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AIR FORCE

HUMAN RESOURCES

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A096732
HUMAN RESOURCES, LOGISTICS AND COST
FACTORS IN WEAPON SYSTEM DEVELOPMENT:
DEMONSTRATION IN THE FULL SCALE
DEVELOPMENT PHASE OF AIRCRAFT
SYSTEM ACQUISITION, APPENDIXES B TO R.

By

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This final report was submitted by Dynamics Research Corporation, 60 Concord Street, Wilmington, Massachusetts 01887, under Contract F33615-77-C-0016, Project 1959, with the Logistics and Technical Training Division, Air Force Human Resources Laboratory (AFSC), Wright-Patterson Air Force Base, Ohio 45433. Dr. William B. Askren was the Work Unit Scientist for the Laboratory.

This report has been reviewed by the Office of Public Affairs (PA) and is releasable to the National Technical Information Service (NTIS). At NTIS, it will be available to the general public, including foreign nations.

This technical report has been reviewed and is approved for publication.

ROSS L. MORGAN, Technical Director
Logistics and Technical Training Division

RONALD W. TERRY, Colonel, USAF
Commander

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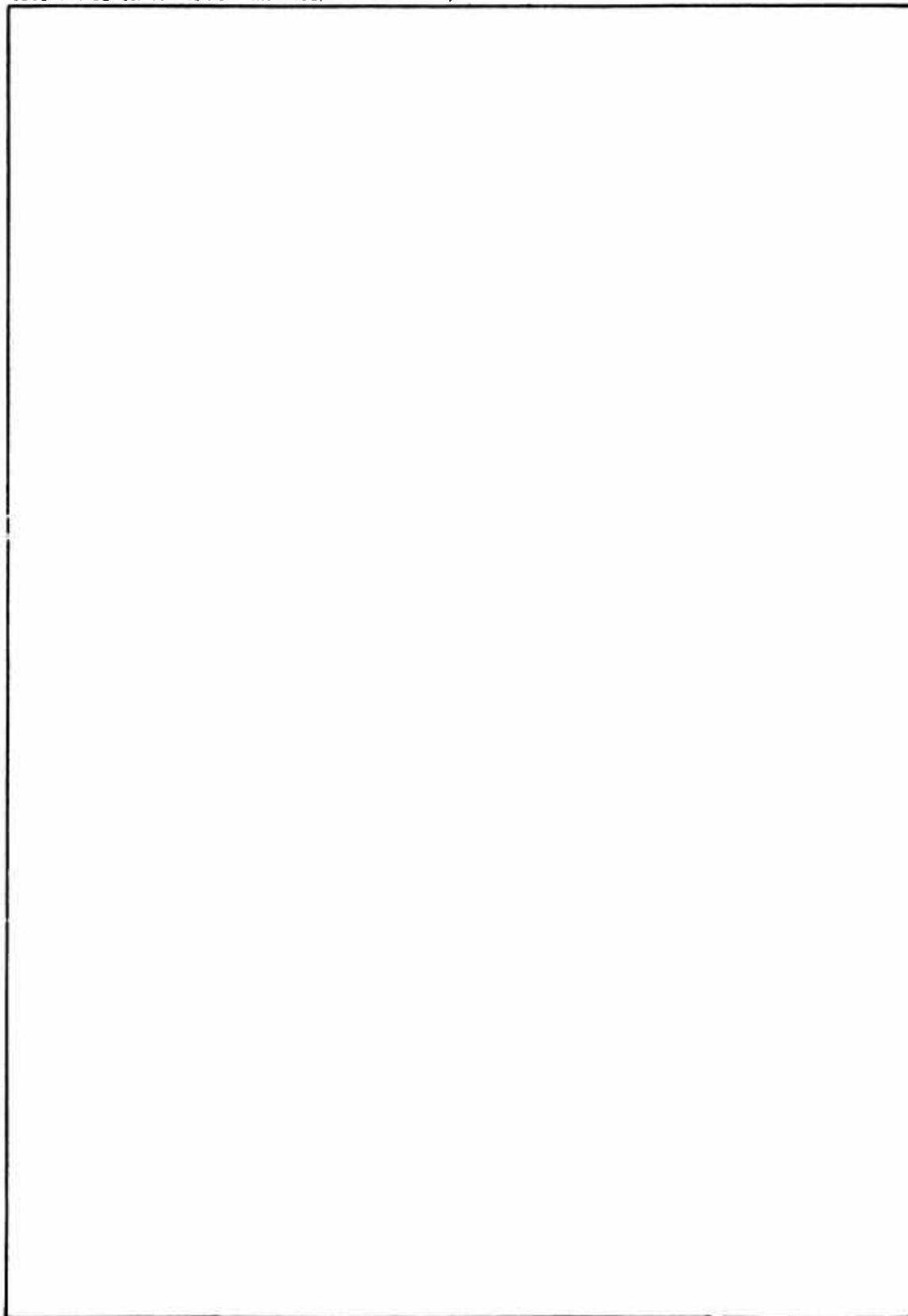
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consolidated data base	job guide development	task analysis															
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design option decision trees	logistic support elements	training															
human resource in design trade-offs	maintenance manpower modeling	weapon system acquisition															
instructional system development	system ownership costing																
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The coordinated human resource technology and the consolidated data base were demonstrated in the full-scale development phase of weapon system acquisition. The results of this demonstration are reported in Volume I. This volume consists of Appendices B through R to that demonstration report and provides additional details of the demonstration.																	

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INTRODUCTION

The information presented in Appendices B to R was developed during the demonstration of the coordinated human resource technology (CHRT) and the consolidated data base (CDB) in the full-scale development phase of aircraft acquisition. These data supplement those included in the basic report and provide significant additional detail.

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APPENDIX B DESIGN OPTION DECISION TREES

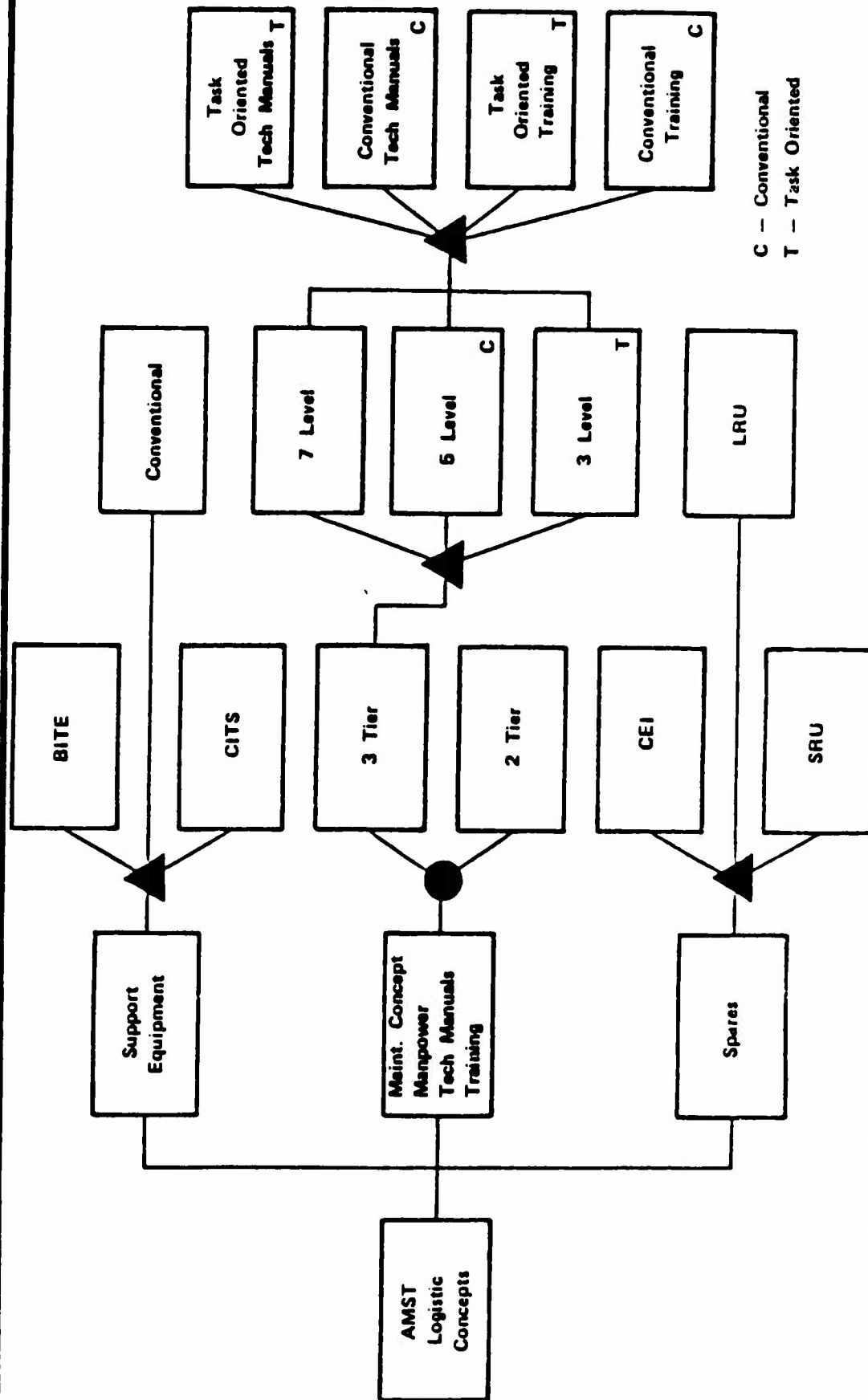
This section lists the full set of Design Option Decision Trees, which were completed during the MED Phase demonstration. Samples are provided.

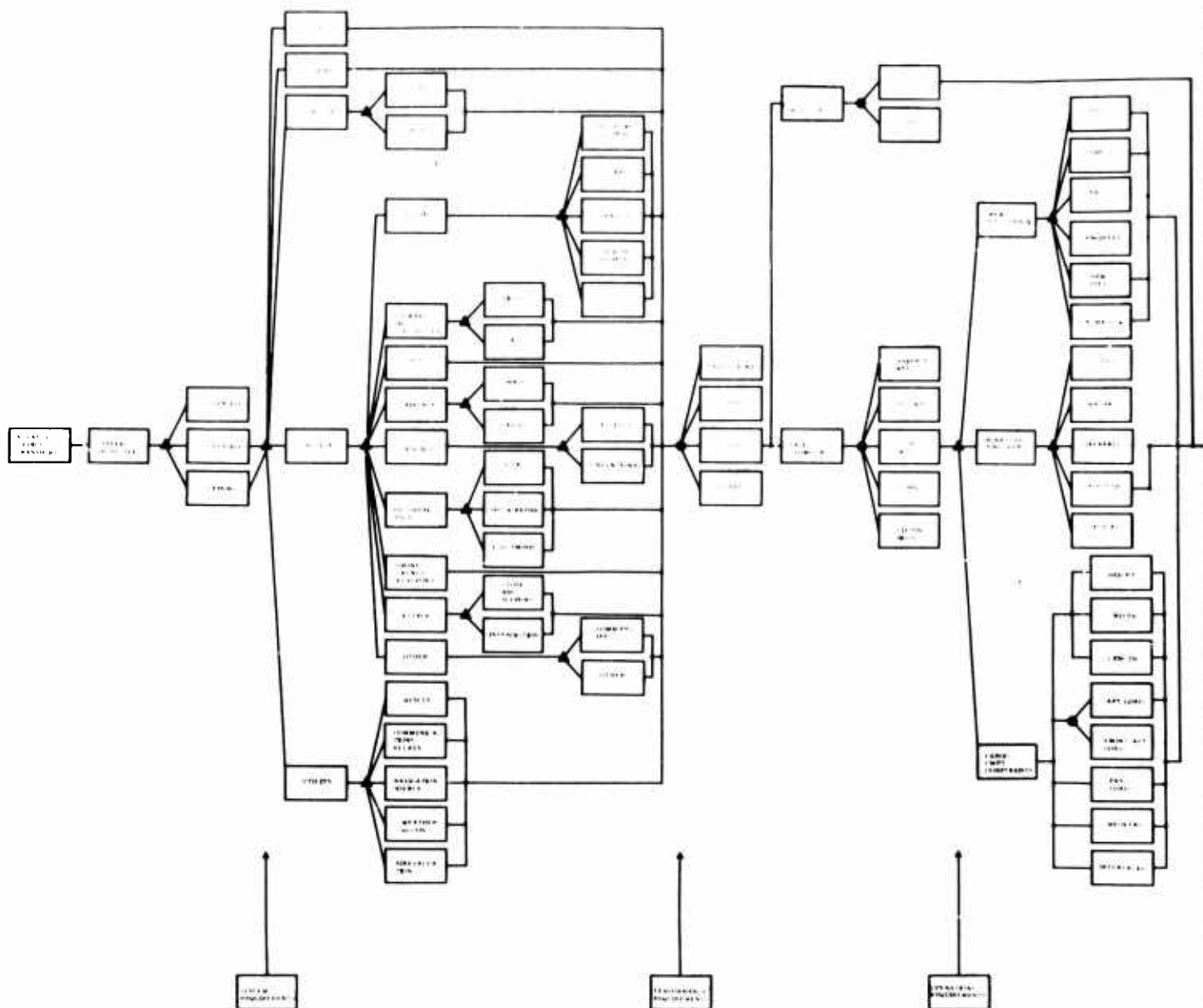
DESIGN OPTION DECISION TREE DRAWING LIST

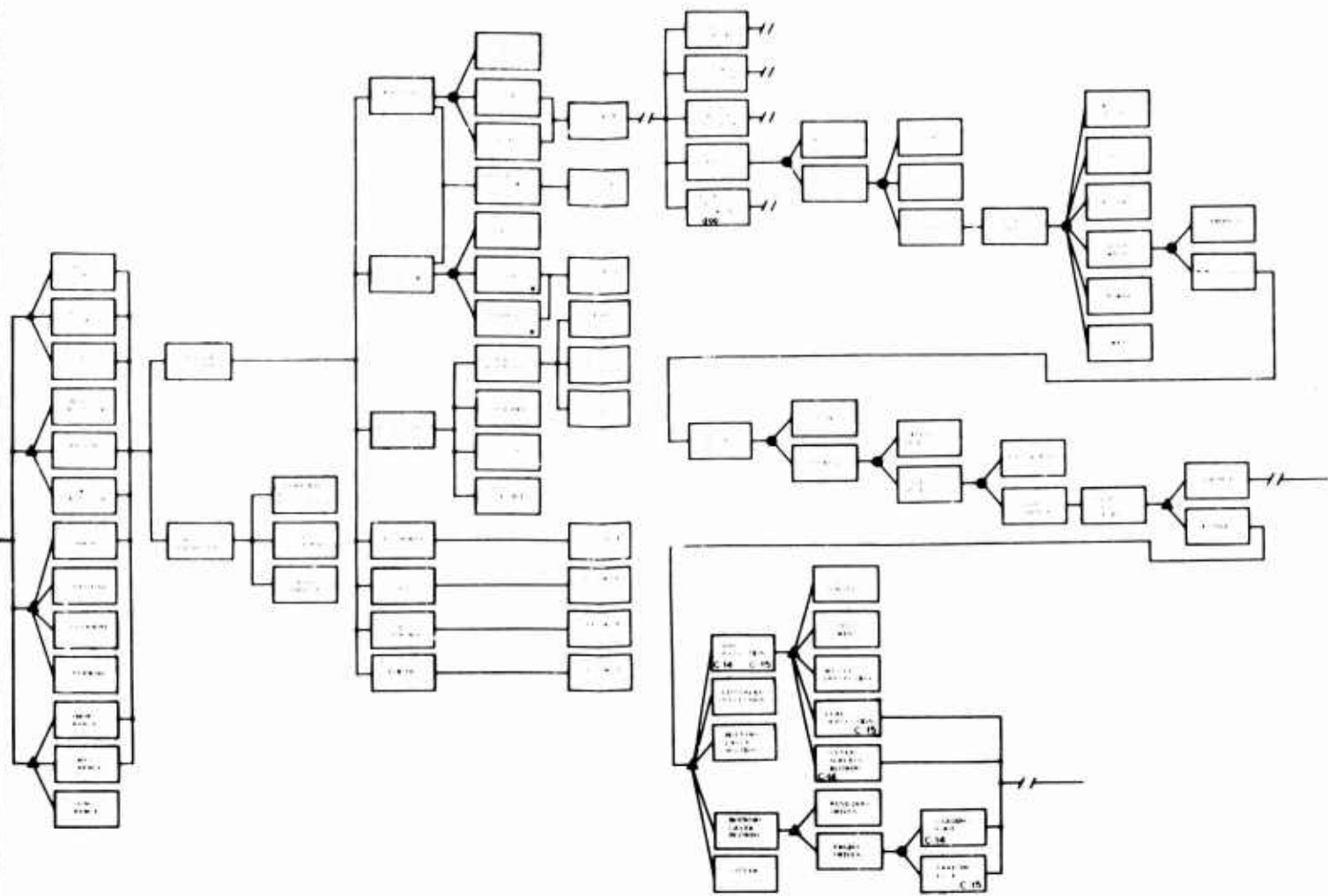
DWG #	TITLE	SHEET	OF
*--	AMST Logistic Option Tree	1	1
*1000	AMST System	1	1
*1100	AMST Avionics	1	8
1100	AMST Avionics (ECM)	2	8
1100	AMST Avionics (Radar)	3	8
1100	AMST Avionics (Navigation)	4	8
1100	AMST Avionics (Communications)	5	8
1100	AMST Avionics (Integration)	6	8
*1100	AMST Avionics (Info. Process.)	7	8
1100	AMST Avionics (Inst. & Display)	8	8
*1200	AMST Landing Gear	1	3
*1200	AMST Landing Gear (Main Gear)	2	3
1200	AMST Landing Gear (Nose Gear)	3	3

* Indicates those design option decision trees included in this report.

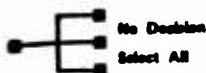
DEMONSTRATE CHRT IN FULL SCALE DEVELOPMENT
AMST MED PHASE
LOGISTICS OPTION TREE







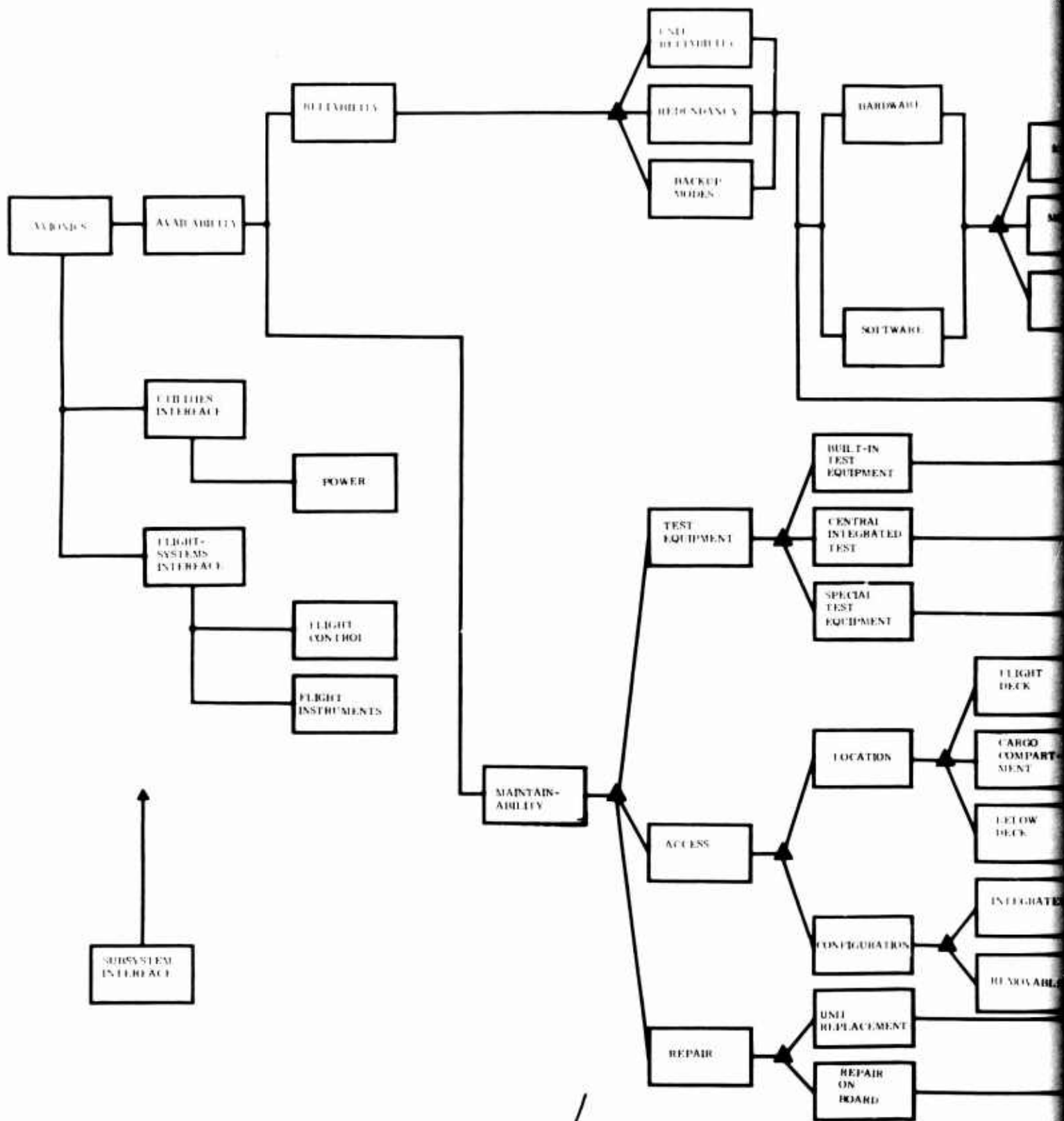
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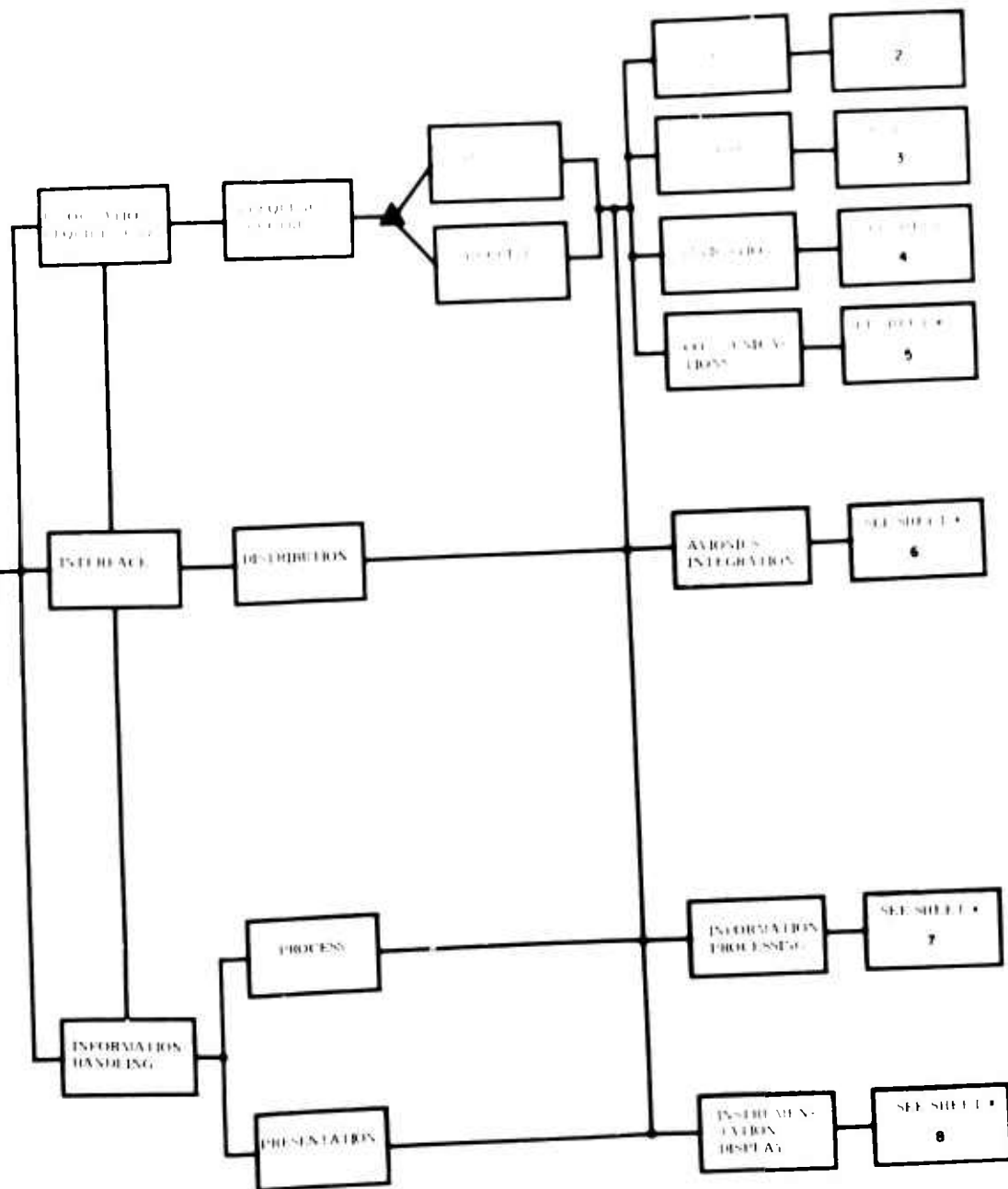
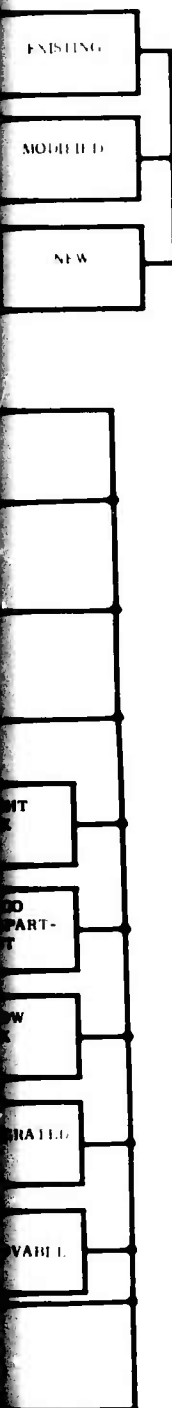


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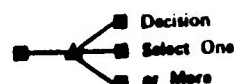
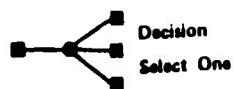
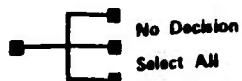
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DECISION TO BE MADE

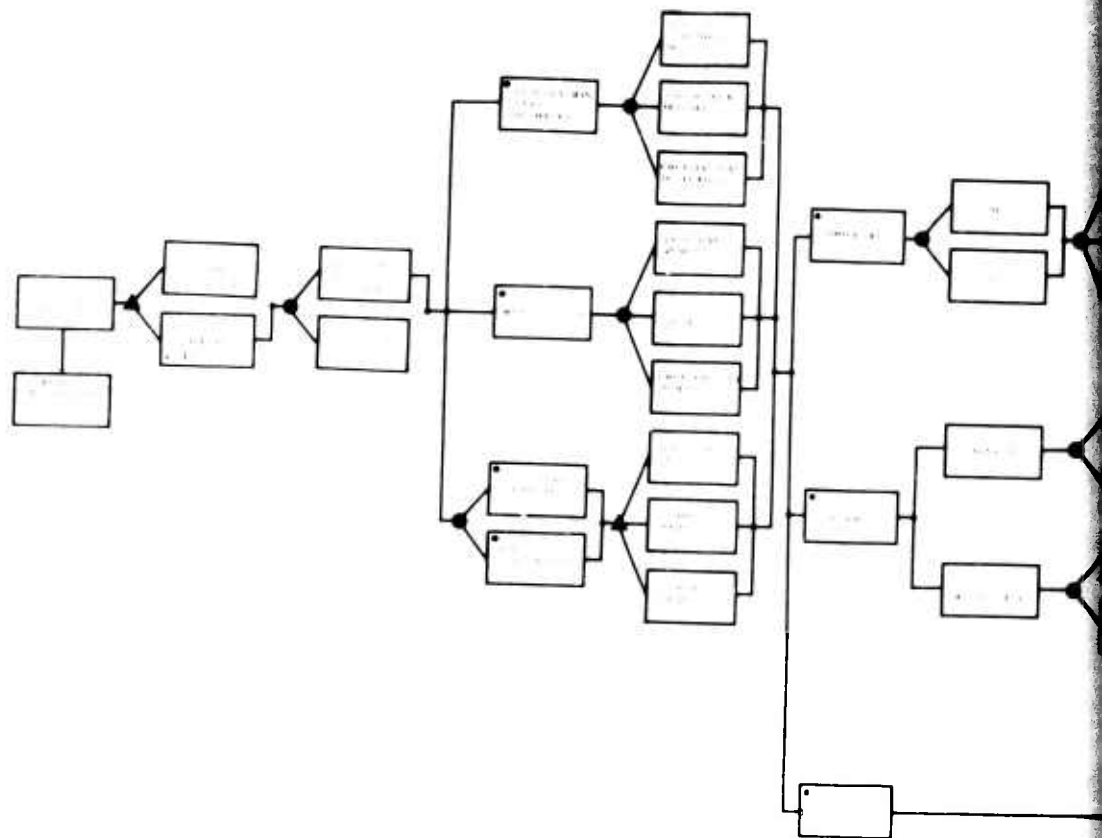
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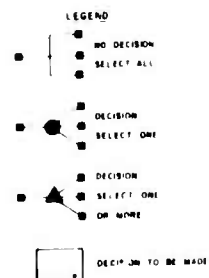


DRC DYNAMICS RESEARCH CORPORATION
60 CONCORD STREET, WILMINGTON, MA. 01887

DECISION TREE-AMST AVIONICS

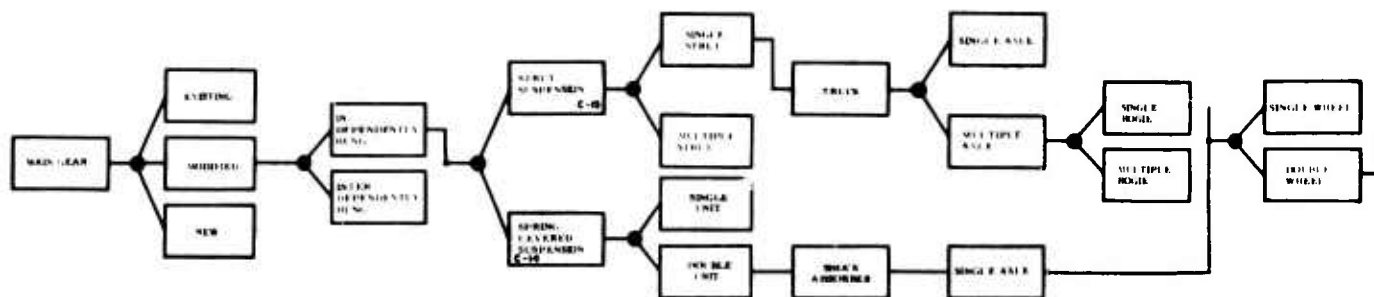
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SCALE: NONE		10 OCTOBER 1978	SHEET OF 8





DRC DYNAMICS RESEARCH CORPORATION 80 CONCORD STREET WILMINGTON, MA 01897			
DECISION TREE-AMST AVIONICS (INFO PRCS)			
SIZE J	CODE IDENT CHRT	DRAWING NO 1100	REV B
SCALE NONE		NO. OCTOBER 1978	SHEET 1 OF 1





GUIDELINES
APPENDIX C
TASK-ORIENTED APPROACH GUIDELINES

Maintenance action networks are prepared to reflect a conventional approach to personnel, training, and technical manuals. The conventional approach assumes 5-skill-level manning on the flightline with 3-skill-level helpers. These personnel are supported with conventional training and conventional technical manuals. A major system level alternative considered during this demonstration was a task-oriented approach. This assumes primarily 3-level skills on the flightline supported with task-oriented training and task-oriented technical manuals. In order to evaluate this option, the maintenance action networks had to be updated to reflect direct impact of such an approach. This section describes the conservative actions taken and rationale used to accomplish this update.

