD), Phase I, which demonstrates that an AEGIS ship (or other surface based missile launch platform) using one or more surrogate airborne sensor partners can provide greatly expanded air defense capabilities leading to a robust capability against overland cruise missiles beyond based radar line-of-sight; 2) and a CMD Phase II that accelerates and aligns E-2C Airborne Early Warning (AEW) aircraft and Standard Missile (SM-2) programs toward a fielded CMD capability and balances performance, cost, schedule and risk across multiple technology programs; and initiates advanced missile technology efforts to develop and demonstrate engagement capabilities against next generation overland cruise missiles. The Airship Demonstration assesses the potential contribution that airships could make to the airborne component of the ship self defense/cooperative engagement capability, over-the-horizon targeting and surveillance, and other relevant mission areas. Supporting the Strategic Deterrence and Strategic Sealift/Protection JMAs, the Mobile Offshore Base Project will demonstrate the feasibility of a forward positioned Strike Platform in geographical areas where surrounding non-aligned countries desire to maintain their sovereignty.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS

1. (U) FY 1995 ACCOMPLISHMENTS:
   - (U) ($217) STUDIES AND SIMULATIONS:
     - (U) Initiated
       -- (U) Modeling and simulation of ship-based over-the-horizon cruise missile defense with airborne surveillance and tracking to develop operational concepts for deployment jointly with the Army and Air Force. This is the last year for this task. Starting in FY 96, the effort will be continued under the Cruise Missile Defense Technology Program.

   - (U) ($3,150) NATACMS:
     - (U) Completed:
       -- (U) Ship systems modifications

- (U) Shipboard system integration
-- (U) Demonstration firing and documentation of results.

• (U) (FY 1995) MOUNTAIN TOP/PHASE I of Cruise Missile Defense Advanced Technology (CMD ACTD) effort (Continued effort from FY 1994, funding in PE 0603792N):
- (U) Initiated:
-- (U) Work to design system to transfer Cooperative Engagement Capability (CEC) data to Army PATRIOT Battery for analysis of future development and in preparation for simulated Army missile firing events.

- (U) Completed:
-- (U) Design and integration studies for airborne platform prototype and modify SM-2 missiles to be used in test.
-- (U) Integration and conduction of mountain top test of Advanced Research Projects Agency (ARPA) surveillance radar sensor suite, MK-74 Missile Fire Control System and (CEC) against low flyers.
-- (U) Installation of CEC units on the mountain top and in designated AEGIS ship and complete ship's training.
-- (U) Planning for live fire demonstration.

• (U) ($6,603) AIRSHIP DEMONSTRATION (Expanded effort From FY 1994 Funding in PE 0603755N/Assessment of potential contribution of airships to airborne components of ship defense):
- (U) Completed
-- (U) Operational evaluations of the Airship as an advanced sensor platform.
-- (U) Demonstration of operations of Airship as a potential airborne component of CEC for ship defense.
-- (U) Demonstration of Specific Emitter Identifier for combat identification (ID).
-- (U) Demonstration of an advanced sensor for cruise missile detection.
-- (U) Operations demonstrating Airship Platform in the Littoral.

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 1996

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603238N
PROGRAM ELEMENT TITLE: Precision Strike and Air Defense Advanced Technology

3. (U) FY 1996 PLAN:

- (U) ($46,653) PHASE I ($18,629) AND PHASE II ($28,024) OF CMD ACTD
  - (U) Phase I (Mountain Top) Activities: Complete final captive seeker sea clutter data collection, and Navy SM-2 live missile firings against Over the Horizon (OTH) target drones using data from the mountain top sensor suite. Complete Army simulated missile firings at OTH target drones using data from the mountain top sensor suite. Prepare required reports. Complete Phase I of the CMD ACTD.
  - (U) Phase II Activities: Upgrade baseline E-2C AEW aircraft and Standard Missile (SM-2) programs. Initiate design, development, and integration efforts for surveillance platform and advanced missile seeker/fuze. Design tests for airborne sensors against airborne targets. Develop Phase II captive seeker sea/land data collection test plan. Expand Makaha Radar Facility FY 1997 and FY 1999 critical experiments/demonstrations (MRF 97 & MRF 99); upgrade weapon control modes, overland performance,and handover.

- (U) ($1,872) Portion of extramural program reserved for Small Business Innovative Research assessment in accordance with 15 U.S.C. 638.

4. (U) FY 1997 PLAN:

- (U) ($46,311) Cruise Missile Defense Phase II
  - (U) Initiate:
    - (U) Makaha Radar Facility (MRF 97) critical experiments/demonstration
  - (U) Continue:
    - (U) Test planning for Makaha Radar Facility (MRF 97 and MRF 99)
    - (U) Design, development integration and planning efforts begun in FY 1996 for the Phase II demonstration to support extended horizon engagement of cruise missiles.
    - (U) Advanced missile seeker and fuze technology development and surveillance upgrades leading toward captive flight testing in FY 1999.

B. (U) PROGRAM CHANGE SUMMARY:

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FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 1996

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603238N
PROGRAM ELEMENT TITLE: Precision Strike and Air Defense Advanced Technology

	FY 1995	FY 1996	FY 1997
(U) FY 1996 President's Budget:	37,170	64,502	67,423
(U) Adjustments from FY 1996 PRESBUDG:	-505	-15,977	-21,112
(U) FY 1997 PRESBUDG Submit:	36,665	48,525	46,311

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: FY 1995 reduction reflects a combination of (-$1,500) due to a Congressional S&T rescission and a minor increase in program requirements (+995). Funding level decrease in FY 1996 reflects Program Review decision to split the PE into two projects: (-$13,500) moves to MOB stand alone project R2266; undistributed Congressional reductions (-$1,326); revised DoD inflation estimates (-$701). FY 1997 changes reflect: revised DoD inflation estimates (-$1,400); minor repricing adjustments (-$639); a transfer to Mobile Offshore Base (MOB)(-$9,731) and a reduction based on program realignment (-$11,381).

(U) Schedule: Not Applicable

(U) Technical: Not Applicable

C. (U) OTHER PROGRAM FUNDING SUMMARY: Not applicable.

(U) RELATED RDT&E:
(U) PE 0601153N (Defense Research Sciences)
(U) PE 0602111N (Air and Surface Weapons Technology)
(U) PE 0602121N (Surface Ship and Submarine HM&E Technology)
(U) PE 0602122N (Aircraft Technology)
(U) PE 0602234N (Materials, Electronics and Computer Technology)

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FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 1996

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603238N
PROGRAM ELEMENT TITLE: Precision Strike and Air Defense Advanced Technology

(U) PE 0603006A (C3 Advanced Technology)
(U) PE 0603226E (Experimental Evaluation of Innovative Technologies)
(U) PE 0603238F (Air Defense/Precision Strike Technology Demo)
(U) PE 0603245F (Advanced Flight Technology Integration)
(U) PE 0603270N (Advanced Electronic Warfare Technology)
(U) PE 0603401F (Advanced Spacecraft Technology)
(U) PE 0603563N (Ship Concept Advanced Design)
(U) PE 0603601F (Conventional Weapons Technology)
(U) PE 0603726F (C3I Subsystem Integration)
(U) PE 0603755N (Ship Self Defense/Cooperative Engagement Capability)
(U) PE 0603772A (Advanced Tactical Computer Science and Sensor Technology)
(U) PE 0603794N (C3 Advanced Technology)
(U) PE 0604866C (Patriot Risk Reduction Mitigation)

D. (U) SCHEDULE PROFILE: Not applicable.

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FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 1996

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603238N
PROGRAM ELEMENT TITLE: Precision Strike and Air Defense Advanced Technology

PROJECT NUMBER & TITLE	FY 1995 ACTUAL	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
R2266 Mobile Offshore Base	0	13,893	9,249	4,610	0	0	0	0	27,752

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This project is a new start in FY 96. This project focuses science and technology resources in the areas of Precision Strike and Air Superiority/Defense in support of the Joint Chiefs of Staff's top five Joint Warfighting Capabilities and the following Joint Mission Areas: Joint Strike, Joint Littoral Warfare, Strategic Deterrence and Strategic Sealift/Protection.

(U) The Mobile Offshore Base (MOB) Project will demonstrate the feasibility of a forward positioned Strike Platform in geographical areas where surrounding non-aligned countries desire to maintain their sovereignty. This new task will develop a MOB concept to provide a means by which a long-term U.S. presence can be maintained. Technology issues associated with both semi-submersible and mono-hull modules connected into platforms between 1500 and 3000 meters in length will be explored. Technical challenges include mobility to get on station, as well as sea keeping and stability to support cargo transfer.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1995 ACCOMPLISHMENTS: Not Applicable

2. (U) FY 1996 PLAN: (New project start)

- (U) ($13,893) MOBILE OFFSHORE BASE (New start will transfer ARPA developed technology to the U.S. Navy for continued development and technology demonstration):
  - (U) Initiate:
    - -- (U) Transfer ARPA developed critical technologies for MOB components.
    - -- (U) Sub-scale tests of the complete system to demonstrate and determine risks associated with full scale construction.

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 1996

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603238N
PROGRAM ELEMENT TITLE: Precision Strike and Air Defense Advanced Technology

4. (U) FY 1997 PLANS:

- (U) ($9,249) MOBILE OFFSHORE BASE:
  - (U) Initiate:
    -- (U) Definition of and resolution of significant technical issues.
    -- (U) Development and design of high sea-state cargo transfer concepts.
    -- (U) Design and fabrication of MOB test models.
  - (U) Continue:
    -- (U) Development of inter-module connectors and anchoring systems.
    -- (U) Evaluation of MOB survivability.
    -- (U) Full scale design.
  - (U) Complete:
    -- (U) Design of high sea-state cargo transfer concept.
    -- (U) Testing of models.
    -- (U) MOB survivability study.

B. (U) PROGRAM CHANGE SUMMARY:

	FY 1995	FY 1996	FY 1997
(U) FY 1996 President's Budget:	0	0	0
(U) Adjustments from FY 1996 PRESBUDG:	0	+13,893	+9,249
(U) FY 1997 PRESBUDG Submit:	0	13,893	9,249

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: New project created starting in FY 1996. FY 1996 and FY 1997 MOB funding and task moved to this project from Project R2145.
(U) Schedule: Not Applicable
(U) Technical: Not Applicable

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 1996

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603238N
PROGRAM ELEMENT TITLE: Precision Strike and Air Defense Advanced Technology

C. (U) OTHER PROGRAM FUNDING SUMMARY:

	FY 1995 ACTUAL	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
(U) OPN Line 150000									
	0	0	0	0	209,085	0	209,045	433,249	851,379

(U) RELATED RDT&E:
- (U) PE 0601153N (Defense Research Sciences)
- (U) PE 0602111N (Air and Surface Weapons Technology)
- (U) PE 0602121N (Surface Ship and Submarine HM&E Technology)
- (U) PE 0602122N (Aircraft Technology)
- (U) PE 0603226E (Experimental Evaluation of Innovative Technologies)
- (U) PE 0603238F (Air Defense/Precision Strike Technology Demo)
- (U) PE 0603245F (Advanced Flight Technology Integration)
- (U) PE 0603563N (Ship Concept Advanced Design)
- (U) PE 0603601F (Conventional Weapons Technology)

D. (U) SCHEDULE PROFILE: Not applicable.

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FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: March 1996

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603270N
PROGRAM ELEMENT TITLE: Advanced Electronic Warfare Technology

(U) COST: (Dollars in Thousands)

PROJECT NUMBERR & TITLE	FY 1995 ACTUAL	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
E2194 Electronic Warfare Advanced Technology	7,473	7,312	7,371	9,509	9,623	9,807	10,016	CONT.	CONT.
U2090 Functional Recognition & Response	6,606	6,553	7,714	8,320	8,459	8,614	8,792	CONT.	CONT.
TOTAL	14,079	13,865	15,085	17,829	18,082	18,421	18,808	CONT.	CONT.

(U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: Advanced Electronic Warfare Technology (AEWT) is the Navy's continuing, core Advanced Technology Development program for Electronic Warfare (EW) and is oriented to demonstrate and transition EW technology in cooperation with the other Services, placing special emphasis on Naval EW applications of Command and Control Warfare. This program continues to develop technologies which support the effective employment of naval force capabilities in the conduct of the Navy's Joint Mission Areas as defined by the Chief of Naval Operations (CNO) (i.e., Joint Strike, Littoral Warfare, Surveillance, Surface Electronic Warfare/Intelligence, Deterrence, Maritime Support of Land Forces and Readiness & Shore Training). P.E. 0603270N is managed at the Office of Naval Research (ONR) by the same office that directs P.E. 0602270N (Navy EW Technology) and provides the vast majority of projects to this program for demonstration and potential transition to full scale development. The ONR program manager is also a principal of the Joint Director of Laboratories (JDL) Technology Panel for EW which oversees and coordinates Tri-Service 6.2 & 6.3A EW programs. Consequently, this program is planned jointly in accordance with Tri-Service Reliance agreements which allocate various EW disciplines and their attendant technology development responsibilities between the Army, Air Force and the Navy. As part of the Integrated Science and Technology EW Program, it is subject to the review and execution oversight of the JDL. AEWT is responsive to CNO guidance and the Systems Commands' warfighting requirements and needs. It develops EW technologies to counter a broad range of electromagnetic threats and is linked to future joint warfighting capabilities of "maintaining near perfect real-time knowledge of the enemy..." and "to counter the threat of...cruise missiles to the Continental United States and deployed

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FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 1996

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603270N
PROGRAM ELEMENT TITLE: Advanced Electronic Warfare Technology

forces."

(U) The program transitions new technologies to Tactical Air, low observable aircraft, surface EW platforms, and Pre-planned Product Improvement programs (including multi-spectral/multi-modal sensors and seekers). This is done by improving threat detection, identification, location and response through developmental upgrades and direct, advanced technology insertions. Currently, AEWT consists of two projects:

(U) E2194 - Electronic Warfare Advanced Technology: This project continues efforts initiated under the Integrated Navy Electronic Warfare System program. Efforts have been streamlined and focused from prior years into a continuing core program aimed at reducing the integration risk of advanced EW systems and to facilitate the transition of high-payoff EW technologies into the Fleet.

(U) U2090 - Functional Recognition & Response: Develops algorithms and techniques to recognize emitters by measuring and analyzing their observable, radar function parameters. Uses nondevelopmental item or develops hardware (as required) to implement Functional Recognition demonstrations and assess overall operational improvement to extant capabilities.

(U) JUSTIFICATION FOR BUDGET ACTIVITY: This program is budgeted within the ADVANCED TECHNOLOGY DEVELOPMENT Budget Activity because it encompasses design, development, simulation, or experimental testing or prototype hardware to validate technological feasibility and concept of operations and reduce technological risk prior to initiation of a new acquisition program or transition to an ongoing acquisition program.

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FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: March 1996

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603270N

PROGRAM ELEMENT TITLE: Advanced Electronic Warfare Technology Warfare Technology

PROJECT NUMBER: E2194

PROJECT TITLE: Electronic Warfare Advanced Technology

(U) COST: (Dollars in thousands)

PROJECT NUMBER & TITLE	FY 1995 ACTUAL	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
E2194 Electronic Warfare Advanced Technology	7,473	7,312	7,371	9,509	9,623	9,807	10,016	CONT.	CONT.

A. MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: The program transitions new technologies to TACAIR, low observable aircraft, surface Electronic Warfare (EW) platforms, and Pre-planned Product Improvement programs (including multi-spectral/multi-modal sensors and seekers) by improving threat detection, identification, location and response through developmental upgrades and direct, advanced technology insertions.

(U) This is a continuation of efforts initiated under the Integrated Navy Electronic Warfare System program. Efforts have been streamlined and focused from prior years into a continuing core program aimed at reducing the integration risk of advanced EW systems and to facilitate the transition of high-payoff EW technologies into the Fleet.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1995 ACCOMPLISHMENTS:

- (U) ($3,922) Conducted lab and flight test of integrated Ultraviolet Missile Approach Warning System (UV MAWS), AN/ALE-47, AN/ALE-50, and advanced expendables suite performance demonstration. Verified performance during Air-to-Air live fire testing.
- (U) ($1,915) Designed, fabricated and tested integrated missile/laser warning processor and countermeasure processor.
- (U) ($1,636) Initiated integration of MAWS and directed infrared countermeasures (IRCM) hardware and software.

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 1996

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603270N PROJECT NUMBER: E2194
PROGRAM ELEMENT TITLE: Advanced Electronic Warfare Technology PROJECT TITLE: Electronic Warfare
Warfare Technology Advanced Technology

2. (U) FY 1996 PLAN:

- (U) ($3,470) Conduct lab and flight tests of integrated UV MAWS, AN/ALE-47, AN/ALE-50, Laser Warning System (LWS), BOL Chaff dispenser launcher expendable (BOL) and Advanced Expendables suite. Complete "FISHEYE" LWS prototype and effectiveness demonstration.
- (U) ($728) Validate algorithms for passive missile identification and time to impact. Verify performance during Air-to-Air live fire testing.
- (U) ($2,600) Conduct advanced countemeasures effectiveness analysis and demonstration.
- (U) ($477) Continue integration of Army developed directed energy countermeasures with Tactical Air warning/response suite.
- (U) ($37) Portion of extramural program reserved for Small Business Innovative Research assessment in accordance with 15 U.S.C. 638.

3. (U) FY 1997 PLAN:

- (U) ($1,536) Complete passive missile identification and time-to-intercept techniques. Verify performance during Air-to-Air live fire testing.
- (U) ($1,446) Initiate passive missile identification and tailored-response effectiveness evaluation.
- (U) ($2,053) Demonstrate advanced missile countermeasures techniques.
- (U) ($1,409) Commence feasibility demonstration of TACAIR directed energy countermeasures.
- (U) ($927) Design, fabricate and flight test and integrated missile/laser warning sensor system.

B. (U) PROGRAM CHANGE SUMMARY:

	FY 1995	FY 1996	FY 1997
(U) FY 1996 PRESIDENT'S BUDGET:	7,709	7,664	9,185
(U) ADJUSTMENTS FROM FY 1996 PRESBUDG:	-236	-352	-1,814

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FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: March 1996

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603270N
PROGRAM ELEMENT TITLE: Advanced Electronic Warfare Technology

PROJECT NUMBER: E2194
PROJECT TITLE: Electronic Warfare Advanced Technology

(U)	FY 1997 PRESBUDG SUBMIT:	7,473	7,312	7,371

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: The FY 1995 change reflects an execution update. FY 1996 change reflects: MRTFB (-$115); Congressional undistributed cut (-$149); and revised DoD economic assumptions (-$88). The FY 1997 reduction reflects a combination of revised DoD inflation adjustments (-$223); minor pricing adjustments (-$1,091), and a program requirements adjustment (-$500).

(U) Schedule: FY 1997 net reduction of $1,814 will delay commencement of feasibility demonstration of TACAIR directed energy countermeasures; a downscoping of design and fabrication and a delay in missile/laser warning sensor system flight tests.

(U) Technical: Not applicable.

C. (U) OTHER PROGRAM FUNDING SUMMARY: Not applicable.

(U) RELATED RDT&E:

This Program Element (PE) adheres to Tri-Service Reliance Agreements on EW with oversight and coordination provided by the Joint Director of Laboratories and is associated with efforts that are being pursued under the following Army and Air Force PEs:

(U) PE 0601153N (Defense Research Sciences)
(U) PE 0602204F (Aerospace Avionics)
(U) PE 0602234N (Materials, Electronics and Computer Technology)
(U) PE 0602270N (Electronic Warfare Technology)

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FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: March 1996

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603270N
PROGRAM ELEMENT TITLE: Advanced Electronic Warfare Technology

PROJECT NUMBER: E2194
PROJECT TITLE: Electronic Warfare Advanced Technology

(U) PE 0602270A (Electronic Warfare Technology)
(U) PE 0603217N (Air Systems and Weapons Advanced Technology)
(U) PE 0603270A (Electronic Warfare Technology)
(U) PE 0603270F (Electronic Combat Technology)
(U) PE 0603792N (Advanced Technology Transition)(U) PE 0604223A (Commanche)
(U) PE 0604270N (EW Development)

D. SCHEDULE PROFILE: Not applicable.

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FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: March 1996

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603270N
PROGRAM ELEMENT TITLE: Advanced Electronic Warfare Technology

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 1995 ACTUAL	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
U2090 Functional Recognition & Response	6,606	6,553	7,714	8,320	8,459	8,614	8.792	CONT.	CONT.

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This project develops and demonstrates counters to previously unknown threat systems which may be encountered for the first time during hostilities. Systems include anti-ship missile seekers, surface-to-air guidance systems, aircraft intercept radars, and ship surveillance and targeting systems. The Specific Emitter Identification (SEI) technology developed in this program significantly enhances the ability to quickly and accurately perform Combat Identification (ID) and support the Joint Mission Areas as defined by the Chief of Naval Operations (i.e., Joint Strike, Surveillance, Surface Electronic Warfare (EW)/Intelligence, etc.). Existing EW warning and countermeasure systems will be modified with techniques demonstrated under this program that do not rely on specific parameters. The approach will demonstrate related technology developed in the EW technology base through field trials and at-sea demonstrations.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1995 ACCOMPLISHMENTS:
   - (U) ($750) Developed Artificial Intelligence methods for Generic Countermeasures (CM), Functional ID, and Unconventional subsystems.
   - (U) ($809) Demonstrated at-sea, Generic CM assessment capability in response to Electronic Countermeasures (ECM)

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applications for AN/SLQ-32.

- (U) ($750) Integrated counter-terminal and counter-targeting techniques package into the AN/SLQ-32 Digital Radio Frequency Memory Unit.
- (U) ($575) Designed a generic ship EW system including subsystem requirements and transition path for AN/SLQ-32 ships.
- (U) ($750) Inserted Functional ID capability into the AN/ALQ-99 jammer system.
- (U) ($750) Integrated advanced onboard ECM techniques with AN/ALE-39/47 and the Integrated Towed Decoy (ITD) and demonstrated the incorporation of coherent ECM against imaging and polarization diverse threats.
- (U) ($775) Integrated generic threat assessment module into Naval Tactical Command System-Afloat.
- (U) ($750) Integrated Advanced Tactical EW Environment Simulator into the Central Target Simulator.
- (U) ($697) Continued field and at-sea testing of systems containing advanced SEI techniques and functional ID algorithms.

2. (U) FY 1996 PLAN:

- (U) ($800) Develop generic hardware for inserting improved Functional ID capability into existing receiver systems.
- (U) ($673) Fabricate the integrated suite consisting of chaff, ECM, ITD and Expert System technology for use against advanced coherent threats.
- (U) ($600) Modify Advanced Active Expendable Decoy (AAED) hardware and commence tests against imaging radars and radars with polarization diversity/ Non-Cooperative Target Recognition.
- (U) ($757) Extend ITD hardware to operate in the Millimeter Wave (MMW) range through the development and integration of a MMW optical link.
- (U) ($850) Demonstrate active and passive methods of countering Proforma links.
- (U) ($900) Fabricate high power radio frequency generator unit for testing Functional ID hardware and software.
- (U) ($800) Modify ALQ-170 testbed to develop parametrically agile missile model to test upgraded ALQ-170 simulators and advanced responsive Electronic Support Measuring systems.

