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Research Note 84-38

ESTIMATING MANPOWER, PERSONNEL, AND TRAINING REQUIREMENTS
EARLY IN THE WEAPON SYSTEM ACQUISITION PROCESS:
AN APPLICATION OF THE HARDMAN METHODOLOGY
TO THE ARMY'S DIVISION SUPPORT WEAPON SYSTEM (APPENDICES)

AD A138537

Thomas E. Mannle, Jr.
Dynamics Research Corporation

Daniel T. Risser
Army Research Institute

Submitted by:

Bruce W. Knerr, Chief
SYSTEMS MANNING TECHNICAL AREA

and

Jerrold M. Levine, Director
SYSTEMS RESEARCH LABORATORY



U. S. Army

Research Institute for the Behavioral and Social Sciences

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Manpower Requirement Estimation	QQPRI	Manpower costs												
Howitzer Systems	Task list generation	Logistics analysis												
Training Requirement Estimation	Training device requirements													
Human Resources in LCSMM	Training costs													
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) A Navy methodology designed to assess the human resource requirements of emerging weapon systems was applied to the Army's proposed Division Support Weapon System (DSWS), a self-propelled howitzer system which will eventually replace the present M109 howitzer series. The goal of the project was to determine whether or not this HARDMAN (hardware vs. manpower) Methodology could be used to examine the manpower, training, and personnel demands of proposed Army weapon systems. While the project examined only one system, the														

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results of the project indicated that Army data was reasonably good in this case and the general analytic approach appeared to be useable. A second, more extensive project has been initiated to further assess the utility and generalizability of the methodology.

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PREFACE

This report describes the application of the first four steps of the prototype HARDMAN methodology to an Army weapon system. The methodology was used to conduct an analysis of the manpower, personnel, and training requirements and costs generated by the operation and maintenance of the Self-Propelled Howitzer (SPH) of the proposed Enhanced Self-Propelled Artillery Weapon System (ESPAWS).

The prototype HARDMAN methodology is an integrated set of data base management techniques and analytic tools, designed to provide timely and fully documented assessments of the human resource requirements and costs associated with an emerging system's design. Additionally, the methodology provides the capability to determine the impact of a system's manpower, personnel, and training resource demand on the Army's current and/or projected supply of those assets, thereby targeting problem areas in system supportability. Effective tradeoff analyses can then be conducted through iteration of the methodology.

Volume I of this report details the application of the first four steps of the HARDMAN methodology to the ESPAWS SPH and the study's findings. Volume II provides supporting or supplemental data in a number of appendices.

The study effort was authorized under Task Order A-1 of Contract Number N61339-80-D-0005. The contract monitors were Drs. Donald O. Weitzman and Daniel T. Risser. Work related to the study was conducted by members of the Advanced Systems Department, Dynamics Research Corporation, Wilmington, Massachusetts. The Contract Program Manager was Peter Weddle. The Report Manager was Thomas E. Mannle, Jr. Principal contributors on the DRC Staff were Laurel Brown, David Herlihy, Edward Marquardt, Lawrence O'Brien, and Cecil Wakelin. Other contributors were Marjorie Bristol, John Glasier, David Hickernell, Richard Mills, John Snow and Annemarie Walsh. The principal programming was accomplished by Alan Pincus and Robert Kistler; David Hickernell provided supplementary programming. Administrative support was provided by Mary Shaffer, Nancy Tannalfo, Dianna DiGregorio, Debra Allfrey, Anne Bauman, Debra Mahoney, and Beth Kosis.

The success of the project was due in large part to the cooperation of a number of government organizations which provided support and assistance to ARI but bear no

responsibility for the results of the study. ARI is particularly grateful for the assistance provided by the U.S. Army Armaments Research and Development Command, Dover, New Jersey, (Program Manager - Cannon Artillery Weapon Systems); the U.S. Navy HARDMAN Program Office, Naval Annex, Washington, D.C.; the U.S. Army Field Artillery Center and School, Fort Sill, Oklahoma (TRADOC System Manager -- Cannon); Headquarters, Fort Sill, Oklahoma (Comptroller); the ARI Field Unit, Fort Sill, Oklahoma; Headquarters, Training and Doctrine Command (TRADOC) Fort Monroe, Virginia (Deputy Chief of Staff -- Resource Management, and Deputy Chief of Staff -- Training); and the U.S. Army Armaments Material Readiness Command, Rock Island, Illinois (Logistics Assessment).

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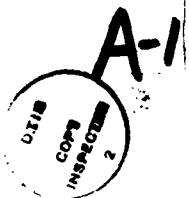


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INTRODUCTION

The information presented in Appendices A through C was developed during the application of the HARDMAN Methodology to the Enhanced Self-Propelled Artillery Weapon System (ESPAWS) prior to and during the conceptual stage of its development. A Consolidated Data Base (CDB) was developed to support the analysis of a suitable conceptual system to represent an ESPAWS design.