The action is described and the rationale for each action then follows in parentheses. The rationale has been substantiated by a thorough review of the literature which addresses the implications of the task-oriented approach. The percentages used are representative of conclusions found in the literature.

1. Reduce the times for flightline cannot-duplicate, troubleshoot, and maintain an aircraft by 10 percent each. (Proceduralized aids reduce maintenance times.)
2. Reduce flightline probability of cannot-duplicate by 50 percent and reduce the number cannot-duplicate actions accordingly. (Proceduralized aids will increase possibility of time diagnosis.)
3. Increase MFHBMA, as appropriate, based on action (2) above.
4. Reduce shop probability of cannot duplicate by 50 percent and reduce the number of flightline remove and replace actions accordingly. (Proceduralized aids reduce false removals.)
5. Increase the number of flightline cannot-duplicate

actions by the same number of action (4) to reflect early cannot-duplicate determination. (Proceduralized aids reduce false removals.)

6. Retain personnel quantity and AFSC skills, but modify skill levels as follows:
 - a. Assure that one 413X1 is always a 5-level to provide supervision.
 - b. Assure that all shop personnel called to flightline are 5-level (no reduction in shop skills is assumed for this study).
 - c. Set all flightline specialists performing cannot-duplicate, troubleshooting, and remove and replace tasks at the 3-level (proceduralized aids allow jobs to be performed by lesser skills).
 - d. For maintain-on-aircraft actions and each AFSC involved, require one specialist at 5-level and all others of the same AFSC at the 3-level. (Maintain-on-aircraft is assumed to be a more difficult and complex action. Therefore, skills cannot be reduced.)

APPENDIX D

SAMPLE RMCM REPORTS STANDARD STATION-KEEPING EQUIPMENT

REPORT NO. 1 --- SYSTEM COST									

PIUP = 15 YEARS BASE YEAR - 1978									
ORIGINAL - AMST STATION KEEPING EQUIPMENT COST DATA - STANDARD									
PERTURBED - NOCHANGE									
	ORIGINAL		PERTURBED		DIFFERENCE				
	COST	% LCC	COST	% LCC					
RC - RECURRING									
CS - SUPPORT	52,950,152.5	63.470%	52,950,152.5	63.470%	0.	0.			
CO - OPERATION	0.	0.	0.	0.	0.	0.			
NRC - NON-RECURRING									
CPD - B & D	0.	0.	0.	0.	0.	0.			
CSI - SYSTEM INVESTMENT	18,685,890.0	22.398%	18,685,890.0	22.398%	0.	0.			
COI - SUPPORT INVESTMENT	11,788,884.3	14.131%	11,788,884.3	14.131%	0.	0.			
CDP - DISPOSAL	0.	0.	0.	0.	0.	0.			
LCC - TOTALS	83,424,927.0	100.000%	83,424,927.0	100.000%	0.	0.			

REPORT NO. 2 -- EXPANDED NON-RECURRING COSTS (MRC)

ORIGINAL - AMST STATION KEEPING EQUIPMENT COST DATA - STANDARD
PERTURBED - NOCHANGE

	ORIGINAL		PERTURBED		DIFFERENCE
	COST	% LCC	COST	% LCC	
RC - RECURRING.....	52,950,152.5	63.470Z	52,950,152.5	63.470Z	0.
PIUP - 15 YEARS					
CDP - DISPOSAL.....	0.	0.	0.	0.	0.
MRC - NON-RECURRING					
CPD - R & D.....	0.	0.	0.	0.	0.
CSI - SYSTEM INVESTMENT					
CPP - PROCUREMENT.....	18,685,890.0	22.398Z	18,685,890.0	22.398Z	0.
CPM - PROJECT MANAGEMENT.....	0.	0.	0.	0.	0.
CPI - SUPPORT INVESTMENT					
CPTI - MAINTENANCE TRAINING.....	0.	0.	0.	0.	0.
CSPI - SPARES.....	11,625,288.5	13.935Z	11,625,288.5	13.935Z	0.
CDBI - SEA DEPT.....	0.	0.	0.	0.	0.
CSEI - SEA FIELD.....	0.	0.	0.	0.	0.
CSWI - SOFTWARE ACQUISITION.....	0.	0.	0.	0.	0.
CJGI - MAINTENANCE MANUALS.....	163,146.3	0.196Z	163,146.3	0.196Z	0.
CIMI - INVENTORY MANAGEMENT.....	449.3	0.001Z	449.3	0.001Z	0.
CFAI - FACILITIES.....	0.	0.	0.	0.	0.
LCC - TOTALS.....	83,424,927.0	100.000Z	83,424,927.0	100.000Z	0.

REPORT NO. 3 -- EXPANDED RECURRING COSTS (RC)

ORIGINAL - AMST STATION KEEPING EQUIPMENT COST DATA - STANDARD
PERTURBED - NOCHANGE

	ORIGINAL		PERTURBED		DIFFERENCE
	COST	% LCC	COST	% LCC	
NRC - NON-RECURRING.....	30,474,774.3	36.530%	30,474,774.3	36.530%	0.
CDP - DISPOSAL.....	0.	0.	0.	0.	0.
RC - RECURRING (FOR PIUP = 15 YEARS)					
CO - OPERATION					
CFL - FUEL.....	0.	0.	0.	0.	0.
CUP - PERSONNEL					
CAC - AIRCREW.....	0.	0.	0.	0.	0.
COO - OTHER OPERATIONS.....	0.	0.	0.	0.	0.
CS - SUPPORT					
COM - ON-EQUIPMENT MAINTENANCE.....	8,191,877.9	9.819%	8,191,877.9	9.819%	0.
CSM - INTERMEDIATE MAINTENANCE.....	6,809,978.6	8.163%	6,809,978.6	8.163%	0.
CPT - TRAINING.....	2,919,809.4	3.500%	2,919,809.4	3.500%	0.
CSP - SPARES.....	4,812,479.3	5.769%	4,812,479.3	5.769%	0.
CDB - DEPOT MAINTENANCE.....	29,995,337.0	35.955%	29,995,337.0	35.955%	0.
CSE - SUPPORT EQUIPMENT.....	0.	0.	0.	0.	0.
CSW - SOFTWARE.....	0.	0.	0.	0.	0.
CJG - MAINTENANCE MANUALS.....	183,539.8	0.220%	183,539.8	0.220%	0.
CIM - INVENTORY MANAGEMENT.....	37,130.4	0.045%	37,130.4	0.045%	0.
LCC - TOTALS.....	83,424,927.0	100.000%	83,424,927.0	100.000%	0.

RECURRING COST ELEMENTS (PER YEAR)

ID	COM	Σ RCV	CSM	Σ RCV	CPT	Σ RCV	CSP	Σ RCV	CDR	Σ RCV	CJG	Σ RCV	CIW	Σ RCV	TOTAL
	537,295.5	346,828.5	185,645.9	320,831.9	1,999,689.1	11,635.9	2,165.9	3,404,092.8							
	15,221	9,825	5,259	0.089	56,648	0.330	0.061	96,433							
	8,829.7	107,170.1	9,008.0	0.	0.	600.1	309.4	123,917.3							
	0.250	3,036	0.255	0.	0.	0.017	0.009	3,567							
	546,125.2	453,998.6	194,654.2	320,831.9	1,999,689.1	12,236.0	2,475.4	3,530,010.2							
	15,671	12,861	5,514	9,089	56,648	0.347	0.070	100,000							

OTHER RECURRING COSTS -- CSE.....

TEST STATION/TEST DRAWER (CSM).....	0.
TEST STATION/TEST DRAWER (CPT).....	0.
CDR OVERHAUL.....	0.
CSM.....	0.
C/L.....	0.
CAC.....	0.
COO.....	0.

TOTAL RCY.....	3,530,010.2
	100,000

NON-RECURRING COST ELEMENTS

[illegible]

REPORT NO. 5 -- COSTS BY LRU CONTRIBUTIONS

RECURRING COST ELEMENTS (PER YEAR)

OUTPUT FILE - AMST STATION KEEPING EQUIPMENT COST DATA - STANDARD

ID	COM	CSM	CPT	CSP	CDR	CEM	TOTAL
--	---	---	---	---	---	---	----
DAM251	29,585.3	9,954.8	5,854.6	9,606.5	80,718.5	309.4	136,029.1
DAM252	211,687.6	120,945.7	65,381.6	205,553.9	1,617,676.3	0.009	2,221,554.6
DAM253	283,185.3	212,115.4	111,389.0	102,245.7	284,294.3	0.009	62,933
DAM254	7,481.3	2,655.5	1,977.8	1,980.7	9,610.7	0.009	28,146
DAM255	510.1	22.9	97.0	100.8	1,031.6	0.009	2,071.8
DAM256	4,335.8	1,111.2	848.8	1,336.8	6,267.3	0.009	14,209.3
DAM257	510.1	22.9	97.0	7.5	90.6	0.009	1,037.5
DAM258	8,829.7	107,170.1	9,008.0	0.000	0.000	0.009	125,317.2
	0.250	3.036	0.255	0.000	0.000	0.009	3,550
	546,125.2	453,998.6	194,634.0	320,831.9	1,999,689.1	2,475.4	3,517,774.2
	15,471	12,861	5,514	9,089	56,648	0.070	99,653

OTHER RECURRING COSTS -- CSE

CSM	0.
CJ6	12,236.0
CFL	0.
CAC	0.
COO	0.
TEST STATION/TEST DRAWER (CSM)	0.0
TEST STATION/TEST DRAWER (CPT)	0.0
CDR OVERHAUL	0.

TOTAL RCT..... 3,530,010.2
100,000

NON-RECURRING COST ELEMENTS

ID	CSPI	Σ MRC	CPP	Σ MRC	CIMI	Σ MRC	TOTAL
0AN251	424,774.2	1,394	1,863,000.0	6,113	56.2	0.000	2,287,830.4
0AN252	7,593,069.9	26,916	7,652,000.0	26,413	56.2	0.000	15,045,126.0
0AN253	3,273,665.2	10,742	5,589,000.0	18,340	56.2	0.000	8,862,721.4
0AN254	88,206.9	0.289	1,204,740.0	3,953	56.2	0.000	1,293,003.0
0AN255	25,481.7	0.084	1,086,750.0	3,566	56.2	0.000	1,112,287.9
0AN256	215,188.6	0.706	1,409,670.0	4,626	56.2	0.000	1,624,914.8
0AN257	1,892.9	0.006	80,730.0	0.265	56.2	0.000	82,679.1
0AN258	0.	0.	0.	0.	56.2	0.000	56.2
0AN259	0.	0.	0.	0.	0.000	0.000	0.000
OTHER NON-RECURRING COSTS -- CPTI	11,622,279.5	38,137	18,685,890.0	61,316	449.3	30,308,618.8	99,455
CDNI	0.	0.	0.	0.	0.	0.	0.
CSEL	0.	0.	0.	0.	0.	0.	0.
CSWI	0.	0.	0.	0.	0.	0.	0.
CJGI	0.	0.	0.	0.	0.	0.	0.
CFAL	0.	0.	0.	0.	0.	0.	0.
CRD	0.	0.	0.	0.	0.	0.	0.
CPH	0.	0.	0.	0.	0.	0.	0.
SPRTS	0.	0.	0.	0.	0.	0.	0.
WMC	0.	0.	0.	0.	0.	0.	0.
TOTAL MRC	30,474,774.3	100,000					

REPORT NO. 6 -- RELIABILITY, MAINTAINABILITY, AND AVAILABILITY BY SUBSYSTEM

OUTPUT FILE - AMST STATION KEEPING EQUIPMENT COST DATA - STANDARD

SUBSYS	MEMBMA	MTTR		MTTR/KPH		MMH/KPH		AVAIL	SUBSYSTEM LCC CONTRIBUTION	
		FLIGHT	SHOP	FLIGHT	SHOP	FLIGHT	SHOP		FLIGHT	SHOP
DAN250	26.30	2.985	1.853	113.506	70.441	178.388	118.920	0.89806	11,798,819.4	73,649,952.0
DAN250	78.00	0.300	2.500	3.846	32.051	3.846	32.051	0.99617	346,666.0	1,790,161.1

REPORT NO. 7
MANPOWER COSTS PER YEAR BY AFSC'S AND SUBSYSTEMS SUPPORTED

OUTPUT FILE - AMST STATION KEEPING EQUIPMENT COST DATA - STANDARD
ANNUAL BASE FLYING HOURS (ABFH) = 21043.80
NUMBER OF BASES (NB) = 6
PERCENT OF TOTAL LABOR DEVOTED TO DIRECT LABOR (EFF) = 60.00%

AFSC	SUBSYS	LOADED LABOR RATE (LLR M)	DIRECT MMH/FM FLIGHTLINE (FMMH M/M)	TOTAL LABOR FLIGHTLINE (MURF M/M)	DIRECT MMH/FM SHOP (SMMH M/M)	TOTAL LABOR SHOP (MURS M/M)	TOTAL LABOR	TOTAL COST
32831		7.779271						
	DAM250		0.05647	1980.624	0.04848	1700.320	3680.943	240,938.5
	DAM250		0.00385	134.896	0.	0.	134.896	8,829.7
	TOTAL		0.06032	2115.520	0.04848	1700.320	3815.841	249,768.2
32851		12.759271						
	DAM250		0.11351	3980.986	0.07044	2470.566	6451.552	415,042.7
	DAM250		0.	0.	0.03205	1124.135	1124.135	107,170.1
	TOTAL		0.11351	3980.986	0.10249	3594.701	7575.686	722,232.8
53153		12.759271						
	DAM250		0.00841	294.987	0.	0.	294.987	28122.73
	TOTAL		0.00841	294.987	0.	0.	294.987	28122.73

REPORT NO. 8A

SPARES REQUIREMENTS -- INVESTMENT

OUTPUT FILE - AMST STATION KEEPING EQUIPMENT COST DATA - STANDARD

NUMBER OF BASES (NB) = 6
 ANNUAL PEAK BASE FLYING HOURS (PBHM) = 50116.80
 EXPECTED BACK ORDER (EBO) = 0.10

DEPOT REPAIR CYCLE TIME (DRCT) = 0.17 YRS.
 BASE REPAIR CYCLE TIME (BRCT) = 0.13 YRS.

LRU	SHOP SPARES		DEPOT SPARES		UNIT COST		COST OF LRU SPARES		COST OF SRU SPARES		TOTAL COST
	LRU (STKL)	SRU (STKS)	LRU (DPL)	SRU (DPLS)	LRU (UC)	SRU (UCSRU)	SHOP (LRUSS)	DEPOT (LRUDS)	SHOP (SRUSS)	DEPOT (SRUDS)	
BAN251	1	6	9.28353	3.09451	6000	1000.00	6,000.0	55,701.2	6,000.0	3,094.5	70,795.7
BAN252	1	1	48.69408	35.42681	24000	2000.00	24,000.0	1,168,658.0	2,000.0	70,853.6	1,265,511.6
BAN253	1	1	26.07214	86.46846	18000	666.67	18,000.0	469,298.6	666.7	57,645.6	545,610.9
BAN254	1	2	1.70732	1.24492	3880	1293.33	3,880.0	6,624.4	2,586.7	1,610.1	14,701.1
BAN255	1	0	0.21341	0.	3500	1166.67	3,500.0	747.0	0.	0.	4,247.0
BAN256	6	2	0.99593	0.71138	4540	1513.33	27,240.0	4,521.5	3,026.7	1,076.6	35,864.8
BAN257	1	0	0.21341	0.	260	260.00	260.0	55.5	0.	0.	315.5
BAN253	1	0	0.	0.	0	0.	0.	0.	0.	0.	0.
TOTAL	13	12	87.17984	126.94608	60180	7900.00	82,880.0	1,705,606.1	14,280.0	134,280.4	1,937,066.6

TOTAL ALL BASES..... 11,622,279.4
 OTHER COSTS:
 SPARE PARTS (SPRTS)..... 3,009.0
 WAR RESERVE MATERIAL COST (WRMC)..... 0.
 TOTAL..... 3,009.0
 TOTAL CSPI..... 11,625,288.4

REPORT NO. 88

SPARES REQUIREMENTS PER YEAR -- REPLACEMENT

OUTPUT FILE - AMST STATION KEEPING EQUIPMENT COST DATA - STANDARD

NUMBER OF BASES (NB) = 6
ANNUAL BASE FLYING HOURS (ABFH) = 21043.80

LRU	MRTS PROB- (PM)	CONDEMNATION RATE		UNIT COST		COST OF SPARES		TOTAL COST
		LRU (FCL)	SRU (FCS)	LRU (UC)	SRU (UCSRU)	LRU (LBRUS)	SRU (SBRUS)	
DAN251	0.02610	0.01	0.05	6000.00	1000.00	1,253.0	348.1	1,601.1
DAN252	0.13690	0.01	0.05	24000.00	2000.00	26,289.5	7,969.4	34,259.0
DAN253	0.07310	0.01	0.05	18000.00	666.67	10,557.1	6,483.8	17,040.9
DAN254	0.00480	0.01	0.05	3800.00	1293.33	149.0	181.1	330.1
DAN255	0.00060	0.01	0.05	3500.00	1166.67	16.8	0.	16.8
DAN256	0.00280	0.01	0.05	4540.00	1513.33	101.2	121.1	222.8
DAN257	0.00060	0.01	0.05	260.00	240.00	1.2	0.	1.2
DAN253	0.	0.01	0.05	0.	0.	0.	0.	0.
TOTAL	0.24510	0.08	0.40	60180.00	7900.00	38,368.5	15,103.5	53,472.0
TOTAL CSP (ALL BASES) --								320,831.9

REPORT NO. 9 -- SUPPORT EQUIPMENT REQUIREMENTS/COST

OUTPUT FILE - ARST STATION KEEPING EQUIPMENT COST DATA - STANDARD

ANNUAL PEAK BASE FLYING HOURS (PRFH) = 56116.80
 NUMBER OF BASES (NB) = 6
 AVAILABLE ANNUAL OPERATING HOURS (AACH) = 2080.00

TEST STATION				INITIAL		COST OF INTER-		COST OF SOFTWARE		INVESTMENT		REPLACEMENT	
SE ID	DEMAND	REPAIR	UTIL	# PER	UNIT	SE	SE SPARES	COST/BASE	(CPUSE)	COST/BASE	(CSEI)	COST	(CSE)
	TIME	TIME	RATE	BASE	COST		COST/BASE	(CSEI)	(CSEI)	(CSEI)	(CSEI)	(CSEI)	(CSEI)
	(TSDEM)	(TSOOT)	(A)	(NSER)	(UCSE)		(CSEI)	(CSEI)	(CSEI)	(CSEI)	(CSEI)	(CSEI)	(CSEI)
8888 0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL SHOP PECULIAR SE COSTS PER BASE.....													
0													

OTHER BASE LEVEL COSTS:

COMMON SHOP BASE SE COST (MCA).....
 EQUIPMENT INDEPENDENT BASE SE COST (BPA).....
 PECULIAR AND COMMON FLIGHTLINE SE (FLA).....
 TOTAL OTHER SE COSTS (OBSEC).....

TOTAL SE COST PER BASE..... 0.

CSEI -- TOTAL NON-RECURRING SE COST (ALL BASES)..... 0
 CSE -- TOTAL RECURRING SE COST PER YEAR (ALL BASES)..... 0
 TOTAL RECURRING SE COST OVER USAGE PERIOD OF 15 YEARS..... 0
 SUPPORT EQUIPMENT LIFE CYCLE COST..... 0

REPORT NO. 10 -- COST OF TRAINING

OUTPUT FILE - AMST STATION KEEPING EQUIPMENT COST DATA - STANDARD

ANNUAL BASE FLYING HOURS (ABFH) = 21043.80
NUMBER OF BASES (NB) = 6

AFSC	TTS COURSE LENGTH WEEKS (WKR)	TTS COST/ AFSC (CTTS)	OJT COST/ AFSC (COJT)	MANPOWER REQUIREMENTS (MU)	ANNUAL TURNOVER RATE (TRS)	TOTAL COST
32851	0.	0.	2,512.0	3,94567	0.254	3,178.3
32831	30.00	19,734.5	0.	1,98742	0.676	29,127.9
53153	0.	0.	2,834.0	0.15384	0.246	136.1

TOTAL COST PER BASE..... 32,442.3
TOTAL CPT (ALL BASES)..... 194,654.0
TOTAL RECURRING CPT (PIUP = 15 YEARS)..... 2,919,809.5
NON-RECURRING INITIAL CADRE COST (CPTI)..... 0.
LIFE CYCLE TRAINING COST..... 2,919,809.5

APPENDIX E
PRELIMINARY TASK IDENTIFICATION MATRIX

The Preliminary Task Identification Matrix (PTIM) is designed for the purpose of identifying the maintenance task requirements for each item on the equipment list and noting at what level (organizational, intermediate, depot) the task is carried out. The sources of data for developing the matrix are many and varied. Where the matrix is being developed for a new system that is still under development, the analysis has to depend heavily on the systems documentation that is required by the Air Force systems engineering management procedure. When the system for which the PTIM is being developed already exists, the following documents can be utilized:

- Technical Orders and Manuals (TOs and TMs)
- Engineering Reports
- Standard Operating Procedures
- Parts Inventories
- Special Tools and Test Equipment Manuals
- Illustrated Parts Breakdowns
- Other Records

In addition to the above, valuable information can be obtained through interviews with knowledgeable maintenance personnel who are familiar with the equipment. In our case, it is anticipated that TOs and TMs and interviews with knowledgeable and experienced maintenance personnel will be the main source of information for the completion of the PTIM. It should be kept in mind that PTIM is just that, i.e., preliminary or first cut statements of the total set of maintenance tasks that are performed on the system. It is, therefore, subject to refinement and greater detail as the ISD/JGD process develops.

It is obviously critical to identify all hardware items since the omission of an item will result in the omission of tasks and hence they will not be represented in the JGM and

training. The inputs for equipment identification as specified in AFHRL-TR-73-43 (I & II) are as follows:

1. Group Assembly Parts List, Numerical Indexes, and the S M & R codes.
2. Optimum Repair Level Analysis.
Level of Repair Analysis in compliance with MIL-STD-1390 (Navy).
4. Provisionary Lists.
5. End Item Maintenance Sheets or Maintenance Sheets system documentation.
6. Technical Orders and Manuals.

As a minimum, the preparation of the PTIM requires a Group Assembly Parts List or an Illustrated Parts Breakdown and the associated Source, Maintenance, and Recoverability codes. The format for the PTIM is essentially as shown in Figure E-1. The column and row headings are defined as follows:

Maintenance Function

- | | | | |
|----|-----------|---|--|
| 1. | adjust | - | to manipulate the equipment in some manner so as to bring it to some specified position or state--usually to bring it from some out-of-tolerance condition to an in-tolerance condition. |
| 2. | align | - | to bring into precise adjustment or correct relative position by lining up. |
| 3. | calibrate | - | using special measurements or comparison with a standard, to determine the accuracy, deviation, or variation in a piece of equipment and to correct where necessary. |

4. check out - to perform specific operations to verify operational readiness of the equipment--to test.
5. troubleshoot - to isolate the source of a malfunction or failure to an item whose parts are replaceable or repairable.
6. clean - to wash, scrub, or apply solvents to remove dirt, corrosion, or grease.
7. disassemble/assemble - to remove and replace the parts of an item for purposes of inspection, cleaning, repair, or replacement.
8. inspect - to perform a visual, auditory, or tactile examination or check for specific conditions in order to determine the serviceability of an item by comparing its physical and mechanical characteristics with some standard.
9. lubricate - to put lubrication on specific locations.
10. operate - to control equipment in order to achieve the intended function.
11. remove/replaced - to interchange an unserviceable item with a serviceable one.
12. repair - to restore an item to operable condition by means other than total replacement of a part.
13. service - to perform operations required periodically such as replenish consumable supplies, to keep an item in proper operating condition.

Whereas in the format recommended in AFHRL-TR-73-43 (I & II) checkout/troubleshoot is listed as one maintenance function,

they probably should be separated, as one can occur without the other especially in the case of scheduled maintenance.

Systems Hardware Item

The equipment items are listed in the row headings. The titles that are being used in CHRT (e.g., brakes/anti-skid) are adequate for initial efforts at the PTIM; however, at some point, these pieces of equipment must be broken down into finer detail. A simple identification such as Main Landing Gear - Mechanical Parts is not sufficient. The greater detail can be obtained from the Group Assembly Parts List or from the IPB.

Code-Reference Designator

The codes showing subordination should be as specified in MIL-M-008910A (AS) and the codes as well as the reference designator should follow the guidelines suggested in AFHRL-TR-73-43 (I & II). However, it is suggested that there also be a code column carrying the DRC code designator (e.g., GLC-173) since this will facilitate the cross-checking of data within the CDB.

Found in Troubleshooting

A check will be placed in this column when, if the hardware item malfunctions, the malfunction is uncovered by the troubleshooting of a superordinate hardware item. The items checked are those that are replaced or repaired as the result of a particular troubleshooting routine.

One further departure from the PTIM format presented in AFHRL-TR-73-43 (I & II) is suggested. The matrix cells are divided diagonally so that in each cell the notation of level of maintenance can be entered and, when the PTIM is annotated, the head, book, joint notation can also be entered. However, this results in an unnecessarily cluttered display, and a separate matrix for both these notations would be better despite the added pieces of paper.

The cell entries for the PTIM are as follows:

- No maintenance task of this type is performed on the hardware item.
- O A maintenance task of this type is performed at the organizational level.
- I A maintenance task of this type is performed at the intermediate level.
- D A maintenance task of this type is performed at the depot level.
- O A maintenance task of this type is performed at both the organizational and intermediate levels.

PTIMs of several detail levels follow. These were derived from a PTIM for the entire landing gear which is not shown. A PTIM for those hardware items removed and order of removal for the subject task is provided in Figure E-2. Finally, a detailed PTIM is provided in Figure E-3.

FOUND IN TROUBLESHOOTING	CODE	SYSTEM HARDWARE ITEM	DRC CODE	REFERENCE DESIGNATOR	MAINTENANCE FUNCTION													NOTES
					ADJUST	ALIGN	CALIBRATE	CHECK OUT	TROUBLESHOOT	CLEAN	DISASSEMBLE/ASSEMBLE	INSPECT	LUBRICATE	OPERATE	REMOVE/REPLACE	REPAIR	SERVICE	
1	7	Wheel & Tire Assembly	GLC170	C-141														
		Tire																
		Wheel																
		Bearings (2 ea.)																
		Grease Retainers (2 ea.)																
		Felt Seal 2 ea.																
		Retainer Rings (2 ea.)																
		Snap Ring (Inner) (1)																
		Lock Ring (1)																
		Axle Nut (1)																
		Corner Pin (1)																
		Stud Detector (1)																
		Screen (3 ea.)																
		Hub Cap (1)																
		Snap Ring (1)																
		Nut Lock (1)																
		Valve Core (1)																
		Valve Cover (1)																

Figure E-2 LANDING GEAR DETAILED PTIM (IN ORDER OF REMOVAL - WHEEL, TIRE, AND BRAKE ASSEMBLY)

Figure E-2 (concluded)

FOUND IN TROUBLESHOOTING	CODE	SYSTEM HARDWARE ITEM	DRC CODE	REFERENCE DESIGNATOR	MAINTENANCE FUNCTION													NOTES
					ADJUST	ALIGN	CALIBRATE	CHECK OUT	TROUBLESHOOT	CLEAN	DISASSEMBLE/ASSEMBLE	INSPECT	LUBRICATE	OPERATE	REMOVE/REPLACE	REPAIR	SERVICE	
1		Landing Gear System																
1	1	Main Landing Gear																
1	1	Mechanical Parts																
1	1	Landing Gear Assembly																
1	1	Center Pin																
1	1	Nut																
1	1	Washer																
1	1	Washer																
1	1	Torque Link Assembly																
1	1	Star Washer																
1	1	Nut																
1	1	Bolt																
1	3	Brake/Air Seal																
1	3	Seal Drummer																
1	3	Brakes																
1	3	Roller Drum																
1	3	Spinner (Outer)																
1	3	Spinner (Inner)																

Figure 6-3 LANDING GEAR DETAILED PRELIMINARY TASK IDENTIFICATION MATRIX (PTIM) (Task - Remove and Replace Main Landing Gear Brake)

LANDING GEAR DETAILED PRELIMINARY TASK IDENTIFICATION MATRIX (PTIM)
(TASK - REMOVE AND REPLACE MAIN LANDING GEAR BRAKE)

03/79

FOUND IN TROUBLESHOOTING	CODE	SYSTEM HARDWARE ITEM	DRC CODE	REFERENCE DESIGNATOR	MAINTENANCE FUNCTION													NOTES
					ADJUST	ALIGN	CALIBRATE	CHECK OUT	TROUBLESHOOT	CLEAN	DISASSEMBLE/ASSEMBLE	INSPECT	LUBRICATE	OPERATE	REMOVE/REPLACE	REPAIR	SERVICE	
1	7	Wheel and Tire																
1	7	M/LG Wheel																
1	7	M/LG Wheel Assembly																
1	7	Shock Ring																
1	7	Hub Cap																
1	7	Grease Retainer Ring																
1	7	Felt Grease Ring																
1	7	3 Screws (Shut Downer)																
1	7	Center Pin (Locking)																
1	7	Axle Nut																
1	7	Lock Ring																
1	7	Grease Retainer Ring																
1	7	Bearing (Overhaul)																
1	7	Sealing																
1	7	Grease Retainer																
1	7	Felt Grease Seal																
1	7	Grease Retainer																
1	7	Bearing (Inboard)																

Figure E 3 (continued)

[illegible]

APPENDIX F USER DESCRIPTION

Various types of user descriptions are discussed in AFHRL-TR-73-43. Initially, the Air Force would provide the technical manual developer with a preliminary user description, a statement of the type of maintenance technician expected to be working on the system. It describes the technician in terms of aptitudes, experience, and job related skills and knowledges. At the same time the Air Force would specify an existing military population most analogous to the expected technical manual users. The contractor would then assess this population to determine differences between the statement of characteristics listed in the preliminary user description and those of the analogous population. This assessment would eventually result in a modified user description, a more complete and realistic statement of the technical manual user.