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 1996

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603270N PROJECT NUMBER: U2090
PROGRAM ELEMENT TITLE: Advanced Electronic Warfare Technology PROJECT TITLE: Functional Recognition & Response

- (U) ($700) Demonstrate artificial intelligence techniques for Generic CM, Functional ID and Uninitiated Modulation On Pulse (UMOP).
- (U) ($467) Continue field testing of advanced UMOP and SEI techniques into existing receiver and surveillance systems.
- (U) ($6) Portion of extramural program reserved for Small Business Innovative Research assessment in accordance with 15 U.S.C. 638.

3. (U) FY 1997 PLAN:

- (U) ($1,200) Demonstrate Functional ID system for generic hardware.
- (U) ($714) Complete flight test plans for using the optimized chaff (AN/ALE-39), Expert system and AAED integrated suite against surrogate Micro Wave threats at China Lake.
- (U) ($1,300) Test coodinated onboard jamming and towed decoy using fiber optic link.
- (U) ($1,000) Demonstrate Shipboard sensor fusion hardware.
- (U) ($1,000) Verify fidelity and resolution of generic threat simulator.
- (U) ($1,300) Integrate and test two low probability of intercept seekers for identification and response technique effectiveness.
- (U) ($1,200) Airborne and shipboard test hardware/software to establish effectiveness of newly developed concepts.

B. (U) PROGRAM CHANGE SUMMARY:

	FY 1995	FY 1996	FY 1997
(U) FY 1996 PRESIDENT'S BUDGET:	6,759	6,868	7,659
(U) Adjustments from FY 1996 PRESBUDG:	-153	-315	+55

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FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 1996

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603270N PROJECT NUMBER: U2090
PROGRAM ELEMENT TITLE: Advanced Electronic Warfare Technology PROJECT TITLE: Functional Recognition & Response

(U) FY 1997 PRESBUDG Budget Submit:	6,606	6,553	7,714

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: FY 1995 change reflects a execution adjustment. FY 1996 adjustment reflects: minor program adjustment (-$103); Congressional undistributed cuts (-$133); and revised DoD economic assumptions (-$79). Funding change in FY 1997 is a combination of +$500 increase for MMIC demonstration; minor pricing adjustments (-$202) and revised DoD inflation adjustments (-$243).

(U) Schedule: Not applicable.

(U) Technical: Not applicable.

C. (U) OTHER PROGRAM FUNDING SUMMARY: Not applicable.

(U) RELATED RDT&E PROGRAMS: This PE adheres to Tri-Service Reliance Agreements on EW with oversight and coordination provided by the JDL and is associated with efforts that are being pursued under the following Army and Air Force PEs:

(U) PE 0601153N (Defense Research Sciences)
(U) PE 0602204F (Aerospace Avionics)
(U) PE 0602234N (Materials, Electronics and Computer Technology)
(U) PE 0602270A (Electronic Warfare Technology)
(U) PE 0602270N (Electronic Warfare Technology)
(U) PE 0603270A (Electronic Warfare Technology)
(U) PE 0603270F (Electronic Combat Technology)

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FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: March 1996

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603270N
PROGRAM ELEMENT TITLE: Advanced Electronic Warfare Technology
PROJECT NUMBER: U2090
PROJECT TITLE: Functional Recognition & Response

(U) PE 0603792N (Advanced Technology Transition)

D. SCHEDULE PROFILE: Not applicable.

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: March 1996

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603270N
PROGRAM ELEMENT TITLE: Advanced Electronic Warfare Technology

PROJECT NUMBER: U2090
PROJECT TITLE: Functional Recognition & Response

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FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: March 1996

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603508N
PROGRAM ELEMENT TITLE: Ship Propulsion System

(U) COST:

(Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 1995 ACTUAL	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
R2224 Ship and Submarine Hull, Mechanical and Electrical (HM&E) Advanced Technology	14,610	14,491	25,649	28,756	33,359	33,426	31,904	CONT.	CONT.
S1848 Gas Turbine Engine Technology	2,999	2,801	2,908	3,099	3,329	3,401	3,481	CONT.	CONT.
TOTAL	17,609	17,292	28,557	31,855	36,688	36,827	35,385	CONT.	CONT.

(U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This program element (PE) provides for affordable surface ship and submarine hull, mechanical, and electrical system core technology developments that contribute to meeting top joint warfare capabilities established by the Joint Chiefs of Staff; namely, to promptly engage regional forces in decisive combat on a global level.

(U) There are two projects: Gas Turbine Engine Technology (S1848) and Ship and Submarine HM&E Advanced Technology (R2224). Products from this PE will improve the effectiveness and operational efficiency of all Navy ship and submarine platforms in all Joint Mission Areas. Affordability is addressed through evaluation in exploratory development programs and large-scale demonstrations to reduce costs associated with design, fabrication, outfitting, maintenance, and operation. All naval platforms inherently require mobility, efficiency, reliability, and availability as a primary requirement for Naval Warfare. This program directly supports the Readiness, and Support and Infrastructure Joint Mission Area in the area of sustainability and supports Joint Strike, Joint Littoral, Joint Surveillance, Joint Surface Electronic Warfare, Strategic Deterrence, and Maritime Support for Land Forces, and Strategic Sealift relative to reduced signatures and increased survivability.

(U) JUSTIFICATION FOR BUDGET ACTIVITY: This program is budgeted within the ADVANCED TECHNOLOGY DEVELOPMENT Budget Activity because it encompasses design, development, simulation, or experimental testing or prototype hardware to validate technological feasibility and concept of operations and reduce technological risk prior to initiation of a new acquisition program or transition to an ongoing acquisition program.

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FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 1996

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603508N
PROGRAM ELEMENT TITLE: Ship Propulsion System

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 1995 ACTUAL	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
R2224 Ship and Submarine Hull, Mechanical and Electrical (HM&E) Advanced Technology	14,610	14,491	25,649	28,756	33,359	33,426	31,904	CONT.	CONT.

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: Ship and Submarine Hull, Mechanical, and Electrical (HM&E) Advanced Technology is a FY 1996 new project created due to the restructuring of Program Element (PE) 0603555N, Project R2142. The project develops and demonstrates technological improvements for HM&E systems in support of present and future surface ship and submarine platforms. The project improves overall platform performance (stealth, survivability, mobility, efficiency, reliability and availability) and reduces maintenance, overhaul, and life cycle costs. The current effort in this project is the Advanced Vibration Reducer (AVR). The goal of AVR is to develop a full-scale prototype system which reduces submarine far-field acoustic signature. This technology address submarine signature issues and will be applicable to current or future submarine class.

(U) PROGRAM ACCOMPLISHMENT AND PLANS:

1. (U) FY 1995 ACCOMPLISHMENTS:
   - (U) ($14,610) AVR:
     (U) Installed system at Land Based Test Facility and begin system check out to bring on-line.

2. (U) FY 1996 PLAN:
   - (U) ($14,491) AVR:
     (U) Install system on R&D submarine.
     (U) Conduct testing at Land Based Test Facility.
     (U) Complete ship installation studies and ship temporary alteration (TEMPALT) preparation.

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 1996

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603508N PROGRAM ELEMENT TITLE: Ship and Submarine HM&E Advanced Technology

PROJECT NUMBER: R2224 PROJECT TITLE: Ship and Submarine HM&E Advanced Technology

3. (U) FY 1997 PLAN:

- (U) ($16,349) AVR:
  (U) Install system on R&D submarine.
  (U) Conduct first sea trial. The following data will be taken for post trial analysis and system optimization:
  (U) Collect structural data; demonstrate basic AVR functions.
  (U) Conduct second sea trial. Demonstrate system performance against Advanced Technology Demonstration goals.
  (U) Evaluate system control configuration.
  (U) Initiate documentation of system design and reporting of system performance data.

- (U) ($9,300) Surface Ship Systems:
  (U) Initiate development of two competitive diesel-fed fuel cell system options for shipboard auxillary power.
  (U) Initiate development of intelligent HM&E ship control systems to minimize manning and increase operational reliability.

B. (U) PROGRAM CHANGE SUMMARY:

	FY 1995	FY 1996	FY 1997
(U) FY 1996 President's Budget:	15,792	15,051	17,124
(U) Adjustments from FY 1996 PRESBUDG:	-1,182	-560	+8,525
(U) FY 1997 PRESBUDG Submit:	14,610	14,491	25,649

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: FY 1995 adjustment reflects S&T Congressional rescission (-$1,000) and reduced program requirements (-$182). FY 1996 fund adjustment reflects Congressional undistributed (-$384); and revised DoD inflation estimates (-$176). FY 1997 fund adjustment reflects revised DoD inflation estimates (-$774) and an increase for new initiatives to reduce long term, system, life cycle costs and improved ship control technologies (+$9,299).

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 1996

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603508N PROGRAM ELEMENT TITLE: Ship and Submarine HM&E Advanced Technology PROJECT NUMBER: R2224 PROJECT TITLE: Ship and Submarine HM&E Advanced Technology

(U) Schedule: AVR land-based testing was delayed due to system startup problems at land based test facility. This was accommodated by moving the system ship installation into FY97 and canceling the third sea trial.

(U) Technical: FY 1997 increase will be used to initiate development of intelligent ship control systems to reduce manning of HM&E systems operating in both normal and post damage modes.

C. (U) OTHER PROGRAM FUNDING SUMMARY: Not applicable.

(U) RELATED RDT&E:
(U) PE 0601153N (Defense Research Sciences)
(U) PE 0602121N (Surface Ship and Submarine HM&E Technology)
(U) PE 0602131M (Marine Corps Landing Force Technology)
(U) PE 0602233N (Readiness, Training and Environmental Quality)
(U) PE 0602234N (Materials, Electronics, and Computer Technology)
(U) PE 0602314N (Undersea Warfare Surveillance Technology)
(U) PE 0602315N (Mine Countermeasures, Mining and Special Warfare Technology)
(U) PE 0603502N (Surface and Shallow Water Mine Countermeasures)
(U) PE 0603513N (Shipboard System Component Development)
(U) PE 0603514N (Personnel/Ship Survivability)
(U) PE 0603553N (Surface Anti-Submarine Warfare)
(U) PE 0603561N (Advanced Submarine Systems Development)
(U) PE 0603563N (Ship Concept Advanced Design)
(U) PE 0603564N (Ship Preliminary Design and Feasibility Studies)
(U) PE 0603569E (ARPA S&T Program)
(U) PE 0603573N (Advanced Surface Machinery Systems)
(U) PE 0604558N (New Design SSN Development)
(U) PE 0604561N (SSN-21 Developments)
(U) Under the Tri-Service Reliance Agreement, the Navy has the lead for this Navy-unique program.

D. (U) SCHEDULE PROFILE: Not applicable.

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FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: March 1996

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603508N
PROGRAM ELEMENT TITLE: Ship and Submarine HM&E

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 1995 ACTUAL	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
S1848 Gas Turbine Engine Technology	2,999	2,801	2,908	3,099	3,329	3,401	3,481	CONT.	CONT.

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: The Gas Turbine Engine Technology project develops and demonstrates technology which directly transitions to the fleet to address current fleet gas turbine engine system problems in reliability and safety. The project also continuously upgrades the performance of current fleet gas turbines and develops technology for application on future gas turbines in areas such as efficiency.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1995 ACCOMPLISHMENTS:
   - (U) ($2,213) LM2500:
     (U) Finalized power turbine magnetic bearings design and procure test hardware.
     (U) Completed testing of new turbine airfoil coatings and blade enhancements.
     (U) Continued fuel study of efficient/low NOx emission developments.
     (U) Initiated design effort for Full Authority Digital Engine Control (FADEC).
     (U) Initiated design effort for condition monitoring system.
   - (U) ($310) 501:
     (U) Investigated feasibility of utilizing recuperation to reduce fuel consumption.
     (U) Initiated insulated fuel nozzle design.
     (U) Initiated development of new first stage turbine blade material and seal.
   - (U) ($476) TF40B:
     (U) Completed demonstration of turbine coatings to reduce maintenance and life cycle costs

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(U) Completed testing of the new seal and bearing design to evaluate performance, MTBF, and reduce life cycle costs.
(U) Completed testing of new designed limiter to allow continued operation without engine shutdown.
(U) Initiated improved axial compressor aero performance.

2. (U) FY 1996 PLAN:
- (U) ($1,500) Complete manufacture and integration of a fully active sensorless magnetic bearing design on to a powerturbine rotor.
- (U) ($803) Initiate Variable Rotor Blade Compressor Study.
- (U) ($435) Initiate design effort on improved axial compressor aero performance.
- (U) ($63) Portion of extramural program reserved for Small Busisness Innovation Research assessment in accordance with 15 U.S.C. 368.

3. (U) FY 1997 PLAN:
- (U) ($413) Initiate study to evaluate component efficiency improvements at part power by active control of external turbine cooling requirements.
- (U) ($400) Initiate design study to apply Micro-Electronic Machines (MEMSs) technology to increase blade loading and surge control to increase compressor performance.
- (U) ($1,500) Complete engine test of magnetic bearing on a power turbine.
- (U) ($595) Rig test Variabe Rotor Blade Compressor.

B. (U) PROGRAM CHANGE SUMMARY:

	FY 1995	FY 1996	FY 1997
(U) FY 1996 President's Budget:	2,974	2,935	3,095
(U) Adjustments from FY 1996 PRESBUDG:	+25	-134	-187
(U) FY 1997 PRESBUDG Submit:	2,999	2,801	2,908

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 1996

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603508N PROJECT NUMBER: S1848
PROGRAM ELEMENT TITLE: Ship and Submarine HM&E PROJECT TITLE: Gas Turbine Engine

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: FY 1995 increase of (+$25) reflects adjusted program requirements. FY 1996 reflects, Congressional undistributed reductions (-$57); revised DoD inflation estimates (-$33), and a minor repricing adjustment (-$44). The FY 1997 reductions reflect lower program requirements (-$100), and revised DoD Inflation estimate (-$87).

(U) Schedule: Not applicable.

(U) Technical: Not applicable.

C. (U) OTHER PROGRAM FUNDING SUMMARY: Not applicable.

(U) RELATED RDT&E:
(U) PE 0601153N (Defense Research Sciences)
(U) PE 0602121N (Surface Ship and Submarine HM&E Technology)
(U) PE 0602122N (Aircraft Technology)
(U) PE 0602234N (Materials, Electronics, and Computer Technology)
(U) PE 0603573N (Advanced Surface Machinery Systems)

D. (U) SCHEDULE PROFILE: Not applicable.

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 1996

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603508N
PROGRAM ELEMENT TITLE: Ship and Submarine HM&E

PROJECT NUMBER: S1848
PROJECT TITLE: Gas Turbine Engine

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FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 1996

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603640M
PROGRAM ELEMENT TITLE: Marine Corps Advanced Technology Demonstrations (ATDs)

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: As the land warfare component of Naval Expeditionary Forces power projection, the Marine Corps has unique and technologically stressing requirements resulting from its' amphibious mission; Marine Air-Ground Task Force (MAGTF) organizational structure; and reliance on maneuver, logistic sustainability, and intensive tempo of operations in diverse environments. Critical Marine Corps requirements being addressed in this program element (PE) are Reconnaissance Standoff Mine Detection for surf zone and ashore; Mine Neutralization; Advanced Infantry and Vehicle Mounted Weapon Systems; application of computer technology and advanced command and control architectures to Battlefield Electronic Support Systems and Command and Control systems; protection from, and tactical employment of, emerging directed energy weapons; and alternative electric very high power/low weight propulsion drive-trains and armor/armament for future vehicles. This is an ongoing program to develop and demonstrate advanced technologies and system concepts in a quasi-operational environment is the less-than-lethal target effect. Multiple transitions into the Demonstration/Validation phase are planned, as well as fieldable prototyping to reduce risk in Engineering and Manufacturing Development. Joint service efforts are in line with Science and Technology Project Reliance agreements and the Joint Chiefs of Staff Joint Warfare Capabilities. Specifically this PE directly supports the following capabilities: to promptly engage regional forces in decisive combat on a global basis, and to respond to all other contingencies and missions in the full spectrum of combat operations (high, mid and low intensity) and in operations-other-war. By providing the technologies to enable these capabilities, this PE primarily supports the goals and objectives of the Strike, Littoral Warfare and Surveillance Joint Mission Areas. This PE supports all of the Marine Corps mission areas.

1. (U) Combat Element (CE) Technology: This area develops and demonstrates technologies and concepts to enhance the Command, Control, Communications and Computers (C4I); Electronic Warfare; Sensors and Electronic Devices; and Modeling and Simulation capabilities of the CE. These ATDs permit the rapid, accurate capture and dissemination of friendly and enemy essential elements of information, permitting greater situational awareness and control of forces. CE also addresses reconnaissance, surveillance, target acquisition, Identification Friend or Foe (IFF), and streamlined communications involved in command and control (C2) of supporting arms and units in amphibious/maneuver operations. Ongoing ATDs are: C2 in the Year 2000 (C2-2000), which will improve the joint interoperability of current and future MAGTF C4I systems by making them operable within the Global Command and Control System (GCCS); Forward Observer/Forward Air Controller (FO/FAC) and Joint tactical Communications Systems, which expand the target acquisition capabilities of forward deployed ground forces and enhance the control of supporting fires to ensure first round destruction; and Advanced Distributed Simulation and Virtual Prototyping Technology, which will be employed to improve user involvement in ATDs and to support concept development, assessment, and training.

2. (U) Ground Combat Element (GCE) Technology: This area develops and demonstrates technologies and concepts to enhance the

GCE's abilities to locate, close with, and destroy the enemy. The principal objectives are to improve tactical mobility and survivability, lethality, and training readiness in order to facilitate the Marine Corps-unique Operational Concept, (Operational Maneuver from the Sea (OMFTS)). Major focus areas are: MOBILITY, which develops technologies for an all electric family of combat and tactical vehicles, incorporating electric armor, electric suspension, electric propulsion suites, and electric guns; and Mine Countermeasures (MCM), which encompasses mobility and survivability, develops technologies to detect mines, minefields, and countermeasure mines rapidly, at safe standoff and fully integrated with the GCE. GCE also addresses: Neutralization of advanced, hardened, and off/route, smart mines, regardless of fuzing; and Fire Support, which develops weapons technologies focusing on electro-magnetic guns (Joint Cannon Caliber Electro-Magnetic Gun (JCCEMG)), directed energy target acquisition/countermeasure systems, and lightweight weapons and armors based on innovative design and advanced materials. Emphasis is placed on reducing the Marine's Combat load, while enhancing survival.

3. (U) Aviation Combat Element (ACE) Technology: This area develops and demonstrates improved close air support capability, enhancing the survivability of assault support helicopter-borne operations, and new technologies to define the air defense posture of the forward battlespace. Other ACE areas of focus are: Detection and Identification of low flying threat remotely piloted vehicles, rotary and fixed wing aircraft; and enhanced lethality and responsiveness of Close Air Support/ Close In Fire Support, which will enable improved support of OMFTS. Technologies to improve in-flight and landing zone (LZ) survivability, situational awareness, and suppression of enemy forces in the vicinity of the LZ will also be developed.

4. (U) Combat Service Support Element (CSSE) Technology: This area develops and demonstrates technologies to enhance the CSSE's ability to provide combat service support to the MAGTF for both traditional and emerging OMFTS Amphibious Operations. Mission Areas emphasized are: Supply, which addresses an operationally reliable, cost effective warehousing system with in-transit/total asset visibility of supplies and equipment for peacetime and expeditionary supply support and demonstrates functional seabasing and selective off-load capabilities through platform design; Maintenance, which addresses reduction of down time on ground equipment through prognostics, self-diagnostics, reliability centered maintenance, interchangeability/ commonality of parts and components, and improved mobile and seabased maintenance facilities; Transportation, which addresses improvements in cargo handling and transportation means available for ship-to-shore movement of supplies and equipment; reduction in tare and delivery time through improved packaging techniques and materials; Expeditionary Engineering, which addresses enhanced mobility, flexibility, and capability of deliberate engineer equipment available to expeditionary forces; Health Services, which addresses enhancement of capability through use of modular medical facilities; and Services, which addresses improvements in water production, bulk liquid distribution, and mobile electric power. Utilizing a systematic approach called Advanced Amphibious Logistics Technology, ATDs will address all functions of Combat Service Support.

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FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 1996

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603640M
PROGRAM ELEMENT TITLE: Marine Corps Advanced Technology Demonstrations (ATDs)

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 1995 ACTUAL	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
C2223 Marine Corps Advanced Technology Demonstrations	24,324	24,973	24,212	24,357	25,296	26,468	27,320	CONT.	CONT.
C2297 CMC Warfighting Lab-Core	0	0	3,500	0	0	0	0	0	3,500
TOTAL	24,324	24,973	27,712	24,357	25,296	26,468	27,320	0	CONT.

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: As the land warfare component of Naval Expeditionary Forces power projection, the Marine Corps has unique and technologically stressing requirements resulting from its' amphibious mission; Marine Air-Ground Task Force (MAGTF) organizational structure; and reliance on maneuver, logistic sustainability, and intensive tempo of operations in diverse environments. Critical Marine Corps requirements being addressed in this program element (PE) are Reconnaissance Standoff Mine Detection for surf zone and ashore; Mine Neutralization; Advanced Infantry and Vehicle Mounted Weapon Systems; application of computer technology and advanced command and control architectures to Battlefield Electronic Support Systems and Command and Control systems; protection from, and tactical employment of, emerging directed energy weapons; and alternative electric very high power/low weight propulsion drive-trains and armor/armament for future vehicles. This is an ongoing program to develop and demonstrate advanced technologies and system concepts in a quasi-operational environment is the less-than-lethal target effect. Multiple transitions into the Demonstration/Validation phase are planned, as well as fieldable prototyping to reduce risk in Engineering and Manufacturing Development. Joint service efforts are in line with Science and Technology Project Reliance agreements and the Joint Chiefs of Staff Joint Warfare Capabilities. This also funds the Commandants' Warfighting Labortoratory (CWL) in conceptual operational assessment of emerging technologies. Specifically this PE directly supports the following capabilities: to promptly engage regional forces in decisive combat on a global basis, and to respond to all other contingencies and missions in the full spectrum of combat operations (high, mid and low intensity) and in operations-other-war. By providing the technologies to enable these capabilities, this PE primarily supports the goals and objectives of the Strike, Littoral Warfare and Surveillance Joint Mission Areas. This PE supports all of the Marine Corps mission areas.

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 1996

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603640M
PROGRAM ELEMENT TITLE: Marine Corps Advanced Technology Demonstrations (ATDs)

(U) JUSTIFICATION FOR BUDGET ACTIVITY: This program is budgeted within the ADVANCED TECHNOLOGY DEVELOPMENT Budget Activity because it encompasses design, development, simulation, or experimental testing or prototype hardware to validate technological feasibility and concept of operations and reduce technological risk prior to initiation of a new acquisition program or transition to an ongoing acquisition program.