Appendix A contains descriptions of the data and data sources supporting the study. Appendix B describes the analytic tools which were used in each step of the methodology. Appendix C contains training analysis information which was included as a separate entity due to the volume of data and analysis products.

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DATA SOURCES INDEX

FUNCTIONAL AREA: MISSION

CATEGORY	DATA	SOURCE	COMMENTS
1. Need	System Operational Need	Chief of Staff of the Army (CSA); Mission Element Need Statement (MENS)	MENS for ESPAWS issued Dec, 1980
2. Capabilities	Operational Capability within Specified Areas	TRADOC: Fire Support Mission Area Analysis (MAA) Phase 1;	
	Mission Requirements	TRADOC: Battlefield Development Plan (BDP) GSA: MENS	
3. Environment	Scenario	TRADOC: Field Artillery Center and School, Ft Sill, OK	
	Operating Concepts (Logistics, Maintenance)	TRADOC: Field Artillery Center and School, Ft Sill, OK	
	Detailed Usage Data; i.e., scenario in terms of usage metrics	TRADOC: Field Artillery Center and School, Ft Sill, OK Mission Profile/ Operational Mode Summary (MP/OMS)	Representative for ESPAWS

FUNCTIONAL AREA: MANPOWER

CATEGORY	DATA	SOURCE	COMMENTS
1. Workload	Maintenance	Navy: Maintenance Data Collection System. (MDCS)	Autoloader, computer, AHRS

FUNCTIONAL AREA: MANPOWER (CONTINUED)

CATEGORY	DATA	SOURCE	COMMENTS
	Maintenance	Army: AR:750-37 Sample Data Collection	
	Operational Manning	ARI: Howitzer Crew Size Model	Primary Fire Tasks
	Operational Manning	Field Artillery School: Mission Profile for SPH	
2. Methodology	Constraints	AR570-2 Manpower Authorization Criteria (MACRIT)	
	Allowances	AR570-2 Manpower Authorization Criteria (MACRIT)	
	Capabilities	Field Artillery School: Mission Profile for SPH	
	Projected Mission Environment	Field Artillery School: Mission Profile for SPH	

FUNCTIONAL AREA: TRAINING

CATEGORY	DATA	SOURCE	COMMENTS
1. Task Requirements	Task by MOSC	Soldier's Manuals Commander's Manuals	
	Tasks by System	Field Manuals Technical Manuals	
	Tasks Accom- plished by MOSC	Consolidated Occupational Data Analysis Program (CODAP)	

FUNCTIONAL AREA: TRAINING (CONTINUED)

CATEGORY	DATA	SOURCE	COMMENTS
	Maintenance Tasks Information	Field Manuals Technical Manuals	
2. Skill/Skill Levels	Task Requirements Required by Skill Level	Soldier's Manuals Commander's Manuals	
	MOS Skill Descriptions	AR611-201 Enlisted Career Management Fields and Occupational Specialties	
	Qualification Standards	Skill Qualification Tests (SQT)	
3. Course Information	Training Paths	Comptroller of the Army (COA): Military Occupational Specialty Cost Handbook	
	Synopsis of Formal School Courses	U.S. Army Formal Schools Catalog, DA PAM 351-4	
	Synopsis of Correspondence Courses	Army Correspondence Course Program	
	Synopsis of Planned Army Training Courses	Individual and Collective Outline Training Plan (ICTP)	
	Instructor Determination Data	TRADOC Form 377-R for relevant courses	
4. Training Devices/ Extension Training Materials	List and Description of Current Items in Inventory	Index And Description of Army Training Devices (DA PAM 310-12) Catalog of TASO Training Devices (TRADOC PAM 71-9) Extension Material Status List (Quarterly Publication)	

FUNCTIONAL AREA: PERSONNEL

CATEGORY	DATA	SOURCE	COMMENTS
1. Current Enlisted Personnel Information	Army Personnel Status	MILPERCEN Enlisted Master File (EMF)	
2. Personnel Management	Military Occupational Specialty Information	AR611-201: Enlisted Career Management Fields and Military Occupational Specialties	

FUNCTIONAL AREA: COST

CATEGORY	DATA	SOURCE	COMMENTS
1. Hardware	Development Costs	ARRADCOM LCC Guidance ESPAWS Contractors	
	Operating and Support Costs	ARRADCOM LCC Guidance ESPAWS Contractors	
2. Personnel	Salaries	Comptroller of the Army (COA): Force Cost Information System: Army Force Planning Cost Handbook (AFPCH)	
	Other Per Capita Costs	Comptroller of the Army (COA): Force Cost Information System: Army Force Planning Cost Handbook (AFPCH) Per Capita Factor	
3. Training	Course Cost Elements: Aggregate	COA: Soldier Cost Information System: MOS Training Cost Handbook (MOSB)	