The resources were not available during this study to implement this procedure. Instead a description of the type personnel who might have been assigned to the AMST was prepared and entitled an estimated user description. The technical manual sample was prepared with this population in mind. The sample estimated user description used is provided as follows.

ESTIMATED USER DESCRIPTION

The Estimated User Description (for the 431X2 career field) is that of personnel being trained with the use of proceduralized technical manuals and task-oriented training procedures. The requirements are as follows:

1. Aptitude: A minimum of 50 be obtained in Mechanical, through the use of Armed Forces Vocational Aptitude Battery (ASVAB) scoring criteria for USAF personnel.
2. Reading Level: A reading level be obtained of more than 60 using the same scoring criteria.
3. Aptitude: Average (ASVAB)

4. Average Time in Service - 18 months
5. Prior Indirect Training - 3 months BMT
Prior Direct Training - Half of the personnel have the required AFSC and 30 days OJT. The other half have eight weeks task-oriented training.
6. Prior Military Work Experience - Half have 2 years experience with the C-130 aircraft. The other half have no military work experience.

APPENDIX G
TECHNICAL MANUAL/TRAINING TRADE-OFF GROUND RULES

A set of ground rules which direct the technical manual/training trade-off is also developed through the integrated task analysis. These ground rules are similar for all systems but must be reviewed and modified for the particular weapon system and user of interest. These ground rules are initially used in developing the ATIM and continuing the tech manual/training trade-off to lower levels. It is important to note that tasks are covered in both manuals and training but the emphasis is different. For example, the need for test equipment and limits to be observed may be presented in a manual, but the use of test equipment is taught. Simple ground rules which are particularly applicable to task-oriented training and proceduralized manuals follow.

Put into Technical Manuals

- Behavioral sequences that are complex and long and which would put a burden on memory
- Behavioral sequences which would require extremely lengthy training/practice periods to produce sufficiently reliable performance
- Tasks that utilize reference information such as tables, graphs, flow charts and schematics, tolerances, etc.
- Tasks that are aided by the presence of illustrations
- Tasks that involve comple
- Tasks that involve complex discriminations or where similarity of cues cause confusion
- Tasks that are performed under stressful conditions that might degrade performance - except time stress
- Infrequently performed tasks.

- Tasks where the probability of error is high and errors are costly.
- Tasks with branching step structures.
- Where low skill level personnel are used.
- Where turnover is high.
- Where procedures change from time to time.

Put into Training:

- Tasks that are not easily described in book form.
- Tasks that are not easily learned on the job (unless they can be put into tech manuals).
- Tasks that need a great deal of practice for acceptable proficiency.
- Tasks where there is little room for error and the errors are costly.
- Tasks which are performed frequently on the job.
- Tasks requiring high speed - where the rate stimulus inputs are high and response outputs are high.
- Tasks that are performed under stress - especially time stress.
- Where environmental constraints interfere with or prohibit use of aids.
- Tasks performed by a large proportion of individuals in a given specialty.

APPENDIX H
TASK ANALYSIS WORK SHEETS*

* Task analysis worksheet samples are provided in this appendix. These cover two tasks: remove brake and install brake. These tasks are accomplished after the wheel and tire have been removed.

TASK ANALYSIS WORK SHEET

Task #	Task Description	Notes & Cautions	Tools & Equipment	Training and JPA Implications
B	Remove Brake			
1.	Remove outer spacer (19) from axle	B-1 Initial conditions: Aircraft is jacked up with wheel and tire assembly removed.		
2.	Request hydraulic specialist to 1) depressurize #3 hydraulic system per T.O. 1C-141A-2-3JG-1 2) disconnect hydraulic line (4) from swivel fitting (3) 3) cap fitting and plug line Separate torque link from brake With screwdriver, bend lock tab on star washer (32) out of the indent on nut (33)			
3.	a)	B-3A Tab must be completely out of indent or nut won't loosen. May require hammer & punch to get tab completely out of the way.	screwdriver hammer punch	B-3 Trg. Whole procedure of torque link removal as there are contingencies difficult to cover in JPA JPA Listing basic steps without attempting to include alternate procedures on basis of contingencies.
b)	With spanner wrench, loosen nut (33) 3 or 4 turns		spanner wrench	
c)	Tap nut (33) with hammer to free bolt (30)		hammer	
d)	By hand, remove nut (33), star washer (32), and bolt (30)	B-3d If bolt sticks, reinstall nut a few turns and rap with hammer again. Do not hit end of bolt or else threads may be damaged.		
e)	Set torque link out of the way by lifting it up and back			

Task #	Task Description	Notes & Cautions	Tools & Equipment	Training and JPA Implications
B4.	With assistant, remove brake (20) from axle	B-4 Caution: Brake must be eased off (not allowed to drag) so as to protect bearing surfaces on axle. Warning: Weight of brake 250 lbs. Warning: Fingers are in some jeopardy		B-4 Trg. Practice on brake removal with explanation of importance of protecting bearing surfaces
5.	Use brake dolly, transport old brake to the service chariot	B-5 Note: Usually new brake would be picked up from chariot at this point in anticipation of brake installation	brake dolly	Trg. Proper method of brake removal to avoid injury to back or fingers
6.	Remove inner spacer (20) from axle			

END OF TASK

Task #	Task Description	Notes & Cautions	Tools & Equipment	Training and JPA Implications
C	Install Brake			
1.	Using solvent, clean axle (22) and spacers (19, 21)	C-1 Inspect spacers for wear or damage	solvent P-D-680	C-1 Trg. Demonstration with examples of adequate and inadequate cleaning
a)	Clean axle and spacers thoroughly with solvent			
b)	Wipe off any excess solvent			
2.	Apply thin film of grease to axle	C-2 Note: Spacers are not greased, just axle	grease MIL-G-81322	C-2 Trg. Demonstration required
3.	Install inner spacer (21) on axle (make sure it is all the way on)	C-3 Flared end goes on first. Frequently requires turning and jiggling to insure that spacer is all the way on		C-3 Trg. Training of technique to get spacer all the way on and demonstration of visual cues to indicate satisfactory execution
4.	Get new brake and completely remove any service tags and wire attachments	C-4 Brake dolly should be used for transport Warning: Possible injury from weight of brake. Any lifting must involve two people.	brake dolly	C-4 Trg. Safety procedures in lifting and handling
5.	Align rotor and stator discs of brake			C-5 Trg. Must be trained—too difficult to describe in JPA
6.	With assistant, install brake onto axle	C-6 Brake must be fully abutted to shoulder on inner spacer Caution: Brake must be eased on so as to avoid damage to bearing surfaces on axle Warnings: Weight of brake, 250 lbs. and hazard to fingers while handling	screwdriver	C-6 Trg. Visual cues that indicate satisfactory task performance Trg. Explanation of importance of protecting bearing surfaces Trg. Safety precautions in lifting and handling

Task #	Task Description	Notes & Cautions	Tools & Equipment	Training and JPA Implications
C7.	Install torque link (31)			
a)	Align torque link with brake	C-7a Bolt holes in link and brake must line up exactly		C-7 Trg. Entire task must be thoroughly trained
b)	Install bolt (30)	C-7b Direction of bolt insertion is critical; threaded end must point toward opposite tire. Flat edge of bolt head must line up with alignment bar on brake housing. (If not lined up, bolt cannot be all the way through and this creates a hazardous condition.) Threaded end of bolt will protrude 1/32 inch from brake housing when installed correctly. (Bolt may have to be tapped with hammer so it will extend the 1/32 inch)	hammer	
c)	install star washer (32) on end of bolt (30)	C-7c Hole in washer conforms to the shape of bolt end so it can be positioned only in a certain position (i.e., washer cannot rotate on bolt end). If washer won't stay in place on end of bolt, a little grease can be put on brake housing so washer can adhere. (But make certain bolt is protruding sufficiently.)		JPA Indication of proper protrusion can be depicted by the thickness of a line or by the separation between two thin lines.

Task #	Task Description	Notes & Cautions	Tools & Equipment	Training & JPA Implications
C7d)	Install nut (33), tightening it by hand	C-7d Caution: Make sure star washer remains properly positioned on end of bolt		
e)	Using spanner wrench, tighten nut (33)	C-7e Tighten to remove all end play May need to use hammer & punch to tighten	spanner wrench (hammer & punch)	
f)	Line up a tab on star washer (32) with an indent on nut (33) by tightening nut slightly			
g)	Using screwdriver, bend tab on star washer (32) part way into nut indent		spanner wrench (hammer & punch) screwdriver	
h)	Using hammer & punch, seat tab into indent		hammer & punch	
8.	Request hydraulic specialist to:			
a)	Remove cap from fitting (3)			
b)	and plug from line (4)			
	Connect line (4) to swivel fitting (3)			
c)	Bleed brake per T.O. 1C-141A-2-3JG-2			
d)	Service hydraulic system per T.O. 1C-141A-2-2JG-5			
e)	Check adjustment of brake and leak check brake per T.O. 1C-141A-2-12JG-6			
9.	Engage parking brake			
a)	Depress upper portion of rudder pedals (40) full forward			
b)	Pull parking brake handle (39) out			
c)	Release rudder pedals (40)			
10.	Install outer spacer (19)	C-10 Flared end away from brake		

END OF TASK

APPENDIX I
TEST EQUIPMENT AND TOOL USE FORMS

The test equipment and tool use forms are initiated early during the integrated task analysis. Initially, they are used to identify the test equipment and tools required and to describe their functions. Finally, the form is used to document the technical manual and training trade-off for test equipment and tools. Those prepared for the torque wrench and one type of spanner wrench are included.

TEST EQUIPMENT AND TOOL USE FORM

Torque Wrench
 PN 7227089-10

Equipment Nomenclature
 Equipment Number

Date
 Analyst

JPA Training Trade-Off		
Functions	Information to be included in JPA	Information to be given in Training
1. Calibrated to 960 inch-pounds - to torque axle nut 2. Calibrated to 480 inch-pounds - to torque axle nut after checking lock ring 3. Calibrated to 600 inch-pounds (rectangular head) to check lock ring	1. Steps in tightening nut and ring 2. Steps in aligning lock ring holes	1. How to use torque wrench 2. Importance of keeping lock ring in place while tightening nut 3. Alignment of lock ring holes

TEST EQUIPMENT AND TOOL USE FORM

Spanner Wrench.

PN. 2559550

Equipment Nomenclature

Equipment Number

Date

Analyst

JPA Training Trade-Off	
Functions	Information to be given in Training
Used to remove and install brake torque link nut and bolt	Information to be included in JPA 1. Use spanner wrench to remove & install torque link nut 2. Directive to align lock tab from star washer with a slot in nut
	Information to be given in Training 1. Identification of wrench 2. How wrench is used to loosen & tighten torque link nut 3. How to align lock tab from star washer with slot in the nut 4. How to discriminate when end play between nut and bolt is removed

APPENDIX J
ANNOTATED TASK IDENTIFICATION MATRICES

The ATIM file is established after completion of the PTIM, user description, technical manual/training trade-off ground rules and task analysis worksheet files. These files provide the decision data necessary to prepare the ATIM; the allocation of task coverage to training or technical manuals.

The ATIM is retained in the CDB as hard copy in a format similar to the PTIM. The complete ATIM for the task - remove and replace main landing gear brake is shown.

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LANDING GEAR DETAILED ANNOTATED TASK IDENTIFICATION MATRIX (ATIM)
(TASK -- REMOVE AND REPLACE MAIN LANDING GEAR BRAKE)

6079

FOUND IN TROUBLESHOOTING	CODE	SYSTEM HARDWARE ITEM	DRC CODE	REFERENCE DESIGNATOR	MAINTENANCE FUNCTION													NOTES
					ADJUST	ALIGN	CALIBRATE	CHECK OUT	TROUBLESHOOT	CLEAN	DISASSEMBLE/ASSEMBLE	INSPECT	LUBRICATE	OPERATE	REMOVE/REPLACE	REPAIR	SERVICE	
1	1	Landing Gear System																
1	1	Main Landing Gear																
1	1	Mechanical Parts																
1	1	Landing Gear Assembly																
1	1	Center Pin		37														
1	1	Washer		38														
1	1	Washer		39														
1	1	Washer		40														
1	1	Washer		41														
1	1	Washer		42														
1	1	Washer		43														
1	1	Washer		44														
1	1	Washer		45														
1	1	Washer		46														
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1	1	Washer		98														
1	1	Washer		99														
1	1	Washer		100														

LANDING GEAR DETAILED ANNOTATED TASK IDENTIFICATION MATRIX (ATIM)
(TASK - REMOVE AND REPLACE MAIN LANDING GEAR BRAKE)

03/79

FOUND IN TROUBLESHOOTING	CODE	SYSTEM HARDWARE ITEM	DRC CODE	REFERENCE DESIGNATOR	MAINTENANCE FUNCTION													NOTES
					ADJUST	ALIGN	CALIBRATE	CHECK OUT	TROUBLESHOOT	CLEAN	DISASSEMBLE/ASSEMBLE	INSPECT	LUBRICATE	OPERATE	REMOVE/REPLACE	REPAIR	SERVICE	
1	7	Wheel and Tire		13 & 28								1			1			
1	7	MILG Wheels		13														
1	7	MILG Wheel Assembly																
1	7	Snap Ring		23														
1	7	Hub Cap		5														
1	7	Grease Retainer Ring		9														
1	7	Felt Grease Ring		1														
1	7	3 Screws (Skid Detector)		24														
1	7	Cutter Pin (Loading)		26											1			
1	7	Axle Nut		7														
1	7	Lock Ring		8														
1	7	Grease Retainer Ring		11														
1	7	Bearing (Outboard)		12														
1	7	Snapring		18														
1	7	Grease Retainer		17														
1	7	Felt Grease Seal		16														
1	7	Grease Retainer		15														
1	7	Bearing (Inboard)		14														

M - Head
B - Block
J - Joint

2 of 3

[illegible]

Figure E-3 (concluded)

APPENDIX K LEVEL-OF-DETAIL GUIDE

The level-of-detail guide is described in AFHRL-TR-73-43 as a statement of how detailed the information provided in a technical manual needs to be based on the target audience and what is known about the equipment system. It consists of a set of coverage rules stating what needs to be told the technician and how deeply the technical manual should go into each matter. One might normally expect this guide to be written for a specific subsystem and technical skill. During this effort a specific sample task within a subsystem was being addressed. As a result, the level-of-detail guide was prepared at a greater level of detail than is normally appropriate.

Level-of-Detail Guide

1. Disconnect leveler rod
Simple statement of steps as they occur in their proper code -
Example:
 "using pliers, remove the cotter pin"
 "Using wrench, remove nut"
 "Put nut and washer back on leveler rod for safe keeping"

These steps will be accompanied by a blow-up diagram which (1) shows the location of the rod and (2) details the assembly.
2. Remove valve core and deflate tire
Simple statement of steps. The appropriate tire pressure which must be reached before proceeding will be specified. The use of the valve core tool and the tire gauge will be taught through training. Cautions will be listed.
3. Remove snapring, hub cap, grease retainer ring, felt grease seal, safety wire, skid detector screws and detector, cotter pin from lock ring, and axle nut.
Simple statement of steps with suggestions to keep things in order of removal to facilitate installment. Also inspect for wear.

4. Inspect wheel for defects
The specific types of defects likely to be encountered will not be described. They will be covered in training: The JPA will only direct the technician to inspect.
5. Remove axle nut and lock ring
Simple statement. The use of the spanner wrench will be taught in training.
6. All steps up through removal of the tire are listed in a straightforward manner with accompanying illustrations. The washing, lubricating of seals, rings, etc., will be covered in training. However, the material used will be listed in the book.
7. Brake removal and installation
Steps are listed in straightforward manner. The steps dealing with the torque link will be described in somewhat more detail, especially the cues required to align/install/etc., star washer, bolt, and nut. For example, there will be information on such things as how to discern when the bolt is properly installed, when the nut is tight, etc. These steps will also be covered in training. The cautions involving brake removal and installation will be emphasized. Here again cues will be emphasized such as how much of the spacer should be showing when brake is properly installed.
8. Tire installation
The most difficult part of putting the tire back on is the alignment of the rotor and stator discs of the brake with the wheel. This will be mentioned in the book but it will be presented in training. Again, mention will be made of the cues that are visible when there is proper installation.

APPENDIX L
LCOM APPLICATION TO AMST LANDING GEAR WITH
FLIGHTLINE SUPPORT EQUIPMENT (SE)

INTRODUCTION

This section summarizes the methodology for inclusion of AGE¹ maintenance networks within the framework of AMST landing gear maintenance networks. The effort involved six steps:

1. Selection of AGE pertinent to landing gear maintenance.
2. Determination and validation of maintenance task data for the AGE.
3. Construction of AGE maintenance networks for LCOM simulation.
4. Running the simulations.
5. The correction of input data resulting from evaluation of simulation model output products and rerunning the simulation.
6. The identification of AGE and manpower requirements necessary to support AMST landing gear maintenance.

METHODOLOGY

The first step in the effort was concerned with identifying the AGE needed to support landing gear maintenance on AMST aircraft. Design decisions during the prototype phase of the study indicated that the landing gear for C-141 aircraft

¹ The acronym AGE for aerospace ground equipment as used in this section is considered synonymous with SE.

would be similar to that used for the AMST. As a result, several bases which maintain C-141 aircraft were each asked to submit a list of the AGE they used, the number of each type of unit assigned to the base, and the monthly demand rate for each of the units. From these lists, nine different units were initially identified as being pertinent to landing gear maintenance. Two of these units were later ignored in the study; the hydraulic servicing cart was dropped because it was not used for landing gear maintenance, and the hydraulic test stand was dropped because of low usage. Of the seven units selected for the study, the three powered AGE units were: the AM32A-60 Gas Turbine Generator Set, the AF/M27M-1 Hydraulic Jacking Manifold (gasoline powered), and the NF-2 Light Cart. The four non-powered AGE units were the MD-3 nitrogen servicing cart, the 35-ton axle jack, the 30-ton tripod jack, and the 70-ton tripod jack.

A trip to Charleston AFB later revealed that an extended version of the 30-ton tripod jack was used there in lieu of the 70-ton tripod jack so this change was made and data was collected accordingly.

Step two dealt with the collection and validation of maintenance task data for the selected AGE. The initial procedure was to extract the data on the AGE from ABD64-A magnetic computer tapes which are a compilation of AFTO Form 349 reports. AFHRL-TR-77-43, "Predicting Powered Support Equipment and Associated Maintenance Manpower Requirements" (Reference L-1) was used as an aid in extracting the data. Tapes for a 6-month period (from around September 1977 to April 1978) were requested from each of five bases. With the assistance of AFHRL, some data were gathered on the generator sets and light carts. It seems that only registered AGE is logged on these tapes and no data were found on the nitrogen carts. The data compiled from the ABD64-A tape extraction process were useful insofar as maintenance personnel listings and task times were concerned.

Following the extraction procedure, scheduled and unscheduled maintenance task flow diagrams were constructed for each of the AGE, both registered and non-registered. Task data such as personnel, resources, and time were entered on the diagrams using available data from the tape extraction and from experienced personnel within the Air Force and DRC. Subsequently, a visit was made to Charleston AFB in order to verify the diagrams and to fill the remaining blanks. Various maintenance shop personnel were interviewed at Charleston including those at dispatching,

gas cart servicing and repair, powered age inspection and servicing, powered age repair, and wheel and tire. The maintenance supervisors and other personnel in these shops were most helpful and informative with the net result that the task flow diagrams for all units were easily completed upon returning. Operational scenario flow diagrams were also completed at that time.

The third step involving construction of AGE maintenance networks for LCOM consisted of two applications. In the first application, the LCOM simulation was to be run using the demand rate for the AGE based upon total aircraft maintenance needs for a given base. In the second application, the AGE demand rate was based upon the particular needs of unscheduled landing gear failures for AMST aircraft. In order to achieve this, it was necessary to integrate the AGE with those of the landing gear.

The basic scheduled and unscheduled maintenance and operating networks for each of the AGE units were constructed from their associated AGE task flow diagrams and prepared in Extended Form 11 format. "Simulating Maintenance Manning for New Weapon Systems," AFHRL-TR-74-97 (Reference L-2) was used as an aid in constructing the networks. The AGE demand rates for this application (Table L-1) were determined from averaging the data received from the five bases. The assigned number of units of each type of age was determined initially by estimating the landing gear maintenance needs of a 52 AMST wing flying about 17 missions per day. This determination was further based on estimation of the downtime probabilities of the AGE and the requirement for periodic maintenance.

The second application of this step uses much the same networks as the first. However, as was noted earlier, they are integrated through their operating scenario into the AMST landing gear unscheduled maintenance networks, since the AGE demand is based upon landing gear failure rates. At present, LCOM is not specifically designed to handle the type of network construction involving SE as used here in that simultaneous landing gear failures, i.e., two failures on one aircraft, can result in multiple demands for the same resource where only one of an AGE type is actually needed. For example, while the AM32A-60 generator can support an entire aircraft, each landing gear failure will call one out. The net result is that there may appear to be a higher demand on AGE than exists in reality. A similar problem is present in the maintenance personnel area. These may be ways of getting around this difficulty, but for this specific scenario, a method has not yet been perceived,

Age Type	Number Assigned	Average Daily Demand Rate Per Unit	Average Daily Dispatches Per Age Type	60 Day*	90 Day*	180 Day*	1 Year*	2 Year*	2 Year* Painting
AM32A-60(A) Generator Set	30	1.33	40	90				8	7
AF/M27M-1 Jacking Manifold	5	.40	2			5		2	2
NF-2 Light Cart	15	.53	8		30			4	4
MD-3 Nitrogen Cart	7	.71	5		14			2	
35 Ton Axle Jack	5	.40	2		10		3		
30 Ton Tripod Jack (Normal)	6+	.17	1		12				
30 Ton Tripod Jack (Extended)	12+	.17	2		22				

+ Used in pairs for jacking aircraft

+ Used in groups of four for jacking aircraft

• The number of maintenance actions of given types scheduled for all AGE of that class over 180 day scenario.

TABLE L-1 ASSIGNMENT, DEMAND AND SCHEDULED MAINTENANCE

although an unsuccessful attempt was made. For both parts of the step, individual networks for each SE type have been constructed and placed in Extended Form 11 compatible format. Each of these SE networks was developed from maintenance flow diagrams based on the SE unscheduled and periodic maintenance requirements. The SE networks for a fixed demand rate are presented in Figures L-1 - L-6. The networks used in conjunction with the AMST landing gear failure demand are essentially the same, but without the mission call(200000) node.

In order to perform the LCOM simulation runs, the fourth step of the effort, it was necessary to build a scenario around the maintenance networks. The scenario is based upon a wing of 52 AMST aircraft in which one-third of the planes fly each day. Aircraft are preflight inspected between 0400 and 1500, takeoff between 0600 and 1700, and fly 5-hour missions. Although SE is available for use around the clock, most of the SE maintenance personnel shops operate only one shift from 0800 to 1600 (based upon Charleston AFB scheduling). This is true of AFSCs 423R5 (powered SE repair), 431Y2 (gas cart service and repair), 427X4 (welding shop), 423X0 (electrical repair) in this model. The remaining AFSCs, 423W5 (powered AGE service and inspect), 431X2 (wheel and tire) and 603X0 (dispatch are on three-shift duty. The simulation scenarios for this model are run for 180-day segments. Each of the scenarios, presented in Figures L-7 and L-8, includes mission or dispatch and periodic maintenance start times, priorities, allowable delay times and frequency of occurrence. An additional important input to the simulation is that of "18" cards for priority specifications. These cards allow for task preempting and expediting, and for overtime allocation in those shops not on three shifts. The initial simulation runs for both scenarios were made with no constraint on manpower; thus, the primary constraints became the task times required to fix the various units and the limiting number of AGE available.