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FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 1996

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603640M PROJECT NUMBER: C2223
PROGRAM ELEMENT TITLE: Marine Corps Advanced Technology Demonstrations (ATDs) PROJECT TITLE: Marine Corps ATDs

(U) Affordability has always been an important aspect of the Marine Corps' investment strategy. The Marine Corps Science and Technology (S&T) program makes every effort to assess the affordability of its technology projects and to optimize investment opportunities. Projects in this PE stress improved tactical mobility and vehicle and personnel survivability, thus affecting affordability. Cost effective techhnologies such as real-time in-transit/total asset visibility of supplies and equipment have demonstrated capabilities during off-load exercises that reduced manpower requirements from approximately 30 embarkation personnel to seven, saved time, increased accuracy, and eliminated logistic bottlenecks. Maintenance related projects address the reduction of equipment down time resulting from prognostics, self-diagnostics, reliability centered maintenance, interchangeability and commonality of parts and components. Cargo handling and transportation technologies address vast improvements for ship-to-shore movement of supplies and equipment resulting in reduction of tare and delivery time through improved packaging techniques and materials.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1995 ACCOMPLISHMENTS:

- (U) ($1,119) Off/Route Smart Mine Clearance (ORSMC): Designed system level neutralization technologies. Conducted Critical Design Review. Fabricated system component/sub-component hardware. Continued signature duplication and surrogate threat emulator efforts (joint with Army).
- (U) ($2,727) Joint Amphibious Mine Countermeasures (JAMC): Completed fabrication of system hardware. Conducted DT 0. Prepared Milestone I documentation. Developed simulators to emulate operational performance. Prepared for transition to Joint Countermine Advanced Concept Technology Demonstration (ACTD) and integrated efforts under this PE. Developed simulators to emulate operational performance.
- (U) ($2,111) Coastal Battlefield Reconnaissance and Analysis (COBRA): Completed fabrication/integration of enhanced sensor into surrogate Pioneer manned aerial vehicle. Completed DT 0. Initiated Operational Testing 0 (OT 0).
- (U) ($2,005) Team Target Engagement Simulator (TTES): Conducted dynamic synthetic environmental development. Integrated behavioral and environmental products into the TTES system. Conducted initial 2-4 combatant tactical training assessment in a synthetic urban environment.

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- (U) ($600) Joint Cannon Caliber Electro Magnetic Gun (JCCEMG): Conducted component testing. Assembled skid mounted gun and conducted gun performance testing (joint with Army).
- (U) ($1,697) Advanced Systems for Air Defense (ASAD): Solicited contract for Electronic Support Measure (ESM) and acoustic passive sensor designs. Began separate contracted development effort to develop and demonstrate passive acoustic and ESM sensor as an Avenger system upgrade.
- (U) ($5,046) C2-2000: Continued MAGTF C4I system software conversion, conducted capability demonstrations, and incorporated test results of transitioning these systems to the GCCS Common Operating Environment (COE). Scope of software conversion and system transition to GCCS COE will decrease due to departmental budgetary constraints. Developed the associated software documentation to reflect movement from a "stove pipe" environment to an "open" environment.
- (U) ($1,418) Forward Observer/Forward Air Controller (FO/FAC): Completed fabrication. Conducted DT 0. Began OT 0 and transition of documentation in preparation for multi-service integration. Developed type-A specification for Demonstration/Validation (DEM/VAL) phase.
- (U) ($37) Survivablility Systems for Amphibious Vehicles: Established performance goals for mine blast and related survivability measures. Completed Low Observable technology designs.
- (U) ($1,175) OUTRIDER: Completed assessments to establish operational concepts and efforts to determine system utility on the battlefield using both man-in-the-loop and force-on-force systems. Prepared documentation to transition to DEM/VAL phase and Milestone I.
- (U) ($3,500) 21ST Century Land Warrior (21CLW): Funded Marine Corps commitment to joint service program led by the Army. This effort was undertaken to significantly enhance combat effectiveness and survivability of the dismounted combatant through evolution in materials, command and control, computers, electro-optics, firepower, navigation, and situational awareness. Initiated related Advanced Lightweight Ground Weaponry (ALWGW) efforts by participating in the Joint Objective Individual Combat Weapon (OICW) program with the Army to fabricate and test early prototypes.
- (U) ($1,549) Joint Integrated Electric Mobility Demonstration: (formerly titled Advanced Engine/Propulsion

Technology) Conducted testing of Advanced Power System. Initiated joint program with the Army and Advanced Research Projects Agency (ARPA), Arlington, Virginia. Conducted detailed conceptual designs.

- (U) ($1,090) Joint Surf Zone Countermeasure (JSZMCM): Continued fabrication of component hardware. Conducted DT/OT 0. Completed integration with JAMC, Navy Shallow Water MCM (SWMCM) programs, and Joint Army/Marine Corps Top Level Demonstration (TLD) via extensive modeling and simulation.

- (U) ($250) Joint Tactical Communications Systems (formerly titled Intentional Short Range Communications (ISRC)) This program transitioned from Exploratory Development, PE 0602131M. Designed, coordinated, and initiated a joint effort with the Navy to demonstrate - in an amphibious/littoral operational scenario - utility of employing advanced communications technologies.

2. (U) FY 1996 PLAN:

- (U) ($2,348) ORSMC: Complete fabrication of system hardware. Finalize signature duplication and surrogate threat emulator efforts. Conduct DT/OT 0. Prepare Milestone I documentation. Transition to PE 0603612M, Project C2104.

- (U) ($3,500) JAMC: Fabricate system prototype. Complete OT 0. Participate in joint MCM ACTD with prototype hardware and modeling and simulation products.

- (U) ($2,935) COBRA: Complete OT 0 and Milestone I documentation. Prepare DEM/VAL phase documentation and type-A specification. Participate, with hardware mounted on Unmanned Aerial Vehicles, in joint MCM ACTD. Transition program to PE 0603635M, Marine Corps Ground Combat/Support System, Project C2247.

- (U) ($1,116) C2-2: Complete MAGTF C4I system software conversion to the GCCS COE. Develop the capability to produce a "virtual" command post through the use of visalization software. Conduct capability demonstrations and transition results to applicable MAGF CE C2 programs. This program transitions to PE 0206626M. Marine Corps Command, Control, Communications Systems, Project C2150, MAGTF C4I, Systems Engineering and Integration (SE&I).

- (U) ($568) Joint TDEW Technology: (formerly shown under OUTRIDER discussion) Continue joint development of frequency agile laser protection and participate in Joint Services TDEW efforts.

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- (U) ($3,500) 21CLW: Complete initial downsizing and integration efforts. Provide technical support to CWL. Conduct interim experiments with two to four systems, assessing achievement of technical goals and operational utility (joint with Army).

- (U) ($2,000) JIEMD: Complete fabrication and integration of testbed platforms featuring electric land propulsion drive, advanced digital control system, and lightweight plastic cooling componets. Begin testing and evaluation. This constitutes Phase I of a joint, ongoing program with the Army's Tank-Automotive Command (TACOM), Warren, Michigan. Complete conceptual design of future mobility systems and initiate preliminary designs. Provide technical support to CWL.

- (U) ($2,670) Joint Modeling and Simulation Technology: Provide technical support to CWL. Develop Technologies to integrate live and virtual simulation in multiple environments. Constructive and virtual representations of dynamic environmental and human features will be required at a level of resolution sufficient to depict individuals and squads. Develop technologies to support capabilities to train while deployed and to conduct mission planning and rehearsal.

- (U) ($500) Advanced Light Weight Ground Weaponry (ALWGW): Continue to participate in the objective Individual Combat Weapon (OICW) Program with the Army to fabricate and test early prototypes.

- (U) ($1,000) TTES: Complete system integration. Conduct assessments with advanced human interface technology of fire team and rifle squad. Adapt TTES technology to support virtual prototyping and the assessment of tactical value of the 21CLW and other advanced infantry technologies. Conduct DT 0 and plan Early Operational Assessment.

- (U) ($890) ASAD: Transition ESM sensor technology to the Program Manager for Air Defense for integration onto the Avenger platform. Continue development of the passive acoustic sensor.

- (U) ($966) Advanced Amphibious Logistics Demonstration: Demonstrate Recording and Tracking Technologies utilizing a family of radio frequency tags to provide in-transit/total asset visibility of supplies and equipment for garrison and expeditionary operations.

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- (U) ($1,000) Integrated Combat operations Center (ICOC) (formerly Joint C4I Technology): Initiate joint development of technologies to support streamlined command and control, enhanced situational awareness, and rapid decision making on future battlefields. these efforts involve multi-disciplinary technologies to include: psychological, biological, expert systems, and computer visualization and facilitization of high cognitive plane mental and intuitive processes. These technologies will lead to an increase in situational awareness and more rapid decision making by the Commander.

- (U) ($461) Joint Tactical Communications Systems: Continue the development of the ISRC in order to demonstrate the ability to construct a "wireless" command post ashore (joint with Army).

- (U) ($1,000) FO/FAC: Complete OT 0 testing and demonstration. Complete system type-A specification and initiate transition to DEM/VAL. Provide technical support to CWL.

- (U) ($519) Portion of extramural 0program reserved for Small Business Innovation Research assessment in accordance with 15 U.S.C.638.

3. (U) FY 1997 PLAN:

- (U) ($1,710) Joint Targeting Sensors: (formerly titled Joint SOMD) Initiate joint program with the Army and ARPA, to develop and demonstrate technologies for the next generation of high resolution sensors and data fusion/processing to conduct rapid reconnaissance of the littoral battlespace.

- (U) ($855) JAMC: Complete transition documentation and support ACTD jointly with the Army and Navy. Evaluate residual system capabilities and transition as appropriate to the Joint TLD.

- (U) ($855) TTES: Demonstrate fire team training and mission rehearsal utility. Complete adaptive effort. Complete DT 0/OT 0, prepare Milestone I documentation, and transition to DEM/VAL phase, PE 0603635M, Project C2250, TTES. Provide technical support to CWL.

- (U) ($428) ASAD: Transition Avenger based acoustic sensor to the Program Manager for integration onto the Avenger.

000205

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BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603640M PROJECT NUMBER: C2223
PROGRAM ELEMENT TITLE: Marine Corps Advanced Technology Demonstrations (ATDs) PROJECT TITLE: Marine Corps ATDs

Shift focus to man-portable passive ESM and acoustic sensors for employment by Stinger fire units. This program transitions to PE 0206623M, Marine Corps Ground Combat/Supporting Arms Systems, Project C1120, Air Defense Missile System.

- (U) ($1,657) Joint Tactical Communications Systems: Demonstrate Probability Detection ultra wideband communication devices for LAN application and small unit COMMS. Conduct DT planning. Provide technical support to CWL.
- (U) ($855) FO/FAC: Continue FO/FAC transition documentation to complete DEM/VAL and incorporate advanced lightweight laser designator capability. Provide technical support to CWL.
- (U) ($661) Joint TDEW Technology: Continue to participate in the design, fabrication, testing and evaluation of frequency agile laser eye protection systems under the Joint Frequency Agile Protection Project. Continue development of high average power lasers, striving for greater waveform control, enhanced cooling techniques and increased applied power at greater distances. Execute those BAA responses selected from the FY 1996 solicitation.
- (U) ($2,992) 21CLW: Provide technical support to CWL. Continue development of technologies to be integrated into the final system configuration. Downsizing and integration is the focus. Initiate planning efforts to conduct final TLD in FY 1998.
- (U) ($1,721) Integrated Combat Operations Center (ICOC): Demonstrate advanced commercial technologies in operational exercises. Initiate modeling and simulation to merge command and control technologies. Provide technical support to CWL.
- (U) ($1,084) Survivability Systems for Amphibious Vehicles: Fabricate Low Observable and MCM subsystems based on BAA responses and begin integration into selected testbed platforms. Continue testing and evaluation of testbed platforms (joint program with Army).
- (U) ($2,138) JIEMD: Complete design and begin fabrication of those subsystems identified as having discrepancies during previous years' testing. Integrate subsystems transitioning from ongoing Exploratory Development efforts. This constitutes Phase II of a joint, ongoing program with the Army's TACOM. Select final design for future mobility concepts.

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: March 1996

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603640M

PROGRAM ELEMENT TITLE: Marine Corps Advanced Technology Demonstrations (ATDs)

PROJECT NUMBER: C2223

PROJECT TITLE: Marine Corps ATDs

- (U) ($2,138) Joint Modeling and Simulation Technology: Continue development of dynamic environmental and human features. Complete development techniques for virtual and live simulation integration. Provide technical support to CWL. Transition to advanced development. Continue development of deployed training mission planning and rehearsal.
- (U) ($1,053) ALWGW: Continue fabrication of prototypes and conduct field testing and redesign of OICW. Continue development of ruggedized fiber optic sight. Initiate development of the very lightweight mortar using advanced aerospace materials.
- (U) ($1,710) Advanced Amphibious Logistics Demonstration: Demonstrate Expeditionary Engineering Technologies such as new family of air transportable, multiple-use cranes, and bridging system to enhance MAGTF Expeditionary Engineering.
- (U) ($855) Joint Identification Friend or Foe (IFF) Technology: Initiate a joint IFF task which will concentrate upon identifying requirements and appropriate technologies to enhance friendly force survivability in a joint operations environment. Initial emphasis will be placed on providing IFF capabilities to MAGTF GCE, both mounted and dismounted.

B. (U) PROGRAM CHANGE SUMMARY:

	FY 1995	FY 1996	FY 1997
(U) FY 1996 President's Budget:	24,333	25,896	26,738
(U) Adjustments from 1996 PRESBUDG:	-9	-923	-6,026
(U) FY 1997 PRESBUDG Submit:	24,324	24,973	20,712

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: FY 1995 change reflected as a decrease in program reqirements (-9). The FY 1996 adjustment of (-621) was due to undistributed Congressional reduction and revised DOD inflation estimate (-302). Fy 1997 changes include a transfer of core JSIMS funding to OSD (-1,500), revised DOD inflation estimates (-731), minor pricing adjustments (-63) and a reduction in program requirements (-232), and a breakout of CWL (-3,500).

000207

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 1996

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603640M PROJECT NUMBER: C2223
PROGRAM ELEMENT TITLE: Marine Corps Advanced Technology Demonstrations (ATDs) PROJECT TITLE: Marine Corps ATDs

(U) Schedule: Not applicable.

(U) Technical: Not applicable.

C. (U) OTHER PROGRAM FUNDING SUMMARY: Not applicable.

(U) RELATED RDT&E:

(U) PE 0602618A (Ballistics Technology)
(U) PE 0603004A (Weapons and Munitions Advanced Technology)
(U) PE 0603005A (Combat Vehicle and Automotive Advanced Technology)
(U) PE 0603606A (Landmine Warfare and Barrier Advanced Technology
(U) PE 0603607A (Joint Service Small Arms Programs)
(U) PE 0603619A (Landmine Warfare and Barrier Advanced Demonstrations)
(U) PE 0603772A (Battlefield Force Integrations)
(U) PE 0604207A (STINGRAY)
(U) PE 0604710A (Night Vision Systems - Engineering Development)
(U) PE 0604806A (Chemical/Biological Defense Equipment - Engineering Development)
(U) PE 0604808A (Landmine Warfare and Barrier Engineering Development)
(U) PE 0602301E (Computing Systems and Communications Technology)
(U) PE 0602702E (Tactical Technology)
(U) PE 0603226E (Experimental Evaluation of Major Innovative Technologies)
(U) PE 0206623M (Marine Corps Ground/Supporting Arms Systems)
(U) PE 0602131M (Marine Corps Landing Force Technology)
(U) PE 0603612M (Marine Corps Mine/Countermeasures Systems)
(U) PE 0603635M (Marine Corps Ground Combat/Support System)
(U) PE 0604719M (Marine Command Control/Communications Systems (Advanced))
(U) PE 0204163N (Fleet Communications)
(U) PE 0602315N (Mine Countermeasures, Mining and Special Warfare Technology)
(U) PE 0603555N (Undersea Superiority Technology Demonstrations)

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BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603640M PROJECT NUMBER: C2223
PROGRAM ELEMENT TITLE: Marine Corps Advanced Technology Demonstrations (ATDs) PROJECT TITLE: Marine Corps ATDs

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION; Sea Dragon Experiments (CWL): This series of experiments will focus on developing tactics, techniques, and procedures (TTP's), as well as define battle formations and incorporate emerging technology, to enhance Marine warfighting capabilities into the next Century. The vision is one of operational reforms necessitated by a dynamic geo-political environment and a Revolution in Military Affairs. Using a Special Purpose Marine Air Ground Task Force (SPMAGTF), the Marine Corps will conduct a number of Advanced Warfighting Experiments (AWE's) and Limited objective Experiments (LOE's) to experiment with an operational concept that envisions a greatly expanded, very fluid, and more opportuntistic battlefield in an environment of Operational Maneuver From The Sea (OMFTS). Experimental forces ill be highly trained, technologicall;y advanced, highly lethal, and intellectually prepared to fight a chaotic environment. The major AWE's will be "Hunter Warrior", Urban Warrior", and "Capable Warrior".

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1997 PLAN:

- (U) ($1,500) CWL: Conduct the Hunter Warrior AWE as joint participant in the Army"s Force 21 AWE. Field the SPMAGTF at the CWL at the 29 Palms/Ft. Irwin area.
- (U) ($1,000) CWL: Write and validate operational concepts, the Experimentation Plan, data collection plan, assessment methology, and Experiment Final Report at CWL.
- (U) ($1,000) CWL: Provide for integration of advanced technologies into SPMAGTF from Marine Corps and othe sources.

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BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603640M PROJECT NUMBER: C2223
PROGRAM ELEMENT TITLE: Marine Corps Advanced Technology Demonstrations (ATDs) PROJECT TITLE: Marine Corps ATDs

B. (U) PROGRAM CHANGE SUMMARY:

	FY 1995	FY 1996	FY 1997
(U) FY 1996 PRESBUDG Submit :	0	0	0
(U) Adjustments from FY 1996 PRESBUDG:	0	0	3,500

(U) FY 1997 Congressional Submit:

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: FY 1997 increase ws the result of the creation of the CWL project line.

(U) Schedule: Not applicable.

(U) Technical: Not applicable.

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DATE: March 1996

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603640M
PROGRAM ELEMENT TITLE: Marine Corps Advanced Technology Demonstrations (ATDs)

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(U) PE 0603782N (Mine and Expeditionary Warfare Advanced Technology)
(U) PE 0603794N (Command, Control, Communications, Advanced Technology)
(U) This program is in compliance with Tri-Service Reliance Agreements.

D. (U) SCHEDULE PROFILE: Not Applicable.

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: March 1996

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603706N
PROGRAM ELEMENT TITLE: Medical Development (Advanced)

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 1995 ACTUAL	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
M0095 Fleet Health Technology	18,081	12,576	12,061	13,002	11,569	10,635	10,876	CONT.	CONT.
M0096 Fleet Health Standards	4,977	4,241	5,281	5,313	5,575	5,696	5,830	CONT.	CONT.
M2022 Bone Marrow Registry	32,762	32,786	20,000	0	0	0	0	0	148,851
M2284 Prostrate Cancer Research	0	7,266	0	0	0	0	0	0	7,266
M2285 DOD Head Injury	0	905	0	0	0	0	0	0	905
M2287 Navy Biodynamics Lab (NBDL)	0	2,906	0	0	0	0	0	0	2,906
TOTAL	55,820	60,680	37,342	18,315	17,144	16,331	16,706	CONT.	CONT.

(U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: The Navy Medical Department's mission includes providing medical care and treatment to Navy and Marine Corps personnel in operational theaters. Goals include increasing return-to-duty rates of troops injured in combat, enhancing personnel performance in demanding Fleet jobs (and the selection of candidates for these jobs), reducing operationally related morbidity and mortality, and ensuring the physical readiness and safety of deployed personnel. This program element supports Joint Support Areas including Readiness, Support & Infrastructure, and Manpower, Personnel & Shore Training. Specific task areas include return to duty of battlefield casualties, blood and stem cell products and substitutes, treatments for wounds and multiple organ system failure, methods for managing injuries related to extreme thermal environments, and new capabilities in field diagnostics and medical/dental support. This program element also provides validated techniques for the selection of personnel based on medical criteria and standards and procedures which will protect Fleet personnel during exposure to Navy and Marine Corps operational environments. The impact of this program element includes improved medical logistics, safety, Service-wide standards and technologies. This program element also has supported the Navy's effort to register and match donors and complete bone marrow transplants.

000212

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: March 1996

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603706N
PROGRAM ELEMENT TITLE: Medical Development (Advanced)

(U) JUSTIFICATION FOR BUDGET ACTIVITY: This program is budgeted within the ADVANCED TECHNOLOGY DEVELOPMENT Budget Activity because it encompasses design, development, simulation, or experimental testing or prototype hardware to validate technological feasibility and concept of operations and reduce technological risk prior to initiation of a new acquisition program or transition to an ongoing acquisition program.

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FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 1996

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603706N
PROGRAM ELEMENT TITLE: Medical Development (Advanced)

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 1995 ACTUAL	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
M0095 Fleet Health Technology	18,081	12,576	12,061	13,002	11,569	10,635	10,876	CONT.	CONT.

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: Encompasses critical endeavors designed to enhance fleet health care, augment field treatment capabilities, and improve medical logistics necessary for support of Naval and Marine Corps forces and combat casualties. Ongoing projects focus on key biomedical and casualty-relevant areas including: (1) blood products, blood substitutes, and hematopoietic stem cells; (2) combat wounds and multiple organ system failure; (3) fleet health in extreme environments; and (4) field diagnostics and medical/dental support capabilities.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1995 ACCOMPLISHMENTS:

- (U) ($1,502) MAMMOGRAM TECHNOLOGY: A standard model was developed to assist in validation and intercomparison of Computer Aided Diagnosis (CAD) techniques. Plans were to (1) develop a high resolution digital mammography image database which has been pathologically verified, (2) perform independent Receiver Operator Characteristic studies at two clinical sites to validate the clinical utility of CAD algorithms and Direct X-ray Detectors for mammography, and (3) use the database to develop training and evaluation material for radiologists. (Congressional plus up.)

- (U) ($700) NAVAL BIODYNAMICS LAB: The effects of motion on cognitive and physical performance were determined. Funds were used to investigate two adverse affects of motion: direct biomechanical interference with physical and cognitive tasks, and the general debilitating effects of motion sickness. (Congressional plus up.)

- (U) ($3,556) BREAST CANCER CENTER: The National Naval Medical Center (NMMC) developed a center of excellence for the management of breast diseases, emphasizing training of medical personnel in specialized methods of early

detection and treatment of breast cancer and focusing on women under 40 years of age for whom routine mammographic screening may not be appropriate. (Congressional plus up.)

- (U) ($1,440) TREATMENT OF CASUALTIES, TO PREVENT SEPSIS AND SHOCK AND COMPLICATIONS ASSOCIATED WITH WOUND INFECTION: Continued development of four new thrusts: (1) identified host inflammatory response differences which occur during comparison of Gram-positive sepsis with Gram-negative sepsis, (2) determined specific effects of antioxidant treatment of sepsis, (3) evaluated two classes of specific anti-inflammatory therapies; one based on inhibition of expression of cell adhesion molecules and the other based on specific inhibition of binding of cell adhesion molecules, and (4) investigated oxygen delivery to tissue during sepsis in animals to identify where oxygen transport is disturbed and how these disruptions in oxygen transport can be treated.