FUNCTION AREA: COST (CONTINUED)

CATEGORY	DATA	SOURCE	COMMENTS
	Detailed	TRADOC: Cost Analysis of Training Centers and Schools (one each)	
	Cost Factors and Estimating Relationships	TRADOC: Resource Factors Handbook	

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APPENDIX A2
THE SAMPLE DATA COLLECTION SYSTEM

A2.1 BACKGROUND

The Army has no periodic field maintenance data reporting system. Interviews with Army sources revealed that this was not always true. From 1962 until 1969, there was such a reporting system in effect, known as TAERS -- The Army Equipment Reporting System. Data collected under the TAERS system were not viewed as being either accurate or reliable for a number of reasons. Prominent among these were that:

- Data were collected by unit personnel in addition to their normal duties;
- Little feedback was received by unit personnel on the purposes for which the data were used. Consequently there was little incentive to record data accurately; and,
- Recognition of these circumstances at the National Maintenance Points (to which data flowed), caused data to be viewed as suspect and thus not exploited, further compounding the problem at the unit level.

In 1969, the TAERS system was eliminated, due to the circular nature of the problem and as a result of resource pressures caused by the Vietnam conflict. In the early 1970's, the Army initiated the Sample Data Collection (SDC)

system in an effort to receive accurate field maintenance data without reporting the TAERS experience.

A2.2 THE SAMPLE DATA COLLECTION SYSTEM

The Sample Data Collection System is prescribed by Army Regulation (AR) 750-37, the most recent version of which is dated June 15, 1977. AR 750-37 prescribes three types of data collection:

- Free Flow: Unedited data recorded by unit personnel, on existing maintenance (TAMMS) forms, and submitted to the National Maintenance Point level.
- Semi-Controlled: Data are recorded by unit personnel on standard or reasonably modified TAMMS forms. On-site representatives collect, edit, and format the data.
- Controlled/Intense: Data are recorded by dedicated data collectors, possibly on special forms.

AR 750-37 also provides that before an SDC effort is approved, an SDC plan must be developed. An SDC plan contains a description of the equipment on which data collection is desired (description, range); the nature, purpose, use, and users of the data; duration, cost of the effort, and the expected availability of resources; sampling technique, sample size, statistical, and engineering analysis methods; and, the essential elements of information, data portrayal, and output product

requirements. A draft Department of the Army (DA) Circular is also included, since each SDC effort is promulgated by circular.

Before SDC plans are approved, AR 750-37 requires each plan to be coordinated so as to ensure proper interface with all existing developmental management information systems that use or plan to use SDC data as inputs. Data requirements of users, other than those who originated the requirement for the data, can then be integrated into the SDC plan.

As of March, 1981, there have been 77 SDC efforts. Some of these have been multiple or extended efforts on the same item or items of equipment. Table A2-1 displays the list of SDC efforts.

A2.3 THE FIELD ARTILLERY SAMPLE DATA COLLECTION (FA SDC)

The Field Artillery Sample Data Collection was initiated in 1977. For the M109A1 subset of the FA SDC, data collection efforts were begun in January, 1977, at Fort Sill, Oklahoma, and in May, 1977, at Fort Hood, Texas and Grafenwoeher, Germany. One battalion (18 SPH) at Fort Sill, two battalions (42 SPH) at Fort Hood, and battalions selected during their annual training cycle in Germany were part of the sample. Over the 2.5 year period (for the tape which DRC used) the sample size was 72 SPH.

Data were collected by contractor personnel using Form 260 from the Armaments Readiness Command (ARRCOM) at Rock Island, Illinois. ARRCOM is the proponent and custodian of the FA Sample Data Collection. These data were formatted by ARRCOM onto computer tape into 44 fields of information.