The simulations, based upon landing gear demand, were run with a modified landing gear failure rate. All failures were reduced by a factor of 5; for example, the mean sorties between maintenance action (MSBA) for a 5-hour sortie of the main landing gear was reduced from 145 to 29. The purpose of this reduction was to increase simulation run turnaround times and to reduce computer processing costs by about 50 percent. While the results of this action would naturally reduce the manpower and resource needs for a 180-day period, it was decided that the main objective of the effort, which was to demonstrate the integration of AGE maintenance

		H	00010	AM32A-60 GENERATOR SET
J0101 HTOW01	J0102 D		00010 31	4 C 1D60 1TUG 1603X0
J0102 Z00000	J0103 S		00010 11	
J0103 HKEEP1	J0104 D		00010 31	30 25L 1D60
J0104 HTOW01	J0105 D		00010 31	
J0105 HSERV1	J0106 D		00010 31	3 C 1D60 1423W5
J0106 DCRMTA	J0107 D		00010 31	
J0107 CALLSA	J0108 C		00010 31	
J0108 HREADY	D		00010 31	
		H	00010	AM32A-60 60 DAY PERIODIC
J0120 HTUG01	J0121 D		00010 31	2 C 1D60 1603X0 1TUG
J0121 Z00000	J0122 S		00010 11	
J0122 H0160D	J0123 D		00010 31	200 25L 1D60 1423R5
J0123 HTUG01	D		00010 31	
		H	00010	AM32A-60 2 YEAR PERIODIC
J0130 HTUG01	J0131 D		00010 31	2 C 1D60 1603X0 1TUG
J0131 Z00000	J0132 S		00010 11	
J0132 H012YR	J0133 D		00010 31	40 25L 1D60 1423R5
J0133 HTUG01	D		00010 31	
		H	00010	AM32A-60 2 YEAR CORROSION CONTROL
J0140 HTUG01	J0141 D		00010 31	2 C 1D60 1603X0 1TUG
J0141 Z00000	J0142 S		00010 11	
J0142 HPREP1	J0143 D		00010 31	200 25L 1D60 1423R5
J0143 HTUG01	D		00010 31	
		H	AA000	AM32A-60 GEN SET UNSCHED MAINT
XCALLSA FAA000	AAA01 F	2	AA000 21	
AAA01 AAA000	AAA02 D		AA000 21	2 C 1603X0 1TUG
AAA02 TAA000	AAA03 D		AA000 21	3 25L 1423W5
AAA03 MAA000	AAA04 E	.80	AA000 21	4 25L 1423W5
AAA04 VAA000	D		AA000 21	2 25L 1423W5
AAA03 RAA000	AAA05 E	.20	AA000 21	22 25L 1423R5
AAA05 VAA001	AAA06 D		AA000 21	5 25L 1423R5
AAA06 SHOP	SAA001 D		AA000 21	
		H	AA000	AM32A-60 CHASSIS/ENCLOSURE/MOBILITY
SAA001 LAAA00	IAAA01 E	.50	AA000 21	
IAAA01 WAAA00	E	.79	AA000 23	34 25L 2423R5
IAAA01 NAAA00	PAAA00 E	.21	AA000 23	10 25L 1423R5
IAAA01 QAAA00	D		AA000 21	
PAAA00 PDEPOT	D		AA000 43	
		H	AA000	AM32A-60 ELEC PWR GEN & CONTROL
SAA001 LAAB00	IAAB01 E	.18	AA000 21	
IAAB01 WAAB00	E	.66	AA000 23	43 25L 2423R5
IAAB01 KAAB00	E	.03	AA000 23	23 25L 1423R5 1423X0
IAAB01 NAAB00	PAAB00 E	.31	AA000 23	20 25L 1423R5
IAAB01 QAAB00	D		AA000 21	
PAAB00 PDEPOT	D		AA000 43	
		H	AA000	AM32A-60 GAS TURBINE ENGINE
SAA001 LAAE00	IAAE01 E	.32	AA000 21	
IAAE01 WAAE00	E	.85	AA000 23	25 25L 2423R5
IAAE01 NAAE00	PAAE00 E	.15	AA000 23	160 25L 1423R5
PAAE00 WAAE01	D		AA000 23	30 25L 2423R5
IAAE01 QAAE00	D		AA000 21	
PAAE00 PDEPOT	D		AA000 43	

Figure L-1 AM32A-60 MAINTENANCE NETWORKS

		H	00010	NF-2	LIGHT CART	
J0401	HTOW04	J0402 D	00010 31	3	C 1NF2	1603X0 1TUG
J0402	Z00000	J0403 S	00010 11			
J0403	HKEEP4	J0404 D	00010 31	50	25L 1NF2	
J0404	HTOW04	J0405 D	00010 31			
J0405	HSERV4	J0406 D	00010 31	4	25L 1NF2	1423W5
J0406	DCRMID	J0407 D	00010 31			
J0407	CALLSD	J0408 C	00010 31			
J0408	HREADY	D	00010 31			
		H	00010	NF-2	90 DAY PERIODIC	
J0420	HTUG04	J0421 D	00010 31	3	C 1NF2	1603X0 1TUG
J0421	Z00000	J0422 S	00010 11			
J0422	H0490D	J0423 D	00010 31	160	25L 1NF2	1423R5
J0423	HTUG04	D	00010 31			
		H	00010	NF-2	2 YEAR WHEEL BEARING	
J0430	HTUG04	J0431 D	00010 31			
J0431	Z00000	J0432 S	00010 11			
J0432	H042YR	J0433 D	00010 31	40	25L 1NF2	1423R5
J0433	HTUG04	D	00010 31			
		H	00010	NF-2	2 YEAR CORROSION CONTROL	
J0440	HTUG04	J0441 D	00010 31			
J0441	Z00000	J0442 S	00010 11			
J0442	HPREP4	J0443 D	00010 31	240	25L 1NF2	1423R5
J0443	HTUG04	D	00010 31			
		H	AC200	NF-2	UNSCHEDULED MAINTENANCE	
XCALLSD	FAC200	AC201 F	5 AC200 21			
AC201	AAC200	AC202 D	AC200 21	2	C 1423W5	
AC202	TAC200	AC203 D	AC200 21	3	25L 2423W5	
AC203	MAC200	AC204 E	.90 AC200 21	5	25L 2423W5	
AC204	VAC200	D	AC200 21	2	25L 1423W5	
AC203	RAC200	AC205 E	.10 AC200 21	23	25L 2423R5	
AC205	VAC201	AC206 D	AC200 21	5	25L 1423R5	
AC206	SHOP	SAC201 D	AC200 21			
		H	AC200	NF-2	CHASSIS	
SAC201	LAC210	IAC210 E	.19 AC200 21			
IAC210	WAC210	E	.17 AC200 23	85	25L 1423R5	
IAC210	NAC210	PAC210 E	.83 AC200 23	15	25L 1423R5	
IAC210	QAC210	D	AC200 21			
PAC210	PDEPOT	D	AC200 43			
		H	AC200	NF-2	ELECTRICAL	
SAC201	LAC220	IAC220 E	.22 AC200 21			
IAC220	WAC220	E	.85 AC200 23	37	25L 1423R5	
IAC220	NAC220	PAC220 E	.15 AC200 23	52	25L 1423R5	
IAC220	QAC220	D	AC200 21			
PAC220	PDEPOT	D	AC200 43			
		H	AC200	NF-2	ENGINE	
SAC201	LAC230	IAC230 E	.59 AC200 21			
IAC230	WAC230	E	.30 AC200 23	34	25L 1423R5	
IAC230	J00000	IAC231 E	.70 AC200 21			
IAC231	NAC230	PAC230 E	.96 AC200 23	34	25L 1423R5	
IAC231	NAC231	PAC231 E	.04 AC200 23	240	25L 1423R5	
IAC231	QAC230	D	AC200 21			
PAC230	PDEPOT	D	AC200 43			
PAC231	PDEPOT	D	AC200 43			

Figure L-2 NF-2 MAINTENANCE NETWORKS

		H	00010	MD-3	NITROGEN CART	
J0501	HTOW05	J0502 D	00010 31	4	C 1MD3	1603X0 1TUG
J0502	Z00000	J0503 S	00010 11			
J0503	HKEEP5	J0504 D	00010 31	10	25L 1MD3	
J0504	HTOW05	J0505 D	00010 31			
J0505	HSERV5	J0506 D	00010 31	2	25L 1MD3	1431Y2
J0506	CALLPE	J0507 C	00010 31			
CALLPE	HRECHG	A	.33 00010 31	7	25L 1MD3	2431Y2
J0507	DCRMTE	J0508 D	00010 31			
J0508	CALLSE	J0509 C	00010 31			
J0509	HREADY	D	00010 31			
		H	00010	MD-3	90 DAY PERIODIC	
J0520	HTUG05	J0521 D	00010 31	3	C 1MD3	1603X0 1TUG
J0521	Z00000	J0522 S	00010 11			
J0522	H0590D	J0523 D	00010 31	40	25L 1MD3	1431Y2
J0523	HTUG05	D	00010 31			
		H	00010	MD-3	2 YEAR PERIODIC	
J0530	HTUG05	J0531 D	00010 31			
J0531	Z00000	J0532 S	00010 11			
J0532	H052YR	J0533 D	00010 31	50	25L 1MD3	1431Y2
J0533	HTUG05	D	00010 31			
		H	AQB00	MD-3	UNSCHEDULED MAINTENANCE	
XCALLSE	FAQB00	AQB01 F	15 AQB00 21			
AQB01	AAQB00	AQB02 D	AQB00 21	5	C 1431Y2	1603X0 1TUG
AQB02	TAQB00	AQB03 D	AQB00 21	3	25L 1431Y2	
AQB03	MAQB00	AQB04 E	.80 AQB00 21	20	25L 1431Y2	
AQB04	VAQB00	D	AQB00 21	2	25L 1431Y2	
AQB03	RAQB00	AQB05 E	.20 AQB00 21	15	25L 1431Y2	
AQB05	VAQB01	AQB06 D	AQB00 21	5	25L 1431Y2	
AQB06	SHOP	SAQB01 D	AQB00 21			
		H	AQB00	MD-3	CHASSIS	
SAQB01	LAQBA0	IAQBA0 E	.30 AQB00 21			
IAQBA0	WAQBA0	D	AQB00 23	20	25L 1427X4	
		H	AQB00	MD-3	CONTROLS & GAUGES	
SAQB01	LAQBC0	IAQBC0 E	.70 AQB00 21			
IAQBC0	WAQBC0	D	AQB00 23	100	25L 1431Y2	
IAQBC0	WAQBC1	D	AQB00 23	40	25L 2431Y2	

Figure L-3 MD-3 MAINTENANCE NETWORKS

		H	00010	M27M-1 HYDRAULIC JACK MANIFOLD
J0301	HTOW03	J0302 D	00010 31	3 C 1M27M 1603X0 1TUG
J0302	Z00000	J0303 S	00010 11	
J0303	HKEEP3	J0304 D	00010 31	30 25L 1M27M
J0304	HTOW03	J0305 D	00010 31	
J0305	HSERV3	J0306 D	00010 31	4 25L 1M27M 1423W5
J0306	DCRMTC	J0307 D	00010 31	
J0307	CALLSC	J0308 C	00010 31	
J0308	HREADY	D	00010 31	
		H	00010	M27M-1 180 DAY GAUGE CALIBRATION
J0320	HTUG03	J0321 D	00010 31	2 C 1M27M 1603X0 1TUG
J0321	Z00000	J0322 S	00010 11	
J0322	H03180	J0323 D	00010 31	160 25L 1M27M 1423R5
J0323	HTUG03	D	00010 31	
		H	00010	M27M-1 2 YEAR WHEEL BEARING
J0330	HTUG03	J0331 D	00010 31	
J0331	Z00000	J0332 S	00010 11	
J0332	H032YR	J0333 D	00010 31	40 25L 1M27M 1423R5
J0333	HTUG03	D	00010 31	
		H	00010	M27M-1 2 YR CORROSION CONTROL
J0340	HTUG03	J0341 D	00010 31	
J0341	Z00000	J0342 S	00010 11	
J0342	HPREP3	J0343 D	00010 31	200 25L 1M27M 1423R5
J0343	HTUG03	D	00010 31	
		H	AT900	M27M-1 UNSCHEDULED MAINTENANCE
XCALLSC	FAT900	AT901 F	4 AT900 21	
AT901	AAT900	AT902 D	AT900 21	2 C 1603X0 1TUG 1423W5
AT902	TAT900	AT903 D	AT900 21	4 25L 1423W5
AT903	MAT900	AT904 E	.90 AT900 21	5 25L 1423W5
AT904	VAT900	D	AT900 21	2 25L 1423W5
AT903	RAT900	AT905 E	.10 AT900 21	25 25L 1423R5
AT905	VAT901	AT906 D	AT900 21	5 25L 1423R5
AT906	SHOP	SAT901 D	AT900 21	
		H	AT900	M27M-1 CHASSIS
SAT901	LAT910	IAT910 E	.18 AT900 21	
IAT910	WAT910	E	.50 AT900 23	20 25L 1423R5
IAT910	NAT910	PAT910 E	.50 AT900 23	15 25L 1423R5
IAT910	QAT910	D	AT900 21	
PAT910	PDEPOT	D	AT900 43	
		H	AT900	M27M-1 HYDRAULICS
SAT901	LAT920	IAT920 E	.49 AT900 21	
IAT920	WAT920	E	.72 AT900 23	22 25L 1423R5
IAT920	NAT920	PAT920 E	.28 AT900 23	20 25L 1423R5
IAT920	QAT920	D	AT900 21	
PAT920	PDEPOT	D	AT900 43	
		H	AT900	M27M-1 ENGINE
SAT901	LAT930	IAT930 E	.33 AT900 21	
IAT930	WAT930	E	.58 AT900 23	25 25L 1423R5
IAT930	J00000	IAT931 E	.42 AT900 21	
IAT931	NAT930	PAT930 E	.94 AT900 23	27 25L 1423R5
IAT931	NAT931	PAT931 E	.06 AT900 23	320 25L 1423R5
IAT931	QAT930	D	AT900 21	
PAT930	PDEPOT	D	AT900 43	
PAT931	PDEPOT	D	AT900 43	

Figure L-4 M27M-1 MAINTENANCE NETWORKS

		H	00010	35 TON AXLE JACK
J0801 HEAVE8	J0802 D		00010 31	3 C 1AJ35T 1431X2
J0802 Z00000	J0803 S		00010 11	
J0803 HKEEP8	J0804 D		00010 31	15 25L 1AJ35T
J0804 HEAVE8	J0805 D		00010 31	
J0805 HSERV8	J0806 D		00010 31	1 C 1AJ35T 1431X2
J0806 DCRMTH	J0807 D		00010 31	
J0807 CALLSH	J0808 C		00010 31	
J0808 HREADY	D		00010 31	
		H	00010	AJ35T 90 DAY INSP, CORR CNTL & LUBE
J0820 HEEVE8	J0821 D		00010 31	2 C 1AJ35T 1431X2
J0821 Z00000	J0822 S		00010 11	
J0822 H0890D	J0823 D		00010 31	50 25L 1AJ35T 1431X2
J0823 HEEVE8	D		00010 31	
		H	00010	AJ35T 1 YEAR HYD FLUSH & PARTS INSP
J0830 HEEVE8	J0831 D		00010 31	
J0831 Z00000	J0832 S		00010 11	
J0832 H081YR	J0833 D		00010 31	40 25L 1AJ35T 1431X2
J0833 HEEVE8	D		00010 31	
		H	AU100	AJ35T UNSCHEDULED MAINTENANCE
CALLSH YNMA08	E	.96	AU100 21	
CALLSH YMA008	AU100 E	.04	AU100 21	
X AU100 FAU100	AU101 F	1	AU100 21	
AU101 AAU100	AU102 D		AU100 21	2 C 1431X2
AU102 TAU100	AU103 D		AU100 21	2 25L 1431X2
AU103 MAU100	AU104 E	.75	AU100 21	5 25L 1431X2
AU104 VAU100	D		AU100 21	2 25L 1431X2
AU103 RAU100	AU105 E	.25	AU100 21	20 25L 1431X2
AU105 VAU101	AU106 D		AU100 21	2 25L 1431X2
AU106 SHOP	SAU100 D		AU100 21	
		H	AU100	AJ35T (RAM) LIFT ASSEMBLY
SAU100 LAU110	IAU110 E	.60	AU100 21	
IAU110 WAU110	D		AU100 23	40 25L 1431X2
		H	AU100	AJ35T RESERVOIR & PUMP ASSY
SAU100 LAU120	IAU120 E	.30	AU100 21	
IAU120 WAU120	D		AU100 23	30 25L 1431X2
		H	AU100	AJ35T CHASSIS
SAU100 LAU130	IAU130 E	.10	AU100 21	
IAU130 WAU130	IAU131 D		AU100 23	35 25L 1431X2
IAU131 XAU130	D		AU100 23	5 25L 1427X4

Figure L-5 35-TON JACK MAINTENANCE NETWORKS

		H	00010	30 TON TRIPOD JACK (NORMAL)
J0601 HEAVE6	J0602 D		00010 31	3 C 2TJ30N 2431X2
J0602 Z00000	J0603 S		00010 11	
J0603 HKEEP6	J0604 D		00010 31	30 25L 2TJ30N
J0604 HEAVE6	J0605 D		00010 31	
J0605 HSERV6	J0606 D		00010 31	2 25L 2TJ30N 1431X2
J0606 DCRMTF	J0607 D		00010 31	
J0607 CALLSF	J0608 C		00010 31	
J0608 HREADY	D		00010 31	
		H	00010	30 TON TRIPOD JACK (EXTENDED)
J0701 HEAVE7	J0702 D		00010 31	3 C 4TJ30E 4431X2
J0702 Z00000	J0703 S		00010 11	
J0703 HKEEP7	J0704 D		00010 31	30 25L 4TJ30E
J0704 HEAVE7	J0705 D		00010 31	
J0705 HSERV7	J0706 D		00010 31	4 25L 4TJ30E 1431X2
J0706 DCRMTF	J0707 D		00010 31	
J0707 CALLSG	J0708 C		00010 31	
J0708 HREADY	D		00010 31	
		H	00010	TJ30N 90 DAY INSP, CORR CNTL & INSP
J0620 HEEVE6	J0621 D		00010 31	2 C 1TJ30N 1431X2
J0621 Z00000	J0622 S		00010 11	
J0622 H0690D	J0623 D		00010 31	40 25L 1TJ30N 1431X2
J0623 HEEVE6	D		00010 31	
		H	00010	TJ30E 90 DAY INSP, CORR CNTL & INSP
J0720 HEEVE7	J0721 D		00010 31	2 C 1TJ30E 1431X2
J0721 Z00000	J0722 S		00010 11	
J0722 H0790D	J0723 D		00010 31	40 25L 1TJ30E 1431X2
J0723 HEEVE7	D		00010 31	
		H	AU200	TJ30N&E UNSCHEDULED MAINTENANCE
CALLSG CALLSF	C		AU200 21	
CALLSF YNMA67	E	.88	AU200 21	
CALLSF YMA067	AU200 E	.12	AU200 21	
X AU200 FAU200	AU201 F	1	AU200 21	
AU201 AAU200	AU202 D		AU200 21	2 C 1431X2
AU202 TAU200	AU203 D		AU200 21	2 25L 1431X2
AU203 MAU200	AU204 E	.50	AU200 21	10 25L 1431X2
AU204 VAU200	D		AU200 21	2 25L 1431X2
AU203 RAU200	AU205 E	.50	AU200 21	20 25L 1431X2
AU205 VAU201	AU206 D		AU200 21	2 25L 1431X2
AU206 SHOP	SAU201 D		AU200 21	
		H	AU200	TJ30N&E (RAM) LIFT ASSEMBLY
SAU201 LAU210	IAU210 E	.60	AU200 21	
IAU210 WAU200	D		AU200 23	40 25L 1431X2
		H	AU200	TJ30N&E MANIFOLD & HYDRAULIC LINE
SAU201 LAU220	IAU220 E	.30	AU200 21	
IAU220 WAU220	D		AU200 23	10 25L 1431X2
		H	AU200	TJ30N&E CHASSIS ASSEMBLY
SAU201 LAU230	IAU230 E	.10	AU200 21	
IAU230 WAU230	IAU231 D		AU200 23	35 25L 1431X2
IAU231 XAU230	D		AU200 23	10 25L 1431X2

Figure L-6 30-TON JACK MAINTENANCE NETWORKS

20	1	3	0600	D60	DSPD60	1	1	0	15	3	1599
20	1	2	0630	D60	DSPD60	1	1	0	15	3	1599
20	1	3	0700	D60	DSPD60	1	1	0	15	3	1599
20	1	2	0730	D60	DSPD60	1	1	0	15	3	1599
20	1	3	0800	D60	DSPD60	1	1	0	15	3	1599
20	1	2	0830	D60	DSPD60	1	1	0	15	3	1599
20	1	3	0900	D60	DSPD60	1	1	0	15	3	1599
20	1	2	0930	D60	DSPD60	1	1	0	15	3	1599
20	1	3	1000	D60	DSPD60	1	1	0	15	3	1599
20	1	2	1030	D60	DSPD60	1	1	0	15	3	1599
20	1	3	1100	D60	DSPD60	1	1	0	15	3	1599
20	1	2	1130	D60	DSPD60	1	1	0	15	3	1599
20	1	3	1200	D60	DSPD60	1	1	0	15	3	1599
20	1	2	1230	D60	DSPD60	1	1	0	15	3	1599
20	1	3	1300	D60	DSPD60	1	1	0	15	3	1599
20	1	2	1330	D60	DSPD60	1	1	0	15	3	1599
20	1	1	0800	D60	PE1600	1	1	0	80	5	2999
20	1	1	1000	NF2	DSPNF2	1	1	0	15	3	1599
20	1	1	1100	NF2	DSPNF2	1	1	0	15	3	1599
20	1	1	1200	NF2	DSPNF2	1	1	0	15	3	1599
20	1	1	1300	NF2	DSPNF2	1	1	0	15	3	1599
20	1	1	1400	NF2	DSPNF2	1	1	0	15	3	1599
20	1	1	1500	NF2	DSPNF2	1	1	0	15	3	1599
20	1	1	1600	NF2	DSPNF2	1	1	0	15	3	1599
20	1	1	1700	NF2	DSPNF2	1	1	0	15	3	1599
20	1	1	1200	M27M	DM27M	1	1	0	15	3	1599
20	1	1	1800	M27M	DM27M	1	1	0	15	3	1599
20	1	1	0730	MD3	DSPMD3	1	1	0	15	3	1599
20	1	1	0930	MD3	DSPMD3	1	1	0	15	3	1599
20	1	1	1130	MD3	DSPMD3	1	1	0	15	3	1599
20	1	1	1330	MD3	DSPMD3	1	1	0	15	3	1599
20	1	1	1530	MD3	DSPMD3	1	1	0	15	3	1599
20	1	1	0700	AJ35T	DAJ35T	1	1	0	15	3	1599
20	1	1	1030	AJ35T	DAJ35T	1	1	0	15	3	1599
20	1	1	1230	TJ30H	DTJ30H	2	2	0	15	3	2999
20	1	1	1230	TJ30E	DTJ30E	4	4	0	15	3	2999
20	2	1	1000	D60	PE12YR	1	1	0	150	5	24999
20	3	1	0800	NF2	PE4900	1	1	0	80	5	8999
20	5	1	0800	NF2	PE42YR	1	1	0	150	5	48999
20	6	1	0800	TJ30E	PE7900	1	1	0	80	5	8999
20	7	1	0800	MD3	PE5900	1	1	0	80	5	18999
20	10	1	0800	AJ35T	PE8900	1	1	0	80	5	18999
20	11	1	0800	TJ30H	PE6900	1	1	0	80	5	15999
20	13	1	0800	M27M	PE3180	1	1	0	80	5	30999
20	13	1	0900	D60	PE1PNT	1	1	0	150	7	24999
20	15	1	0800	AJ35T	PE81YR	1	1	0	80	5	73999
20	17	1	0800	M27M	PE32YR	1	1	0	150	5	146999
20	23	1	0800	M27M	PE3PNT	1	1	0	150	7	146999
20	25	1	0800	NF2	PE4PNT	1	1	0	150	7	48999
20	27	1	0800	MD3	PE52YR	1	1	0	150	5	104999

This data may be decoded using AFMSMET Report 78-1 "LCOM II Simulation Software Users Reference Guide" of 1 May 1978.

Figure L-7 SCENARIO FOR FIXED DEMAND

EN06 DATA FILE GENERATED FOR 180. DAYS. INENT = LGNGE LANDING GEAR FAILURE DEMAND

BINED MISSION SCENARIO

20	1	1	0000 AMST	NOFLT	1 1 0	5.0H	.5H	2.0H	3.0H	3	1999
20	1	1	0700 AMST	NOFLT	1 1 0	5.0H	.5H	2.0H	3.0H	3	1999
20	1	1	0800 AMST	NOFLT	1 1 0	5.0H	.5H	2.0H	3.0H	3	1999
20	1	1	0900 AMST	NOFLT	1 1 0	5.0H	.5H	2.0H	3.0H	3	1999
20	1	1	1000 AMST	NOFLT	1 1 0	5.0H	.5H	2.0H	3.0H	3	1999
20	1	1	1030 AMST	NOFLT	1 1 0	5.0H	.5H	2.0H	3.0H	3	1999
20	1	1	1100 AMST	NOFLT	1 1 0	5.0H	.5H	2.0H	3.0H	3	1999
20	1	1	1130 AMST	NOFLT	1 1 0	5.0H	.5H	2.0H	3.0H	3	1999
20	1	1	1200 AMST	NOFLT	1 1 0	5.0H	.5H	2.0H	3.0H	3	1999
20	1	1	1230 AMST	NOFLT	1 1 0	5.0H	.5H	2.0H	3.0H	3	1999
20	1	1	1300 AMST	NOFLT	1 1 0	5.0H	.5H	2.0H	3.0H	3	1999
20	1	1	1330 AMST	NOFLT	1 1 0	5.0H	.5H	2.0H	3.0H	3	1999
20	1	1	1400 AMST	NOFLT	1 1 0	5.0H	.5H	2.0H	3.0H	3	1999
20	1	1	1500 AMST	NOFLT	1 1 0	5.0H	.5H	2.0H	3.0H	3	1999
20	1	1	1600 AMST	NOFLT	1 1 0	5.0H	.5H	2.0H	3.0H	3	1999
20	1	1	1700 AMST	NOFLT	1 1 0	5.0H	.5H	2.0H	3.0H	3	1999
20	1	1	0000 MD60	FE1800	1 1 0	.1	0	.5	60	5	2999
20	2	1	1000 MD60	FE12VF	1 1 0	.1	0	.5	150	5	14999
20	2	1	1700 MD60	NOFLT	1 1 0	5.0H	.5H	2.0H	3.0H	3	1999
20	3	1	0000 MD60	FE4900	1 1 0	.1	0	.5	60	5	6999
20	5	1	0000 MD60	FE42VF	1 1 0	.1	0	.5	150	5	49999
20	6	1	0000 MD60	FE7900	1 1 0	.1	0	.5	60	5	1999
20	7	1	0000 MD60	FE5900	1 1 0	.1	0	.5	10	5	19999
20	10	1	0000 MD60	FE8900	1 1 0	.1	0	.5	60	5	18999
20	11	1	0000 MD60	FE6900	1 1 0	.1	0	.5	60	5	19999
20	13	1	0000 MD60	FE3180	1 1 0	.1	0	.5	60	5	66999
20	13	1	0000 MD60	FE1PNT	1 1 0	.1	0	.5	150	7	24999
20	15	1	0000 MD60	FE01VF	1 1 0	.1	0	.5	60	5	79999
20	17	1	0000 MD60	FE32VF	1 1 0	.1	0	.5	150	5	149999
20	23	1	0000 MD60	FE3PNT	1 1 0	.1	0	.5	150	7	149999
20	25	1	0000 MD60	FE4PNT	1 1 0	.1	0	.5	150	7	48999
20	27	1	0000 MD60	FE52VF	1 1 0	.1	0	.5	150	5	164999

This data may be decoded using AFMSMET Report 78-1 "LCOM II Simulation Software Users Reference Guide" of 1 May 1978.

Figure L-8 AGE SCENARIO FOR LANDING GEAR FAILURE DEMAND

networks within an aircraft maintenance scenario, was still achieved. The original MSBMAs of the landing gear system were reinstated for the final simulations in order to determine the manpower and resource needs as well as provide for a comparison with Reliability and Maintainability (R&M) model mean value outputs. Results of the initial runs indicated (a) for the constant demand scenario, an overall mission success of 67 percent, and (b) for the landing gear demand scenario, a 100 percent-mission accomplishment.

The fifth step in the effort involved analyzing the output products of each successive simulation run and making changes to the input data in order to create the desired results. The apparent difference between the mission success of the two scenarios is due to the fact that the demand rates of the two are different. While in one case the success is far below that desired, because of an apparent insufficiency of manpower or resources available, in the other, there may be an overabundance of personnel and resources allocated to landing gear and AGE maintenance. In the following paragraphs, the two scenarios are analyzed separately, although it is pointed out that changes made in one with respect to task times, task probabilities, or failure rates are also entered into the other.

On its initial run, the constant demand scenario simulation called AGE indicated an overall 65-percent mission success. Analysis of the output products indicated that it was only the dispatch missions on the "D60" generators and "NF2" light carts that were not totally successful. Further analysis of output products showed that post-sortie times for these two units were greater than 24 hours. Since there are 40 demands per unit on 30 D60 units with a failure expected every two demands, it is not surprising that the average 25-hour post-sortie time would yield the results obtained. Some of this known time is probably due to the fact that repair personnel, AFSC 423R5, work only one shift, so that any maintenance task not completed by 1600 must wait overnight before work is resumed. The 12 percent unsatisfied demand for these AFSCs lends further credence to this. For the second run, the mission scenario was changed slightly to permit a 1-hour delay (originally 30 minutes) on a dispatch call to see if this reduced the number of mission aborts. While the mission success percentage for the D60 went up only .03 percent, the additional half-hour allowed the NF12 enough extra time for repair in the shop for its mission success went up to 100 percent. Average post-sortie, or downtime for the D-60 increased slightly, while for the NF2, it went down to 17 hours.

The next modification to the AGE data input was to change the D60 failure rate from every two demands to every three. Mission success rose to 62 percent for D60 dispatches as a result of this change. However, this value was still not satisfactory; so as an experiment, the 1600 to 2400 shift was activated with two 423R5s in the repair shop. The result, was that dispatch success increased again; this time to 69 percent. This value was still unsatisfactorily low, so a further analysis of the input data was made. It is pointed out here that the input analysis of the input data was made. It is pointed out here that the input networks were constructed from data collected during a visit to Charleston AFB. Task times and failure rates were based upon estimates made by the maintenance personnel in the appropriate shops on base. The demand rate was also based upon Charleston's demand. Since there seemed to be enough units there to meet all maintenance demands, it became necessary to look further into the task times and probabilities for the D60. Several possible areas were considered for modification: (a) the probabilities of flight line maintenance versus shop maintenance, (b) the mean flightline maintenance time, and (c) the remove-and-replace task times in the shop. Each of these modifications was made in turn, with increasing success; the mean probability ratio for flightline/shop maintenance was changed from 80/20 to 90/10. Flightline maintenance time was reduced from 24 minutes to 15 minutes and the mean removal task time was reduced from 2.2 hours to 1.1 hours because this time might have been duplicated initially in the shop maintenance times. With all these changes included, the D60 mission success went up to 89 percent as shown in Figures L-18 through L-20. At this point, it was decided that further manipulations of the maintenance data would serve no useful purpose, and runs for this scenario were concluded.

The scenario based upon AMSI landing gear maintenance demand is called "LGAGE." The first simulation run was made after the third "AGE" run. Results, indicated 100 percent mission accomplishment across the board, as shown in Figures L-21 to L-25. While the 100 percent success may have been affected by the reduced landing gear failure rate, it appeared to be due primarily to the unconstrained number of personnel, the more than adequate supply of AGE resources, and only 17 flights per day. Looking at the Personnel report, Figure L-22, it can be seen that personnel utilization was 4 percent at most. An analysis of manpower demand by hour over the 180-day scenario was conducted using the Manpower Martix output products of the run. For the next run, the number of personnel was limited to from one to four per shift for a

RUN NUMBER		AGE 6		PERFORMANCE SUMMARY										PERIOD FROM 9. TO 109.9										LEVEL 2			
				OPERATIONS		TOTAL		OSP060		PE1600		PE12YR		PE1PMT		OSP003		PE5000		PE52YR		DM27M		PE3100		PE32YR	
1	NUMBER OF MISSIONS REQUESTED					10655.00		7208.00		98.00		8.00		7.00		908.00		14.00		2.00		368.00		5.00		2.00	
2	NUMBER ACCOMPLISHED					9843.00		6366.00		90.00		0.00		7.00		900.00		14.00		2.00		360.00		5.00		2.00	
3	PERCENT ACCOMPLISHED					92.38		88.22		100.00		100.00		100.00		100.00		100.00		100.00		100.00		100.00		100.00	
6	NUMBER OF SORTIES REQUESTED					11015.00		7200.00		90.00		8.00		7.00		900.00		14.00		2.00		360.00		5.00		2.00	
7	NUMBER ACCOMPLISHED					10203.00		6388.40		90.00		0.00		7.00		908.00		14.00		2.00		360.00		5.00		2.00	
8	PERCENT ACCOMPLISHED					92.63		88.72		100.00		100.00		100.00		100.00		100.00		100.00		100.00		100.00		100.00	
T1	NUMBER OF WEATHER CANCELS					0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.	
T2	NUMBER OF WEATHER DELAYS					0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.	
T3	NUMBER OF ALERT REPLENISHMENT					0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.	
T4	NUMBER OF ATTRITIONS					0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.	
T5	NUMBER OF RAM REPAIRS					0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.	
T6	NUMBER OF AIR ABORTS(TOTAL)					0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.	