- (U) ($2,052) BLOOD AND BLOOD PRODUCTS: Continued to obtain data for FDA licensure of (1) human red blood cells frozen with 40% W/V glycerol at -80°C for 20 years, (2) human platelets frozen with 6% DMSO at -80°C for 2 years, and (3) "functionally closed" system to deglycerolize red blood cells enabling post wash storage at 4°C for at least 2 weeks. Continued Phase I clinical trials of enzymatic converted Type B human red cells to universal Type O. Continued studies on a portable, self contained, durable, deployable, ex vivo expansion system for bone marrow stem cells to be used for autologous stem cell transfusion. Initiated studies on extended liquid storage of human red cells to 12-16 weeks. Initiate studies into lyophilized blood products.

- (U) ($1,459) MODULATION OF IMMUNE SYSTEM OF CASUALTIES: Continued studies with T-lymphocyte costimulatory receptors and their role in regulating T-lymphocyte activation in vivo to determine how to regulate (i.e., turn on and off) the immune system. Specifically: (1) characterized the immune system effects of the transgenes in vivo, and studied the effects of a cell surface receptor's (i.e., CD28) biologics in the various in vivo models; and (2) created pure transgenic mouse strains for specific models.

- (U) ($1,728) PHYSIOLOGICAL ENHANCEMENT OF PERFORMANCE IN EXTREME ENVIRONMENTAL CONDITIONS: Continued evaluation of the effects of vasopressin on physiological and behavioral performance under conditions of thermal stress.

- (U) ($2,173) MEDICAL MANAGEMENT TOOLS AND EQUIPMENT USED IN FIELD OPERATIONS: Continued to interface the Epidemiological Information System (EPISYS), SAMS and selected medical databases. Continued to develop models for projecting casualty rates for various battle intensities. Continued to validate the casualty projection

system for shipboard casualties.

- (U) ($2,702) DENTAL EMERGENCY READINESS: Continued to develop new methods and materials to prevent and treat dental emergencies and maximize operational readiness in Navy and Marine Corps personnel. This included: (1) evaluating performance of dental materials in the laboratory and clinic, especially in the area of longevity of autoclaved instruments, (2) evaluating potential of new materials to reduce costs while improving overall infection control, and (3) field testing promising dental equipment, especially for emergency contingencies.

- (U) ($769) PREVENTION AND TREATMENT OF MUSCULOSKELETAL INJURIES: Completed effort to determine role of epidemiological, orthopedic, and biomechanical factors related to the risk of musculoskeletal injury, i.e., overuse, injury among select Navy and Marine Corps populations. Verified a general classification designator generated from an extensive database of biomechanical information designed to identify injury-prone individuals, by employing a prospective cohort study. Designed and implemented intervention strategies to reduce the incidence of injury and to improve the treatment of injury.

2. (U) FY 1996 PLAN:

- (U) ($2,570) TREATMENT OF CASUALTIES, TO PREVENT HEMORRHAGIC SHOCK AND COMPLICATIONS ASSOCIATED WITH COMBAT TRAUMA: Initiate the development of new thrusts: (1) validate the feasibilty and efficiency of life sustainment and casaulty stabilization interventions including metabolic modulations to reduce oxygen requirements, modes of hibernation induction, hypothermic treatments, and control of exsanguination, (2) initiate studies that develop new approaches to treatment of hemorrhagic shock.

- (U) ($2,906) BLOOD AND BLOOD PRODUCTS: Submit data to FDA for license of (1) human red blood cells frozen with 40% W/V glycerol at -80°C for 20 years, (2) human platelets frozen with 6% DMSO at -80°C for 2 years, and (3) "functionally closed" system to deglycerolize red blood cells enabling post wash storage at 4°C for at least 2 weeks. Complete Phase I clinical trials of enzymatic converted Type B cells to Type O cells. Continue studies on a portable, self contained, durable, deployable ex vivo expansion system for bone marrow stem cells to be used for autologous stem cell transfusion. Continue studies on extended liquid storage of human red cells to 12-16 weeks. Continue studies in lyophilized blood product techologies for improved shelf life.

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BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603706N PROGRAM ELEMENT TITLE: Medical Development (Advanced) PROJECT NUMBER: M0095 PROJECT TITLE: Fleet Health Technology

- (U) ($1,970) MODULATION OF IMMUNE SYSTEM OF CASUALTIES: Validate the results of the in vivo studies with T-lymphocyte costimulatory receptors. Initiate use of the transgenic mouse strains for studies which will elucidate costimulatory treatment mechanisms for specific model diseases.

- (U) ($810) PHYSIOLOGICAL ENHANCEMENT OF PERFORMANCE IN EXTREME ENVIRONMENTAL CONDITIONS: Complete the evaluation of the effects of vasopressin, neuropeptide Y, and other transmitted on physiological and behavioral performance under conditions of thermal stress and validate the findings.

- (U) ($2,578) MEDICAL MANAGEMENT TOOLS AND EQUIPMENT USED IN FIELD OPERATIONS: Continue to interface the EPISYS, SAMS and selected medical databases. Continue to develop models for projecting casualty rates for various battle intensities. Complete the validation of the casualty projection system for shipboard use.

- (U) ($743) NAVY DENTAL RESEARCH: Develop efforts encompassing 1) the systematic, scientific investigation of problems related to the oral health, wellness, disease, and injury of Navy and Marine Corps personnel; 2) the development of methods, materials, and products that increase operational readiness and improve dental care in the military setting; and 3) the collection and analysis of data to change or influence policy or doctrine. Examples of specific, high payoff projects include development of a multimedia diagnostic system for corpsmen; risk assessment strategies and program; dental disease progression methods and diagnostics; and a managed dental care system; and study of Navy dental examination periodicity and mercury contamination of wastewater from Navy dental treatment facilities.

- (U) ($976) PREVENTION AND TREATMENT OF MUSCULOSKELETAL INJURIES: Validate the relative risks assigned to epidemiological, orthopedic and biomechanical factors related to musculoskeletal trauma. Complete the validation of the general classification function previously generated to identify injury-prone individuals and initiate prospective cohort study. Assess intervention strategies to reduce the incidence, and improve the treatment, of injury.

- (U) ($23) Portion of extramural program reserved for Small Business Innovation Research assessment in accordance with 15 U.S.C. 638.

3. (U) FY 1997 PLAN:

000217

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 1996

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603706N PROGRAM ELEMENT TITLE: Medical Development (Advanced)

PROJECT NUMBER: M0095 PROJECT TITLE: Fleet Health Technology

- (U) ($2,220) TREATMENT OF CASUALTIES TO PREVENT HEMORRHAGIC SHOCK AND COMPLICATIONS ASSOCIATED WITH COMBAT TRAUMA: Continue the research and development of studies that validate the feasibility and efficiency of life sustainment and casualty stabilization interventions including metabolic controls that reduces oxygen consumption, methods for hibernation induction and hypothermic treatment, as well as control of exsanguation, (2) continue studies into the complications of hemorrhagic shock and late sequela prevention.

- (U) ($2,901) BLOOD AND BLOOD PRODUCTS: Complete additional studies required by FDA for the licensure of enzymatic conversion of Type B red cells to Type O. Conduct preclinical trials of enzymatic conversion Type A to Type O blood. Complete studies on extended liquid storage of human red cells to 12-16 weeks. Initiate studies regarding one step blood freezing technologies that eliminate the need for post-thaw washing. Continue studies in lyophilized blood product technologies for improved shelf life.

- (U) ($1,766) MODULATION OF IMMUNE SYSTEM OF CASUALTIES: Continue using transgenic mouse strains for studies which will elucidate costimulatory treatment mechanisms.

- (U) ($804) PHYSIOLOGICAL ENHANCEMENT OF PERFORMANCE IN EXTREME ENVIRONMENTAL CONDITIONS: Complete the validation of vasopressin effects on physiological and behavioral performance under conditions of thermal stress; begin preparation of FDA licensure package.

- (U) ($2,402) MEDICAL MANAGEMENT TOOLS AND EQUIPMENT USED IN FIELD OPERATIONS: Continue to interface the EPISYS, SAMS and selected medical databases; validate the relationships and ensure the effectiveness. Continue to develop models for projecting casualty rates for various battle scenarios and intensities.

- (U) ($916) NAVY DENTAL RESEARCH: Continue efforts encompassing 1) the systematic, scientific investigation of problems related to the oral health, wellness, disease, and injury of Navy and Marine Corps personnel; 2) the development of methods, materials, and products that increase operational readiness and improve dental care in the military setting; and 3) the collection and analysis of data to change or influence policy or doctrine. Examples of specific high payoff projects include development of a multimedia diagnostic system for corpsmen; risk assessment strategies and program; dental disease progression methods and diagnostics; and a managed dental care system.

000218

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 1996

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603706N PROJECT NUMBER: M0095
PROGRAM ELEMENT TITLE: Medical Development (Advanced) PROJECT TITLE: Fleet Health Technology

- (U) ($1,052) PREVENTION AND TREATMENT OF MUSCULOSKELETAL INJURIES: Develop intervention techniques to reduce the risks of musculoskeletal trauma associated with epidemiological, orthopedic and biomechanical factors. Study the value of intervention techniques which preclude high-risk individuals from becoming victims of musculoskeletal trauma.

B. (U) PROGRAM CHANGE SUMMARY:

	FY 1995	FY 1996	FY 1997
(U) FY 1996 President's Budget:	19,546	13,307	13,582
(U) Adjustments from PRESBUDG:	-1,465	-731	-1,521
(U) FY 1997 PRESBUDG Submit:	18,081	12,576	12,061

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: FY 1995 reduction (-1,465) based on reduced requirements. FY 1996 changes for Congressional Undistributed reductions (-257K), revised DOD inflation estimates (-152K), minor program repricings (-322K). FY 1997 changes include a reduction for revised DOD inflation estimates (-364K), minor pricing adjustments (-57K), and a change to project M0096 (-1100K).

(U) Schedule: Not applicable.

(U) Technical: Not applicable.

C. (U) OTHER PROGRAM FUNDING SUMMARY: Not applicable.

(U) RELATED RDT&E:
(U) PE 0601153N (Defense Research Sciences)
(U) PE 0602233N (Readiness, Training and Environmental Quality)
(U) PE 0604771N (Medical Development (ENG))
(U) This program is coordinated through the Armed Services Biomedical Research Evaluation and Management Committee.

000219

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 1996

BUDGET ACTIVITY: 3
PROGRAM ELEMENT: 0603706N
PROGRAM ELEMENT TITLE: Medical Development (Advanced)
PROJECT NUMBER: M0095
PROJECT TITLE: Fleet Health Technology

D. (U) SCHEDULE PROFILE: Not applicable.

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: March 1996

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603706N
PROGRAM ELEMENT TITLE: Medical Development (Advanced)

(U) COST: (Dollars in thousands)

PROJECT NUMBER & TITLE	FY 1995 ACTUAL	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
M0096 Fleet Health Standards	4,977	4,241	5,281	5,313	5,575	5,696	5,830	CONT.	CONT.

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: Develops valid medical standards for selection, training, and retention, reduces attrition and injury, and enhances personnel performance in Navy operational environments.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1995 ACCOMPLISHMENTS:

- (U) ($461) Reduce attrition and injury: Delivered a validated model for measuring the quality of shore-based safety and health programs. Identified neurotoxicant in turbine lubricants. Developed molecular techniques for screening neurotoxic hazardous materials.
- (U) ($413) Reduce attrition and injury: Developed toxicity assessment methodologies for organic nitrate compounds to improve health risk assessment of shipboard hazardous materials.
- (U) ($458) Reduce attrition and injury: Completed testing of prototype light emitting diode (LED) dosimeter for shipboard radio frequency (RF) exposures. Initiated development of expert system for shipboard industrial hygiene hazard recognition and surveys.
- (U) ($953) Medical standards: Provided biomedical specifications to improve safety and reduce injury in an electromagnetic radiation (EMR)/agile laser battlefield.
- (U) ($888) Reduce attrition and injury: Delivered recommendations to reduce incidence of injury due to aviator neck stress.
- (U) ($1,507) Enhance performance: Continued development of biomedical countermeasures to decrements of physical and cognitive performance during preparation for and performance of sustained combat operations.

- (U) ($297) Reduce attrition and injury: Developed improved countermeasures to heat strain for shipboard engine room and firefighting personnel via torso cooling vests.

2. (U) FY 1996 PLAN:

- (U) ($615) Medical standards for selection: Continue development of gender-neutral occupational strength and fitness standards for aviation and shipboard personnel.
- (U) ($818) Reduce attrition and injury: Develop Physiological Heat Exposure Limit curves for shipboard engine room and firefighting personnel. Develop Physiological Cold Exposure Limit curves for Marine Corps Mountain Warfare Training Center.
- (U) ($278) Reduce attrition and injury: Continue development of shipboard industrial hygiene expert system; deliver prototype.
- (U) ($260) Reduce attrition and injury: Complete testing protocol for screening hazardous materials toxicity assessment methodologies for organic nitrate compounds.
- (U) ($285) Reduce attrition and injury: Deliver pocket-size LED dosimeter for RF radiation. Continue dosimetry research on ship topside RF exposures.
- (U) ($851) Reduce attrition and injury: Develop work-rest cycle operational guidelines for naval firefighters and shipboard engine room personnel. Develop improved cold weather operational guidelines to reduce cold related injuries and enhance performance parameters.
- (U) ($1,134) Enhance performance: Develop alertness monitoring/management system. Develop sleep and alertness enhancers.

3. (U) FY 1997 PLAN:

- (U) ($900) Undersea Medicine, Diver Decompression, and Oxygen Toxicity: Initiate development programs to deliver products that enhance the safety of Navy divers and extend the operational envelope by permitting faster decompression procedures and longer bottom time; develop preventive and treatment methods for oxygen toxicity;

and enhance protocols for improving submarine rescue operations.

- (U) ($884) Medical standards for selection: Continue work in gender-neutral occupational strength and fitness standards for shipboard and aviation duty.
- (U) ($1,390) Deliver guidelines: Provide recommendations for use of biomedical countermeasures to counteract performance decrements associated with sustained operations.
- (U) ($927) Enhance performance: Deliver improved countermeasures to heat strain for shipboard engine room and firefighting personnel via a torso vest.
- (U) ($150) Reduce attrition and injury: Deliver validated expert system for shipboard industrial hygiene hazard recognition and survey reporting.
- (U) ($552) Reduce attrition and injury: Initiate testing, evaluation, and refinement of physiologically-based pharmacokinetic model of shipboard exposures to cleaning solvents. Initiate toxicological evaluation of chemicals associated with Navy workplace exposures to predict health outcomes and develop exposure standards.
- (U) ($478) Reduce attrition and injury: Conduct field measurement and computational dosimetry study of RF radiation exposures in Navy and Marine Corps operational environments.

B. (U) PROGRAM CHANGE SUMMARY:

	FY 1995	FY 1996	FY 1997
(U) FY 1996 President's Budget:	4,312	4,445	4,584
(U) Adjustments from PRESBUDG:	+665	-204	+697
(U) FY 1997 PRESBUDG Submit:	4,977	4,241	5,281

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 1996

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603706N PROGRAM ELEMENT TITLE: Medical Development (Advanced) PROJECT NUMBER: M0096 PROJECT TITLE: Fleet Health Standards

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: FY 1995 increase (+665K) to meet change in program requirements. FY 1996 decrease due to Congressional Undistributed (-87), revised minor program reduction (-87K). FY 1997 changes include a transfer from Project M0095 (+900K), revised DOD inflation estimates (-160K), and minor program repricings (-43K).

(U) Schedule: Not applicable.

(U) Technical: Not applicable.

C. (U) OTHER PROGRAM FUNDING SUMMARY: Not applicable.

(U) RELATED RDT&E:
(U) PE 0601153N (Defense Research Sciences)
(U) PE 0602233N (Readiness, Training and Environmental Quality)
(U) PE 0604771N (Medical Development (ENG))

D. (U) SCHEDULE PROFILE: Not applicable.

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: March 1996

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603706N
PROGRAM ELEMENT TITLE: Medical Development (Advanced)

(U) COST: (Dollars in thousands)

PROJECT NUMBER & TITLE	FY 1995 ACTUAL	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
M2022 Bone Marrow Donor Registry	32,762	32,786	20,000	0	0	0	0	0	148,851

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: The C.W. Bill Young Marrow Donor Recruitment and Research Program is a medical research program with the goal of developing the basis for identifying donors and provide correctly matched marrow for military casualties and patients with diseases best treated with marrow transplantation including marrow suppression caused by radiation or chemical injury.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1995 ACCOMPLISHMENTS:

- (U) ($11,200) Implemented DNA Based Human Leukocyte Antigen (HLA) Typing with Navy Lead and Navy Technology Support for Civilian Laboratory Development (100,000 typings in FY95).
- (U) ($6,401) Continued ongoing civilian contracts to DNA type all HLA genetic loci for more than 2,000 National Marrow Donor Program (NMDP) donor-recipient pair samples held in NMDP repository.
- (U) ($4,800) Continued coordination of national system to identify volunteers willing to provide marrow and platelets, HLA type them, and rapidly select the correctly matched donor and provide the marrow for the transplant -- NMDP. 250,000 donors added to NMDP files through Navy support in FY95.
- (U) ($10,361) Executive Agent for DoD Marrow Donor Program through DoD Policy. 25,000 volunteers recruited by DoD program in 1995.

2. (U) FY 1996 PLAN:

- (U) ($26,904) Expand marrow donor registry base via donor recruitment and typing performed by civilian

contracts to DNA type all HLA genetic loci for more than 2,000 NMDP donor - recipient pair samples held in NMDP repository.

- (U) ($5,184) Clinical implementation of DNA typing procedures for all HLA antigens. Demonstration of class I DNA based typing in early FY 1996.
- (U) ($698) Portion of extramural program reserved for Small Business Innovative Research assessment in accordance with 15 U.S.C. 638.

3. (U) FY 1997 PLAN:

- (U) ($7,000) Advance DNA based HLA typing with Navy Lead and Navy technology support for civilian laboratory development.
- (U) ($5,000) Continue coordination of national system to identify volunteers willing to provide marrow and platelets, HLA type them, and rapidly select the correctly matched donor and provide the marrow for the transplant - the NMDP.
- (U) ($1,000) Expand marrow donor recruitments for more than 3,200 NMDP donor - recipient pair samples held in NMDP repository to determine precise level of HLA matching required for life saving outcome.
- (U) ($5,000) Executive Agent for DoD Marrow Donor Program through DoD Policy to continue recruitments for marrow.
- (U) ($1,500) Continue development of clinical implementation of DNA typing procedures for all HLA antigens (HLA-class II typing implemented and HLA-class I in demonstration stage).
- (U) ($500) Integration of medical research and development capabilities into military medical contingency and civilian emergency planning including small scale demonstration of response to marrow toxic exposure from radiation or chemicals.

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: March 1996

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603706N
PROGRAM ELEMENT TITLE: Medical Development (Advanced)

PROJECT NUMBER: M2022
PROJECT TITLE: Bone Marrow Registry

B. (U) PROGRAM CHANGE SUMMARY:

	FY 1995	FY 1996	FY 1997
(U) FY 1996 President's Budget:	32,762	10,002	0
(U) Adjustments from PRESBUDG:	0	+22,784	+20,000
(U) FY 1997 PRESBUDG Submit:	32,762	32,786	20,000

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: FY 1996 increase due to Congressional plus-up (+24,000), revised DOD inflation estimates (-398K) Congressional Undistributed reductions (-668K), and a minor program reduction (-150K). FY 1997 increase to continue Bone Marrow Registry efforts.

(U) Schedule: Not applicable.

(U) Technical: Not applicable.

C. (U) OTHER PROGRAM FUNDING SUMMARY: Not applicable.

(U) RELATED RDT&E:
(U) PE 0601153N (Defense Research Sciences)
(U) PE 0602233N (Mission Support Technology)
(U) PE 0604771N (Medical Development, Engineering)

This program is coordinated through the Armed Services Biomedical Research and Management Committee.

D. (U) SCHEDULE PROFILE: Not applicable.

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 1996

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603707N
PROGRAM ELEMENT TITLE: Manpower, Personnel, and Training Advanced Technology Development

(U) COST: (Dollars in thousands)

PROJECT NUMBER & TITLE	FY 1995 ACTUAL	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
* R0542 Air Human Factors Engineering	796	1,043	1,126	1,134	1,149	1,174	1,201	CONT.	CONT.
* R1770 Manpower and Personnel Development	3,423	3,749	3,998	3,978	4,243	4,334	4,438	CONT.	CONT.
* R1771 Ship Human Factors Engineering	2,403	2,015	2,183	2,190	2,212	2,257	2,308	CONT.	CONT.
* R1772 Education and Training Development	5,685	4,858	5,920	6,057	7,111	7,238	7,382	CONT.	CONT.
* R1773 Simulation and Training Devices	6,143	5,595	6,046	6,547	7,747	7,293	7,338	CONT.	CONT.
TOTAL	18,450	17,260	19,273	19,906	22,462	22,296	22,667	CONT.	CONT.

* Projects Realignment from L code to R code in FY96.

(U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This program element supports the Joint Support Areas for Manpower & Personnel, Shore Training, and Readiness, Support & Infrastructure; it also supports the Joint Mission Area assessments for most warfare areas, and the Future Joint Warfighting Capabilities identified by the Joint Chiefs of Staff. It develops technologies that enable the Navy to select, assign and manage its people; to train effectively and affordably in classroom settings, in simulated environments and while deployed; and to operate and maintain complex weapon systems. It consists of the following technologies:

1. (U) Human Factors Engineering (HFE): These projects develop information management techniques, advanced interface technologies, and decision support systems, all of which help ensure that complex systems will be operated and maintained more effectively, with fewer human-induced errors, and with greater safety.

2. (U) Manpower and Personnel: This project provides Navy personnel system managers with the ability to choose and retain the right people and to place them in jobs that best use their skills, training, and experience. Fleet readiness can

000228

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 1996

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603707N
PROGRAM ELEMENT TITLE: Manpower, Personnel, and Training Advanced Technology Development

be enhanced and personnel costs reduced via such technologies as modeling, mathematical optimization, advanced testing, statistical forecasting, and human performance measurement.

3. (U) Education and Training Development: This project focuses on the acquisition and maintenance of complex skills through individual and team training technologies. It improves training efficiency and cost-effectiveness by applying operations research and instructional, cognitive, and computer sciences to the logistics, development, delivery, evaluation, and execution of training.

4. (U) Simulation and Training Devices: This project improves mission effectiveness and safety by applying both simulation and instructional technology to the design of affordable training systems. The project develops and evaluates systems to improve advanced training, skill maintenance and mission rehearsal capability.

(U) JUSTIFICATION FOR BUDGET ACTIVITY: This program is budgeted within the ADVANCED TECHNOLOGY DEVELOPMENT Budget Activity because it encompasses design, development, simulation, or experimental testing or prototype hardware to validate technological feasibility and concept of operations and reduce technological risk prior to initiation of a new acquisition program or transition to an ongoing acquisition program.

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 1996

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603707N
PROGRAM ELEMENT TITLE: Manpower, Personnel, and Training Advanced Technology Development

(U) COST: (Dollars in thousands)

PROJECT NUMBER & TITLE	FY 1995 ACTUAL	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
R0542 Air Human Factors Engineering	796	1,043	1,126	1,134	1,149	1,174	1,201	CONT.	CONT.

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This project develops and demonstrates advanced human factors engineering technology to improve the integration of the human in Navy airborne weapons systems. General goals of the project are to enhance human performance effectiveness, reduce design-induced critical human performance errors, and accelerate insertion of advanced HFE technology into existing and new weapons systems. Prior work in this project has focused on developing and refining a decision aiding architecture, the Knowledgeable Observation, Analysis-Linked Advisory System (KOALAS), which is unique in that it allows for both data-driven as well as operator inputs into the decision making process.

(U) The current task focuses on the problem of integrating information from multiple aircraft to enhance performance in the multi-dimensional battle space. Since there are unique data flow requirements for each aircraft, there are risks associated with realizing the full potential of the Navy's proposed SONATA global grid initiative. The purpose of the current task is to mitigate these risks by providing iterative demonstrations of our ability to effectively combine and present information to the operator, and to develop the guidelines and specifications for each platform necessary for the effective implementation of this technology.

(U) Precise navigation and rapid target acquisition in close air support (CAS) and precision strike missions is required for mission success. The requirement for first pass weapon delivery with a minimum of collateral damage makes both missions extremely demanding and requires that pilots work with accurate and timely information to plan and execute the mission.

(U) Currently, during the planning process, photographs are used to provide familiarity with the route, with significant terrain and cultural features along the route and in the target itself. There is no method to display this important information in the aircraft. This project will evaluate the benefits of displaying annotated satellite imagery in the aircraft for use in a CAS-like mission.

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 1996

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603707N PROGRAM ELEMENT TITLE: Manpower, Personnel, and Training Advanced Technology Development PROJECT NUMBER: R0542 PROJECT TITLE: Air Human Factors Engineering

(U) Flight tests using this system will systematically evaluate improvements in navigation and targeting accuracy. Pilot opinion will also be used to evaluate the utility of on-board satellite imagery for CAS and precision targeting. The project will also demonstrate, in the laboratory, enhancements which integrate satellite imagery and terrain elevation data to form pseudo-three dimensional (3-D) satellite imagery. The demonstration will also explore how to present a set of target images from a variety of aspects as a target identification aid.

(U) The payoff will be an advanced cockpit display format of satellite imagery and maps supporting navigation and targeting. This information is expected to improve geographic awareness (thus situational awareness also) and navigation accuracy by 10% or more. Additional payoffs might occur if operators could view the satellite imagery during planning, providing an opportunity for route familiarization and mission rehearsal. Laboratory experiments using pseudo 3-D imagery have shown decreases in response times for target recognition of 20%.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1995 ACCOMPLISHMENTS:

- (U) ($796) Completions:
  - (U) Demonstrated enhanced situational awareness and tactical response in objective warfare scenarios for inter-platform simulation of F-14D, F/A-18, S-3 and ES-3.
  - (U) Documented results of evaluation and completed Human Factors specification and systems integration requirements for the IMMSI architecture.

2. (U) FY 1996 PLAN:

- (U) ($1,043) New Starts:
  - (U) Develop an experimental design for the evaluation. Descriptions of debrief topics, and subjective pilot measures of Image Based Navigation (IBN) utility, geographical awareness, and workload will be identified or developed for use. Analysis procedures will be identified for each of the performance measures obtained.

imagery, Defense Mapping Agency aeronautical charts, maps, Digital Terrain Elevation Data (DTED), and recording discs.

3. (U) FY 1997 PLAN:

- (U) ($1,126) Continuations:
  - (U) Plan demonstration to show that the 3-D scene generation system can show satellite imagery from the viewpoint of the aircraft. Schedule demonstration.
  - (U) Build 3-D Scene Generation System. The hardware and software necessary to show the satellite imagery in 3-D will be developed using algorithms previously developed for the Land Multisensor Correlator, a 6.2 Land Targeting Task of the Air Weaponry Technology Area (PE 0602111N).
  - (U) Integrate with Aircraft Avionics. This task will include integration of necessary hardware and software into the aircraft avionics.

B. (U) PROGRAM CHANGE SUMMARY:

	FY 1995	FY 1996	FY 1997
(U) FY 1996 President's Budget:	969	1,074	1,138
(U) Adjustments from PRESBUDG:	-173	-31	-12
(U) FY 1997 PRESBUDG Submit:	796	1,043	1,126

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: FY 1995 reductions (-$173) due to changes in program requirements. FY 1996 decrease is due to Congressional Undistributed reductions (-$20) and revised DOD inflation estimates (-$11). FY 1997 decreases include revised DOD inflation estimates (-$34) and minor pricing adjustments (+$22).

(U) Schedule: Not applicable.

000232

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: March 1996

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603707N
PROGRAM ELEMENT TITLE: Manpower, Personnel, and Training Advanced Technology Development

PROJECT NUMBER: R0542
PROJECT TITLE: Air Human Factors Engineering

(U) Technical: Not applicable.

C. (U) OTHER PROGRAM FUNDING SUMMARY: Not applicable.

(U) RELATED RDT&E:
(U) PE 0601152N (In-House Laboratory Independent Research)
(U) PE 0601153N (Defense Research Sciences)
(U) PE 0602233N (Readiness, Training and Environmental Quality)
(U) PE 0603792N (Advanced Technology Transition)

D. (U) SCHEDULE PROFILE: Not applicable.

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 1996

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603707N
PROGRAM ELEMENT TITLE: Manpower, Personnel, and Training Advanced Technology Development

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 1995 ACTUAL	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
R1770 Manpower and Personnel Development	3,423	3,749	3,998	3,978	4,243	4,334	4,438	CONT.	CONT.

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This project supports the Manpower & Personnel Joint Support Area by responding to requirements for technologies that will maintain or improve fleet readiness while reducing personnel end strength; enable the Navy to manage the force effectively and efficiently; and optimize the selection and assignment of personnel to highly demanding jobs. The major goals are to ensure that the Navy has a force that is flexible, integrated, responsive, and affordable so that skilled personnel are available to handle complex weapons systems when needed; and that smaller forces will have greater capabilities by placing the right person in the right job at the right time. The program supports the delivery of new technologies in modeling, mathematical optimization, advanced testing, statistical forecasting, and human performance measurement.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1995 ACCOMPLISHMENTS:

- (U) ($473) New Starts:
  - (U) Determined feasibility of econometric modeling of special pays to influence distribution and community specific retention bonuses.

- (U) ($2,156) Continuations:
  - (U) Evaluated the ability of the assignment policy trade-off-system to prove that policy goals are realistic and quantify the tradeoffs among policies such as moving costs, billet gapping and skill match.
  - (U) Designed a decision support system that improves the accuracy of enlisted accession, training, retention, promotion and strength projections by integrating the management of recruiting, delayed entry program, and initial skill training pipelines; designed an enlistment incentive management system to improve use of available recruit training seats and recruit financial incentives.

- (U) Tested, evaluated and demonstrated the accuracy and skill allocation ability of the Medical Manpower Trade-off Analysis Model.
- (U) Tested and evaluated the impact of computer-based technology enhancements on detailing efficiency and effectiveness.

• (U) ($794) Completions:
- (U) Developed computer-based testing methodology for identifying test-takers who are deliberately trying to fail; assess validity of dynamic spatial tests.
- (U) Developed and validated the Quality of Life (QOL) socioeconomic model to predict increases in retention and readiness in response to varying levels of QOL support.
- (U) Demonstrated intelligent prototype policy testing model capable of adjusting its internal computational dimensionality to accommodate the specific policies being tested.

2. (U) FY 1996 PLAN:

• (U) ($1,429) New Starts:
- (U) Assess feasibility of incorporating vocational interest measures into Enlisted classification procedures to supplement aptitude as measured by Armed Services Vocational Aptitude Battery.
- (U) Test and evaluate client-server technology for accessing Navy corporate personnel and billet files for integrated Enlisted, Officer and Reserve management.
- (U) Design officer accession planning system that recognizes strength constraints, accession source mixes, and prevailing recruiting conditions.

• (U) ($520) Continuations:
- (U) Design and test alternative econometric models for allocating distribution-impacting pays, such as sea pay, sub-pay and hazardous duty pay, to skill groups; develop econometric models for allocating retention impacting pays and bonuses, given new Navy skill categories and career paths.

• (U) ($1,800) Completions:
- (U) Test and evaluate the assignment execution monitoring system to measure policy compliance and to provide

feedback for corrective action.

- (U) Conduct technology impact demonstration on assignment policy tradeoff system.
- (U) Develop a decision support system that integrates the management of recruiting, delayed entry program, enlistment incentives, initial skill training and enlisted strength planning to improve ability of these systems to respond to each other.
- (U) Develop recruit attrition and advancement forecasting models; incorporate into enlisted strength policy analysis model; test and evaluate resulting system in operational setting.

3. (U) FY 1997 PLAN:

- (U) ($1,678) New Starts:
  - (U) Evaluate new technologies in market research for application to recruiting strategies.
  - (U) Design techniques to incorporate personnel performance and productivity measures into unit and fleet readiness measures.
  - (U) Assess feasibility of developing force management policy tradeoff model, to determine achievability of proposed policies, given current inventories and potentially conflicting pre-existing policies.

- (U) ($1,800) Continuations:
  - (U) Develop vocational interest scales reflecting aggregated Navy occupational groups and develop computer system to administer and score these scales.
  - (U) Develop client-server prototype for integrated access to corporate enlisted, officer, reserve personnel and billet systems.
  - (U) Develop officer accession planning prototype system that recognizes strength constraints, accession source mixes and prevailing recruiting conditions.

- (U) ($520) Completions:
  - (U) Develop and implement econometric models for allocating distribution-impacting pays and retention-impacting pays to new Navy skill groups, given changes in career paths; integrate with strength policy analysis model to allow economic variables to be systematically factored into policy analyses.

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 1996

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603707N PROGRAM ELEMENT TITLE: Manpower, Personnel, and Training Advanced Technology Development PROJECT NUMBER: R1770 PROJECT TITLE: Manpower and Personnel Development

B. (U) PROGRAM CHANGE SUMMARY:

	FY 1995	FY 1996	FY 1997
(U) FY 1996 President's Budget:	3,495	3,866	4,217
(U) Adjustments from PRESBUDG:	-72	-117	-219
(U) FY 1997 PRESBUDG Submit:	3,423	3,749	3,998

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: FY 1995 reduction (-$72) for minor program requirements changes. FY 1996 reduction is due to Congressional Undistributed reductions (-$73), revised DOD inflation estimates (-$44). FY 1997 reflects revised DOD inflation estimate (-$120) and minor program reductions (-$99).

(U) Schedule: Not applicable.

(U) Technical: Not applicable.

C. (U) OTHER PROGRAM FUNDING SUMMARY: Not applicable.

(U) RELATED RDT&E: This project adheres to Tri-Service Reliance Agreements on Manpower and Personnel Technology. Work is related to and fully coordinated with efforts in:

(U) PE 0601152N (In-House Laboratory Independent Research)
(U) PE 0601153N (Defense Research Sciences)
(U) PE 0602233N (Readiness, Training, and Environmental Quality)
(U) PE 0603007A (Human Factors, Personnel and Training Advanced Technology)
(U) PE 0603227F (Personnel, Training, and Simulation Technology)

D. (U) SCHEDULE PROFILE: Not applicable.

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 1996

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603707N
PROGRAM ELEMENT TITLE: Manpower, Personnel, and Training Advanced Technology Development

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 1995 ACTUAL	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
R1771 Ship Human Factors Engineering	2,403	2,015	2,183	2,190	2,212	2,257	2,308	CONT.	CONT.

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: The goal of this project is to improve ship, task force and battle group operations by developing human factors technology for incorporation into operational systems and training programs. This technology is designed to reduce training and personnel requirements and to enhance mission performance in such areas as global surveillance, joint operations, mission planning, data fusion and Command and Control Warfare. The project supports Joint Chiefs of Staff Future Joint Warfighting Capabilities as well as requirements in several Joint Management Areas, including: Joint Space and Electronic Warfare/Intelligence (e.g., displays for integrating information from multiple sources); Joint Littoral/Strategic Sealift (e.g., aiding decision makers in complex tactical situations under stressful conditions); and Joint Surveillance (e.g., displaying information in formats optimized for the needs of different users).

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1995 ACCOMPLISHMENTS:

- (U) ($1,544) New Starts:
  - (U) Completed information requirements analysis for the newly created position of Command and Control Warfare Commander (C2WC). Determined prototype display formats, information management system and collaborative decisionmaking needs. Coordinated development effort with Command and Control Warfare Center, San Diego.
  - (U) Completed concept of operations study for a research and analysis anchor desk (RAAD). Determined software, hardware, local area network and Worldwide Web connectivity requirements for this integrated workstation. Brought prototype on-line and coordinated development with Gaming & Simulation Facility at USCINCPAC.
  - (U) Conducted requirements analysis study of CINCLANTFLT command center staff functions. Completed study of workflow and collaboration requirements for staff personnel of these facilities. Selected candidate collaborative software and conducted technology demonstrations and evaluation of these tools.

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 1996

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603707N PROGRAM ELEMENT TITLE: Manpower, Personnel, and Training Advanced Technology Development PROJECT NUMBER: R1771 PROJECT TITLE: Ship Human Factors Engineering

- (U) ($400) Continuations:
  - (U) Conducted usability studies to identify strategies Combat Information Center (CIC) operators use when selecting and changing Variable Coded Symbology (VCS) display filters.
  - (U) Conducted studies to determine optimal combinations of VCS symbol sets and coding dimensions (e.g., blinking, strobing, color saturation) and propose VCS design guidelines based on research findings.
  - (U) Compared effectiveness of software- and input device-controlled interface with existing shipboard Console Intercom Units design.
  - (U) Developed, tested and evaluated advanced user interface technologies (e.g., 3-D audio) to improve CIC operator alerting and warning systems; prepared design guidelines for improved audio alerts and alerting mechanisms based on research findings.

- (U) ($459) Completions:
  - (U) Completed overall integration of Disaster Relief Operations anchor desk within the USCINCPAC Command Center Improvement Program. Demonstrated completed anchor desk capabilities in simulated and real world disaster situations at both USCINCPAC as well as within wide area network demonstrations conducted among the various Unified Commands.

2. (U) FY 1996 PLAN:

- (U) ($622) New Start:
  - (U) Conduct information and display requirements analysis for prototype open systems architecture for combat systems workstation.
  - (U) Develop improvements to acoustic detection workstation to improve classification of targets and passive target motion analysis.

- (U) ($987) Continuations:
  - (U) Complete development of all prototype display formats, collaborative linkages and information management systems for the C2WC.
  - (U) Integrate intelligent agents and other artificial intelligence and advanced visualization techniques into the RAAD. Participate in and conduct technology demonstrations of RAAD capabilities at command exercises.

- (U) Develop main user-computer interface for command center staff personnel. Quantitatively evaluate value added by workflow, groupware and collaborative software.

- (U) ($406) Completions:
  - (U) Effect linking of TAC-3 computer equipped with advanced human-system integration tools and techniques to a real-time Navy tactical database.
  - (U) Conduct man-in-the-loop testing and evaluations of the above tools and techniques to validate their utility in the context of a real-time scenario involving multiple CIC watchstanders.
  - (U) Effect transition of Advanced Information Management Evaluation and Demonstration software products to real-world Navy TAC systems; ensure all transitioned software complies with TAC approved X-Window and Motif design standards.

3. (U) FY 1997 PLAN:

- (U) ($833) Continuation:
  - (U) Complete overall interface design for prototyping combat system console. Quantitatively evaluate the reduction in life cycle management costs by this console. Integrate virtual presence capabilities into the console.

- (U) ($1,350) Completion:
  - (U) Do prototype testing in both shore and afloat environments of the C2WC workstation. Transition software and hardware to Joint Maritime Communication Information System program.
  - (U) Complete integrated workflow software package for command staff personnel. Demonstrate the package during routine and time critical situations. Complete on-line help and training modules. Transition to command center.
  - (U) Complete user interface, connectivity and database integration into the RAAD. Demonstrate RAAD capability during real-world and simulated crisis actions. Transition workstation to USCINCPAC.

000240

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 1996

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603707N PROGRAM ELEMENT TITLE: Manpower, Personnel, and Training Advanced Technology Development

PROJECT NUMBER: R1771 PROJECT TITLE: Ship Human Factors Engineering

B. (U) PROGRAM CHANGE SUMMARY:

	FY 1995	FY 1996	FY 1997
(U) FY 1996 President's Budget:	2,054	2,076	2,206
(U) Adjustments from PRESBUDG:	+349	-61	-23
(U) FY 1997 PRESBUDG Submit:	2,403	2,015	2,183

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: FY 1995 increase (+$349) results from increase to program requirements. FY 1996 decrease (-$38) Congressional Undistributed reductions, revised DOD inflation estimate (-$23). FY 1997 decrease is composed of (-$66) for revised DOD inflation estimates and other minor pricing adjustments (+$43).

(U) Schedule: Not applicable.

(U) Technical: Not applicable.

C. (U) OTHER PROGRAM FUNDING SUMMARY: Not applicable.

(U) RELATED RDT&E:

(U) PE 0601152N (In-House Laboratory Independent Research)
(U) PE 0601153N (Defense Research Sciences)
(U) PE 0602233N (Readiness, Training, and Environmental Quality)
(U) PE 0602270E (Technology Development)
(U) PE 0603226E (Advanced Distributed Simulation)
(U) PE 0604703N (Manpower, Personnel, Training, Simulation and Human Factors)

D. (U) SCHEDULE PROFILE: Not applicable.

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 1996

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603707N
PROGRAM ELEMENT TITLE: Manpower, Personnel, and Training Advanced Technology Development

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 1995 ACTUAL	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
R1772 Education and Training Development	5,685	4,858	5,920	6,057	7,111	7,238	7,382	CONT.	CONT.

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This project addresses requirements in the Shore Training Joint Support Areas by focusing advanced technology on the acquisition and maintenance of complex skills through both individual and team training. It applies operations research and instructional, cognitive, and computer sciences in order to address requirements for improving (a) training throughput, efficiency and affordability necessary for "right-sizing" both the operational forces and the training infrastructure; (b) the effectiveness of training for increasingly complex weapons systems employed in littoral warfare, under fast-paced and stressful conditions, and with limited opportunities for "real-world" practice; and (c) training assessment and training system feedback capabilities for maximizing training responsiveness to operational requirements.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1995 ACCOMPLISHMENTS:

- (U) ($615) New Starts:
  - (U) Began development of a case-based learning approach to training material assessment of shipboard engineering/propulsion plants in a virtual environment.

- (U) ($4,513) Continuations:
  - (U) Completed development of multi-media curriculum authoring and training delivery system prototype that enables rapid development and revision of curricula and that exploits Interactive Electronic Technical Manuals (IETMs) for training; began evaluation of student learning and retention effects.
  - (U) Continued development of Interactive Multisensor Analysis Training technology for Undersea Warfare to aid tactical visualization and control and expand emphasis on technologies which address the problems of skill

degradation.
- (U) Continued development and began evaluations of training seat reservation, school seat allocation, and course scheduling system for more efficient training throughout and increased fleet readiness.

- (U) ($557) Completion:
  - (U) Demonstrated and evaluated enhanced interactive video-teletraining for providing "hands-on" and behavior-oriented training from primary delivery site to multiple remote sites.

2. (U) FY 1996 PLAN:

- (U) ($875) Completions:
  - (U) Complete development and demonstration of Navy training reservation system and course scheduling system, including yield management models and mission critical/readiness models to optimize the use of training pipeline resources and maximize responsiveness to fleet Navy Enlisted Classification requirements.

- (U) ($3,983) Continuations:
  - (U) Complete evaluation of student learning and retention effects due to IETM multi-media classroom training innovations; complete development of IETM curriculum decision algorithm.
  - (U) Continue development and demonstration of Interactive Multisensor Analysis Training system for Undersea Warfare, including capability for classroom and for individual and team employment training.
  - (U) Continue development of a case-based learning approach to training material assessment of shipboard engineering/propulsion plants in a virtual environment.

3. (U) FY 1997 PLAN:

- (U) ($1,615) New Start:
  - (U) Design methodology and system to measure quantitatively combat readiness using standardized, valid and reliable measures of effectiveness (MOEs) for battle groups, platforms and weapon subsystems with links to both team and individual training.

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 1996

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603707N
PROGRAM ELEMENT TITLE: Manpower, Personnel, and Training Advanced Technology Development
PROJECT NUMBER: R1772
PROJECT TITLE: Education and Training Development

- (U) ($4,305) Continuations:
  - (U) Expand development, demonstration and evaluation of Interactive Multisensor Analysis Training system for Undersea Warfare to additional warfare areas to assess generalizability and efficacy.
  - (U) Continue development of a case-based learning approach to training material assessment of shipboard engineering/propulsion plants in a virtual environment.

B. (U) PROGRAM CHANGE SUMMARY:

	FY 1995	FY 1996	FY 1997
(U) FY 1996 President's Budget:	5,797	5,010	5,154
(U) Adjustments from PRESBUDG:	-112	-152	+766
(U) FY 1997 PRESBUDG Submit:	5,685	4,858	5,920

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: FY 1995 reduction (-$112) resulting from reduced program requirements. FY 1996 is composed of (-$94) Congressional Undistributed reductions, and revised DOD inflation estimates (-58). FY 1997 increase results from revised DOD inflation estimates (-$179), minor repricings (-$55), and increase in program requirements (+$1,000).

(U) Schedule: Not applicable.

(U) Technical: Not applicable.

C. (U) OTHER PROGRAM FUNDING SUMMARY: Not applicable.

000244

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: March 1996

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603707N
PROGRAM ELEMENT TITLE: Manpower, Personnel, and Training Advanced Technology Development

PROJECT NUMBER: R1772
PROJECT TITLE: Education and Training Development

(U) RELATED RDT&E: This project adheres to Tri-Service Reliance Agreements on Training Systems technology. Work is related to and fully coordinated with efforts in:

(U) PE 0601152N (In-House Laboratory Independent Research)
(U) PE 0601153N (Defense Research Sciences)
(U) PE 0602233N (Readiness, Training and Environmental Quality)
(U) PE 0604703N (Personnel, Training, Simulation, and Human Factors)
(U) PE 0603007A (Human Factors, Personnel, and Training Advanced Technology)
(U) PE 0603227F (Personnel, Training, and Simulation Technology)
(U) PE 0605798D (Joint Services Manpower and Personnel Technology)

D. (U) SCHEDULE PROFILE: Not applicable.

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 1996

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603707N
PROGRAM ELEMENT TITLE: Manpower, Personnel, and Training Advanced Technology Development

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 1995 ACTUAL	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
R1773 Simulation and Training Devices	6,143	5,595	6,046	6,547	7,747	7,293	7,338	CONT.	CONT.