				OPERATIONS		TOTAL		PE3PMT		DSPMF2		PEA900		PEA2YR		PEA9MT		DAJ351		PEA900		PEA1YR		DLJ38M		PE6900	
1	NUMBER OF MISSIONS REQUESTED					10655.00		2.00		1440.00		30.00		4.00		4.00		360.00		10.00		3.00		90.00		12.00	
2	NUMBER ACCOMPLISHED					9843.00		2.00		1440.00		30.00		4.00		4.00		360.00		10.00		3.00		90.00		12.00	
3	PERCENT ACCOMPLISHED					92.38		100.00		100.00		100.00		100.00		100.00		100.00		100.00		100.00		100.00		100.00	
6	NUMBER OF SORTIES REQUESTED					11015.00		2.00		1440.00		30.00		4.00		4.00		360.00		10.00		3.00		90.00		12.00	
7	NUMBER ACCOMPLISHED					10203.00		2.00		1440.00		30.00		4.00		4.00		360.00		10.00		3.00		90.00		12.00	
8	PERCENT ACCOMPLISHED					92.63		100.00		100.00		100.00		100.00		100.00		100.00		100.00		100.00		100.00		100.00	
T1	NUMBER OF WEATHER CANCELS					0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.	
T2	NUMBER OF WEATHER DELAYS					0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.	
T3	NUMBER OF ALERT REPLENISHMENT					0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.	
T4	NUMBER OF ATTRITIONS					0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.	
T5	NUMBER OF RAM REPAIRS					0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.	
T6	NUMBER OF AIR ABORTS(TOTAL)					0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.	

				OPERATIONS		TOTAL		DTJ30E		PE7900		OTHER	
1	NUMBER OF MISSIONS REQUESTED					10655.00		90.00		22.00		0.	
2	NUMBER ACCOMPLISHED					9843.00		90.00		22.00		0.	
3	PERCENT ACCOMPLISHED					92.38		100.00		100.00		0.	
6	NUMBER OF SORTIES REQUESTED					11015.00		360.00		22.00		0.	
7	NUMBER ACCOMPLISHED					10203.00		360.00		22.00		0.	
8	PERCENT ACCOMPLISHED					92.63		100.00		100.00		0.	
T1	NUMBER OF WEATHER CANCELS					0.		0.		0.		0.	
T2	NUMBER OF WEATHER DELAYS					0.		0.		0.		0.	
T3	NUMBER OF ALERT REPLENISHMENT					0.		0.		0.		0.	
T4	NUMBER OF ATTRITIONS					0.		0.		0.		0.	
T5	NUMBER OF RAM REPAIRS					0.		0.		0.		0.	
T6	NUMBER OF AIR ABORTS(TOTAL)					0.		0.		0.		0.	

Figure L-18 FINAL AGE SIMULATION

PERFORMANCE SUMMARY										PERIOD FROM 0. TO 180.0										LEVEL 2
A I R C R A F T																				
	TOTAL	XAJ351	XD60	XM03	XM27M	XM2	XTJ30E	XTJ30M	OTHER											
13 NUMBER OF AIRCRAFT-AUTH (EOP)	80.00	5.00	38.00	7.00	5.00	15.00	12.00	6.00	0.											0.
14 NUMBER OF AIRCRAFT-DAYS AVAIL	14400.00	980.00	5400.00	1250.00	980.00	2700.00	2160.00	1080.00	0.											0.
15 PCT SORTIES-INCL ALERT	.30	.17	.50	.38	.17	.23	.07	.07	0.											0.
16 PCT UNSCHED MAINTENANCE	1.06	.14	2.16	.67	.63	.65	.03	.03	0.											0.
17 PCT SCHED MAINTENANCE	12.80	4.02	21.71	6.98	7.28	14.28	2.98	2.98	0.											0.
18 PCT NGRS	0.	0.	0.	0.	0.	0.	0.	0.	0.											0.
19 PCT MISSION-MAINT STATUS	.32	.35	.34	.31	.35	.46	.15	.15	0.											0.
20 PCT SERVICE + WAITING	20.16	.00	36.99	10.23	20.41	21.95	.00	.00	0.											0.
21 PCT OPERATIONALLY READY	65.38	95.32	38.30	81.59	70.97	62.42	96.76	96.86	0.											0.
22 AVG. AC POST SORTIE TIME(HRS)	10.75	2.11	18.64	5.47	16.39	15.24	3.88	3.66	0.											0.
23 AVG. NO. OF SORTIES/ A/C /DAY	.71	.41	1.20	.73	.41	.55	.18	.18	0.											0.
24 FLYING HOURS	1021.12	37.33	649.82	91.67	36.93	147.92	38.23	19.22	0.											0.
25 NUMBER OF ECF TASKS FLOWN	0.	0.	0.	0.	0.	0.	0.	0.	0.											0.
26 AVG. AC PRESORTIE TIME(HRS)	.37	.30	.48	.40	.38	.30	.29	.29	0.											0.
P E R S O N N E L																				
	TOTAL	A23R5	A23M5	A23R8	A27XA	A31X2	A31Y2	A83X0	OTHER											
27 MANHOURS AVAILABLE (100)	2044.80	316.80	432.00	43.20	28.00	432.00	144.00	640.00	0.											0.
28 PERCENT UTILIZATION	9.02	13.48	11.05	0.	.24	2.38	6.19	11.51	0.											0.
29 MANHOURS USED (100)	184.34	42.71	47.75	0.	.07	18.27	8.92	74.61	0.											0.
30 PCT UNSCHED MAINTENANCE	24.19	36.67	44.72	0.	188.08	5.34	24.53	5.35	0.											0.
31 PCT SCHED MAINTENANCE	79.81	63.33	55.23	0.	0.	94.66	75.47	93.68	0.											0.
32 NUMBER OF MEN DEMANDED	A2555.00	977.00	1618.00	0.	4.00	2965.88	1730.88	282875.88	0.											0.
33 PCT AVAILABLE (PRIME)	99.26	87.82	99.98	0.	75.00	100.00	88.96	100.00	0.											0.
34 PCT AVAILABLE (SUBST.)	0.	0.	0.	0.	0.	0.	0.	0.	0.											0.
35 PCT PROV. BY EXPEDITE	.00	.20	0.	0.	0.	0.	0.	0.	0.											0.
36 PCT PROV. BY PREEMPTION	.02	.82	0.	0.	0.	0.	0.	0.	0.											0.
37 PCT DEMANDS NOT SATIS.	.71	11.16	.02	0.	25.00	0.	11.04	0.	0.											0.
38 OVERTIME MANHOURS USED (100)	.09	.04	0.	0.	0.	0.	.83	0.	0.											0.
39 SIMULATED MH PER FLYING HOUR	18.05	4.18	4.68	0.	.01	1.01	.87	7.31	0.											0.
S H O P R E P A I R																				
	TOTAL	AA888	AA888	AA888	AC218	AC228	AC238	AT918	AT928	AT938	AQ8A8									
44 NO. OF REPAIRABLE GENERATIONS	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.				0.					
45 PCT BASE REPAIR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.				0.					
46 PCT DEPOT REPAIR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.				0.					
47 AVERAGE BASE REPAIR CYCLE	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.				0.					
48 PCT ACTIVE REPAIR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.				0.					
49 PCT WHITE SPACE	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.				0.					
50 NO. OF ITEMS IN REPAIR (EOP)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.				0.					
51 NO. OF ITEMS BACKLOGGED (EOP)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.				0.					

Figure L-19 FINAL AGE SIMULATION

RUN NUMBER		AGE		6		P E R F O R M A N C E S U M M A R Y										PERIOD FROM 0. TO 100.0										LEVEL 2			
S H O P R E P A I R														S U P P L Y															
44 NO. OF REPAIRABLE GENERATIONS		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.	
45 PCT BASE REPAIR		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.	
46 PCT DEFECT REPAIR		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.	
47 AVERAGE BASE REPAIR CYCLE		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.	
48 PCT ACTIVE REPAIR		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.	
49 PCT WHITE SPACE		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.	
50 NO. OF ITEMS IN REPAIR (EOP)		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.	
51 NO. OF ITEMS BACKLOGGED (EOP)		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.	
S H O P R E P A I R														S U P P L Y															
54 TOT DOLLAR INVEST. (1000) (EOP)		5100.00		300.00		300.00		300.00		300.00		300.00		300.00		300.00		300.00		300.00		300.00		300.00		300.00		300.00	
55 FILL RATE PERCENT		100.00		100.00		100.00		100.00		100.00		100.00		100.00		100.00		100.00		100.00		100.00		100.00		100.00		100.00	
56 NUMBER OF BACKORDER-DAYS		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.	
57 NUMBER OF UNITS DEMANDED		200.00		100.00		29.00		51.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00	
58 PCT OFF-THE-SHELF		100.00		100.00		100.00		100.00		100.00		100.00		100.00		100.00		100.00		100.00		100.00		100.00		100.00		100.00	
59 PCT EXPEDITED REPAIR		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.	
60 PCT PREEMPTION		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.	
61 PCT DEMANDS NOT SATIS.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.	
62 NUMBER OF CANNIBALIZATIONS		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.	
63 NO. ITEMS ON BACKORDER (EOP)		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.	
S H O P R E P A I R														S U P P L Y															
54 TOT DOLLAR INVEST. (1000) (EOP)		5100.00		300.00		300.00		300.00		300.00		300.00		300.00		300.00		300.00		300.00		300.00		300.00		300.00		300.00	
55 FILL RATE PERCENT		100.00		100.00		100.00		100.00		100.00		100.00		100.00		100.00		100.00		100.00		100.00		100.00		100.00		100.00	
56 NUMBER OF BACKORDER-DAYS		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.	
57 NUMBER OF UNITS DEMANDED		200.00		100.00		29.00		51.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00	
58 PCT OFF-THE-SHELF		100.00		100.00		100.00		100.00		100.00		100.00		100.00		100.00		100.00		100.00		100.00		100.00		100.00		100.00	
59 PCT EXPEDITED REPAIR		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.	
60 PCT PREEMPTION		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.	
61 PCT DEMANDS NOT SATIS.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.	
62 NUMBER OF CANNIBALIZATIONS		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.	
63 NO. ITEMS ON BACKORDER (EOP)		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.	
E Q U I P M E N T														S U P P L Y															
64 TOT DOLLAR INVEST. (1000) (EOP)		3600.00		100.00		600.00		140.00		100.00		240.00		120.00		2000.00		0.		0.		0.		0.		0.		0.	
65 EQUIPMENT HOURS AVAIL. (100)		7776.00		216.00		1296.00		302.40		216.00		640.00		510.40		259.20		4320.00		0.		0.		0.		0.		0.	
70 EQUIPMENT HOURS AVAIL. (100)		7776.00		216.00		1296.00		302.40		216.00		640.00		510.40		259.20		4320.00		0.		0.		0.		0.		0.	
71 PCT USED-UNSCHEM MAINT		0.06		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.	
72 PCT USED-UNSCHEM MAINT		0.06		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.	
73 PCT UNUSCH		93.29		95.98		78.29		93.10		92.72		05.71		96.10		96.96		98.27		0.		0.		0.		0.		0.	
74 NUMBER OF BACKORDER-DAYS		0.12		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.	
75 NUMBER OF UNITS DEMANDED		62947.00		1479.8025067.00		3943.00		1467.00		5074.00		2566.00		936.0020795.00		0.		0.		0.		0.		0.		0.		0.	
76 PCT AVAILABLE		99.98		100.00		100.00		100.00		100.00		100.00		99.42		100.00		100.00		0.		0.		0.		0.		0.	
77 PCT PROV. BY EXPECT. IE		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.	
78 PCT PROV. BY PREEMPTION		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.	
79 PCT DEMANDS NOT SATIS.		0.02		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.	
80 EQUIP HOURS BACKLOG (100) (EOP)		0.00		0.		0.		0.00		0.		0.		0.		0.		0.		0.		0.		0.		0.		0.	

Figure L-20 FINAL AGE SIMULATION

70N NUMBER LGAGE5

P E R F O R M A N C E S U M M A R Y

PERIOD FROM 0. TO 100.0

LEVEL 2

C O P E R A T I O N S

	TOTAL	NCFLT	PE1600	PE1200	PE1000	PE1000	PE1000	PE1000	PE1000	PE1000	PE1000	PE1000	PE1000	PE1000	PE1000	PE1000
1 NUMBER OF MISSIONS REQUESTED	3335.00	3120.00	90.00	8.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00
2 NUMBER ACCOMPLISHED	3335.00	3120.00	90.00	8.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00
3 PERCENT ACCOMPLISHED	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
6 NUMBER OF SORTIES REQUESTED	3335.00	3120.00	90.00	8.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00
7 NUMBER ACCOMPLISHED	3335.00	3120.00	90.00	8.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00
8 PERCENT ACCOMPLISHED	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
11 NUMBER OF WEATHER CANCELS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12 NUMBER OF WEATHER DELAYS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13 NUMBER OF ALERT REPLENISHMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14 NUMBER OF ATTRITIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15 NUMBER OF RAN REPAIRS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16 NUMBER OF AIR ABORTS (TOTAL)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

C O P E R A T I O N S

	TOTAL	PE4200	PE4000	PE3800	PE3600	PE3400	PE3200	PE3000	PE2800	PE2600	PE2400	PE2200	PE2000	PE1800	PE1600	PE1400
1 NUMBER OF MISSIONS REQUESTED	3335.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
2 NUMBER ACCOMPLISHED	3335.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
3 PERCENT ACCOMPLISHED	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
6 NUMBER OF SORTIES REQUESTED	3335.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
7 NUMBER ACCOMPLISHED	3335.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
8 PERCENT ACCOMPLISHED	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
11 NUMBER OF WEATHER CANCELS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12 NUMBER OF WEATHER DELAYS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13 NUMBER OF ALERT REPLENISHMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14 NUMBER OF ATTRITIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15 NUMBER OF RAN REPAIRS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16 NUMBER OF AIR ABORTS (TOTAL)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

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	TOTAL	AMST	XA35T	XA35T	XA35T	XA35T	XA35T	XA35T	XA35T	XA35T	XA35T	XA35T	XA35T	XA35T	XA35T	XA35T
13 NUMBER OF AIRCRAFT AUTH. (ECPI)	132.00	52.00	5.00	38.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00
14 NUMBER OF AIRCRAFT-LAYS AVAIL	23760.00	9360.00	900.00	5400.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00
15 PCT SORTIES/ALCL ALERTS	2.75	6.97	.01	.81	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
16 PCT UNSCHED MAINTENANCE	.30	.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17 PCT SCHED MAINTENANCE	1.00	3.45	.30	1.50	.26	.26	.26	.26	.26	.26	.26	.26	.26	.26	.26	.26
18 PCT NCRS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19 PCT MISSION WAIT STATUS	.00	.19	.02	.12	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
20 PCT SERVICE + WAITING	1.96	3.19	.00	2.33	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
21 PCT OPERATIONAL READY	93.02	45.45	99.60	96.00	99.73	99.73	99.73	99.73	99.73	99.73	99.73	99.73	99.73	99.73	99.73	99.73
22 AVG. AC PCT SORTIE TIME (HRS)	5.21	3.32	4.74	47.01	4.53	28.00	37.05	4.46	4.47	4.47	4.47	4.47	4.47	4.47	4.47	4.47
23 AVG. AC OF SORTIES/ALCL /DAY	.14	.33	.01	.02	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
24 FLYING HOURS	15071.60	15650.00	1.30	10.51	1.60	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
27 NUMBER OF ECF TASKS FLOWN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
28 AVG. AC PRESCRTIE TIME (HRS)	1.09	2.00	.20	.20	.39	.20	.20	.20	.20	.20	.20	.20	.20	.20	.20	.20

Figure L-21 INITIAL LGAGE SIMULATION

RUN NUMBER LGAGES		P E R F O R M A N C E S U M M A R Y												PERIOD FROM 0. TO 100.0		LEVEL 2
P E R S O N N E L																
27	MANHOURS AVAILABLE (100)	20000.00	423R5	423H5	423X8	42338	42334	42353	42354	427X4	431X2	431V2				
28	PERCENT UTILIZATION	1.00	4.01	.31	0.	1.42	.93	2.26	3.56	0.	.30	.12				
29	MANHOURS USED (100)	200.54	200.54	6.54	0.	18.28	6.69	16.26	25.63	0.	6.57	.98				
30	PCT UNSCHED MAINTENANCE	52.63	6.59	48.70	0.	100.00	100.00	100.00	100.00	0.	5.00	3.30				
31	PCT SCHED MAINTENANCE	47.37	91.81	51.30	0.	0.	0.	0.	0.	0.	95.92	96.72				
33	NUMBER OF MEN DEMANDED	22400.00	245.00	2069.00	0.	677.00	511.00	959.00	1442.00	0.	1642.00	76.00				
34	PCT AVAILABLE (PRIME)	92.72	97.96	100.00	0.	63.37	34.83	62.67	71.54	0.	100.00	97.19				
35	PCT AVAILABLE (SUBST.)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.				
36	PCT PROV. BY EXPEDITE	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.				
37	PCT PROV. BY PREEMPTION	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.				
38	PCT DEMANDS NOT SATIS.	7.28	2.04	0.	0.	36.63	65.17	17.33	20.36	0.	0.	2.26				
39	OVERTIME MANHOURS USED (100)	.41	.04	0.	0.	.07	.05	.09	.10	0.	0.	0.				
40	SIMULATED MH PER FLYING HOUR	1.33	.18	.04	0.	.07	.04	.10	.16	.16	.16	.16				
P E R S O N N E L																
27	MANHOURS AVAILABLE (100)	20000.00	4313R	4313M	43131	4315R	4315M	43151	53135	53150	53154	53155				
28	PERCENT UTILIZATION	1.00	.01	.17	1.01	.74	.23	3.29	.00	.06	.75	.75				
29	MANHOURS USED (100)	200.54	.06	1.23	7.27	5.31	1.63	76.98	.42	.43	5.48	5.42				
30	PCT UNSCHED MAINTENANCE	52.63	100.00	100.00	100.00	100.00	100.00	25.41	100.00	100.00	100.00	101.00				
31	PCT SCHED MAINTENANCE	47.37	0.	0.	0.	0.	0.	74.59	0.	0.	0.	0.				
33	NUMBER OF MEN DEMANDED	22400.00	2.00	93.00	440.00	306.00	325.00	10541.00	2.00	19.00	269.60	271.48				
34	PCT AVAILABLE (PRIME)	92.72	100.00	94.62	76.12	62.14	95.56	100.00	100.00	100.00	96.65	96.68				
35	PCT AVAILABLE (SUBST.)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.				
36	PCT PROV. BY EXPEDITE	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.				
37	PCT PROV. BY PREEMPTION	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.				
38	PCT DEMANDS NOT SATIS.	7.28	0.	5.38	23.88	37.56	0.00	0.	0.	0.	3.35	3.32				
39	OVERTIME MANHOURS USED (100)	.41	0.	0.	.04	.03	0.	0.	0.	0.	0.	0.				
40	SIMULATED MH PER FLYING HOUR	1.33	.08	.01	.08	.03	.01	.45	.00	.00	.43	.03				
P E R S O N N E L																
27	MANHOURS AVAILABLE (100)	20000.00	603X8	OTHER												
28	PERCENT UTILIZATION	1.00	.42	0.												
29	MANHOURS USED (100)	200.54	9.83	0.												
30	PCT UNSCHED MAINTENANCE	52.63	6.02	0.												
31	PCT SCHED MAINTENANCE	47.37	93.98	0.												
33	NUMBER OF MEN DEMANDED	22400.00	2699.00	0.												
34	PCT AVAILABLE (PRIME)	92.72	100.00	0.												
35	PCT AVAILABLE (SUBST.)	0.	0.	0.												
36	PCT PROV. BY EXPEDITE	0.	0.	0.												
37	PCT PROV. BY PREEMPTION	0.	0.	0.												
38	PCT DEMANDS NOT SATIS.	7.28	0.	0.												
39	OVERTIME MANHOURS USED (100)	.41	0.	0.												
40	SIMULATED MH PER FLYING HOUR	1.33	.46	0.												

Figure L-22 INITIAL LGAGE SIMULATION

RUN NUMBER LGAGE5		P E R F O R M A N C E S U M M A R Y										PERIOD FROM 0. TO 100.0				LEVEL 2	
S M O P R E F A I R																	
44	NO. OF REPAIRABLE GENERATIONS	TOTAL	OTHERS	AAA00	AA000	AB000	AE000	AC210	AC220	AC230	AI91C	AT920	AI930				
45	PCT BASE REPAIR	600.00	0.	100.00	100.00	0.	0.	100.00	0.	100.00	100.00	0.	0.				
46	PCT DEPOT REPAIR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.				
47	AVERAGE BASE REPAIR CYCLE	12.00	0.	60.73	0.	0.	0.	0.	0.	0.	60.65	0.	0.				
48	PCT ACTIVE REPAIR	100.00	0.	100.00	0.	0.	0.	0.	0.	0.	100.00	0.	0.				
49	PCT WHITE SPACE	0.00	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.				
50	NO. OF ITEMS IN REPAIR (ECP)	57.00	0.	0.	1.00	0.	1.00	0.	1.00	0.	0.	0.	0.				
51	NO. OF ITEMS BACKLOGGED (ECP)	1.00	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.				
S M O P R E F A I R																	
44	NO. OF REPAIRABLE GENERATIONS	600.00	21.00	54.00	11.00	14.00	2.00	2.00	54.00	3.00	17.00	7.00	275.00				
45	PCT BASE REPAIR	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00				
46	PCT DEPOT REPAIR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.				
47	AVERAGE BASE REPAIR CYCLE	11.88	12	46	60.88	60.18	60.43	2.64	60.81	11.56	60.81	60.81	60.27				
48	PCT ACTIVE REPAIR	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00				
49	PCT WHITE SPACE	0.00	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.				
50	NO. OF ITEMS IN REPAIR (ECP)	57.00	0.	1.00	2.00	6.00	0.	2.00	0.	1.00	0.	0.	21.00				
51	NO. OF ITEMS BACKLOGGED (ECP)	1.00	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.00				
S M O P R E F A I R																	
44	NO. OF REPAIRABLE GENERATIONS	600.00	39.00	12.00	35.00	1.00	3.00	3.00	0.	30.00	0.	0.00	02.00				
45	PCT BASE REPAIR	100.00	100.00	100.00	100.00	100.00	100.00	100.00	0.	100.00	0.	100.00	100.00				
46	PCT DEPOT REPAIR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.				
47	AVERAGE BASE REPAIR CYCLE	10.00	2.26	60.10	3.64	60.01	60.00	0.	0.	0.	0.	57.92	0.09				
48	PCT ACTIVE REPAIR	100.00	100.00	100.00	100.00	100.00	100.00	0.	100.00	0.	0.	100.00	100.00				
49	PCT WHITE SPACE	0.00	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.				
50	NO. OF ITEMS IN REPAIR (ECP)	57.00	1.00	5.00	0.	0.	1.00	0.	0.	0.	0.	0.	0.				
51	NO. OF ITEMS BACKLOGGED (ECP)	1.00	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.				
S M O P R E F A I R																	
44	NO. OF REPAIRABLE GENERATIONS	600.00	19.00	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.				
45	PCT BASE REPAIR	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00				
46	PCT DEPOT REPAIR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.				
47	AVERAGE BASE REPAIR CYCLE	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00				
48	PCT ACTIVE REPAIR	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00				
49	PCT WHITE SPACE	0.00	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.				
50	NO. OF ITEMS IN REPAIR (ECP)	57.00	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.				
51	NO. OF ITEMS BACKLOGGED (ECP)	1.00	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.				

Figure L-23 INITIAL LGAGE SIMULATION

RUN NUMBER LGAGES		PERFORMANCE SUMMARY										PERIOD FROM 0. TO 100.0				LEVEL 2
S U P P L Y																
54 TOT DOLLAR INVEST. (1000) (EOP)		TOTAL	OTHERS	AA00	AA00	AA00	AA00	AA00	AA00	AA00	AA00	AC220	AC230	AT910	AT920	AT930
55 FILL RATE PERCENT		9000.00	0.	300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00
56 NUMBER OF BACKORDER-DAYS		100.00	0.	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	0.	100.00	100.00	0.	0.
57 NUMBER OF UNITS DEMANDED		706.00	0.	10.00	6.00	4.00	1.00	1.00	1.00	1.00	1.00	0.	1.00	1.00	0.	0.
58 PCT OFF-TIME-SHELF		100.00	0.	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	0.	100.00	100.00	0.	0.
59 PCT EXPEDITED REPAIR		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
60 PCT PREEMPTION		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
61 PCT DEMANDS NOT SATIS.		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
62 NUMBER OF CANNIBALIZATIONS		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
63 NO. ITEMS ON BACKORDER (EOP)		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

S U P P L Y																
54 TOT DOLLAR INVEST. (1000) (EOP)		9000.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00	13000	13000	13000	13000	13000
55 FILL RATE PERCENT		100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
56 NUMBER OF BACKORDER-DAYS		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
57 NUMBER OF UNITS DEMANDED		706.00	21.00	54.00	11.00	14.00	2.00	54.00	54.00	100.00	100.00	100.00	100.00	100.00	100.00	275.00
58 PCT OFF-TIME-SHELF		100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
59 PCT EXPEDITED REPAIR		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
60 PCT PREEMPTION		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
61 PCT DEMANDS NOT SATIS.		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
62 NUMBER OF CANNIBALIZATIONS		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
63 NO. ITEMS ON BACKORDER (EOP)		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

S U P P L Y																
54 TOT DOLLAR INVEST. (1000) (EOP)		9000.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00	13000	13000	13000	13000	13000
55 FILL RATE PERCENT		100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
56 NUMBER OF BACKORDER-DAYS		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
57 NUMBER OF UNITS DEMANDED		706.00	39.00	12.00	35.00	1.00	3.00	0.	0.	0.	0.	0.	0.	0.	0.	42.00
58 PCT OFF-TIME-SHELF		100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
59 PCT EXPEDITED REPAIR		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
60 PCT PREEMPTION		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
61 PCT DEMANDS NOT SATIS.		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
62 NUMBER OF CANNIBALIZATIONS		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
63 NO. ITEMS ON BACKORDER (EOP)		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

S U P P L Y																
54 TOT DOLLAR INVEST. (1000) (EOP)		9000.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00	13000	13000	13000	13000	13000
55 FILL RATE PERCENT		100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
56 NUMBER OF BACKORDER-DAYS		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
57 NUMBER OF UNITS DEMANDED		706.00	19.00	19.00	19.00	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
58 PCT OFF-TIME-SHELF		100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
59 PCT EXPEDITED REPAIR		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
60 PCT PREEMPTION		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
61 PCT DEMANDS NOT SATIS.		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
62 NUMBER OF CANNIBALIZATIONS		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
63 NO. ITEMS ON BACKORDER (EOP)		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

Figure L-24 INITIAL LGAGE SIMULATION

RUN NUMBER LGAGES		P E R F O R M A N C E S U M M A R Y										P E R I O D F R O M 0. TO 101.0				L E V E L 2	
E Q U I P M E N T																	
		TOTAL	AJ35T	066	M03	M27M	MF2	TJ30E	TJ30M	TUG	OTHER						
58	TOT DOLLAR INVEST. (1000)(EOP)	5632.00	180.00	680.00	100.00	100.00	308.00	298.00	120.00	4000.00	0.						
69	EQUIPMENT HOURS AUTH. (100)	12096.00	216.00	1296.00	302.40	216.00	640.00	510.40	259.20	8640.00	0.						
69	EQUIPMENT HOURS AVAIL. (100)	12096.00	216.00	1296.00	302.40	216.00	640.00	510.40	259.20	8640.00	0.						
70	EQUIPMENT HOURS UNSCHEM MAINT	.34	1.51	1.39	.20	.72	1.12	1.21	1.21	.11	0.						
71	PCT USED-UNSCHEM MAINT	.46	.89	2.14	.37	.85	1.37	.69	.62	.10	0.						
72	PCT USED-UNSCHEM MAINT	99.21	97.60	96.47	99.43	90.43	97.51	90.10	90.17	99.90	0.						
73	PCT UNUSED	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.						
74	NUMBER OF BACKORDER-DAYS	10924.00	771.00	3546.00	195.00	341.00	1306.00	1322.00	664.00	2699.00	0.						
75	NUMBER OF UNITS DEMANDED	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	0.						
76	PCT AVAILABLE	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.						
77	PCT PROV. BY EXPECTE	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.						
78	PCT PROV. BY PREEMPTION	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.						
79	PCT DEMANDUS NOT SATIS.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.						
80	EQUIP HOURS BACKLOG (100)(EOP)	.02	0.	.02	0.	0.	.00	0.	0.	0.	0.						

Figure L-25 INITIAL LGAGE SIMULATION

shop, depending upon the AFSC. The run was made and the output results indicated a mean utilization of 19 percent, with a maximum of 51 percent. This seemed satisfactory in light of the fact that some of the work centers required a set number of people for a job that is not performed often. Also, increasing utilization by decreasing the number of people would lead to an inability to perform maintenance during peak demand times, resulting in a much higher mission abort rate. Twelve AMST missions were not accomplished, yielding a 99 percent mission success overall. Figures L-26 - to L-30 illustrate the results of this run.

A final LGAGE simulation, with MSBMA values for the landing gear set to their true (original) values, was not made prior to updating of LCOM to version 3.0.

Toward the end of this effort, a study was conducted which compared manpower and AGE utilization requirements of a given scenarios for the LCOM and R&M models. The study required constructing a maintenance network which could be fully utilized by both R&M and LCOM models for comparative purposes. This network focused on the AMST landing gear maintenance with flightline AGE usage but no AGE maintenance. The LCOM simulation RMLCOM was run using the network and both manpower and support equipment data were output from the post processor programs. A short program, called TIMETOIL, was written to extract AGE usage time against each type of AGE from the voluminous data produced by LCOM. In order to extract flightline AGE data from the R&M model, two changes to the model program were necessary. The first change involved (a) calculating usage time on the flightline in a manner similar to that used for calculating personnel utilization time and (b) formatting a presentation for the output data. This change is now designed to handle any flightline resource that might turn up in Extended Form 11 networks.