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This project supports the Shore Training Joint Support Area, as well as most Joint Mission Areas (JMAs) and Joint Chiefs of Staff Future Joint Warfighting Capabilities, all of which depend on high quality training to ensure mission success. The project responds to requirements for effective and affordable training and mission rehearsal capability by applying advanced simulation technology and innovative instructional concepts to the design of training systems. Examples of JMA requirements supported by tasks in this project include: training skilled personnel to handle complex weapons that may not be fired for extended periods (Strategic Deterrence); training for near-real-time targeting (Joint Strike); training operators and decision makers to respond to data received and processed at increasing speeds (Joint Space and Electronic Warfare (EW)/Intelligence); and training personnel to deal with target sets that are variable and difficult to identify as friendly or hostile (Joint Surveillance).

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1995 ACCOMPLISHMENTS:

- (U) ($1,321) New Start:
  - (U) Demonstrated real-time beam forming and signal processing simulation technology combined with innovative instructional techniques in order to strengthen submarine sonar employment training and increase utilization of the BQQ-5 Sonar System from about 30% to nearly 100% of its designed capabilities.

- (U) ($3,322) Continuations:
  - (U) Demonstrated NASNET Distributed Interactive Simulation (DIS) technology on fielded F-14B and F-14D trainers as part of an effort to provide high fidelity training systems networks for affordable training that will exercise all aviation components in a realistic environment including joint operations.

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 1996

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603707N PROGRAM ELEMENT TITLE: Manpower, Personnel, and Training Advanced Technology Development

PROJECT NUMBER: R1773 PROJECT TITLE: Simulation and Training Devices

- (U) Continued deployable instructor support program by beginning development of a guidance system to assist in diagnosing performance, selecting scenarios and implementing training strategies. This program is essential if the fleet is to realize the vast potential of embedded and onboard tactical team training systems, which currently lack support or training for instructors.

- (U) ($1,500) Completion:
  - (U) Implemented DIS protocols and demonstrated the ability of a simulated Combat Direction Center to respond to a wide variety of automated and semi-automated forces; tested DIS network connectivity in joint training and mission rehearsal scenarios in order to improve the Navy's ability to operate in a wide variety of force configurations, including some that may not be defined until units are on the scene.

2. (U) FY 1996 PLAN:

- (U) ($1,685) New Start:
  - (U) Develop simulators for training submarine piloting and navigation skills. Select and evaluate training requirements, simulator components and supporting data bases.

- (U) ($2,401) Continuations:
  - (U) Demonstrate vastly improved shipboard instructor support based on new technology onboard a ship in support of afloat training and Batle Force Tactical Trainer (BFTT) in order to improve tactical team training.
  - (U) Continue to improve innovative instructional and simulation techniques for sonar employment training using Commercial-Off-the-Shelf (COTS) hardware in order to greatly improve training and to reduce training systems costs by a factor of ten.

- (U) ($1,509) Completion:
  - (U) Implement NASNET DIS technology in additional fielded training systems such as the E-2C trainers. Demonstrate the networking of Naval aviation trainers to Navy ships via BFTT and other services' training devices to improve joint training and mission rehearsal.

000247

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 1996

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603707N PROGRAM ELEMENT TITLE: Manpower, Personnel, and Training Advanced Technology Development

PROJECT NUMBER: R1773 PROJECT TITLE: Simulation and Training Devices

3. (U) FY 1997 PLAN:

- (U) ($174) New Start:
  - (U) Initiate development of technology for computer generated threat scenarios that is fully automated, self learning, and DIS compliant in order to reduce the cost and improve the effectiveness of tactical training in all warfare areas.

- (U) ($4,550) Continuations:
  - (U) Evaluate the effectiveness of competing submarine piloting and navigation simulators. Conduct training facility evaluation of simulator responsiveness to officer of the deck (OOD) skill requirements.
  - (U) Continue demonstration of improved shipboard training in support of afloat training and BFTT.

- (U) ($1,322) Completion:
  - (U) Demonstrate improved instructional and simulation techniques for sonar employment training using COTS hardware in order to greatly improve training and to reduce training systems costs.

B. (U) PROGRAM CHANGE SUMMARY:

	FY 1995	FY 1996	FY 1997
(U) FY 1996 President's Budget:	6,178	5,771	7,333
(U) Adjustments from PRESBUDG:	-35	-176	-1,287
(U) FY 1997 PRESBUDG Submit:	6,143	5,595	6,046

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: FY 1995 reduction (-$35) results from reduced program requirements. FY 1996 decrease is composed of (-$109) Congressional Undistributed reductions, and revised DOD inflation estimates (-$67). FY 1997 reductions include revised DOD inflation estimates (-$182), minor repricing adjustments (-$5), and reduced program requirements (-$1,100).

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 1996

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603707N
PROGRAM ELEMENT TITLE: Manpower, Personnel, and Training Advanced Technology Development
PROJECT NUMBER: R1773
PROJECT TITLE: Simulation and Training Devices

(U) Schedule: Not applicable.

(U) Technical: Not applicable.

C. (U) OTHER PROGRAM FUNDING SUMMARY: Not applicable.

(U) RELATED RDT&E: This project adheres to tri-service Reliance agreements on Training Systems technology. Work is related to and fully coordinated with efforts in:

(U) PE 0601152N (In-House Laboratory Independent Research)
(U) PE 0601153N (Defense Research Sciences)
(U) PE 0602233N (Readiness, Training and Environmental Quality)
(U) PE 0603216A (Synthetic Flight Simulator Devices Development)
(U) PE 0603227F (Personnel, Training and Simulation Technology)

D. (U) SCHEDULE PROFILE: Not applicable.

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 1996

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603712N
PROGRAM ELEMENT TITLE: Environmental Quality & Logistics Advanced Technology

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 1995 ACTUAL	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
R2289 Automated Schematic Capture Auto, Navy (ASCAN)	0	3,394	0	0	0	0	0	3,394	3,394
R2206 Environmental Requirements Advanced Technology (ERAT)	5,400	6,043	5,860	5,932	5,928	6,051	6,191	CONT.	CONT.
R1910 Logistics Engineering Advanced Demonstrations (LEAD)	16,046	14,702	14,110	14,976	15,317	17,089	17,943	CONT.	CONT.
TOTAL	21,446	24,139	19,970	20,908	21,245	23,140	24,134	CONT.	CONT.

(U) In Fiscal Year 1996 project unit T1910 changed to R1910, reflecting efforts shift to Office of Naval Research cognizance.

(U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This Program Element funds the Navy's advanced technology development core efforts in environmental quality and logistics. The focus is on Navy-unique aspects of these technologies. The Logistics Engineering Advanced Demonstrations (LEAD) project applies advanced technology to logistics needs and problems to: design weapons systems support to eliminate requirements for large logistics tails; reduce the high cost of maintaining weapon systems and improve readiness; assist program managers with technology to support weapon systems within shortened development cycles; and, reduce weapons system repair downtime. Beginning in FY 1995, tasks formerly associated with Logistics Technology Development (LOGDEV) were combined into the LEAD project. Also in FY 1995, an environmental quality project began that is aimed at demonstrating ways to reduce shipboard pollution, remediation of harbors and shore facilities, and improve industrial treatment processes. Ongoing environmental quality efforts funded under LEAD transitioned to this new project. Program response to affordabililty requirements includes research and development on antifouling hull coatings, interactive electronic technical manuals, flexible computer integrated manufacturing, and standard hardware acquisition and reliability.

000250

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: March 1996

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603712N
PROGRAM ELEMENT TITLE: Environmental Quality & Logistics Advanced Technology

(U) JUSTIFICATION FOR BUDGET ACTIVITY: This program is budgeted within the ADVANCED TECHNOLOGY DEVELOPMENT Budget Activity because it encompasses design, development, simulation, or experimental testing or prototype hardware to validate technological feasibility and concept of operations and reduce technological risk prior to initiation of a new acquisition program or transition to an ongoing acquisition program.

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 1996

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603712N
PROGRAM ELEMENT TITLE: Environmental Quality & Logistics Advanced Technology

(U) COST (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 1995 ACTUAL	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
R2206 Environmental Requirements Advanced Technology (ERAT)	5,400	6,043	5,860	5,932	5,928	6,051	6,191	CONT.	CONT.

1. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This project supports near-term advances in support of the four Project Reliance environmental quality pillars: Pollution Prevention, Clean-up, Conservation, and Compliance. Primary focus will be on minimizing shipboard pollution, remediation of harbors and shore facilities, and improved methods of industrial waste treatment. The Environmental Quality task on Non-Polluting/Biodegradable Antifouling Hull Coatings moved to this project from project T1910 in FY 1995.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1995 ACCOMPLISHMENTS:

(U) Environmentally Sound Ships:

(U) Non-Polluting/Biodegradable Antifouling Hull Coatings (AFHC):
- (U) ($1,989) Awarded Phase 3 Broad Agency Announcement (BAA) contracts for easy release coatings and phase 2 contracts for natural antifoulants.
- (U) ($585) Conducted physical property and small scale testing of easy release and natural antifouling coatings.
- (U) ($251) Initiated ship tests of natural antifouling coatings.

(U) Shipboard Non-Oily Wastewater Treatment:
- (U) ($475) Initiated effort to perform biological pre-treatment and ultraviolet post-treatment of non-oily wastewater to obtain an acceptable effluent.

000252

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: March 1996

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603712N
PROGRAM ELEMENT TITLE: Environmental Quality & Logistics Advanced Technology

PROJECT NUMBER: R2206
PROJECT TITLE: Environmental Requirements Advanced Technology (ERAT)

(U) Automated Underwater Hull Maintenance/Monitoring System:
- (U) ($1,899) Began hull sensor selection for integration on underwater robotic hull maintenance vehicle to detect cracks and repair areas on hull.

(U) Environmentally Safe Shipyards:

(U) Destruction of Hazardous Waste by Supercritical Water Oxidation (SCWO):
- (U) ($201) Construction of a SCWO plant was cancelled based on re-evaluaition of return on investment (ROI) and the emergence of promising new technology. Initiated prototype testing of SCWO technology to treat organic, toxic waste at industrial treatment facilities.

2. (U) FY 1996 PLAN:

(U) Envirohmentally Sound Ships:

(U) Non-Polluting/Biodegradable AFHC:
- (U) ($2,756) Complete small scale test of coatings. Evaluate ship patch/stripe tests and transition to the Naval Sea Systems Command 6.4 Demonstration and Validation Program.

(U) Shipboard Non-Oily Wastewater Treatment:
- (U) ($350) Conduct pierside demonstration of prototype wastewater treatment system.

(U) Automated Underwater Hull Maintenance/Monitoring System:
- (U) ($2,937) Complete initial vehicle design and select vehicle command and control system.

3. (U) FY 1997 PLAN:

(U) Environmentally Sound Ships:

(U) Shipboard Non-Oily Wastewater Treatment:
- (U) ($1,100) Test, debug and demonstrate prototype wastewater treatment assembly aboard ship.

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: March 1996

UDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603712N
PROGRAM ELEMENT TITLE: Environmental Quality & Logistics Advanced Technology

PROJECT NUMBER: R2206
PROJECT TITLE: Environmental Requirements Advanced Technology (ERAT)

(U) Automated Underwater Hull Maintenance/Monitoring System:
- (U) ($2,690) Develop prototype cleaning tool under commercial contract and conduct field tests on image analysis process for underwater operations.

(U) Environmentally Safe Shipyards/Field Activities:

(U) Environmentally Benign Logistics Operations:
- (U) ($743) Initiate effort to design and demonstrate alternative environmentally benign and improved storage, transportation and handling processes.

(U) Development of Biotreatment Processes for Marine Sediment:
- (U) ($1,327) Initiate effort to demonstrate advanced concepts in treatment of offshore dredge spoils.

(U) PROGRAM CHANGE SUMMARY:	FY 1995	FY 1996	FY 1997
(U) FY 1996 President's Budget:	5,738	6,234	6,161
(U) Adjustments from FY96 PRESBUDG:	-338	-191	-301
(U) FY 1997 PRESBUD Submit:	5,400	6,043	5,860

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: FY 1995 reduction reflects a reduction in program requirements. FY 1996 change reflects: revised DoD inflation estimates (-$73) and Congressional undistributed reductions (-$118). Change in FY 1997 funding reflects revised DoD inflation estimates (-$178) and other minor pricing adjustments (-$123).

(U) Schedule: Not applicable.

Exhibit R-2

000354

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 1996

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603712N PROGRAM ELEMENT TITLE: Environmental Quality & Logistics Advanced Technology

PROJECT NUMBER: R2206 PROJECT TITLE: Environmental Requirements Advanced Technology (ERAT)

(U) Technical: Development/test of SCWO prototype was cancelled based on reevaluation of ROI and emergence of new technologies.

C. (U) OTHER PROGRAM FUNDING SUMMARY: Not applicable.

(U) RELATED RDT&E:
(U) PE 0601153N (Defense Research Sciences)
(U) PE 0602233N (Readiness, Training & Environmental Quality Technology)
(U) PE 0602234N (Materials, Electronics, and Computer Technology)
(U) PE 0603792N (Advanced Technology Transition)

D. (U) SCHEDULE PROFILE: Not applicable.

FY 1997 RDT&E,N PROGRAM ELEMENT/PROJECT COST BREAKDOWN DATE: March 1996

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603712N
PROGRAM ELEMENT TITLE: Environmental Quality & Logistics Advanced Technology

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 1995 ACTUAL	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
R1910 Logistics Engineering Advanced Demonstrations (LEAD)	16,046	14,702	14,110	14,976	15,317	17,089	17,943	CONT.	CONT.

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: The LEAD project improves weapon system readiness and supportability through development of advanced logistics technology. Tasks in this project will provide advanced diagnostic and test capabilities, and advanced industrial technology for ship maintenance and Advanced Electronics Standards Development. Project facilitates transition of concepts from Applied Research to other research and development categories or directly to the fleet. Work in the Logistics Technology Development project (T1816) moved to this project in FY 1995. The Non-Polluting/Biodegradable Antifouling Hull Coatings task moved from this project to new project R2206 in FY 1995.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1995 ACCOMPLISHMENTS:

(U) Imaging Technology:
- (U) ($2,000) Conducted imaging technology development.

(U) Standard Hardware Acquisition and Reliability Program (SHARP):
- (U) ($2,600) Continued standard product development in support of electronic circuit assemblies, advanced enclosure systems, power systems and energy systems for insertion of new technologies. This reduced development time and costs and logistics support costs associated with non-standard components, and improved system reliability.
- (U) ($1,100) Developed advanced electronics packaging/cooling techniques.
- (U) ($1,130) Developed guidance for use by weapon system designers to mitigate the logistics risk of utilizing Commercial Off the Shelf (COTS) products. Included product guidance, electromagnetic interference studies and COTS battery charger task.

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- (U) ($1,100) Demonstrated improved repairability and logistics support of electronic circuit assemblies.

(U) Shipboard Flexible Computer Integrated Manufacturing (FCIM):
- (U) ($290) Conducted system planning and design for tender application.
- (U) ($900) Completed system integration, installation and training on tender.
- (U) ($700) Conducted system testing on tender and prepare for operational transition.

(U) Interactive Electronic Technical Manuals (IETM):
- (U) ($1,630) Completed system development and integration to prototype limited production capability.
- (U) ($200) Performed test of conversion capability on sample technical manuals selected by Systems Commands.

(U) Real-Time Infrared System Test Set (RTIR):
- (U) ($1,164) Began design and fabrication of infrared demonstration test set for use in diagnostics and maintenance.

(U) Laser Weld Repair of Naval Materials:
- (U) ($870) Began integration of new laser, neural net and fiber optic technology into capability to repair shipboard mechanical components faster and more economically. Completed development and demonstration of a valve repair cell using laser technology.

(U) Next Generation Test Generator:
- (U) ($779) Began effort to generate end-to-end performance test patterns of new test generator system with application to avionics and non-avionics system diagnostics.

(U) Diamond Film as an Electronic Module Substrate:
- (U) ($783) Initiated demonstration effort to mount 500 watt capability on substrate and to downsize required cooling system.

(U) Automated Shipboard Fueling System:
- (U) ($800) Initiated adaptation of the existing DDG-963/CG-47 Fuel Fill and Control System simulation model for the preliminary design of the Automated DDG-51 Fuel Fill and Control System.

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 1996

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603712N PROGRAM ELEMENT TITLE: Environmental Quality & Logistics Advanced Technology

PROJECT NUMBER: R1910 PROJECT TITLE: Logistics Engineering Advanced Demonstration (LEAD)

2. (U) FY 1996 PLAN:

(U) SHARP
- (U) ($840) Demonstrate advanced electronic packaging cooling and interconnect techniques for support of high performance electronics. Efforts include high temperature packaging, transmit and receive module and optical backplane interconnect developments.
- (U) ($2,160) Demonstrate improved repairability and logistics support in cost efficient and timely transportable techniques and processes for replacing nonprocurable and unreliable electronic circuit assemblies. Specific efforts include demonstrating analog modeling and simulation and first pass prototyping and assisting weapon system designers in using COTS products.

(U) Shipboard FCIM:
- (U) ($900) Transition afloat-based FCIM to fleet implementation.

(U) IETM:
- (U) ($780) Complete prototype package defining automated technical data conversion process for government-owned and proprietary software.
- (U) ($520) Transfer technical manual conversion technology and prototype processes to government programs and the public domain.

(U) RTIR:
- (U) ($1,290) Design and fabricate a greater definition infrared array (256x256 pixels) for use in built-in test equipment to expand its usability across systems.

(U) Laser Weld Repair of Naval Materials:
- (U) ($529) Develop and demonstrate ship propeller shaft repair using a laser working cell.

(U) Diamond Film as Electronic Module Substrate:
- (U) ($790) Fabricate Standard Electronic Modules (SEM) format E size diamond film on substrates/heatsinks and electronic circuitry on 6" x 6" SEM-E substrates.

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 1996

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603712N PROGRAM ELEMENT TITLE: Environmental Quality & Logistics Advanced Technology PROJECT NUMBER: R1910 PROJECT TITLE: Logistics Engineering Advanced Demonstration (LEAD)

(U) Automated Shipboard Fueling System:
- (U) ($1,625) Complete engineering design for DDG-51 automated fueling system and perform pierside testing and initiate at-sea tests.

(U) Automatic Test and Calibration of Equipment:
- (U) ($960) Initiate effort to design and demonstrate a capability to conduct remote test and calibration of equipment to eliminate requirements for labor-intensive equipment removal.

(U) Advanced Waterfront Structures for Ship Repair and Logistics Operations:
- (U) ($900) Initiate effort to demonstrate improved performance of new technology for waterfront structures.

(U) Power Measurement Systems:
- (U) ($1,118) Initiate effort to demonstrate new, low cost Radio Frequency (RF) power measurement devices.

(U) Advanced Diagnostics:
- (U) ($990) Initiate effort to demonstrate next generation non-intrusive devices utilizing advanced facilities diagnostics concepts.

(U) Facilities for Offshore Movement of Material:
- (U) ($1,300) Initiate effort to demonstrate and evaluate improved Lighterage Platform and Connector Systems.

3. (U) FY 1997 PLAN:

(U) SHARP:
- (U) ($812) Demonstrate advanced electronic packaging cooling and interconnect techniques for support of high performance electronics. Tasks include high temperature packaging, advanced thermal interconnects, advanced convection cooling, dual use advanced photonics technology and high throughput interconnects.
- (U) ($2,140) Demonstrate improved repairability and logistics support in cost efficient and timely, transportable techniques and processes for replacing nonprocurable/unreliable electronic circuit assemblies. Specific tasks include mixed mode modeling and simulation and assisting weapon system designers in using COTS products.

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FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 1996

BUDGET ACTIVITY: 3
PROGRAM ELEMENT: 0603712N
PROGRAM ELEMENT TITLE: Environmental Quality & Logistics Advanced Technology
PROJECT NUMBER: R1910
PROJECT TITLE: Logistics Engineering Advanced Demonstration (LEAD)

(U) RTIR:
- (U) ($1,313) Demonstrate full scale real time infrared test set in a realistic field environment and begin transition to weapon systems programs.

(U) Laser Weld Repair of Naval Materials:
- (U) ($401) Develop and demonstrate a laser repair cell utilizing a 3-dimensional telerobotic manipulator. Begin transition of dual-use technology to government and commercial activities.

(U) Diamond Film as Electronic Module Substrate:
- (U) ($525) Perform thermal, electrical and environmental module and enclosure tests and demonstrations.

(U) Automated Shipboard Fueling System:
- (U) ($812) Complete at-sea tests of shipboard fueling system and system documentation.

(U) Advanced Diagnostics:
- (U) ($1,124) Continue effort to demonstrate next generation automatic non-intrusive devices utilizing advanced diagnostics concepts.

(U) Automatic Test and Calibration of In-Service Equipment:
- (U) ($883) Continue effort to define required interactive interfaces between multiple pieces of equipment for producing self-calibration and test.

(U) Advanced Material Availability:
- (U) ($1,109) Initiate effort to test and demonstrate advanced fabrication materials and automated manufacturing processes for use in a broad range of afloat and ashore logistics operations.

(U) Equipment Configuration:
- (U) ($709) Develop and demonstrate a realtime design/logistics interface capability that assures a high degree of accuracy between actual product configuration and associated databases.

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FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: March 1996

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603712N
PROGRAM ELEMENT TITLE: Environmental Quality & Logistics Advanced Technology

PROJECT NUMBER: R1910
PROJECT TITLE: Logistics Engineering Advanced Demonstration (LEAD)

(U) Power Measurement Systems:
- (U) ($1,337) Continue effort to demonstrate new low cost RF power measurement devices.

(U) Facilities For Offshore Movement of Materials:
- (U) ($1,461) Continue effort to demonstrate and evaluate improved lighterage platforms and connector systems.

(U) Advanced Water Front Structures for Ship Repair and Logistics Operations:
- (U) ($1,484) Continue effort to demonstrate improved performance of new technology for waterfront structures.

B. (U) PROGRAM CHANGE SUMMARY:

	FY 1995	FY 1996	FY 1997
(U) FY 1996 President's Budget:	16,272	15,270	16,313
(U) Adjustments from PRESBUDG:	-226	-568	-2,203
(U) FY 1997 PRESBUDG Submit:	16,046	14,702	14,110

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: FY 1995 change reflects reduced program requirements (-$226). Funds adjustment in FY 1996 reflects Congressional undistributed cuts (-$309), and revised DoD inflation estimates (-$178). FY 1997 change reflects revised DoD inflation estimates (-$427), minor repricing adjustments (-$1,395) and a reduction in program requirements (-$381).

(U) Schedule: Not applicable.

(U) Technical: Not applicable.

C. (U) OTHER PROGRAM FUNDING SUMMARY: Not applicable.

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 1996

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603712N PROGRAM ELEMENT TITLE: Environmental Quality & Logistics Advanced Technology

PROJECT NUMBER: R1910 PROJECT TITLE: Logistics Engineering Advanced Demonstration (LEAD)

(U) RELATED RDT&E:
- (U) PE 0601153N (Defense Research Sciences)
- (U) PE 0602233N (Readiness, Training & Environmental Quality Technology)
- (U) PE 0602234N (Materials, Electronics, and Computer Technology)
- (U) PE 0603792N (Advanced Technology Transition)

D. (U) SCHEDULE PROFILE: Not applicable.

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FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: March 1996

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603712N
PROGRAM ELEMENT TITLE: Environmental Quality & Logistics Advanced Technology

PROJECT NUMBER: R1910
PROJECT TITLE: Logistics Engineering Advanced Demonstration (LEAD)

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FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 1996

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603782N
PROGRAM ELEMENT TITLE: Mine and Expeditionary Warfare Advanced Technology

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 1995 ACTUAL	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
R2226 Countermeasures (MCM) Advanced Technology	41,890*	39,002	42,753	41,636	44,764	49,767	46,701	CONT.	CONT.

* FY 1995 reflects FY 1996 Science & Technology restructure: Funding moved from former project R2127 and Program Element (PE) 0603555N, project R2142.

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This program supports demonstrations of technologies for Naval Expeditionary Forces performing the missions of Mine and Expeditionary Warfare. The technologies support a range of capabilities enabling Naval Expeditionary Forces to influence operations ashore.

(U) The previous focus of this PE was to demonstrate and evaluate the capability to adapt the Magic Lantern Advanced Development Model system to meet the shallow water (SW) and surf zone (SZ) minefield detection goals. In FY 1996, this PE has been combined with the appropriate advanced technology demonstrations (ATDs) previously in PE 0603555N and refocused to more effectively transition technologies responding to high-priority Naval Expeditionary Warfare mission requirements. The emphasis is on simulating and testing prototypes of technologies with the potential for providing Naval capabilities in five major areas:

- Mine Countermeasure techniques for clandestine surveillance and reconnaissance; mine hunting and clearance; and organic ship protection.
- Battlefield surveillance, reconnaissance, and targeting.
- Naval fire support.
- Command, control, communications, information processing, and mission planning supporting land battles.

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- Force mobility and survivability.

Projects will produce prototypes suitable for testing in operational environments and will rely on modeling and simulation to investigate military capability.

(U) Due to the sheer volume of efforts included in this PE, the programs described in the Accomplishments and Plans sections are representative selections of the work included in this PE.

(U) JUSTIFICATION FOR BUDGET ACTIVITY: This program is budgeted within the ADVANCED TECHNOLOGY DEVELOPMENT Budget Activity because it encompasses design, development, simulation, or experimental testing or prototype hardware to validate technological feasibility and concept of operations and reduce technical risk prior to initiation of a new acquisition program or transition to an ongoing acquisition program.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1995 ACCOMPLISHMENTS:

- (U) ($4,960) SW MCM DEMOS: Completed testing of Magic Lantern Adaptation in realistic operational conditions. Identified critical environmental parameters and technology. Developed automatic target recognition capability in the imaging system. Developed plans for reducing the size and weight of existing hardware.
- (U) ($16,173) EXPLOSIVE NEUTRALIZATION: Conducted small scale in-water explosive performance tests against threat mines. Integrated fire control subsystem with platform.
- (U) ($13,102) ADVANCED LIGHTWEIGHT INFLUENCE SWEEP GEAR: Finalized acoustic and magnetic component designs. Awarded acoustic and magnetic subsystem procurement packages to initiate subsystem fabrication based on design specification.
- (U) ($7,655) ADVANCED DEGAUSSING: Continued scale engine room mockup with magnetic engines and corrosion,

stray, and eddy current source reduction analyses for MCM ships. Developed Closed Loop Degaussing concepts and evaluated advanced deperming techniques on a full scale steel hull surface ship.

2. (U) FY 1996 PLAN:

- (U) ($2,492) ADVANCED SURVEILLANCE/RECONNAISSANCE: Utilize advanced satellite, aircraft and surface craft based sensors to assess their ability for surveillance and reconnaissance of littoral battle spaces and to determine the effectiveness for mine and expeditionary warfare applications. Develop automatic target recognition/acquisition algorithms and multi-sensor data fusion techniques to meet the requirement of rapid, wide-area surveillance/reconnaissance and fire control.

- (U) ($14,908) ADVANCED MINE and OBSTACLE CLEARANCE: Demonstrate at-sea deployment of line charge array from air cushion platform. Demonstrate lethality of beach-zone array against land mines. Demonstrate lethality of SZ sub-array design against SZ mines.

- (U) ($6,964) ADVANCED MINE SWEEPING: Continue fabrication and factory testing of full-scale acoustic and magnetic subsystems capable of meeting the requirements of in-stride capability to sweep mines in SW. Continue integration of subsystems on air cushion platforms for demonstration testing.

- (U) ($4,925) ADVANCED DEGAUSSING: Continue scale engine room mockup with magnetic engines and corrosion, stray, and eddy current source reduction analyses for MCM ships. Complete deperming test on full-scale surface combatant. Conduct closed loop degaussing tests with on-board sensor suite on a surface combatant to develop prediction algorithms.

- (U) ($1,000) MODELING AND SIMULATION: Develop modeling and simulation capability and conduct wargames and simulation exercises to investigate and document the military utility of potential Expeditionary Warfare Systems. Provide background for selection of prototyping projects.

- (U) ($1,000) ADVANCED AIRBORNE TARGET DESIGNATOR: Initiate development of a prototype airborne target designator based on United States Marine Corps Forward Observer/Forward Air Controller technology suitable for over the horizen (OTH) Naval Surface Fire Support (NSFS) operations. The prototype will be used to demonstrate

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a capability for shipboard control of guided weapons launched from ground launchers, ships, and aircraft.

- (U) ($250) EXPEDITIONARY WARFARE COMMUNICATIONS NETWORKING: Conduct a preliminary investigation of optimizing land-to-sea communication networks for supporting OTH NSFS operations. Concepts to be examined will include: prototype ship-to-shore, high data rate, digital, dynamically controlled network for timely sensor-to-shooter connectivity supporting littoral operations such as close air support and Naval fire support including existing or planned systems for linking organic and theater surveillance assets such as Joint Surveillance Target Attack Radar System, EP-3, ES-3, and Airborne Warning and Control System. High Frequency (HF)/Very HF /Ultra HF, cellular, and satellite communications systems such as Joint Tactical Information Distribution System, Common High Bandwidth Datalink, Military Strategic and Tactical Relay, and wideband line-of-sight tactical video will be included. Prototypes to be considered should be interoperable with the Improved Data Modem and Automated Target Handoff System and be capable of transitioning to the Navy's Communication Support System.

- (U) ($6,800) JOINT COUNTERMINE Advanced Concepts Technology Demonstration (ACTD): Plan and integrate appropriate technology programs, prepare test sites, and provide logistics support for demonstrating the operational effectiveness of the combined systems participating in the ACTD. Develop the required communication links and system simulations necessary to enhance the integration and to evaluate the military utility of the Mine and Expeditionary Warfare systems of the ACTD. Produce multiple system hardware copies to leave behind with the fleet as residuals.

- (U) ($250) SURFACE SURVEILLANCE, TARGET ACQUISITION, AND FIRE CONTROL: Initiate concept development of a prototype airborne radar providing an all-weather Moving Target Indicator, target acquisition and fire control capability for targeting of munitions delivered OTH by NSFS.

- (U) ($413) Portion of extramural program reserved for Small Business Innovative Research assessment in accordance with 15 U.S.C. 638.

3. (U) FY 1997 PLAN:

- (U) ($2,500) ADVANCED SURVEILLANCE/RECONNAISSANCE: Continue utilizing advanced sensors to measure critical battle space parameters and quantify their effectiveness. Demonstrate capabilities in automatic target

recognition and multi-sensor data fusion.

- (U) ($14,627) ADVANCED MINE and OBSTACLE CLEARANCE: Demonstrate at-sea deployment of inert SZ array from air cushion platform. Begin transition of the explosive array technology to PE 0603502N for integration with tactical delivery systems.
- (U) ($6,000) ADVANCED DEGAUSSING: Continue scale engine room mockup with magnetic engines and corrosion, stray, and eddy current source reduction analyses for MCM ships. Complete analysis of test results of ship deperming and algorithm development of degaussing controllers. Transition products to PE 0603513N.
- (U) ($6,360) ADVANCED MINE SWEEPING: Perform component check out and demonstration on test platform.
- (U) ($1,200) MODELING AND SIMULATION: Continue modeling and simulation to investigate the military utility of potential Mine and Expeditionary Warfare systems. Provide background for selection of prototyping projects.
- (U) ($2,120) ADVANCED AIRBORNE TARGET DESIGNATOR: Conduct lab and field testing of prototype hardware and software. Initiate packaging and configuration design studies.
- (U) ($2,238) C4I TECHNOLOGY: Perform limited communication system interoperability tests in a laboratory and range environment. Develop a simulation characterizing network performance in an operational environment.
- (U) ($7,000) JOINT COUNTERMINE ACTD: Continue integrating the technology programs, preparing the test sites, and providing logistics support for the ACTD. Continue developing the communication links and system simulations for the ACTD. Continue producing residual hardware to leave behind with the fleet.
- (U) ($708) SURFACE SURVEILLANCE, TARGET ACQUISITION, AND FIRE CONTROL: Initiate packaging studies and cost analyses. Initiate integration of radar, signal processor and data link. Conduct laboratory and limited field tests of hardware and software modules.

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FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 1996

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603782N PROGRAM ELEMENT TITLE: Mine and Expeditionary Warfare Advanced Technology

PROJECT NUMBER: R2226 PROJECT TITLE: Countermeasures (MCM) Advanced Technology

B. (U) PROGRAM CHANGE SUMMARY:

	FY1995	FY1996	FY1997
(U) FY 1996 President's Budget:	40,989	50,958	50,958
(U) Adjustments from 1996 PRESBUDG:	+901	-11,956	-8,205
(U) FY 1997 PRESBUDG Submit:	41,890	39,002	42,753

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: FY 1995 increase reflects increases in program requirements. FY 1996 (-10,000K) Congressional reduction based on budget growth, (-1,482K) reduction due to Congressional Undistributed, (-474K) Revised DOD Economi Assumptions. FY 1997 changes include minor price adjustments (-970K), revised DOD inflation estimates (-1,305K), reduced program requirements (-930K), and program realignment (-5,000K).

(U) Schedule: Not applicable.

(U) Technical: Not applicable.

C. (U) OTHER PROGRAM FUNDING SUMMARY: Not applicable.

(U) RELATED RDT&E:
(U) PE 0601153N (Defense Research Sciences)
(U) PE 0602131M (Marine Corps Landing Force Technology)
(U) PE 0602314N (Undersea Surveillance and Weapons Technology)
(U) PE 0602315N (MCM, Mining and Special Warfare Technology)

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 1996

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603782N
PROGRAM ELEMENT TITLE: Mine and Expeditionary Warfare Advanced Technology
PROJECT NUMBER: R2226
PROJECT TITLE: Countermeasures (MCM) Advanced Technology

(U) PE 0602435N (Oceanographic and Atmospheric Technology)
(U) PE 0603502N (Surface and Shallow Water MCM)
(U) PE 0603513N (Shipboard System Component Dev)
(U) PE 0603528N (Non-Acoustic ASW)
(U) PE 0603612M (Marine Corps Mine Countermeasures)
(U) PE 0603640M (Marine Corps Advanced Technology)
(U) PE 0604373N (Airborne Mine Countermeasures)
(U) PE 0604784N (Distributed Surveillance System)

D. (U) SCHEDULE PROFILE: Not Applicable.

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FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: March 1996

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603782N
PROGRAM ELEMENT TITLE: Mine and Expeditionary Warfare Advanced Technology

PROJECT NUMBER: R2226
PROJECT TITLE: Countermeasures (MCM) Advanced Technology

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FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 1996

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603792N
PROGRAM ELEMENT TITLE: Advanced Technology Transition

PROJECT NUMBER & TITLE	FY 1995 ACTUAL	FY 1996 ACTUAL	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
R1889 Advanced Technology Demonstration	70,003	75,594	104,424	125,930	141,693	149,266	153,948	CONT.	CONT.
R2290 SLICE	0	2,908	0	0	0	0	0	2,908	2,908
TOTAL	70,003	78,502	104,424	125,930	141,693	149,266	153,948	CONT.	CONT.

(U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This program demonstrates high-risk/high-payoff technologies that could significantly improve Joint Chiefs of Staff's Future Joint Warfighting Capabilities. Advanced Technology Demonstration (ATD) programs cover integrating and assessing technology in a realistic operational environment. These programs offer an opportunity to identify and move efficiently emerging technologies from laboratory experiments to fleet systems. ATD programs are selected for a match between technological potential and Navy requirements which are derived from operational issues of concern to the fleet, Joint Mission Area/Support Area assessments, and the Science and Technology Roundtables. Risk-reducing ATDs are focused on laying the technical foundations for acquiring improvements to future joint warfighting capabilities. Each demonstration is designed to assess the extent to which the technology is feasible, affordable and compatible with operational concepts and projected force structure. Fiscal year 1996 funds for project R2290 reflect a Congressional increase to complete construction for a demonstration of a new low waterplane design of a small waterplane area twin hull ship.

(U) JUSTIFICATION FOR BUDGET ACTIVITY: This program is budgeted within the ADVANCED TECHNOLOGY DEVELOPMENT Budget Activity because it encompasses design, development, simulation, or experimental testing or prototype hardware to validate technological feasibility and concept of operations and reduce technological risk prior to initiation of a new acquisition program or transition to an ongoing acquisition program.

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FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: March 1996

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603792N
PROGRAM ELEMENT TITLE: Advanced Technology Transition

PROJECT NUMBER: R1889
PROJECT TITLE: Advanced Technology Transition

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1995 ACCOMPLISHMENTS:

- (U) ($1,500) SYNTHETIC APERTURE RADAR (SAR) COUNTERMEASURES -- Completed final demonstration of SAR countermeasure system and transitioned to advanced development.
- (U) ($186) MULTIBAND ANTI-SHIP MISSILE DEFENSE TACTICAL ELECTRONIC WARFARE SYSTEM (MATES) -- Delivered final report documenting technology developed for surface ship self defense against incoming cruise missiles.
- (U) ($4,278) TORPEDO TERMINAL PLACEMENT -- Completed final in-water demonstration of heavyweight and lightweight configurations and prepared system and software specifications.
- (U) ($3,153) ADVANCED ANTI-SUBMARINE WARFARE RECEIVER -- Completed ATD with realistic testing of improved sonobuoy communication prototype system.
- (U) ($5,025) FREEZE-DRIED RED BLOOD CELLS -- Completed ATD with pre-clinical trials and will seek Federal Drug Administration investigational approval for a new drug.
- (U) ($5,115) ADVANCED SELF-DEFENSE COMBAT SYSTEM (ASDCS) -- Completed ATD: installed in land-based work station and conducted multiple target encounter simulated test to demonstrate operational capability of ASDCS.
- (U) ($3,017) HELMET MOUNTED MISSION REHEARSAL SIMULATION SYSTEM -- Completed integration of helmet-mounted display with enhanced photo imagery display capability, including rapid updates of target/threat imagery.
- (U) ($3,277) DATA/VOICE INTEGRATION -- Continued ATD: demonstrated integrated voice and data services over low-bandwidth, mixed-media network such as High Frequency (HF), Ultra HF Satellite Communication, and HF Line of Sight and demonstrated interoperability between warrior and high speed terrestrial networks via interconnections to the Global Grid demonstration testbed.
- (U) ($5,580) LOW PROBABILITY OF INTERCEPT (LPI) COMMUNICATIONS -- Continued ATD: performed system integration and completed flight demonstration of both communication link performance and performance against various intercept receiver types.
- (U) ($4,278) LPI SENSORS -- Continued ATD: completed common module sensor fabrication and integration and completed integration and installation of shipboard sensor system.
- (U) ($5,681) AIR VEHICLE DIAGNOSTIC SYSTEM (AVDS) -- Continued ATD: trained neural network diagnostic software to identify and warn of helicopter gearbox impending failure using seeded faults and tested ability of system to correctly

identify faulty and non-faulty gearboxes, and to diagnose specific faults.

- (U) ($4,185) ADVANCED HYBRID PROPULSOR -- Continued ATD: conducted water tunnel and tow tank tests at 1/16 scale, demonstrated cavitation in maneuvers, and conducted structural and shock analyses.
- (U) ($2,720) HIGH FREQUENCY SURFACE WAVE RADAR (HFSWR) -- Initiated ATD to demonstrate a cost effective transmitter and antenna that meets the power gain and performance parameters to satisfy baseline target detection requirements for warning of low-flying low-signature threat cruise missiles and tactical ballistic missiles.
- (U) ($3,255) EAGER (PREFERENTIAL ACQUISITION DECOY) -- Initiated ATD to demonstrate preferential acquisition decoy for ship self defense against threat cruise missiles. Designed airframe and propulsion system, modified existing flight control system, procured electronic payload, and initiated modifications.
- (U) ($4,275) SHALLOW WATER (SW) TORPEDO GUIDANCE & CONTROL (G&C) -- Initiated ATD to develop/demonstrate detection classification/homing algorithms against a diesel-electric submarine in SW environments.
- (U) ($4,371) VIBROTACTILE SPATIAL ORIENTATION -- Initiated ATD to improve flight safety by demonstrating a nonvisual, tactile feedback system for maintaining pilot orientation to the horizon. Conducted initial demonstration in fixed wing aircraft.
- (U) ($7,221) ADVANCED ENCLOSED MAST/SENSOR SYSTEM -- Initiated ATD to demonstrate an integrated composite antenna mast for surface ship applications having reduced signature, reduced topside weight, and improved antenna/sensor performance. Completed design, verified performance predictions, and commenced fabrication of full-scale structural mast land-based test article.
- (U) ($1,513) SINGLE CHANNEL GROUND AND AIRBORNE RADIO SYSTEM -- Conducted Congressionally-directed demonstration.
- (U) ($1,373) Selected and performed planning for FY 1997-start ATDs. Conducted independent reviews of on-going ATD programs.

2. (U) FY 1996 PLAN:

- (U) ($1,000) DATA/VOICE INTEGRATION -- Complete final demonstration. Provide integrated data and voice services network for tactical communication systems and transition to communications support systems (CSS) advanced development.
- (U) ($420) LPI COMMUNICATIONS -- Complete ATD of a LPI communication system that allows aircraft to communicate covertly at greater range.
- (U) ($2,000) LPI SENSORS -- Complete integration and installation of airborne system, conduct shipboard/flight testing

of the sensor system to demonstrate performance in classifying radar contacts based on unique doppler signature, and transition optical sensor system to advanced development.

- (U) ($3,850) AVDS -- Complete flight and ground demonstrations of fully-integrated system and evaluate performance. Prepare data package for transition of technology to operational systems.
- (U) ($5,000) ADVANCED HYBRID PROPULSOR -- Conduct 1/4 scale propulsor performance demonstration on the Large Scale Vehicle at Lake Pend Oreille, ID. Evaluate acoustic performance and transition technology to New Attack Submarine.
- (U) ($5,475) HFSWR -- Continue ATD: exercise simulator to examine effects of various threat scenarios, prepare system specifications, and award contract for shipboard demonstration system.
- (U) ($4,000) EAGER (PREFERENTIAL ACQUISITION DECOY) -- Continue ATD: complete system design, fabricate test hardware, integrate subsystems, and bench test.
- (U) ($5,000) SW TORPEDO G & C -- Continue ATD: demonstrate SW classification and environmental adaptation to achieve enhanced performance against diesel-electric submarines in SW environments.
- (U) ($7,458) ADVANCED ENCLOSED MAST/SENSOR SYSTEM -- Continue ATD: conduct land-based testing of full-scale structural mast to confirm predictions/design.
- (U) ($4,800) HIGHLY RESPONSIVE MISSILE CONTROL SYSTEM -- Initiate ATD to improve ship self defense against anti-ship cruise missiles, via highly maneuverable intercept missile technology. Define performance requirements and develop required control system algorithms.
- (U) ($3,600) SMART SKINS ARRAY -- Initiate ATD to embed large aperture antenna arrays in aircraft skin for improved sensor performance. Complete design verification and subcomponent testing.
- (U) ($4,950) TACTICAL AIRCRAFT DIRECTED INFRARED COUNTERMEASURES (DIRCM) -- Initiate ATD to track and jam infrared (IR) guided missile threats to aircraft. Complete performance testing of mid-IR laser and develop system software for pointer/tracker.
- (U) ($5,000) ADVANCED MISSILE AIRFRAME -- Initiate ATD to demonstrate a hybrid missile airframe to restore U.S. tactical advantage against advanced air threats. Perform design of airframe and jet reaction control device.
- (U) ($6,000) COMPETENT MUNITIONS FOR THE 5" GUN -- Initiate ATD to demonstrate a low cost, highly accurate guidance and control package for improved naval surface fire support from surface ship 5" guns. Conduct inertial guidance gyro demonstration.
- (U) ($3,000) ADVANCED EMBEDDED TRAINING FOR SHIPBOARD SYSTEMS -- Initiate ATD to improve shipboard training. Complete integration of enabling technologies including: eye tracking, advanced computer technology, helmet-mounted displays,

and advanced visualization techniques.

- (U) ($4,500) ADVANCED ELECTRONIC COUNTERMEASURES (ECM) TRANSMITTER FOR SHIP DEFENSE -- Initiate ATD to provide more effective soft-kill capability against anti-ship cruise missiles. Complete system design and performance trade-off.
- (U) ($5,000) MULTI-BEAM, MULTI-FREQUENCY, SUBMARINE SUPER HIGH FREQUENCY (SHF) PHASED ARRAY ANTENNA -- Initiate ATD to improve submarine connectivity with the littoral battleforce. Perform module design and layout for phased array demonstration.
- (U) ($1,500) BALL-JOINT GIMBAL FOR JOINT STRIKE WEAPONS -- Initiate task to demonstrate a low-cost, ball-joint gimbal for future strike weapon seekers. Complete seeker design tradeoff studies. Design, fabricate, and evaluate prototype ball-joint gimbal. This task will transition to PE 0603217N, Project R0447, in FY 1997 for continued development and flight test demonstration
- (U) ($1,500) PRECISION STRIKE NAVIGATOR (PSN) -- Initiate task to demonstrate a highly accurate, compact, low-cost Inertial Measurement Unit (IMU) that will provide pinpoint guidance even if Global Positioning System is lost. Complete waveguide design and fabrication and initiate fabrication of PSN IMU. This task will transition to PE 0603217N, Project R2264, in FY 1997 for continued development and flight test demonstration.
- (U) ($65) Portion of extramural program reserved for Small Business Innovative Research assessment in accordance with 15 U.S.C. 638.
- (U) ($1,476) Select and perform planning for FY 1998-start ATDs. Conduct independent reviews of on-going ATD programs.