The second change implemented in the R&M model program was specific to the effort, wherein there are different possible combinations of AGE for each of possible landing gear failures. In LCOM, this parallelism is handled through node probabilities. Since parallelism is not within the designed scope of the R&M model, a "work around" was conceived such that additional or parallel subsystems having only flightline tasks were permitted, and each subsystem of a set was used to model an AGE combination for the given failure type. For example, a main landing gear failure required one of five AGE combinations (e.g., a D-60 or D-60 and an NF-2) for flightline maintenance. Thus five main

RUN NUMBER	LOG	DATE	TIME	PERIOD	FROM	TO	LEVEL
1	NUMBER OF REQUESTS	3335.00	3120.16	92.32	0.00	7.00	2.00
2	NUMBER ACCOMPLISHED	3323.00	3116.00	92.64	0.00	7.00	2.00
3	PERCENT ACCOMPLISHED	99.64	99.62	100.00	100.00	100.00	100.00
4	NUMBER OF SCOTIES REQUESTED	3335.00	3120.16	92.32	0.00	7.00	2.00
5	NUMBER ACCOMPLISHED	3323.00	3116.00	92.64	0.00	7.00	2.00
6	PERCENT ACCOMPLISHED	99.64	99.62	100.00	100.00	100.00	100.00
7	NUMBER OF WEATHER GAGES	3335.00	3120.16	92.32	0.00	7.00	2.00
8	NUMBER OF WEATHER GAGES	3323.00	3116.00	92.64	0.00	7.00	2.00
9	NUMBER OF ALERT REFLECTIONS	3335.00	3120.16	92.32	0.00	7.00	2.00
10	NUMBER OF ALERT REFLECTIONS	3323.00	3116.00	92.64	0.00	7.00	2.00
11	NUMBER OF ATTACHMENTS	3335.00	3120.16	92.32	0.00	7.00	2.00
12	NUMBER OF ATTACHMENTS	3323.00	3116.00	92.64	0.00	7.00	2.00
13	NUMBER OF PH REPAIRS	3335.00	3120.16	92.32	0.00	7.00	2.00
14	NUMBER OF PH REPAIRS	3323.00	3116.00	92.64	0.00	7.00	2.00
15	NUMBER OF AIRBORNE TOTALS	3335.00	3120.16	92.32	0.00	7.00	2.00
16	NUMBER OF AIRBORNE TOTALS	3323.00	3116.00	92.64	0.00	7.00	2.00

[illegible]

	TOTAL	WASA	JA1351	X063	X403	X427M	INE2	XTJCE	X13EM	QIMER
13 NUMBER OF AIRCRAFT AUTH. (LCPI)	132.00	52.00	5.00	30.00	7.00	5.00	15.00	12.00	6.00	3.
14 NUMBER OF AIRCRAFT DAYS AVAILABLE	23760.00	9360.00	960.00	5400.00	1260.00	900.00	2700.00	2160.00	1080.00	2.
15 PCT FORTIES (INCL. ALERT)	2.74	6.44	.01	.01	.01	.00	.01	.00	.00	0.
16 PCT UNASCHED MAINTENANCE	.35	.00	.00	.00	.00	.00	.00	.00	.00	0.
17 PCT SCHED MAINTENANCE	1.60	3.45	.25	1.53	.24	.50	.93	.16	.19	0.
18 PCT NCMI	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
19 PCT MISSION WAIT STATUS	.07	.15	.02	.02	.01	.01	.01	.01	.01	0.
20 PCT SERVICE + WAITING	3.92	7.14	.10	1.99	.00	.67	1.10	.10	.64	0.
21 PCT OFFERED TO FULLY READY	91.54	41.04	94.68	36.44	99.75	98.73	97.67	93.80	59.79	0.
22 AVG. FC. FCST. SCHEDULE (TIME/HRS)	7.69	4.15	4.69	43.32	4.18	29.77	35.74	4.62	3.93	0.
23 AVG. NO. OF SOR. IFS/ A/L /CPY	.14	.33	.01	.02	.91	.01	.01	.01	.01	0.
24 FLYING HOURS	15811.75	15567.24	1131	10.51	1.68	.98	3.80	2.20	1.20	1.
17 NUMBER OF FCF TASKS FLOWN	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
18 AVG. AD. PRESCRIPTION TIME (HRS)	2.11	2.14	.20	.28	.30	.26	.30	.28	.23	0.

Figure L-26 CONstrained LGAGE Simulation

P E R F O R M A N C E S U M M A R Y										PERIOD FROM DA 10 18.00										LEVEL 2																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
P E R S O N N E L										TOTAL		A2125		A2126		A2127		A2128		A2129		A2130		A2131		A2132		A2133		A2134		A2135		A2136		A2137		A2138		A2139		A2140		A2141		A2142		A2143		A2144		A2145		A2146		A2147		A2148		A2149		A2150		A2151		A2152		A2153		A2154		A2155		A2156		A2157		A2158		A2159		A2160		A2161		A2162		A2163		A2164		A2165		A2166		A2167		A2168		A2169		A2170		A2171		A2172		A2173		A2174		A2175		A2176		A2177		A2178		A2179		A2180		A2181		A2182		A2183		A2184		A2185		A2186		A2187		A2188		A2189		A2190		A2191		A2192		A2193		A2194		A2195		A2196		A2197		A2198		A2199		A2200		A2201		A2202		A2203		A2204		A2205		A2206		A2207		A2208		A2209		A2210		A2211		A2212		A2213		A2214		A2215		A2216		A2217		A2218		A2219		A2220		A2221		A2222		A2223		A2224		A2225		A2226		A2227		A2228		A2229		A2230		A2231		A2232		A2233		A2234		A2235		A2236		A2237		A2238		A2239		A2240		A2241		A2242		A2243		A2244		A2245		A2246		A2247		A2248		A2249		A2250		A2251		A2252		A2253		A2254		A2255		A2256		A2257		A2258		A2259		A2260		A2261		A2262		A2263		A2264		A2265		A2266		A2267		A2268		A2269		A2270		A2271		A2272		A2273		A2274		A2275		A2276		A2277		A2278		A2279		A2280		A2281		A2282		A2283		A2284		A2285		A2286		A2287		A2288		A2289		A2290		A2291		A2292		A2293		A2294		A2295		A2296		A2297		A2298		A2299		A2300		A2301		A2302		A2303		A2304		A2305		A2306		A2307		A2308		A2309		A2310		A2311		A2312		A2313		A2314		A2315		A2316		A2317		A2318		A2319		A2320		A2321		A2322		A2323		A2324		A2325		A2326		A2327		A2328		A2329		A2330		A2331		A2332		A2333		A2334		A2335		A2336		A2337		A2338		A2339		A2340		A2341		A2342		A2343		A2344		A2345		A2346		A2347		A2348		A2349		A2350		A2351		A2352		A2353		A2354		A2355		A2356		A2357		A2358		A2359		A2360		A2361		A2362		A2363		A2364		A2365		A2366		A2367		A2368		A2369		A2370		A2371		A2372		A2373		A2374		A2375		A2376		A2377		A2378		A2379		A2380		A2381		A2382		A2383		A2384		A2385		A2386		A2387		A2388		A2389		A2390		A2391		A2392		A2393		A2394		A2395		A2396		A2397		A2398		A2399		A2400		A2401		A2402		A2403		A2404		A2405		A2406		A2407		A2408		A2409		A2410		A2411		A2412		A2413		A2414		A2415		A2416		A2417		A2418		A2419		A2420		A2421		A2422		A2423		A2424		A2425		A2426		A2427		A2428		A2429		A2430		A2431		A2432		A2433		A2434		A2435		A2436		A2437		A2438		A2439		A2440		A2441		A2442		A2443		A2444		A2445		A2446		A2447		A2448		A2449		A2450		A2451		A2452		A2453		A2454		A2455		A2456		A2457		A2458		A2459		A2460		A2461		A2462		A2463		A2464		A2465		A2466		A2467		A2468		A2469		A2470		A2471		A2472		A2473		A2474		A2475		A2476		A2477		A2478		A2479		A2480		A2481		A2482		A2483		A2484		A2485		A2486		A2487		A2488		A2489		A2490		A2491		A2492		A2493		A2494		A2495		A2496		A2497		A2498		A2499		A2500		A2501		A2502		A2503		A2504		A2505		A2506		A2507		A2508		A2509		A2510		A2511		A2512		A2513		A2514		A2515		A2516		A2517		A2518		A2519		A2520		A2521		A2522		A2523		A2524		A2525		A2526		A2527		A2528		A2529		A2530		A2531		A2532		A2533		A2534		A2535		A2536		A2537		A2538		A2539		A2540		A2541		A2542		A2543		A2544		A2545		A2546		A2547		A2548		A2549		A2550		A2551		A2552		A2553		A2554	
RUN NUMBER	LCAGEE																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
P E R S O N N E L										TOTAL		A2125		A2126		A2127		A2128		A2129		A2130		A2131		A2132		A2133		A2134		A2135		A2136		A2137		A2138		A2139		A2140		A2141		A2142		A2143		A2144		A2145		A2146		A2147		A2148		A2149		A2150		A2151		A2152		A2153		A2154		A2155		A2156		A2157		A2158		A2159		A2160		A2161		A2162		A2163		A2164		A2165		A2166		A2167		A2168		A2169		A2170		A2171		A2172		A2173		A2174		A2175		A2176		A2177		A2178		A2179		A2180		A2181		A2182		A2183		A2184		A2185		A2186		A2187		A2188		A2189		A2190		A2191		A2192		A2193		A2194		A2195		A2196		A2197		A2198		A2199		A2200		A2201		A2202		A2203		A2204		A2205		A2206		A2207		A2208		A2209		A2210		A2211		A2212		A2213		A2214		A2215		A2216		A2217		A2218		A2219		A2220		A2221		A2222		A2223		A2224		A2225		A2226		A2227		A2228		A2229		A2230		A2231		A2232		A2233		A2234		A2235		A2236		A2237		A2238		A2239		A2240		A2241		A2242		A2243		A2244		A2245		A2246		A2247		A2248		A2249		A2250		A2251		A2252		A2253		A2254		A2255		A2256		A2257		A2258		A2259		A2260		A2261		A2262		A2263		A2264		A2265		A2266		A2267		A2268		A2269		A2270		A2271		A2272		A2273		A2274		A2275		A2276		A2277		A2278		A2279		A2280		A2281		A2282		A2283		A2284		A2285		A2286		A2287		A2288		A2289		A2290		A2291		A2292		A2293		A2294		A2295		A2296		A2297		A2298		A2299		A2300		A2301		A2302		A2303		A2304		A2305		A2306		A2307		A2308		A2309		A2310		A2311		A2312		A2313		A2314		A2315		A2316		A2317		A2318		A2319		A2320		A2321		A2322		A2323		A2324		A2325		A2326		A2327		A2328		A2329		A2330		A2331		A2332		A2333		A2334		A2335		A2336		A2337		A2338		A2339		A2340		A2341		A2342		A2343		A2344		A2345		A2346		A2347		A2348		A2349		A2350		A2351		A2352		A2353		A2354		A2355		A2356		A2357		A2358		A2359		A2360		A2361		A2362		A2363		A2364		A2365		A2366		A2367		A2368		A2369		A2370		A2371		A2372		A2373		A2374		A2375		A2376		A2377		A2378		A2379		A2380		A2381		A2382		A2383		A2384		A2385		A2386		A2387		A2388		A2389		A2390		A2391		A2392		A2393		A2394		A2395		A2396		A2397		A2398		A2399		A2400		A2401		A2402		A2403		A2404		A2405		A2406		A2407		A2408		A2409		A2410		A2411		A2412		A2413		A2414		A2415		A2416		A2417		A2418		A2419		A2420		A2421		A2422		A2423		A2424		A2425		A2426		A2427		A2428		A2429		A2430		A2431		A2432		A2433		A2434		A2435		A2436		A2437		A2438		A2439		A2440		A2441		A2442		A2443		A2444		A2445		A2446		A2447		A2448		A2449		A2450		A2451		A2452		A2453		A2454		A2455		A2456		A2457		A2458		A2459		A2460		A2461		A2462		A2463		A2464		A2465		A2466		A2467		A2468		A2469		A2470		A2471		A2472		A2473		A2474		A2475		A2476		A2477		A2478		A2479		A2480		A2481		A2482		A2483		A2484		A2485		A2486		A2487		A2488		A2489		A2490		A2491		A2492		A2493		A2494		A2495		A2496		A2497		A2498		A2499		A2500		A2501		A2502		A2503		A2504		A2505		A2506		A2507		A2508		A2509		A2510		A2511		A2512		A2513		A2514		A2515		A2516		A2517		A2518		A2519		A2520		A2521		A2522		A2523		A2524		A2525		A2526		A2527		A2528		A2529		A2530		A2531		A2532		A2533		A2534		A2535		A2536		A2537		A2538		A2539		A2540		A2541		A2542		A2543		A2544		A2545		A2546		A2547		A2548		A2549		A2550		A2551		A2552		A2553		A2554	
227	MANPOLES AVAILABLE (100)	1166.40	57.66	172.80	16.48	43.20	20.80	43.20	57.60	16.47	172.80	26.60																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											

ITEM NUMBER		PERIOD FROM A 10 10 10										LEVEL 2	
S H C P L E F A I R		S L M H A R Y											
44 NO. OF REPAIRABLE GENERATIONS		TOTAL	13AF	13AG	13AH	13AI	13AJ	13AK	13AL	13AM	13AN	13AO	13AP
45 PCT BASE REPAIR		752.00	0.	6.00	2.00	1.00	0.	0.	1.00	0.	0.	0.	0.
46 PCT DEPT REPAIR		100.00	0.	100.00	100.00	100.00	0.	0.	100.00	0.	0.	0.	0.
47 AVERAGE BASE REPAIR CYCLE		3.27	0.	6.21	7.6	12.00	0.	0.	62.10	0.	0.	0.	0.
48 PCT ACTIVE REPAIR		100.00	0.	100.00	100.00	100.00	0.	0.	100.00	0.	0.	0.	0.
49 PCT WHITE SPACE		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
50 NO. OF ITEMS IN REPAIR (ECF)		56.00	0.	2.00	1.00	0.	0.	0.	0.	0.	0.	0.	0.
51 NO. OF ITEMS BACKLOGGED (ECPI)		5.00	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

S H C P L E F A I R		S L M H A R Y											
44 NO. OF REPAIRABLE GENERATIONS		TOTAL	13AF	13AG	13AH	13AI	13AJ	13AK	13AL	13AM	13AN	13AO	13AP
45 PCT BASE REPAIR		752.00	0.	6.00	2.00	1.00	0.	0.	1.00	0.	0.	0.	0.
46 PCT DEPT REPAIR		100.00	0.	100.00	100.00	100.00	0.	0.	100.00	0.	0.	0.	0.
47 AVERAGE BASE REPAIR CYCLE		3.27	0.	6.21	7.6	12.00	0.	0.	62.10	0.	0.	0.	0.
48 PCT ACTIVE REPAIR		100.00	0.	100.00	100.00	100.00	0.	0.	100.00	0.	0.	0.	0.
49 PCT WHITE SPACE		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
50 NO. OF ITEMS IN REPAIR (ECF)		56.00	0.	2.00	1.00	0.	0.	0.	0.	0.	0.	0.	0.
51 NO. OF ITEMS BACKLOGGED (ECPI)		5.00	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

S H C P L E F A I R		S L M H A R Y											
44 NO. OF REPAIRABLE GENERATIONS		TOTAL	13AF	13AG	13AH	13AI	13AJ	13AK	13AL	13AM	13AN	13AO	13AP
45 PCT BASE REPAIR		752.00	0.	6.00	2.00	1.00	0.	0.	1.00	0.	0.	0.	0.
46 PCT DEPT REPAIR		100.00	0.	100.00	100.00	100.00	0.	0.	100.00	0.	0.	0.	0.
47 AVERAGE BASE REPAIR CYCLE		3.27	0.	6.21	7.6	12.00	0.	0.	62.10	0.	0.	0.	0.
48 PCT ACTIVE REPAIR		100.00	0.	100.00	100.00	100.00	0.	0.	100.00	0.	0.	0.	0.
49 PCT WHITE SPACE		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
50 NO. OF ITEMS IN REPAIR (ECF)		56.00	0.	2.00	1.00	0.	0.	0.	0.	0.	0.	0.	0.
51 NO. OF ITEMS BACKLOGGED (ECPI)		5.00	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

S H C P L E F A I R		S L M H A R Y											
44 NO. OF REPAIRABLE GENERATIONS		TOTAL	13AF	13AG	13AH	13AI	13AJ	13AK	13AL	13AM	13AN	13AO	13AP
45 PCT BASE REPAIR		752.00	0.	6.00	2.00	1.00	0.	0.	1.00	0.	0.	0.	0.
46 PCT DEPT REPAIR		100.00	0.	100.00	100.00	100.00	0.	0.	100.00	0.	0.	0.	0.
47 AVERAGE BASE REPAIR CYCLE		3.27	0.	6.21	7.6	12.00	0.	0.	62.10	0.	0.	0.	0.
48 PCT ACTIVE REPAIR		100.00	0.	100.00	100.00	100.00	0.	0.	100.00	0.	0.	0.	0.
49 PCT WHITE SPACE		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
50 NO. OF ITEMS IN REPAIR (ECF)		56.00	0.	2.00	1.00	0.	0.	0.	0.	0.	0.	0.	0.
51 NO. OF ITEMS BACKLOGGED (ECPI)		5.00	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

Figure L-28 CONSTRAINED LGAGE SIMULATION

RUN NUMBER LGAGE6									
P E R F O R M A N C E S U M M A R Y									
P E R I O D F A C H 6 3 1 0 1 6 1 1 3									
L E V E L 2									
S U P P L Y									
TOTAL									
54 TOT DOLLAR INVEST. (1000) (EOP)	9700.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00
55 FILL RATE PERCENT	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
56 NUMBER OF BACKORDER-DAYS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
57 NUMBER OF UNITS DEMANDED	700.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
58 PCT OFF-THE-SHELF	10.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
59 PCT EXPEDITED REPAIR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
60 PCT PREEMPTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
61 PCT DEMANDS NOT SATIS.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
62 NUMBER OF CANNIBALIZATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
63 NO. ITEMS ON BACKORDER (EOP)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S U P P L Y									
TOTAL									
54 TOT DOLLAR INVEST. (1000) (EOP)	9000.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00
55 FILL RATE PERCENT	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
56 NUMBER OF BACKORDER-DAYS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
57 NUMBER OF UNITS DEMANDED	700.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
58 PCT OFF-THE-SHELF	10.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
59 PCT EXPEDITED REPAIR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
60 PCT PREEMPTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
61 PCT DEMANDS NOT SATIS.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
62 NUMBER OF CANNIBALIZATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
63 NO. ITEMS ON BACKORDER (EOP)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S U P P L Y									
TOTAL									
54 TOT DOLLAR INVEST. (1000) (EOP)	9000.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00
55 FILL RATE PERCENT	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
56 NUMBER OF BACKORDER-DAYS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
57 NUMBER OF UNITS DEMANDED	700.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
58 PCT OFF-THE-SHELF	10.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
59 PCT EXPEDITED REPAIR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
60 PCT PREEMPTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
61 PCT DEMANDS NOT SATIS.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
62 NUMBER OF CANNIBALIZATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
63 NO. ITEMS ON BACKORDER (EOP)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Figure L-29 CONSTRAINED LGAGE SIMULATION

WEN NUMBER LGAGE		P E R F O R M A N C E				S U M M A R Y				P E R I O D F R O M				L E V E L			
		Y01M1		A01M1		M01		M21M		NF2		L030E		L030M		L030	
68	100 COLLAT INVEST (1000) (LOP)	500.00		100.00	600.00	140.00	160.00	160.00	160.00	360.00		240.00		120.00		400.00	4.
69	EQUIPMENT FOURS AVAIL (100)	12000.00		216.00	12000.00	302.40	216.00	216.00	216.00	648.00		516.00		252.20		864.00	8.
70	EQUIPMENT FOURS AVAIL (100)	12000.00		216.00	12000.00	302.40	216.00	216.00	216.00	648.00		516.00		252.20		864.00	8.
71	PLT USED-UNSCOPED MAINT	.37		1.82	1.55	.27	.72	.72	.72	1.21		1.21		1.21		.11	0.
72	PLT USED-SCOPED MAINT	.47		.99	2.17	.36	.88	.88	.88	1.41		.69		.60		.11	0.
73	ELL UNUSEL	93.17		57.13	96.28	99.17	96.30	96.30	96.30	97.37		96.11		96.28		99.89	1.
74	NUMBER OF BACKORDER-DAYS	8.78		0.	0.	0.	0.	0.	0.	0.		6.97		2.71		0.	0.
75	NUMBER OF LOTS DEMANDED	11665.00		355.64	3453.46	246.40	337.00	337.00	337.00	1531.00		1306.90		656.00		2081.00	1.
76	LOT AVAILABLE	107.30		100.00	100.00	100.00	100.00	100.00	100.00	100.00		100.00		100.00		100.00	0.
77	LOT FROM BY EXPEDITE	1.		0.	0.	0.	0.	0.	0.	0.		0.		0.		0.	0.
78	LOT FROM BY FREEMPTION	0.		0.	0.	0.	0.	0.	0.	0.		0.		0.		0.	0.
79	LOT DEMANDS NOT SATISF	0.		0.	0.	0.	0.	0.	0.	0.		0.		0.		0.	0.
80	EQUIP HOURS BACKLOG (100) (LOP)	.11		0.	.10	.01	0.	0.	0.	0.		0.		0.		0.	0.

Figure L-30 CONSTRAINED LGAGE SIMULATION

landing gear subsystems were placed in the network. The total task time for each task type (e.g., troubleshoot or remove and replace) was then proportionately subdivided among the five subsystems, based upon the likelihood of a given AGE combination. The use of different support equipment combinations was considered in the shop tasks for this scenario, so that only one of each subsystem type was required for those tasks.

Results of this comparison study are presented in Table L-2 and Table L-3. For the AGE demand, the percent difference in overall usage time between the two models is less than 4 percent of the total. The primary reason for the differences in the two models appears to be due to the random nature of the Logistics Composite Model in failure selection and the probability distribution of the maintenance task times.

Table L-2

COMPARISON OF AGE USAGE (FLIGHTLINE)
BETWEEN LCOM AND R&M

Unit	HRS/KFH		(Δ) (HRS)	Δ % =
	LCOM	R&M		LCOM-R&M R&M
AJ35T	114.92	137.87	-22.95	-16.65
D60	592.45	609.87	-17.42	-2.86
MD3	27.42	25.18	2.24	8.90
M27M	53.51	51.41	2.10	4.08
NF2	237.50	250.90	-13.40	-5.34
TJ30E	53.51	51.41	2.10	4.08
TJ30N	53.51	51.41	2.10	4.08
TOTALS	1132.82	1178.05	-45.23	-3.84

The results shown in Table L-3 for manpower utilization in maintenance manhours per thousand flight hours (MMH/KFH) show approximately a 5 percent overall difference between the models. The reasons are again primarily those discussed above. The two columns of R&M output data are listed to illustrate the slight changes in workhour needs due to differences between the model which incorporates AGE usage and that which also handles the different AGE combinations. One column lists the number of personnel

Table L-3

COMPARISON OF MANPOWER UTILIZATION
BETWEEN LCOM AND R&M

		MMH/KFH			$\Delta \% =$ $\frac{1 - 3}{3}$	Mean # Personnel/ Work Center
	AFSC	LCOM 1	R&M (Modified for AGE) 2	R&M (Orig.) 3		
1	42330	329.38	348.08	348.08	-5.37	6
2	42334	222.56	257.11	230.19	-3.31	5
3	42350	472.20	524.11	508.96	-7.22	9
4	42354	583.54	626.65	626.65	-6.88	11
5	4313R	0.27	25.32	12.41	-97.82	1
6	4313W	43.38	42.15	42.15	2.93	1
7	43131	244.41	249.23	248.41	-1.61	5
8	4315R	153.25	149.70	147.16	4.14	3
9	4315W	57.86	55.27	55.27	4.68	2
*10	53151	931.67	609.87	609.87	52.77	(16) 11
11	53135	.123	.165	.165	-25.65	1
12	53150	3.35	3.41	3.41	-1.87	1
13	53154	73.27	84.08	84.08	-12.86	2
14	53155	73.39	84.24	84.24	-12.88	2
Totals		3188.65	3059.39	3001.05	6.25	(65) 60

*includes inspection, preflight and post flight tasks in LCOM which are not in R&M - approx. 338.91 MMH/KFH are used - removing this, yields:

10	43151	592.76	609.87	-2.81
and overall,				
Totals		2849.74	3059.39	-5.04

needed for each work center. The total, 60, represents only direct labor personnel performing landing gear maintenance within the scope of the scenario.

REFERENCES FOR APPENDIX L

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APPENDIX M SAMPLE TRAINING PLAN

C-141 AIRCRAFT BRAKE AND WHEEL REMOVAL

INTRODUCTION

This training plan presents the content, instructional components, and instructional delivery system appropriate for task-oriented training related to brake and wheel removal/replacement on the C-141 aircraft. The entire training plan was developed employing a modified version of the instructional system development (ISD) process described in Air Force Manual 50-2. The training outlined by this plan is complemented by a task-oriented technical manual which covers the same maintenance operation.

RELATIONSHIP BETWEEN THE ISD PROCESS AND TRAINING PLAN DEVELOPMENT

The total ISD process includes the actual development, implementation, and evaluation/revision of a given training program. Thus, the development of a training plan constitutes only a portion of the ISD process. That portion, commonly termed "training program design," is depicted in the nine-step model presented in Figure M-1. Each of the nine steps and related procedures is discussed in the next section.

STEPS IN TRAINING PLAN DEVELOPMENT

The first step in training plan development is to select the specific task areas for which training will be required. For the C-141 wheel and brake removal/replacement, task areas were identified via an integrated task analysis of an actual C-141 wheel and brake assembly (for this training plan, a modified version of the integrated task analysis procedure described in AFHRL-TR-73-43 was employed). The integrated task analysis also identified and documented each

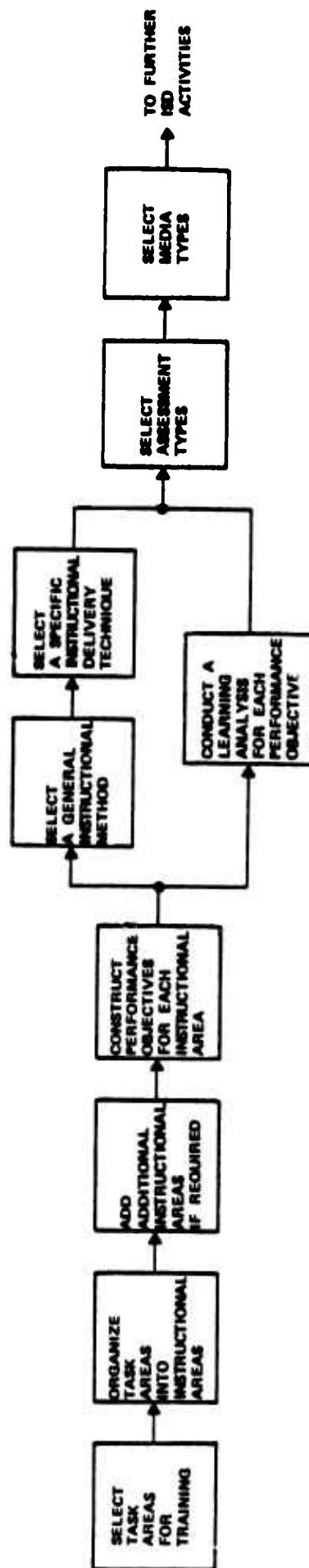


FIGURE M-1

PORTION OF THE ISD PROCESS USED IN THE DEVELOPMENT OF A TRAINING PLAN

of the discrete tasks involved in the removal/replacement operation.

The integrated task analysis of the C-141 wheel and brake removal/replacement revealed 10 task areas. These 10 areas subsumed each of the discrete tasks. Pictorially, the task areas, as well as their relationship to both the removal/replacement operation, and the discrete tasks are shown in Figure M-2.

The second step in training plan development is to categorize each of the task areas into an instructional area. Basically, an instructional area is defined as a group of task areas which, for training purposes, are closely related. For the C-141 brake and wheel removal/replacement, the instructional areas and their related task areas are shown in Figure M-3.

The third step is to add additional instructional areas as appropriate. Additional instructional areas are sometimes required either to complete the overall instructional sequence (e.g., introduction, summary) or to achieve the objectives of task-oriented training (e.g., a special skill required for a task area). For this training plan, three instructional areas were added. The areas and a rationale for the addition of each are as follows:

1. Orientation to Brake and Wheel Removal/Replacement - This instructional area was added to complete the overall instructional sequence. It will be used to introduce the entire brake and wheel removal/replacement operation to the students. In addition, it will provide an opportunity to describe the process of instruction to be used during the entire training program.
2. Use of Special Tools for Brake and Wheel Removal/Replacement - This area was added to achieve the objectives of task-oriented training. It assures that students can both recognize and use those special tools involved in C-141 brake and wheel removal/replacement.
3. Wheel and Brake Removal/Replacement on the C-141 Aircraft - This instructional area was added to complete the overall instructional sequence. It assures students an opportunity to demonstrate skill mastery on the actual C-141 aircraft.