3. (U) FY 1997 PLAN:

- (U) ($5,525) HFSWR -- Complete ATD with at-sea demonstration of HFSWR against low-flying aircraft targets and sea-skimming target drones.
- (U) ($4,500) EAGER (PREFERENTIAL ACQUISITION DECOY) -- Complete preliminary testing, assemble demonstration vehicle, integrate vehicle and payload, and conduct final demonstration.
- (U) ($5,500) SW TORPEDO G & C -- Complete ATD with demonstration of the complete SW detection/classification/homing processing system using the MK50 and ADCAP sensors.
- (U) ($7,900) ADVANCED ENCLOSED MAST/SENSOR SYSTEM -- Fabricate at-sea mast, install and conduct initial performance demonstration of at-sea mast. Transition to advanced development for extended at-sea trials.
- (U) ($6,500) HIGHLY RESPONSIVE MISSILE CONTROL SYSTEM -- Continue ATD: complete performance assessment and

hardware/software integration.

- (U) ($4,200) SMART SKINS ARRAY -- Continue ATD: fabricate Advanced Development Model (ADM) and conduct ADM ground test/analysis.
- (U) ($5,400) TACTICAL AIRCRAFT DIRCM -- Complete ATD: demonstrate advanced laser-based countermeasures against infrare seeking missiles through flight testing and field demonstrations of developed hardware and countermeasures techniques.
- (U) ($4,100) ADVANCED MISSILE AIRFRAME -- Continue ATD: complete fabrication of airframe, rocket motor, jet reaction control, autopilot, and telemetry.
- (U) ($6,000) COMPETENT MUNITIONS FOR THE 5" GUN -- Continue ATD: conduct inertial guidance fuse package demonstration.
- (U) ($4,000) ADVANCED EMBEDDED TRAINING FOR SHIPBOARD SYSTEMS -- Continue ATD: conduct demonstration of an advanced training prototype system.
- (U) ($5,500) ADVANCED ECM TRANSMITTER FOR SHIP DEFENSE -- Continue ATD: complete fabrication, assemble and conduct component/subsystem testing.
- (U) ($6,000) MULTI-BEAM, MULTI-FREQUENCY, SUBMARINE SHF PHASED ARRAY ANTENNA -- Continue ATD: build X-band module and perform design qualification tests.
- (U) ($2,888) LOW COST MISSILE SYSTEM -- Initiate ATD to demonstrate performance capability of a low cost, wingless an finless tactical missile to deliver payload at supersonic speeds. Perform design of airframe, actuator, control syste and combuster and begin fabrication of subsystems.
- (U) ($2,500) SOLID STATE VISIBLE/LONG WAVE INFRARED (LWIR) COLOR NIGHT VISION SYSTEM -- Initiate ATD to demonstrate a sensor-fusion night vision device that enables perceptual separation of terrain types and objects. Complete design of low-light charged couple device (LL CCD) imager and develop real-time processing for image enhancement and visible-LWI fusion.
- (U) ($3,950) MULTIFUNCTION ELECTROMAGNETIC RADIATING SYSTEM (MERS) -- Initiate ATD to demonstrate a low cost, shipboard antenna system that merges several sensors into a single antenna system. Complete antenna design and initiate fabrication of performance model.
- (U) ($4,000) ANTITORPEDO TORPEDO (ATT) TECHNOLOGY FOR SURFACE AND SUBMARINE APPLICATION -- Initiate ATD to improve surface ship and submarine point defense against torpedoes, via ATT technology. Conduct in-water demonstrations against maneuvering torpedo targets in a clean environment.
- (U) ($4,100) MISSILE AGILITY/KINEMATIC ENHANCEMENT (MAKE) -- Initiate ATD to demonstrate a surface-to-air missile capable of rapid lateral maneuvers to facilitate direct hit capability against tactical ballistic missiles. Perform

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 1996

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603792N PROGRAM ELEMENT TITLE: Advanced Technology Transition PROJECT NUMBER: R1889 PROJECT TITLE: Advanced Technology Transition

design of high thrust, fast response jet reaction control (JRC) and boost propulsion units; complete 6-degree of freedom simulation for system analysis/design; conduct wind tunnel tests of airframe.

- (U) ($4,800) ADVANCED TACTICAL ACOUSTIC COMMUNICATIONS -- Initiate ATD to demonstrate real-time connectivity with subsurface platforms operating at speed and depth using undersea tactical communications links with useful ranges and data rates. Define system architecture including data rate/range capabilities, allocated frequencies and bandwidth. Develop interconnect and test principal elements in local at-sea tests.
- (U) ($2,500) DNA VACCINES FOR COMPLEX MULTISTAGE ORGANISMS, AND OTHER ORGANISMS OF MILITARY IMPORTANCE -- Initiate ATD to demonstrate DNA vaccines designed to protect against complex, multistage microorganisms or against multiple simple pathogens. Perform gene cloning to produce human-use plasmids.
- (U) ($3,000) PLASMA-ARC PYROLYSIS OF SHIPBOARD SOLID WASTE -- Initiate ATD to demonstrate full-scale plasma-arc pyrolysis system for controlled thermal destruction of shipboard wastes. Design and test feed subsystem in lab-scale reactor; demonstrate process control with various waste feed mixtures.
- (U) ($2,000) ADVANCED COMMUNICATIONS INTELLIGENCE (COMINT) VOICE PROCESSING -- Initiate ATD to demonstrate speech processing system to automatically interpret, sort and prioritize intercepted voice COMINT signals. Complete system design and performance trade-off; assemble and integrate algorithms.
- (U) ($4,000) "BEST BUY"-LOW COST CAPABILITY MULTIPLICATION FOR FIVE-INCH FIRE SUPPORT PROJECTILES -- Initiate ATD to demonstrate a high capacity projectile utilizing a high lift-to-drag composite airframe for launch from a five-inch gun. Design and fabricate quick-connect joint which connects payload and propellant sections.
- (U) ($4,000) LITTORAL WARFARE REAL-TIME ELECTROMAGNETIC INTERFERENCE (EMI) MANAGEMENT SYSTEM -- Initiate ATD to improve bandwidth availability and reduce interference through instantaneous control of combat system frequency assignments. Define data requirements and develop EMI prediction and assessment models.
- (U) ($1,561) Select and perform planning for FY 1999-start ATDs. Conduct independent reviews of on-going ATD programs.

B. (U) PROGRAM CHANGE SUMMARY:

	FY 1995	FY 1996	FY 1997
(U) FY 1996 President's Budget:	71,668	96,825	108,423
(U) Adjustments from FY 1996 PRESBUDG:	-1,665	-21,231	-3,999

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 199

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603792N PROGRAM ELEMENT TITLE: Advanced Technology Transition PROJECT NUMBER: R1889 PROJECT TITLE: Advanced Technology Transition

(U) FY 1997 PRESBUDG Submit: 70,003 75,594 104,424

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: FY 1995 decrease due to Science and Technology rescission ($1,000) and reduced program requirements (-$665). FY 1996 decrease due to Congressional undistributed ($18,825), undistributed Congressional reductions ($1,485); and revised DoD economic assumptions ($921). FY 1997 cut reflects a combination of direction to execute a high risk, high payoff demonstration of an improved projectile for naval surface fire support (+$5,000), revised DoD inflation estimates (-$3,198) and other pricing adjustments (-$5,801).

(U) Schedule: Reductions have delayed a new start demonstration of an electromagnetic environment monitoring system fo real-time control of combat system frequency assignment from FY 1996 to FY 1997. Terminations in FY 1996 include Helmet-Mounted Mission Rehearsal Simulation System and Vibrotactile Spatial Orientation.

(U) Technical: Reductions have delayed the Navy's ability to demonstrate key advanced technology developments which ar essential to the Navy's future warfighting capability.

C. (U) OTHER PROGRAM FUNDING SUMMARY: (Dollars in thousands) Not Applicable.

(U) RELATED RDT&E:

- (U) PE 0601153N (Defense Research Sciences)
- (U) PE 0602111N (Air and Surface Weapons Technology)
- (U) PE 0602121N (Surface Ship and Submarine HM&E Technology)
- (U) PE 0602122N (Aircraft Technology)
- (U) PE 0602232N (Space and Electronic Warfare (SEW) Technology)
- (U) PE 0602233N (Readiness, Training and Environmental Quality Tech)
- (U) PE 0602234N (Materials, Electronics & Computer Technology)
- (U) PE 0602270N (Electronic Warfare Technology)

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BUDGET ACTIVITY: 3
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- (U) PE 0602314N (Undersea Warfare Surveillance Technology)
- (U) PE 0602435N (Oceanographic & Atmospheric Technology)
- (U) PE 0602633N (Undersea Warfare Weapon Technology)

D. SCHEDULE PROFILE: Not applicable.

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DATE: March 1996

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603792N
PROGRAM ELEMENT TITLE: Advanced Technology Transition

PROJECT NUMBER: R1889
PROJECT TITLE: Advanced Technology Transition

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FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: March 1996

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603794N
PROGRAM ELEMENT TITLE: C3 Advanced Technology

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 1995 ACTUAL	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
X2091 Space and Electronic Warfare (SEW) Advanced Technology	9,615	15,043	16,445	19,653	17,088	17,395	17,745	CONT.	CONT.
Advanced Targeting	9,997	10,666	12,823	8,305	955	948	942	CONT.	CONT.
TOTAL	19,612	25,709	29,268	27,958	18,043	18,343	18,687	CONT.	CONT.

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This Program Element (PE) develops communications technologies, real-time precision targeting information and decision aids which support the effective utilization of naval forces in conducting Joint operations with the other Services or our allies. Efforts include development of high capacity, low-probability-of-intercept communication; distributed networks; distributed command and control real-time multi-level secure systems; integrated voice/data/video communications techniques; software specification tools; algorithms for specific target identification and precision targeting; interactive collaborative decision aids; and supporting technologies for a multi-mission broadband antenna and Command, Control, and Communications (C3) embedded training. The PE is planned jointly in accordance with Tri-Service Reliance agreements for C3 technology and is reviewed and approved by the principals of the Joint Directors of Laboratories for Reliance.

(U) This PE primarily supports the following Joint Mission Areas and Support Areas: Strike Warfare, Littoral Warfare, Space and Electronic Warfare (SEW)/Intelligence, Strategic Deterrence, Sealift/Protection, and Readiness/Training. The focus is on development and demonstrations of next-generation C3 systems, demonstrating a capability to perform precision targeting aided by real-time interactive force level planning and rehearsal in a joint arena supporting a multi-platform environment, aircraft, and submarines. There are two projects supported by the PE:

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 1996

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603794N
PROGRAM ELEMENT TITLE: C3 Advanced Technology

1. (U) SEW Advanced Technology (X2091) -- This project is pursuing work in telecommunications, networking, security, and real time decision aids for Joint military operations. Efforts will develop and demonstrate a multinet, multimedia communications controller that provides a smart software-intelligent interface between user Transmit/Receive communications systems capable of adjusting bandwidth/frequency to balance system loading, as well as state-of-the-art telecommunications technologies such as high data rate local-area-networks (LAN) that can meet unique military data transfer requirements using commercially developed Asynchronous Transfer Mode (ATM)/Synchronous Optical Network technologies. These high speed LANs will provide the ability to perform collaborative strike planning in the Real-Time Support for Joint Power Projection project by developing and integrating multi-node expert computer workstations and intelligent data bases, through ATM networking which will eventually operate in the gigabits per second regime. Information can then be communicated electronically from a shipboard multi-beamed steerable antenna interoperating with reconnaissance and surveillance sensors and aircraft to enhance joint strike planning among Navy platforms and between other Services. In addition, integrating of real-time information from sources such as the Precision Signals Intelligence (SIGINT) Targeting System (PSTS) and tactical reconnaissance and surveillance data will greatly improve asset allocation, precision targeting and execution of strike missions.

2. (U) Advanced Targeting (R2239) -- the PSTS is a Joint Service/Defense Agency effort to develop and demonstrate the capability to provide tactical users with near-real-time target identification and precision targeting information, sensor-to-shooter target updating, and Battle Damage Assessment. PSTS will enhance the tactical utility/applicability of existing national assets and provide the tactical commander with performance improvements in terms of targeting accuracy, targets of interest, timeliness, and target identification. Technical challenges include development of advanced signal processing and data fusion algorithms for target detection and classification; and exploitation of multiple signal characteristics for specific emitter identifications.

(U) JUSTIFICATION FOR BUDGET ACTIVITY: This program is budgeted within the ADVANCED TECHNOLOGY DEVELOPMENT Budget Activity because it encompasses design, development, simulation, or experimental testing or prototype hardware to validate technological feasibility and concept of operations and reduce technological risk prior to initiation of a new acquisition program or transition to an ongoing acquisition program.

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 1996

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603794N
PROGRAM ELEMENT TITLE: C3 Advanced Technology

(U) COST: (Dollars in thousands)

PROJECT NUMBER & TITLE	FY 1995 ACTUAL	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
X2091 Space and Electronic Warfare (SEW) Advanced Technology	9,615	15,043	16,445	19,653	17,088	17,395	17,745	CONT.	CONT.

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: Demonstrate advanced technology components, subsystems and systems that will improve the Navy's Command, Control and Communications (C3) distributed networks in areas such as high data rates, optimization and automation of network resources, multi-level access and security of databases and the ability to transmit and receive multi-media data (voice/data/video) over narrow bandwidth communication circuits. Capabilities realized from these efforts will contribute to the Navy's ability to maintain an accurate situational assessment and tactical picture in near-real-time through shared knowledge of threatening situations which can then be communicated to all forces in near-real-time. Projects will be conducted in the following areas: (1) Automated Integrated Communication Systems (AICS) that utilizes digital networking techniques to integrate wideband voice/data/video data for transmitting over narrowband communication links; (2) Specification Tool for Software Requirements (STSR) for verification of software specifications; (3) Multi-Level Secure (MLS) systems that provide embedded security for communicating at multi-security levels; (4) Supporting technologies; e.g., Multi-Mission Broadband Antennas (MMBA); (5) Real-Time Support for Joint Power Projection Operations (RTS/JPP) that provides collaborative strike force planning and mission execution for Joint service systems.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1995 ACCOMPLISHMENTS:

- (U) ($664) AICS: Demonstrated system connectivity from platform to platform across multinet media. Demonstrated system Information Security solutions.
- (U) ($674) STSR: Completed report on toolset's software design. Extended specification editor and simulator. Developed initial version of software verifier. Demonstrated simulator and verifier.
- (U) ($709) MLS: Evaluated test configurations against security policy. Evaluated impact of tested MLS technology on reducing overall system risks.

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- (U) ($1,456) MMBA: Completed risk-reduction studies of individual module design emphasizing Transmit and Receive (T/R) module interference. Investigated signal processing and beam steering risks associated with over 20 thousand T/R module design. Reviewed contractor preliminary design proposals.
- (U) ($2,722) JPP/RTS: Conducted joint strike planning demonstrations at Washington, DC sites (Naval Research Laboratory and Washington Planning Center), operational and training sites (USACOM and Navy Strike Warfare Center) that included two modules: (1) force level rehearsal module for rapid, collaborative planning, three dimensional visualization, rehearsal and replanning of a strike mission plan enhanced with radar terrain masking, tactical situation display, and environmental and electronic warfare effects and (2) target analysis module for target visualization and access to intelligence databases. Interfaced the rehearsal module with existing Joint planning and execution systems such as the Tomahawk Strike Coordination Module (TSCM), Contingency Tactical Air Planning System, and Joint Maritime Command Information System (JMCIS) for initial test and validation.
- (U) ($2,400) JPP/RTS: Conducted F/A-18 flight simulation of in-air strike offensive and defensive mission management, including rerouting, replanning, retargetting and receipt of sensor data from joint sensors and evaluate the capability in joint exercises.
- (U) ($990) JPP/RTS: Designed an Asynchronous Transfer Mode/Synchronous Optical Network based Scalable High Performance local-area-network (LAN) laboratory demonstration at 155 megabit per second rate. Evaluated performance in land-based site with multi-protocol shipboard interfaces.

2. (U) FY 1996 PLAN:

- (U) ($1,070) STSR: Conduct a full-scale demonstration of the STSR toolset, the specification editor, the consistency and completeness checker, the simulator, and the initial verifier. Extend software verifier. The extended verifier will handle larger software specifications and verify several more classes of application properties. Develop "target" software requirements specification to support system demonstration.
- (U) ($1,362) AICS: Develop the AICS network management architecture. Develop network management systems and segment specification. Develop COTS-based prototype distributed mmanager, communications automation manager, and bandwidth mamager.
- (U) ($1,042) MLS: Define a distributed information system problem. Define the critical requirements for solution to the security problem. Perform system engineering trade-off analysis. Prototype segments of distributed MLS assured strike planning architecture.
- (U) ($4,601) JPP/RTS: Integrate at Navy operational site new technology modules for strike planning and execution with collaborative planning and query services and other technology efforts directed toward Global Command and

Control System development. Modules will be installed on fleet workstations that will allow collaborative planning, rehearsal and monitoring of a strike operation. With optimized distributed algorithms, collaborative planning tools, a scalable high performance shipboard LAN, and tactical aircraft workstations, simulated tactical information can be utilized to demonstrate in real-time, optimized planning and routing of a strike mission coordinated from the JMCIS.

- (U) ($4,938) JPP/RTS: Conduct flight demonstrations of advanced real-time information flow to the F/A-18 cockpit with on-board defensive and offensive decision aids and improved situational awareness.
- (U) ($1,787) JPP/RTS: Demonstrate a 155 megabit per second strike planning LAN with interfaces to distributed mission planning and intelligence system aboard an aircraft carrier.
- (U) ($243) Portion of extramural program reserved for Small Business Innovation Research assessment in accordance with 15 U.S.C.638.

3. (U) FY 1997 PLAN:

- (U) ($5,750) JPP/RTS: Plan optimization and multiple interdependent routing algorithms in Navy demonstration site. Conduct joint multi-laboratory field demonstrations of interoperable planning and execution systems for Commander Joint Task Force and Joint Air Force Component Command power projection planning and exercise of joint strike assets. Design Common Ground Station that supports multi-Service Commander's need for real-time information.
- (U) ($2,716) JPP/RTS: Conduct Joint Navy/Air Force flight demonstration of advance cockpit information management, synthetic environment and helmet-mounted display technology.
- (U) ($3,200) JPP/RTS: Demonstrate and test 2.4 gigabit per second LAN prototype shipboard LAN supporting advanced planning systems and intelligence.
- (U) ($2,000) JPP/RTS/MMBA: Contract for Navy demonstration prototype at NMBA with joint applicability. Emphasize simulation in support of coherent C3 systems.
- (U) ($1,858) AICS: Demonstrate Joint systems that shows integrated interface with JCS required global and theater level network control and management. Demonstration will include operational interface with US Army developed Joint communication and planning system.
- (U) ($921) MLS: Network security requirements (i.e., distributed identification and authentication, encryption, key management, and operating system support) resulting from the FY 1996 MLS Strike planning security architecture comparisions will be evaluated and tested against the assurance strategy/security architecture and security policy.

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 199

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603794N PROJECT NUMBER: X2091
PROGRAM ELELEMENT TITLE: C3 Advanced Technology PROJECT TITLE: SEW Advanced Technology

B. (U) PROGRAM CHANGE SUMMARY:

	FY 1995	FY 1996	FY 1997
(U) FY 1996 President's Budget:	9,744	15,792	17,387
(U) Adjustments from FY96 PRESBUDG:	-129	-749	-942
(U) FY 1997 PRESBUDG Submit:	9,615	15,043	16,445

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: FY 1995 change results from a reduction in requirements (-$129).

(U) Funding: FY 1996 changes include Congressional undistributed (-$329); decrease for Revised DoD inflation estimates (-$182) and a minor repricing adjustment (-$238).

(U) Funding: FY 1997 changes include revised DoD inflation estimates (-$499); minor program repricings (-$143) and reduced program requirements (-$300).

(U) Schedule: Not applicable.

(U) Technical: Not applicable.

C. (U) OTHER PROGRAM FUNDING SUMMARY: Not applicable.

(U) RELATED RDT&E:

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: March 1996

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603794N PROJECT NUMBER: X2091
PROGRAM ELELEMENT TITLE: C3 Advanced Technology PROJECT TITLE: SEW Advanced Technology

(U) PE 0301567G (Computer Security Program)
(U) PE 0303140N (Information Systems Security Plan)
(U) PE 0601153N (Defense Research Sciences)
(U) PE 0602232N (Space and Electronic Warfare (SEW) Technology)
(U) PE 0602234N (Materials, Electronics and Computer Technology)
(U) PE 0604231N (Tactical Command Systems)
(U) PE 0604574N (Navy Tactical Computer Resources)

D. SCHEDULE PROFILE: Not applicable.

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: March 1996

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603794N
PROGRAM ELEMENT TITLE: C3 Advanced Technology

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 1995 ACTUAL	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
R2239 Advanced Targeting	9,997	10,666	12,823	8,305	955	948	942	CONT.	CONT.

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: The Precision Spaceborne Targeting System (PSTS) addressed in the Director of Defense, Research, and Engineering Global Surveillance and Communications Thrust is a Joint Service/Defense Agency effort to develop and demonstrate the capability to provide tactical users with near-real-time specific target identification and precision targeting information, sensor-to-shooter target updating and Battle Damage Assessment. The proposed system will enhance the tactical utility and application of existing national assets so as to provide the tactical commander involved in future conflicts with significant performance improvements, resulting in a total surveillance network which is more responsive to changing world economic and political threats in terms of targeting accuracy, targets of interest, timeliness, and target identification. PSTS will develop Joint Service/Defense Agency cooperative precision targeting site enhancements and Global Concept of Operations for optimal asset cooperative utilization and minimal operational impact. Technical challenges include development of advanced signal processing and data fusion algorithms for target detection and classification methodology; exploitation of multiple signal characteristics for specific emitter identification; modeling and simulation to assure optimal resource allocation for coopertive precision targeting and primary mission performance; and data compression technologies.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1995 ACCOMPLISHMENTS:
   (U) ($9,997) Available above SECRET level of classification.

2. (U) FY 1996 PLAN:
   (U) ($10,666) Available above SECRET level of classification.

FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: March 1996

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603794N
PROGRAM ELEMENT TITLE: C3 Advanced Technology

3. (U) FY 1997 PLAN:
(U) ($12,823) Available above SECRET level of classification.

B. (U) PROGRAM CHANGE SUMMARY:

	FY 1995	FY 1996	FY 1997
(U) FY 1996 President's Budget:	10,098	11,002	13,320
(U) Adjustments from FY96 PRESBUDG:	-101	-336	-497
(U) FY 1997 PRESBUDG Submit:	9,997	10,666	12,823

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: FY 1995 changes reflect reduced program requirements (-$10). FY 1996 changes reflect the following adjustments: Congressional undistributed reductions (-$208) and revised DoD inflation estimates (-$128). FY 1997 changes include revised DoD inflation estimates (-$387) and a reduction in program requirements (-$110).

(U) Schedule: Not applicable.

(U) Technical: Not applicable.

C. (U) OTHER PROGRAM FUNDING SUMMARY: Available above SECRET level of classification.

(U) RELATED RDT&E: Available above SECRET level of classification.

D. (U) SCHEDULE PROFILE: Not applicable.

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FY 1997 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: March 1996

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603794N
PROGRAM ELEMENT TITLE: C3 Advanced Technology

PROJECT NUMBER: R2239
PROJECT TITLE: Advanced Targeting