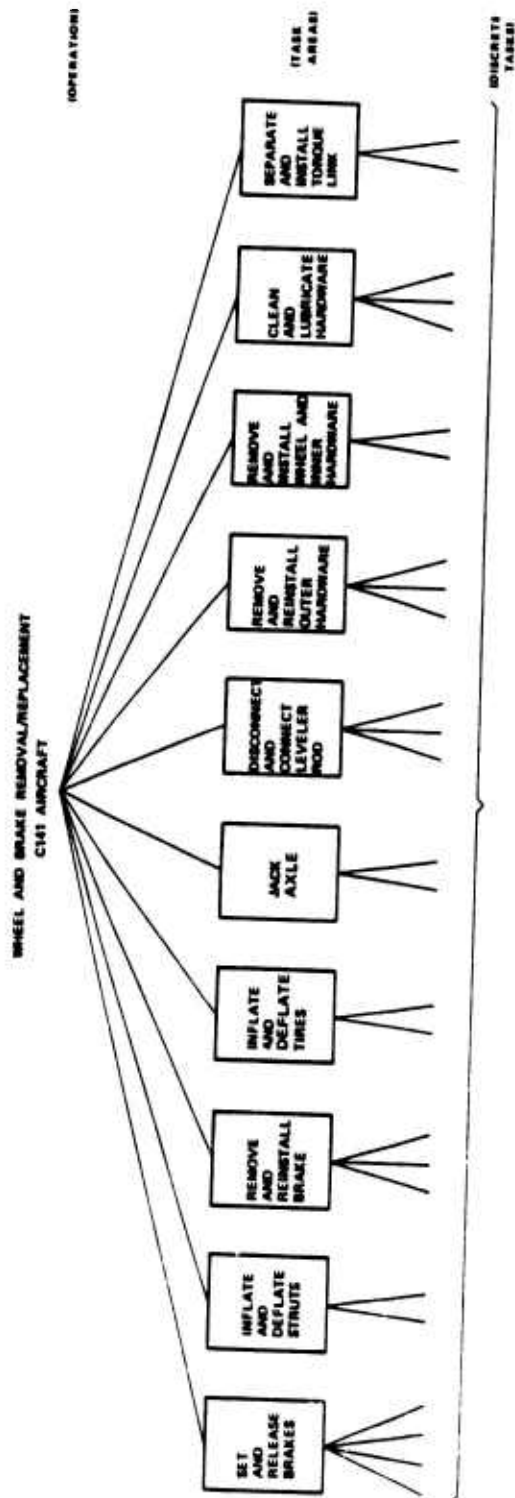


FIGURE M-2

RELATIONSHIP OF C141 BRAKE AND WHEEL REMOVAL/REPLACEMENT TASK AREAS
TO BOTH THE OVERALL OPERATION AND THE DISCRETE TASKS

<u>INSTRUCTIONAL AREA</u>	<u>RELATED TASK AREAS</u>
Preparing for C-141 Brake and Wheel Removal/Replacement	* set and release brakes * inflate and deflate struts * jack axle
Removing and Replacing C-141 Wheel	* inflate and deflate tires * disconnect and connect leveler rod * remove and install outer hardware * remove and install wheel&inner hdwr. * clean and lubricate hardware (partial)
Removing and Replacing C-141 Brake	* remove and install brake * separate and install torque link * clean & lubricate hardware (partial)

Figure M-3

Instructional Areas and Related Task Areas

The fourth step in training plan development is to construct one or more performance objectives for each instructional area (See Figure M-4). Briefly, there are two general purposes for a performance objective (Vaughan, 1977). The first is to communicate to students exactly what is to be learned. The second is to communicate to instructional designers exactly what must be taught. In order to meet both of these purposes, the performance objectives for this training plan were constructed to reflect the criteria outlined by (Mager 1962).

In addition to the Mager criteria, each of the performance objectives was constructed to reflect the application level of Bloom's Taxonomy of Educational Objectives (Bloom et al., 1971). Learning at the level of application will help assure that over job-related performance, rather than simply information recall, is emphasized both in the development and conduct of training. Thus, the training will be better matched to the requirements of the job. The performance objectives for the entire sequence of instruction related to C-141 wheel and brake removal/replacement are presented in Appendix N.

The fifth step in training plan development is to conduct a learning analysis of each performance objective. Briefly, the purpose of a learning analysis is to both state and sequence each of the prerequisite learning (termed enabling objectives) required for successful attainment of a performance objective (Gagne, 1970). It is the enabling objectives which provide the specific focus for both the development of instructional materials and assessments.

As with the construction of performance objectives the content of each learning analysis reflects the levels of learning within Bloom's Taxonomy. This assures that the list of enabling objectives within each analysis is complete (reflects all of the prerequisite of learning required by the performance objective) well as correctly sequenced (in respect to the re complexity of Bloom learning types). The learning analyses for all of the performance objectives within the C-141 brake and wheel removal/replacement training plan are presented in Appendix O.

The sixth step in training plan development is to select the general method by which training will be delivered. Any single method (e.g., computer assisted instruction, teacher led instruction, small group instruction) or array of methods could be selected. Normally, this methodological decision is made based upon the type and complexity of the

<u>INSTRUCTIONAL AREA</u>	<u>SOURCE OF INSTRUCTIONAL AREA</u>	<u>PERFORMANCE OBJECTIVE NUMBER</u>
Orientation to C-141 Brake and Wheel Removal/Replacement	additional (introduction)	1
Use of Special Tools For C-141 Brake and Wheel Removal/Replacement	additional (special skill)	2
Preparing For C-141 Brake and Wheel Removal/Replacement	integrated task analysis	3 (strut inflation/ deflation) 4 (axle jacking) 5 (brake set/ release)
Removing and Replacing C-141 Wheel	integrated task analysis	6
Removing and Replacing C-141 Brake	integrated task analysis	7
Wheel and Brake Removal/Replacement on the C-141 Aircraft	additional (real world skill demonstration)	8

Figure M-4

C-141 Wheel and Brake Removal/Replacement -
Instructional Areas and Related Performance Objectives

performance objectives (and related learning analyses), the ability of the learners, and the environment for training.

For this training plan, the general method of "self-instruction" was selected. This choice was made based upon a number of considerations. First, the complexity of the performance and enabling objectives is not of a level which would preclude presentation via a self-instructional format. Second, recent trends in training include a movement toward valid and predictable instruction which is exportable (i.e., capable of replication at a variety of locations without special facilities or personnel). By definition, validity and predictability are consistently achievable only via highly structured self-instructional approaches to learning. Third, the concept of self-instruction will permit students to spend as much or as little study time as required in order to achieve the goal of mastery learning.

The selection of self-instruction is not intended to remove, or reduce the importance of, the instructor within a training program. Rather, self-instruction permits many of the lower level types of learning to be mastered by a student working independently. Instructional personnel are thus able to devote their expertise to the more crucial aspects of training; e.g., complex skill development, individual student supervision, individual student assessment, and remediation.

The seventh step in training plan development is to select the primary instructional delivery technique which will adequately carry out the general method of instruction. For this training plan, "instructional modules" were chosen as the primary delivery technique. The choice was made because instructional modules are useable by a wide range of students who possess varying abilities to learn, speed in learning, and levels of interest. Further, a given instructional module may include a variety of different media forms reflecting various student interests (a more thorough discussion of instructional modules in general and for this training plan may be found in Appendix P).

The eighth step is to select an assessment type for each performance and enabling objective. The assessment type selected for the performance objective will indicate the manner in which student performance (for purposes of grading) will be judged. The performance objective statement normally indicates the assessment type to be used.

The assessment types selected for the enabling objectives will indicate the format of diagnostic tests (when given before instruction) and/or self-tests (when given following instruction). However, enabling objective assessment items are not used for grading purposes.

The assessment type chosen for a given enabling objective is based upon two constraints. First, that the assessment type can adequately measure the behavior specified in the enabling objective. Second, that any restrictions imposed by the instructional method (in this case self-instruction) or the instructional delivery technique (in this case modules) can be reflected. The enabling objectives and a preliminary choice of assessment type for each presented in Appendix Q.

The ninth and final step in training plan development is to select a media type for each enabling objective.*

As with assessment types, media types are selected in respect to the behavior specified within the objective, as well as, by any restrictions imposed by either the method of instruction or instructional delivery technique. In addition, media type is often a direct product of the abilities and interests of the students who will undertake the instruction.

For the training plan under discussion, a single tentative media type has been selected for each enabling objective. Alternative and/or additional media types may later be chosen in order to satisfy the different learning abilities and interests of different students. The tentative media type selected for each enabling objective is presented in Appendix Q.

* (Note: Media types are not selected for a performance objective because performance objective is not directly taught. Rather, the behavior specified in the performance objective is the result of the attainment of related enabling objectives.

VALIDATION AND USE OF A TRAINING PLAN

The preceding paragraphs described that portion of the ISD process required to complete the developmetn of a training plan for brake and wheel removal/replacement on the C-141 aircraft. Those paragraphs, as well as the content of Appendices N to Q and constitute the training plan. This training plan for the brake and wheel removal/replacement operation is considered preliminary and should undergo review and revision by three groups of individuals:

1. Instructional designers who can analyze the contents of the plan in respect to accepted standards of instructional design.
2. Equipment user's who can analyze the contents of the plan in respect to the maintenance needs of Air Force work units.
3. Equipment builders who can analyze the contents of the plan in respect to the maintenance requirements of the equipment under consideration.

This validation process would continue until an acceptable degree of consensus on the contents of the training is obtained. At this point, the training plan would be deemed "final."

Upon acceptance of a final training plan, the following ISD activities would be undertaken:

1. Development of the assessment items.
2. Development of the instructional materials.
3. Packaging of instructional materials and assessments into self-instructional modules.
4. Training for the instructors vis-a-vis the use of self-instructional modules as well as the supervision and evaluation of student performance in a self-instructional setting.
5. Design and development of required equipment mockups.

6. Field test and revision of the instruction in order to achieve predictability and consistency.
7. Deployment of training.

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APPENDIX N
TRAINING PLAN PERFORMANCE OBJECTIVES
C141 WHEEL AND BRAKE REMOVAL/REPLACEMENT

PERFORMANCE OBJECTIVE 1:

Given 10 multiple choice items, the student will be able

- a. to identify the tasks and task sequence involved in the removal/replacement of a C141 wheel and brake assembly and
- b. to recognize situations in which removal/replacement of the wheel and brake assembly is necessary.

To successfully achieve this objective, the student must correctly answer nine of the test items.

PERFORMANCE OBJECTIVE 2:

Given the five special tools required for brake and wheel removal/replacement on the C141 aircraft and mockups of fasteners requiring the tools, the student will

- a. select the tool required by each fastener and
- b. use each tool to loosen and tighten the related fastener.

To satisfy this objective, the student must follow the tool use and safety procedures outlined in the module.

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PERFORMANCE OBJECTIVE 3:

Given mockups of a high pressure nitrogen servicing cart and of a given C141 main landing gear strut, a height to which the strut is to be raised, and a C141 strut inflation/deflation checklist, the student will be able to inflate and deflate the strut mockup. To successfully achieve this objective, the student must accomplish the following steps:

1. Determine if strut inflation/deflation is required.
2. Set up, operate, and shut down the servicing cart.
3. Ensure that maximum strut extension limits are not exceeded.
4. Ensure that maximum strut servicing limits are not exceeded.
5. Ensure that maximum permitted differential in strut heights are not exceeded.
6. Carry out each of the strut inflation/deflation procedures indicated in the module.
7. Carry out each of the related safety procedures indicated in the module.

PERFORMANCE OBJECTIVE 4:

Given mockups of a C141 main landing gear strut and aircraft jack, and a C141 axle jacking checklist, the student will be able to raise and lower the strut (aircraft). To successfully achieve the objective the student must accomplish each of the following steps:

1. Inspect the jack prior to use.
2. Correctly position the jack.
3. Raise the wheel approximately one inch.

4. Carry out each of the axle jacking procedures indicated in the module.
5. Carry out each of the related safety procedures indicated in the module.

PERFORMANCE OBJECTIVE 5:

Given a brake number, mockups of C141 rudder pedals, hydraulic system control panel, and a C141 brake setting/releasing checklist, the student will be able to set and release the brakes. To successfully achieve this objective, the student must accomplish the following steps:

1. Pressurize the correct hydraulic system for the given brake.
2. Check that the brakes are actually set.
3. Carry out each of the brake setting/releasing procedures indicated in the module.
4. Carry out each of the related safety procedures indicated in the module.

PERFORMANCE OBJECTIVE 6:

Given mockups of a C141 axle, wheel and related inner and outer hardware incorporating one or more defective parts, and a C141 wheel removal/replacement checklist, the student will be able to remove and replace the wheel/related hardware. To successfully achieve this objective, the student must accomplish the following steps:

1. Inspect all required hardware components and identify/replace and which are defective.
2. Correctly lubricate all required hardware components.
3. Use all tools correctly.

4. Torque wheel to proper tolerances.
5. Verbally indicate cautions and carry them out.
6. Carry out each of the wheel removal/replacement procedures indicated in the module.
7. Carry out each of the related safety procedures indicated in the module.

PERFORMANCE OBJECTIVE 7:

Given mockups of a C141 axle, brake assembly, strut, and torque link incorporating one or more defective parts, a brake removal and replacement checklist, and the instructor acting as a hydraulic specialist, the student will be able to remove and replace the C141 brake assembly/related hardware and recognize/replace all defective parts. To successfully achieve this objective, the student must accomplish the following steps:

1. Request the hydraulic specialist to depressurize the hydraulic system and cap/plug the cap/filler.
2. Use all tools correctly.
3. Inspect all required hardware components and identify/replace any which are defective.
4. Correctly lubricate all required hardware components.
5. Verbally indicate cautions and carry them out.
6. Carry out each of the brake removal/replacement procedures indicated in the module.
7. Carry out each of the related safety procedures indicated in the module.

PERFORMANCE OBJECTIVE 8:

Given an actual C141 aircraft, and related C141 job guide, the student will be able to remove and replace both the wheel and brake assembly. To successfully achieve the objective, the student must accomplish the following steps:

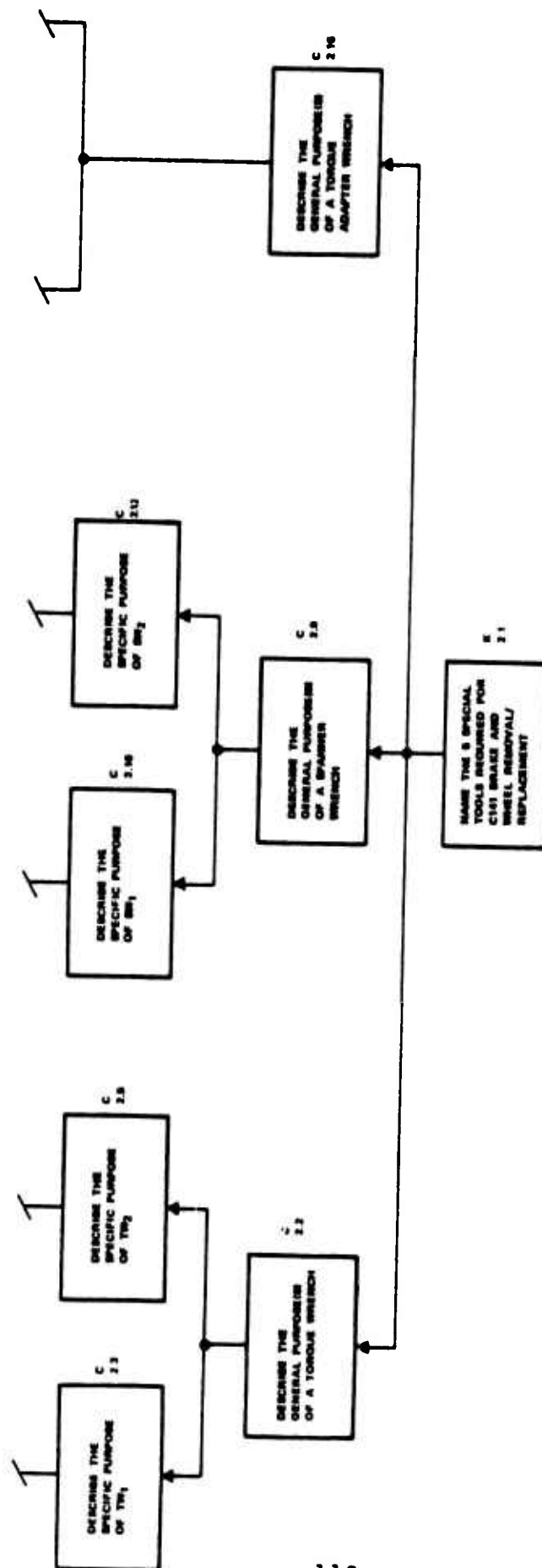
1. Inspect all hardware components and identify/replace any which are defective.
2. Lubricate all required hardware components.
3. Verbally indicate all cautions and carry them out.
4. Carry out the aircraft procedures for the task as indicated in the module.
5. Carry out each of the related safety procedures as indicated in the module.

K - Knowledge
C - Comprehension
A - Application



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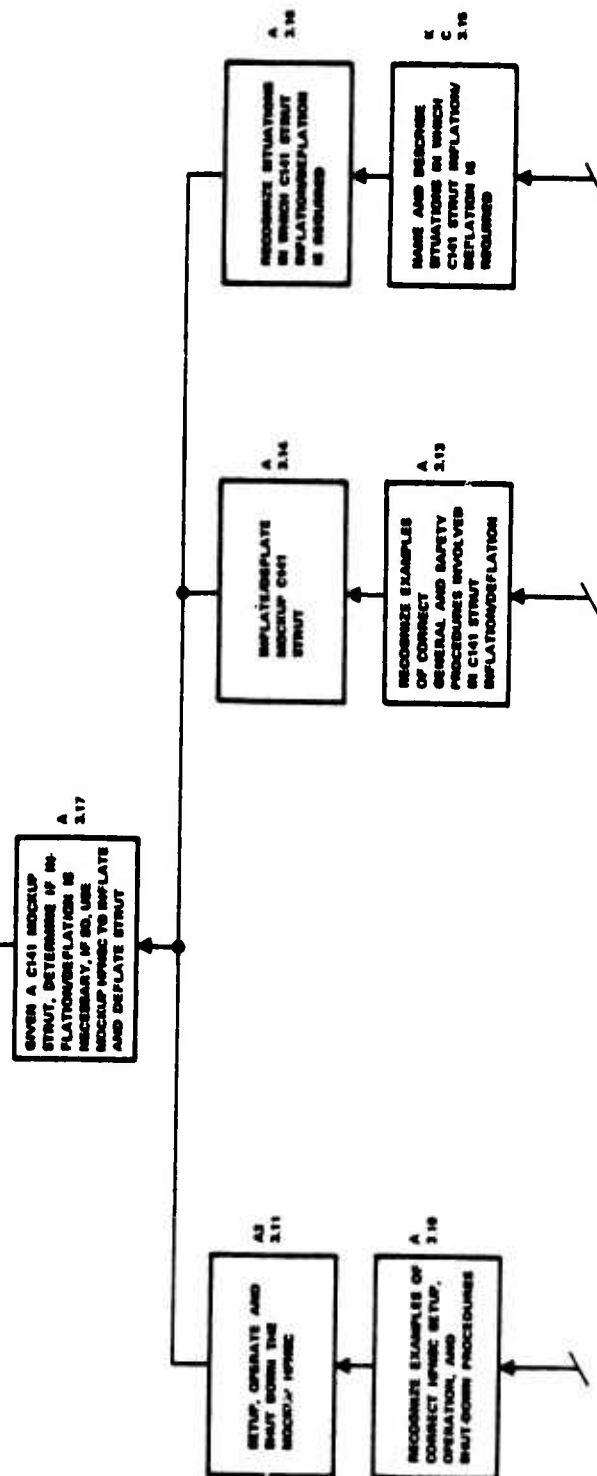


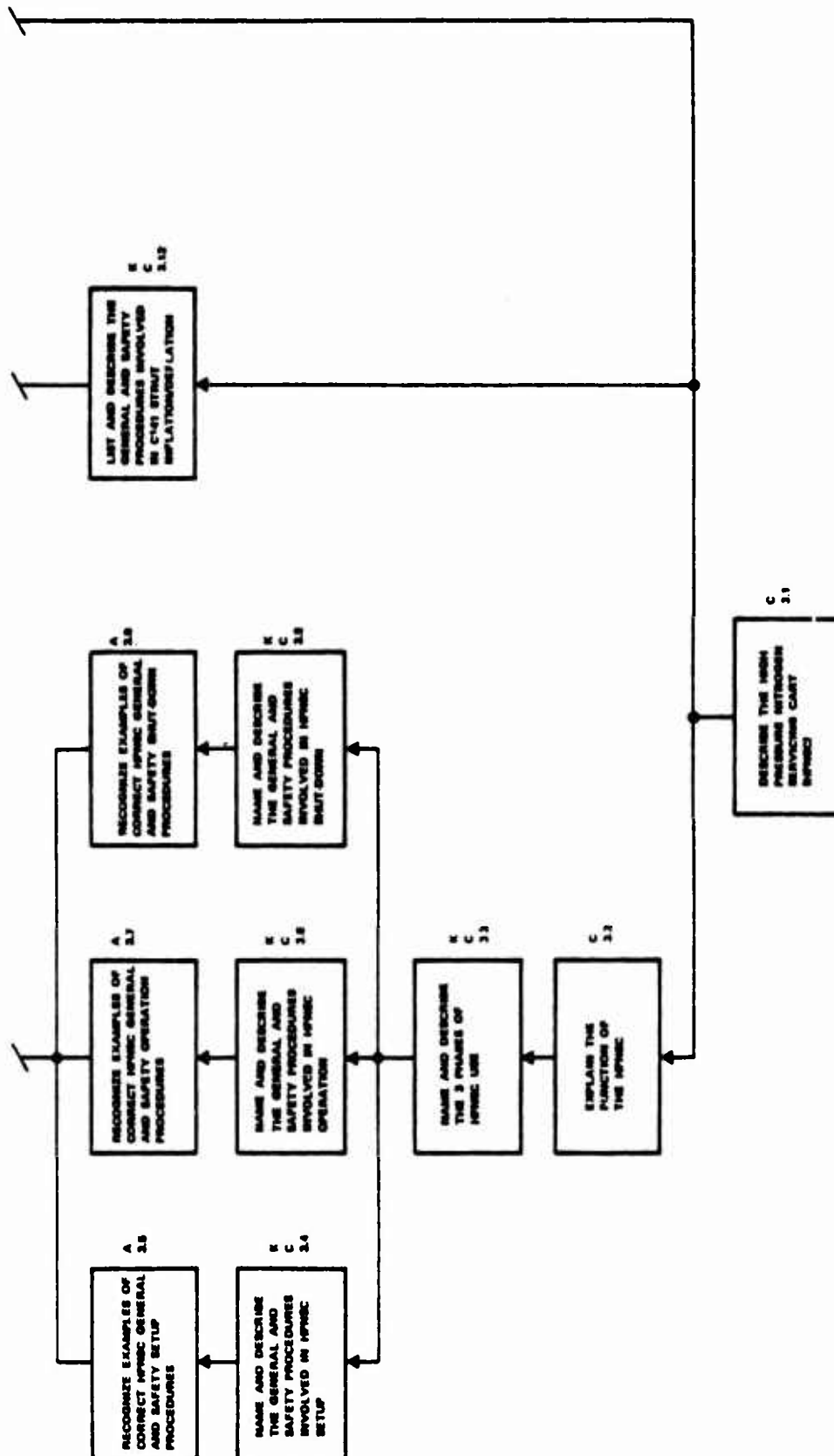


PERFORMANCE OBJECTIVE 3:
 GIVEN MOCKUPS OF A HIGH PRESSURE NITROGEN SERVICING CART AND OF A GIVEN C141 MAIN LANDING GEAR STRUT, A NERST TO REACH THE STRUT IS TO BE RIGGED, AND A C141 STRUT INFLATION/DEFLATION CYCLE, THE STUDENT SHALL BE ABLE TO INFLATE AND DEFLATE THE STRUT MOCKUP TO SUCCESSFULLY ACHIEVE THIS OBJECTIVE, THE STUDENT MUST:

1. DETERMINE IF STRUT INFLATION/DEFLATION IS REQUIRED
2. SET UP, OPERATE, AND SHUT DOWN THE SERVICING CART,
3. NOT EXCEED THE MAXIMUM STRUT EXTENSION LIMITS,
4. NOT EXCEED THE MAXIMUM STRUT SERVICING LIMITS,
5. NOT EXCEED THE MAXIMUM PERMITTED DIFFERENTIAL IN STRUT HEIGHTS,
6. CARRY OUT EACH OF THE STRUT INFLATION/DEFLATION PROCEDURES INDICATED IN THE MODULE.

K - Knowledge
 C - Comprehension
 A - Application

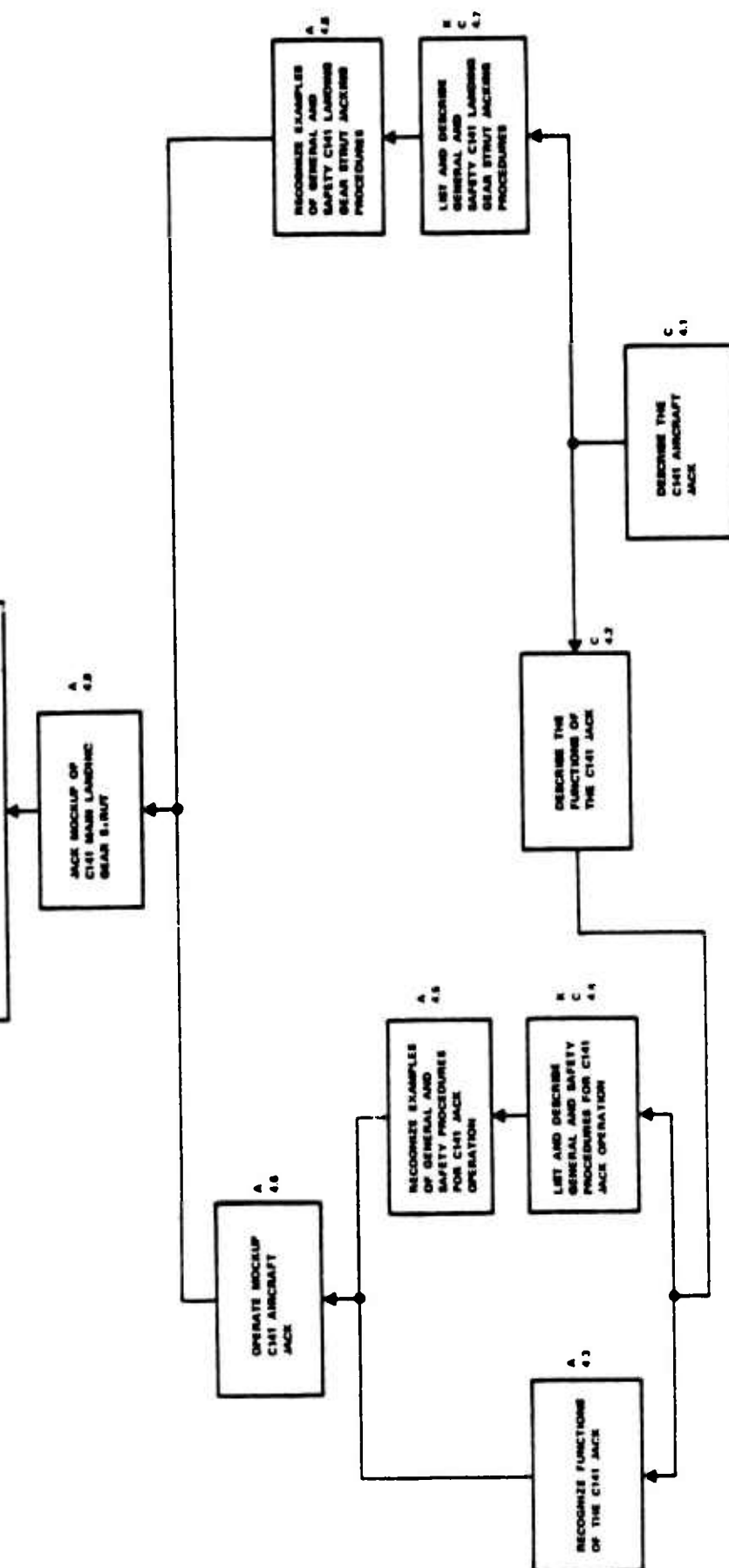




PERFORMANCE OBJECTIVE 4:
 GIVEN MOCKUPS OF A C141 MAIN LANDING GEAR STRUT AND AIRCRAFT JACK, AND A C141 AXEL JACKING CHECKLIST, THE STUDENT WILL BE ABLE TO NAME AND LOWER THE STRUT (AIRCRAFT), TO SUCCESSFULLY ACHIEVE THE OBJECTIVE, THE STUDENT MUST:

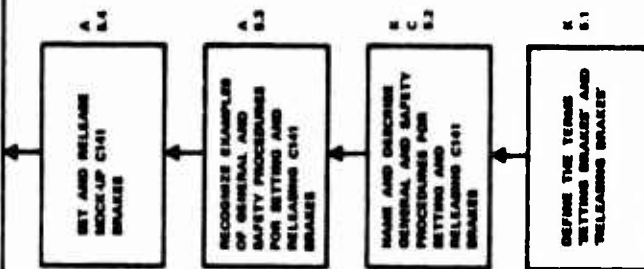
1. INSPECT THE JACK PRIOR TO USE.
2. CORRECTLY POSITION THE JACK.
3. RAISE THE WHEEL APPROXIMATELY ONE INCH.
4. CARRY OUT EACH OF THE AXEL JACKING PROCEDURES INDICATED IN THE MODULE, AND
5. CARRY OUT EACH OF THE RELATED SAFETY PROCEDURES INDICATED IN THE MODULE

K-Knowledge
 C-Comprehension
 A-Application

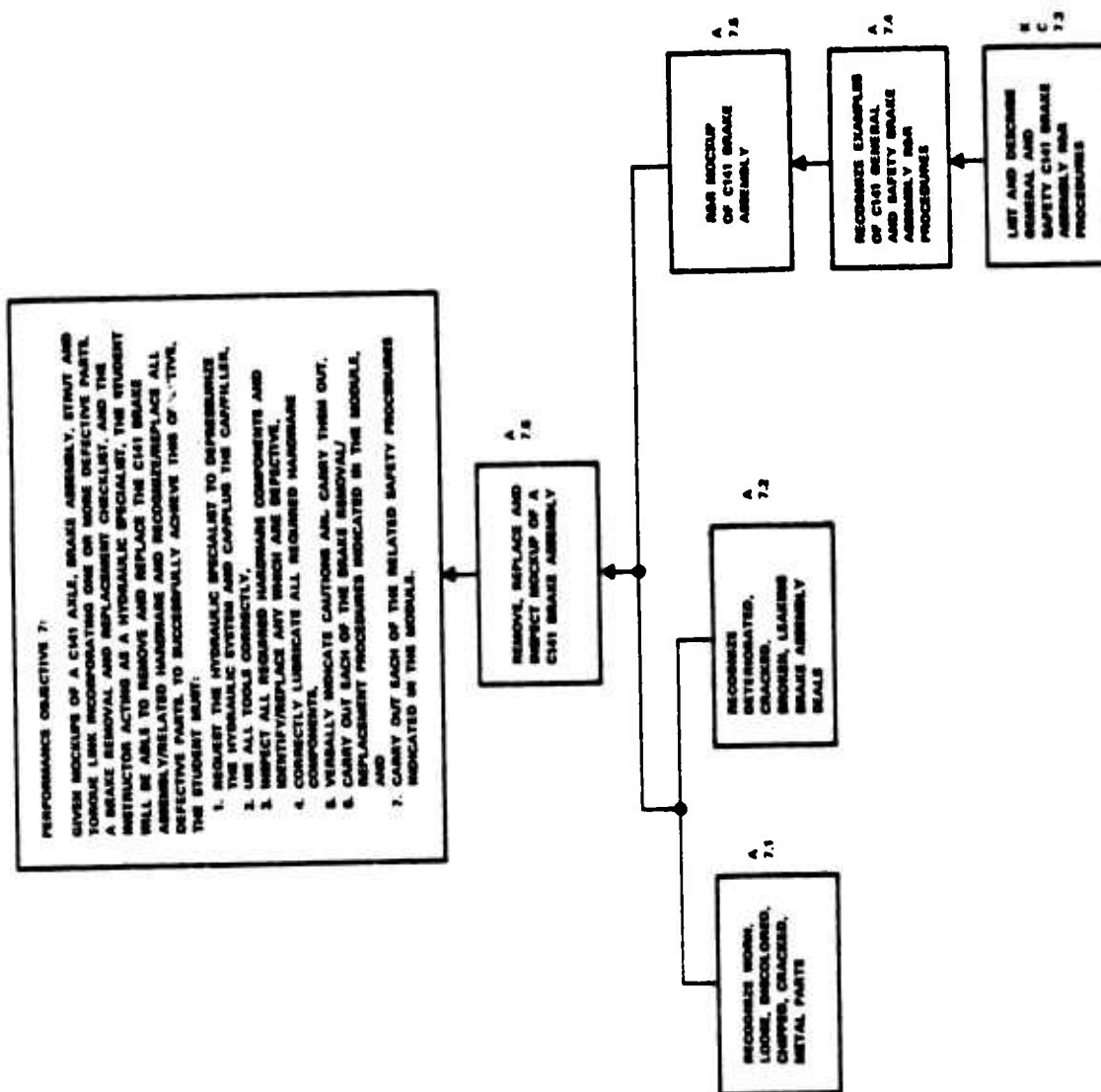


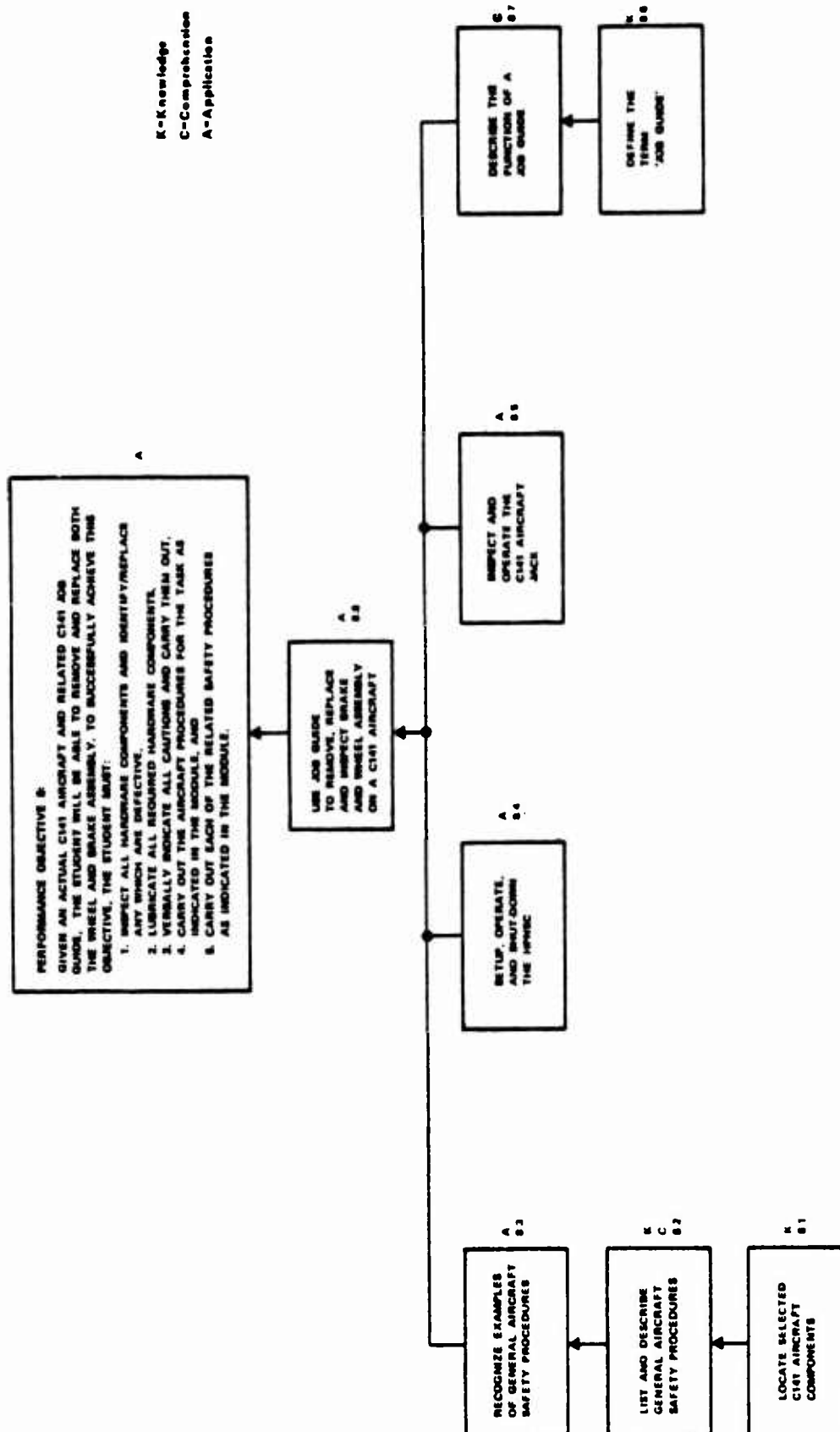


K-Knowledge
 C-Comprehension
 A-Application



K-Knowledge
C-Comprehension
A-Application





APPENDIX P

DESCRIPTION OF MODULARIZED INSTRUCTION

OVERVIEW OF MODULES

A module is an instructional package dealing with a single performance objective. It is an attempt to individualize learning by enabling a trainee to master one unit of instruction before moving to another. The learning experiences within a module are presented in a self-instructional format which permits the trainee to control the rate and intensity of study. Since the module package may involve materials which are portable, the trainee can take it to the library, a study carrel or living quarters. The length of a module may vary from only a few minutes of trainee time to several hours. Modules may be used individually or combined to form sequences of learning devoted to a specific overall outcome (e.g., a particular job skill).

CONTENT OF A MODULE

Modules may vary dramatically in terms of content. Some modules provide only a prescription in the sense that a trainee is told where to obtain and how to use such items as instructional materials and assessments. Conversely, other modules may be totally self-contained in that they would contain everything a trainee required in order to achieve a given performance objective. For the modules related to C-141 brake and wheel removal/ replacement, the following general content is proposed:

1. An introduction including the statement of the performance objective.
2. A diagnostic test related to each of the enabling objectives.
3. An answer key to the diagnostic test, including a relationship chart matching incorrectly answered diagnostic test items with appropriate instruction.

4. All instruction required for each enabling objective (other than that limited amount of instruction requiring either instructor delivery or supervision).
5. Self-tests valid for the instruction within the module.
6. Directions on how and where the module post-test will be administered.

STUDENT USE OF AN INSTRUCTIONAL MODULE

Based upon the above proposed content, the modules would be used in the following general manner:

1. Trainees would begin use of a module by reading the introduction including the performance objective.
2. Trainees would complete the diagnostic test.
3. Depending upon the results of the diagnostic test, the relationship chart would guide each trainee to the appropriate instruction.
4. Upon completion of each segment of instruction, trainees would complete the related self-test.
5. Following completion of all instruction, the trainee would take the post-test related to the module. (The post-test could be given on demand or based upon a schedule provided by the instructor.)

Most of the study related to the module could be undertaken independently at a location of the trainee's choosing. However, that instruction requiring the use of mockups or special tools would be completed within the confines of a training environment under instructor control.

ROLE OF THE INSTRUCTOR

The role of the instructor in modular instruction is that of facilitator and evaluator. Essentially, instructors have limited responsibility for delivering "stand-up" instruction. Instead, they are available to assist trainees in overcoming learning problems on a one-to-one basis. Further, instructors will supervise trainee practice of skills involving mockups or special tools as well as evaluating student completion of each post-test. Thus, in a modular situation, the responsibility for instructional delivery moves from the instructor to the modules while the instructor tends to take on a heavily diagnostic role.

APPENDIX Q
PRELIMINARY MEDIA AND ASSESSMENT CHOICES

C141 BRAKE AND WHEEL REMOVAL/REPLACEMENT

<u>Enabling Objective</u>	<u>Preliminary Medial Choice</u>	<u>Preliminary Assessment Choice</u>
1.1	written instruction	short answer item
1.2	written instruction	short answer item
1.3	written instruction	alternative response item
1.4	written instruction	short answer
1.5	written instruction	short answer
1.6	written instruction	alternative response
1.7	written instruction with still pictures	alternative response with still pictures
1.8	written instruction	short answer
1.9	written instruction with still pictures	alternative response with still pictures
1.10	alternative response	alternative response
2.1	written instruction	short answer
2.2	written instruction	short answer
2.3	written instruction	short answer
2.4	written instruction	alternative response
2.5	written instruction	short answer
2.6	written instruction	short answer
2.7	written instruction with sequenced still pictures	alternative response with sequenced still pictures

2.8	practice	instructor observation
2.9	written instruction	short answer
2.10	written instruction	short answer
2.11	written instruction	alternative response
2.12	written instruction	short answer
2.13	written instruction	short answer
2.14	written instruction with sequenced still pictures.	alternative response with sequenced still pictures
2.15	practice	instructor observation
2.16	written instruction	short answer
2.17	written instruction	alternative response
2.18	written instruction	short answer
2.19	written instruction with sequenced still pictures	alternative response with sequenced still pictures
2.20	practice	instructor observation
2.21	practice	instructor observation
3.1	written instruction	short answer
3.2	written instruction	short answer
3.3	written instruction	short answer
3.4	written instruction	short answer
3.5	written instruction with still pictures	alternative response with still pictures
3.6	written instruction	short answer
3.7	written instruction	alternative response

3.8	with still pictures written instruction	with still pictures short answer
3.9	written instruction with still pictures	alternative response with still pictures
3.10	written instruction with still pictures	alternative response with still pictures
3.11	practice	instructor observation
3.12	written instruction	short answer
3.13	written instruction with still pictures	alternative response with still pictures
3.14	practice	instructor observation
3.15	written instruction	short answer
3.16	written instruction with still pictures	alternative response with still pictures
3.17	practice	instruction observation
4.1	written instruction	short answer
4.2	written instruction	short answer
4.3	written instruction	short answer
4.4	written instruction	short answer
4.5	written instruction with still pictures	alternative response with still pictures
4.6	practice	instructor observation
4.7	written instruction	short answer
4.8	written instruction with still pictures	alternative response with still pictures
4.9	practice	instructor observation

5.1	written instruction	completion
5.3	written instruction with still pictures	alternative response with still pictures
5.4	practice	instructor observation
6.1	written instruction	short answer
6.2	written instruction with still pictures	alternative response with still pictures
6.3	written instruction	short answer
6.4	written instruction with still pictures	alternative response with still pictures
6.5	written instruction	still pictures
6.6	written instruction with still pictures	alternative response with still pictures
6.7	written instruction	short answer
6.8	written instruction with still pictures	alternative response with still pictures
6.9	practice	instructor observation
6.10	written instruction	short answer
6.11	written instruction with still pictures	alternative response with still pictures
6.12	practice	instructor observation
6.13	written instruction	short answer
6.14	written instruction with still pictures	alternative response with still pictures
6.15	practice	instructor observation
7.1	written instruction with still pictures	alternative response with still pictures
7.2	written instruction	alternative response

	with still pictures	with still pictures
7.3	written instruction	short answer
7.4	written instruction with still pictures	alternative response with still pictures
7.5	practice	instructor observation
7.6	practice	instructor observation
8.1	written instruction with still pictures	alternative response with still pictures
8.2	written instruction	short answer
8.3	written instruction with still pictures	alternative response with still pictures
8.4	practice	instructor observation
8.5	practice	instructor observation
8.6	written instruction	completion
8.7	written instruction	short answer
8.8	practice	instructor observation

APPENDIX R
SAMPLE JOB GUIDE MANUAL

REMOVE AND INSTALL MAIN LANDING GEAR
WHEELS AND BRAKES

INPUT CONDITIONS

Applicable Serial Nos: All
Supplies:

Clean rags (as required)
Grease, MIL-G-25760
Oil, MIL-C-6529
Cleaning solvent, P-D-680
Cap and plug kit

Personnel Required: Two

Assistant required to aid in jacking and handling wheel and brake during remove and install.

Specialist required to connect and disconnect hydraulic swivel fittings during remove and install brakes.

Technician required to perform In-Process inspection during installation.

Equipment Condition:

Aircraft parked, chocked and statically grounded per T.O. 1C-141A-2-2JG-4.

Aircraft positioned on hard, level service. Slope tolerance of 1.5 percent, zero degrees, 51-1/2 minutes.

Landing gear ground safety pins installed per T.O. 1C-141A-2-1MS-1.

Main landing gear shock strut serviced per T.O. 1C-141A-2-2JG-5.

No. 3 hydraulic system accumulators pressurized per T.O. 1C-141A-2-3JG-2.

WARNING

Observe all safety precautions in AFM127-101; T.O. 00-25A-1; T.O. 1C-141A-2-1MS-1.

CAUTION

Always jack aft axle first, or both axles simultaneously when there is a requirement to change tires on both axles on one gear.

Special Tools & Test Equipment:

Axle jacks, Type F-2; used to jack bogie (two required if forward wheels are to be removed). (Alternate: Axle jacks, J5; used to jack front or rear axles if both tires are to be changed.)

Torque wrench, calibrated to 960 inch-pounds; used to torque axle nut.

Torque wrench, calibrated to 480 inch-pounds; used to torque axle nut.

Spanner Wrench, PN 3S50034; used to remove and install axle nut.

Torque adapter Wrench, PN 7227089-10; used to check position of lockring.

Valve core Tool, PN 968RB; used to remove or install valve core. (Alternate: Equivalent)

NOTE: Under an emergency situation, or when a MLG brake leak occurs at a station where brake change capability does not exist, it is permissible to cap off a maximum of one brake per main gear for a one time flight to a station having brake change capability. Cap off brake by obtaining cap/plug adapters from crew compartment. Disconnect flex hose (4) from swivel at brake (20). Install female part of adapter to the brake swivel and flex hose (4) to male part of adapter. Using number 3 hydraulic system pressurize affected brake and check for leaks.

REMOVE WHEEL AND TIRE

NOTE: If there is not enough room between the aircraft and axle to remove the wheel, inflate both landing gear struts. (Refer to T.O. 1C-141A-2-2JG-4)

1. Make sure that the parking brakes are off.
2. Remove forward and aft chocks.
3. Disconnect leveler rod (37).
 - a. Remove cotter pin (36).
 - b. Remove nut (35).
 - c. Remove outer washer (34).
 - d. Free leveler rod by pulling it off of bolt.
 - e. Leave inner washer (38) in bolt and put outer washer (34) and nut (35) onto bolt for safekeeping.
 - f. Tie leveler rod to forward torque arm so it will not dangle or be damaged.
4. Jack axle until tire clears ground. (Refer to T.O. 1C-141A-2-2JG-4)
5. Set parking brake.
 - a. Depress top part of rudder pedals (40).
 - b. Pull out parking brake handle (39).
 - c. Release rudder pedals (40).

NOTE: If parking brake handle will not set in the out position, check to make sure that there is enough hydraulic pressure (Refer to T.O.

6. Deflate tire.
 - a. Remove air valve cover.
 - b. Use valve core tool to deflate tire until all air is out.

- c. Use valve core tool to remove valve core.
- 7. Remove outer wheel hardware.
 - a. Remove snapring (23).
 - b. Remove hubcap (5).
 - c. Remove grease retainer ring (9).
 - d. Remove felt grease seal (10).
- 8. Disconnect anti-skid detector (6).
 - a. Use wire snippers to cut and remove safety writing from screws.
 - b. Remove the three screws and place them in hubcap for safekeeping.
 - c. Place skid detector (6) inside axle (22) for safe storage.
- 9. Remove axle nut (7) and lock ring (8).
 - a. Remove cotter pin (25) from lock ring (8) and axle nut (7).
 - b. Use circular spanner wrench to remove axle nut (7).
 - c. Remove lock ring (8).
- 10. Clean axle nut (7) and lock ring (8) with clean rag.
- 11. Remove rest of outer wheel hardware.
 - a. Remove grease retainer ring (11).
 - b. Remove outer bearing (12), catching it in rag and keeping it wrapped in rag for protection.
- 13. With assistance, remove wheel and tire from axle.

CAUTION

In removing wheel, try to support wheel as it comes off so as to avoid damaging end of axle.

END OF TASK

REMOVE BRAKE

NOTE: Remove wheel and tire as per this T.O.

1. Remove outer spacer (19) from axle.
2. Request hydraulic specialist to:
 - 1) Depressurize #3 hydraulic system per T.O. 1C-141A-2-3JG-1.
 - 2) Disconnect hydraulic line (4) and swivel fitting (3).
 - 3) Cap fitting and plug line.
3. Separate torque link (31) from brake (20).
 - a. Use screwdriver to pry lock tab on star washer (32) out of the indent on nut (33).
 - b. Use spanner wrench to loosen nut (33) 3 or 4 turns.
 - c. Tap nut (33) with hammer to free bolt (30).
 - d. Remove nut (33), star washer (32), and bolt (30).
 - e. Set torque link (31) out of the way by lifting it up and back.

CAUTION

In taking the brake off the axle care must be taken to protect the bearing surfaces on the axle.

4. With assistant, remove brake (20) from axle.
5. Use brake dolly to transport brake to service chariot.

NOTE: Sometimes the inner spacer sticks to the brake. Be sure the spacer is removed before brake leaves the area.

END OF TASK

INSTALL BRAKE

1. Using solvent, clean axle (22) and spacers (19,20).
2. Apply a thin film of grease to axle (22).
3. Install inner spacer (21) on axle (22). (Make sure it goes all the way on).
4. Get the new brake (20) and remove any service tags and/or wire attachments.
5. Align the rotor and stator discs of the brake.
6. With assistant, install brake onto axle. (Make sure it is snug against shoulder of inner spacer (21).)
7. Install torque link (31).

- a. Align torque link (31) with brake (20) so that bolt holes line up exactly.

- b. Install bolt (30) so that flat edge of bolt head lines up with alignment bar on brake housing.

NOTE: When bolt is properly installed, the bolt will stick out the other side of the hole by about 1/32 of an inch.

- c. Place star washer (32) on the end of bolt (30).

NOTE: If the star washer will not stay on end of bolt, make sure that the bolt is seated correctly and that it sticks out the right amount. If the bolt does stick out the right amount, then you can hold it in place by applying a little grease to the brake housing for the washer to stick to.

- d. Install nut (33), tightening it with the spanner wrench until all end play in the bolt is removed.

- e. Continue to tighten nut (33) with the spanner wrench (or with a punch and hammer) until a tab on the star washer (32) lines up with an indent on the nut (33).

- f. Use a screwdriver to bend a tab on the star washer (32) part way into an indent on nut (33).

- g. Use a hammer and punch to seat tab securely into the indent.
- 8. Request hydraulic specialist to:
 - 1) Remove cap from fitting (3) and plug from line (4).
 - 2) Connect line (4) to swivel fitting (3).
 - 3) Bleed brake per T.O. 1C-141A-2-3JG-2.
 - 4) Service hydraulic system per T.O. 1C-141A-2-2JG-5.
 - 5) Check adjustment of brake and leak check brake per T.O. 1C-141A-2-12JG-6.
- 9. Set parking brake.
 - a. Depress top part of rudder pedals (40).
 - b. Pull out parking brake handle (39).
 - c. Release rudder pedals (40).
- 10. Install outer spacer (19) with the flared end toward the brake.

END OF TASK

IN-SHOP PREPARATION OF WHEEL FOR INSTALLATION

NOTE: For wheels which have been removed and are to be reinstalled, follow steps 1-6 only. For installation of a new wheel follow steps 7-12 only.

1. Remove inner wheel hardware.
 - a. Remove snapring (18).
 - b. Remove grease retainer ring (17).
 - c. Remove felt seal (16).
 - d. Remove grease retainer ring (15).
 - e. Remove inner bearing (14), placing it in a rag for protection.

NOTE: Check for proper bearing part number - #PN522549.

2. Using cleaning solvent, clean inner and outer wheel hardware.
 - a. Clean felt seals (10, 16).
 - b. Clean retaining rings (9, 11, 15, 17).
 - c. Clean bearings (12, 14).
3. Inspect felt seals, retaining rings, and bearings for wear and defects.
4. Lubricate felt seals (10, 16) with oil.
5. Repack bearings (12, 14) with grease.
6. Install inner wheel hardware.
 - a. Install inner bearing (14).
 - b. Install grease retainer ring (15).
 - c. Install felt seal (16).
 - d. Install grease retainer ring (17).
 - e. Install snapring (18).

NOTE: For wheels that are being reinstalled, step 6 ends the wheel preparation task. For the installation of a new wheel follow steps 7-12.

7. Using cleaning solvent, clean outer wheel hardware.
 - a. Clean felt seal (10).
 - b. Clean retaining rings (9, 11).
 - c. Clean bearing (12).
8. Inspect felt seal, retaining rings, and bearing (9, 10, 11, 12) for wear and defects.
9. Lubricate felt seal (10) with oil.
10. Repack outer bearing (12) with grease.
11. Remove inner wheel hardware to check for proper bearing part number - #PN-522549.
 - a. Remove snapring (18).
 - b. Remove grease retainer ring (17).
 - c. Remove and discard paper protective seal.
 - d. Remove felt seal (16).
 - e. Remove grease retainer ring (15).
 - f. Remove bearing (14) and check for proper part number - #PN-522549.
12. Reinstall inner wheel hardware.
 - a. Install bearing (14).
 - b. Install grease retainer ring (15).
 - c. Install felt seal (16).
 - d. Install grease retainer ring (17).
 - e. Install snapring (18).

END OF TASK

INSTALL WHEEL AND TIRE

NOTE: Prepare wheel for installation as per this T.O.

NOTE: Before starting installation, check to be sure parking brakes are set.

1. Visually inspect wheel and tire assembly as per T.O. 1C-141A-2-1MS-1.
2. Check tire pressure for proper inflation (190 +10, -5 psi).
3. Check to make sure that the outer spacer (19) has been installed with flared end towards the brake.
4. Remove inner wheel hardware to check for proper bearing part number - #PN-522549.
 - a. Remove snapring (18).
 - b. Remove grease retainer ring (17).
 - c. Remove felt seal (16).
 - d. Remove grease retainer ring (15).
 - e. Remove bearing (14) and check for proper part number - #PN-522549.
5. Reinstall inner wheel hardware.
 - a. Install bearing (14).
 - b. Install grease retainer ring (15).
 - c. Install felt seal (16).
 - d. Install grease retainer ring (17).
 - e. Install snapring (18).
6. With assistance, put wheel onto axle and engage it with brake.
 - a. Check alignment of rotors on brake.
 - b. Guide wheel onto axle.

NOTE: Lift wheel carefully so as not to damage end of axle.

- c. Keep aligning rotors as necessary while jiggling wheel all the way on.
- 7. Install outer bearing (12).
- 8. Install lock ring (8) and axle nut (7).
 - a. Install lock ring (8) with lock keys in axle lock slots.
 - b. While holding lock ring (8) in place with one hand, install axle nut (7) and hand tighten it with other hand.
- 9. Release brakes.
- 10. Using spanner wrench (round head), torque axle nut (7) to 960 inch pounds.

NOTE: While tightening axle nut, rotate wheel clockwise.
- 11. Let up on axle nut tightness by backing off to zero inch pounds.
- 12. Using spanner wrench (rectangular head), torque lock ring (8) to 600 inch pounds (in either direction) to insure that the lock keys are firmly seated in axle lock slots.

WARNING

If ring nut (8) is not properly seated, the whole wheel assembly can come off.

- 13. Using spanner wrench (round head), torque axle nut (7) to 480 inch pounds.
- 14. Continue tightening axle nut (7) until the first (of the three) locking holes you come to lines up with an indent on the lock ring (8).
- 15. Install cotter pin (25).
 - a. Insert cotter pin (25) through indent in lock ring (8) and into locking hole in axle nut (7).

- b. Secure cotter pin and flatten rounded head into lock ring indent.
16. Install anti-skid detector (6).
- a. Remove anti-skid detector (6) from inside the axle (22) and place in position on axle nut (7).
 - b. Secure anti-skid detector with three screws (24).
NOTE: Be sure screws are securely seated but do not overtighten them.
 - c. Safety wire the three screws (24) using single strand method.
17. Install rest of outer wheel hardware.
- a. Install grease retainer ring (11).
 - b. Install felt seal (10).
 - c. Install grease retainer ring (9).
 - d. Install hubcap (5) with key inserted into alignment hole in wheel.
 - e. Install snapring (23).
18. Release parking brake.

CAUTION

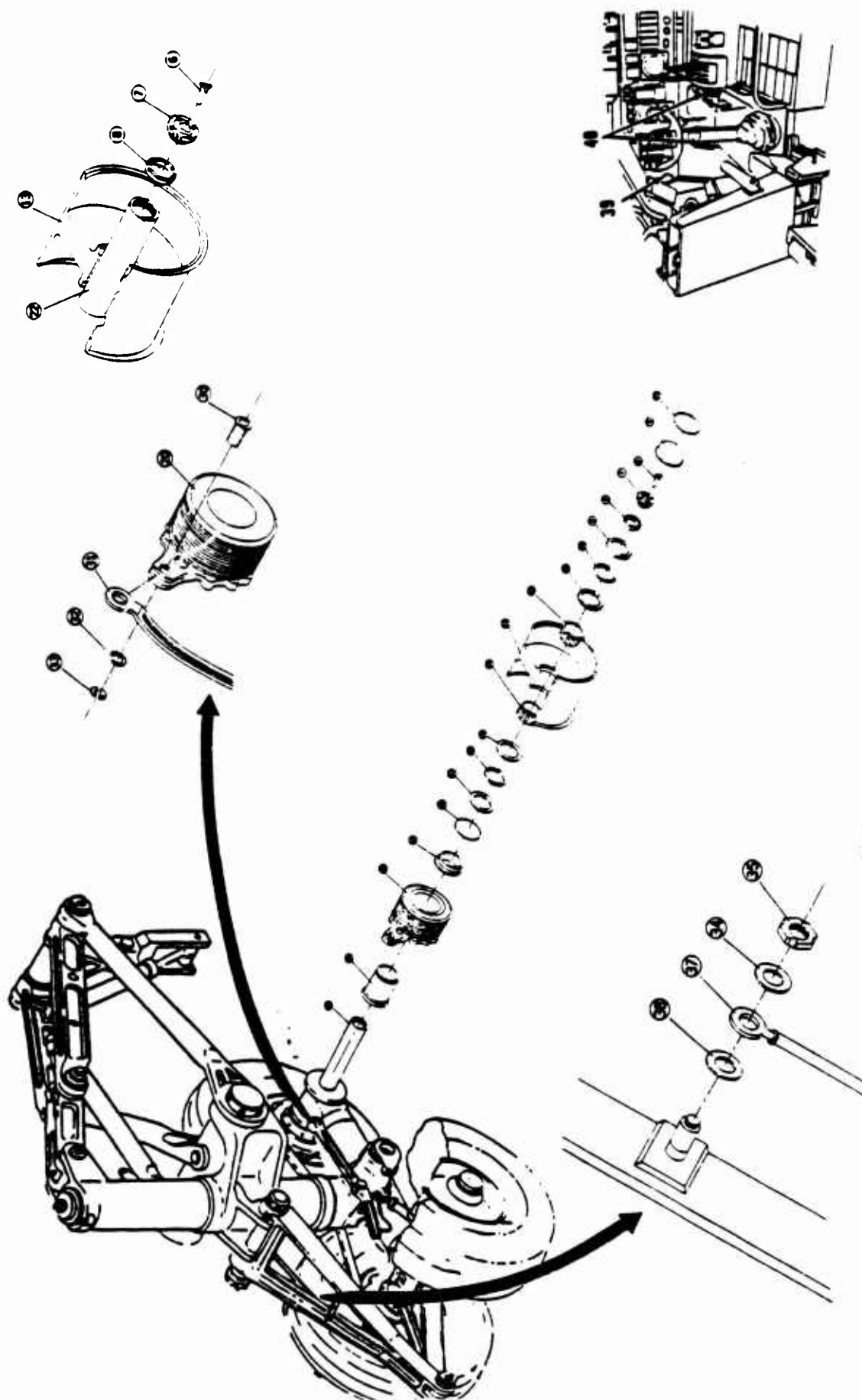
Be sure to get all equipment out from under the aircraft before lowering the jacks.

NOTE: If both axles are jacked, do step 17a to both jacks at the same time.

19. Lower aircraft.
- a. Slowly release pressure on jack.
 - b. When jack is clear of jack pad (38.2), remove jack.
20. Put forward and aft wheel chocks into place.
21. Install leveler rod (37).
- a. Untie leveler rod.

- b. Remove nut (35) and outer washer (34), leaving inner washer (38) on bolt.
 - c. Place end of leveler rod (37) onto bolt.
 - d. Put on washer (34) and nut (35).
 - e. Tighten nut (35) finger tight and then back off so that one of the indents on the nut aligns with the cotter pin hole in the bolt.
 - f. Insert and secure cotter pin (36).
22. Deflate the struts (Refer to T.O. 1C-141A-2-2JG-4).

END OF TASK



Note. - Item 36, cotter pin, not shown.

Figure 12 C-141 WHEEL AND BRAKE ASSEMBLY
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