Table A2-1 SAMPLE DATA COLLECTION EFFORTS

<u>DA Circular No.</u>	<u>Equipment Nomenclature</u>	<u>Type Collection</u>
750-37-1	Gun, Air Defense 20mm M114A1E1	Note: Semi-Controlled Unless otherwise noted
750-37-2	Generator, 60kw 60Hz SF-60-MD	
750-37-3	Truck, ¼ ton, M151A1/A2	
750-37-4	Armored Reconnaissance Airborne Assault Vehicle, M551	
750-37-5	Truck 5 Ton M809	
750-37-6	Truck 1-¼ ton, M561	
750-37-7	Terminal, Digital Subscriber AN/FYA-71	
750-37-8	Radio Set, AN/GRC-106A	
750-37-9	Radar Set, AN/PPS-5A	
750-37-10	Radio Set, AN/GRC-143	
750-37-11	Truck, Commercial Tractor 5 ton 1HC Model 2000D	
750-37-12	LANCE	
750-37-13	Generator, 15kw 60Hz SF-15-MD	
750-37-14	Gun, Air Defense, M163A1 VULCAN	
750-37-15	M 551 (Extend)	
750-37-16	M 151 (Extend)	
750-37-17	AN/FYA-71 (Extend)	
750-37-18	M561 (Extend)	
750-37-19	VULCAN (Extend)	
750-37-20	Trucks, 5 ton and 2-½ ton, Useful Life	
750-37-21	LANCE (Extend)	
750-37-22	HAWK	
750-37-23	Truck, Commercial Tractor, 2000D (Extend)	
750-37-24	Teletype, TT-638U	
750-37-25	M561 (Extend—3rd year)	
750-37-26	M151 (Extend—3rd year)	
750-37-27	HAWK (Extend)	
750-37-28	LANCE (Extend—3rd year)	
750-37-29	Trucks, 5 and 2-½ ton, Useful Life (Extend)	
750-37-30	GOER Vehicle	
750-37-31	Countermeasures Set, AN/GLO-3	
750-37-32	GOER Vehicle	
750-37-33	Trucks, 5 and 2-½ ton, Useful Life (Extend)	
750-37-34	Generator, 60kw (2nd time)	
750-37-35	Truck, M880	
750-37-36	Truck, 5 ton (Extend)	
750-37-37	Field Artillery Weapons Systems	
750-37-38	Tugs	
750-37-39	COMSEC Equipment, TSEC/KG-27	
750-37-40	Truck, 5 ton (Extend)	
750-37-41	Helicopter, Attack, AH-15 COBRA	
750-37-42	M880 (Extend)	
750-37-43	Field Artillery Weapon Systems (Extend—2nd year)	
750-37-44	M880 (Extend)	

Table A2-1 (continued)

<u>DA Circular No.</u>	<u>Equipment Nomenclature</u>	<u>Type Collection</u>
750-37-45	Administrative Use Vehicles (AUV) in Germany	
750-37-46	Transport, Heavy Equipment, M911	
750-37-47	FA Weapon Systems (Extend, 3rd year)	Controlled
750-37-48	Radar, Forward Area Acquisition (FAAR)/Chapparral	
750-37-49	Aircraft Systems	
750-37-50	Fire Control, AN/TSQ-73	
750-37-51	VULCAN	Controlled
750-37-52	COMSEC equipment, TSEC/KY-57/58 VINSON	Controlled
750-37-53	M880 (Extend)	
750-37-54	Tank, M60A3	Controlled
750-37-55	Trucks, Medium and Heavy, M915 series	
750-37-56	Helicopter, Utility, UH-60 Blackhawk	Controlled
750-37-57	Helicopter, Utility, UH-60 Blackhawk	Semi-Controlled
750-37-58	M911 (Extend)	
750-37-59	AUV	
750-37-60	AN/TSQ-73 (Extend)	
750-37-61	FAAR/Chapparral (Extend)	
750-37-62	Aircraft Systems	
750-80-1	FA Weapon Systems (Extend—4th year)	Controlled
750-80-2	Radio Receiver Set, AN/URR-74	
750-80-3	Generators, 5kw, 15kw, 30kw	
750-80-4	VINSON (Extend)	
750-80-5	M880 (Extend)	
750-80-6	Improved HAWK	
750-80-7	M60A3 (Extend)	
750-80-8	M915 (Extend)	
750-80-9	UH-60 (Extend)	Controlled
750-80-10	M911 (Extend)	
750-80-11	Tank and Pump Unit, Petroleum	
750-81-1	Landing Craft, Utility	
750-81-2	Ribbon Bridge	
750-81-3	Medical Unit Surgical, Transportable (MUST)	
750-81-4	UH-60 (Extend)	Semi-Controlled

Source: US Army Materiel Development
and Readiness Command (DARCOM)

DRC extracted 23 fields of interest for the ESPAWS study effort. Table A2-2 portrays one maintenance incident as it appears on the extracted tape, and Table A2-3 provides a fuller explanation of the extracted fields.

A2.4 DRC DATA MANIPULATION TECHNIQUES

From discussions with ARRCOM personnel, and by inspecting an abstract of the data contained in the M109A1 SDC, DRC recognized that the SDC afforded the opportunity to compute at least the RAM parameters of interest, if not also maintenance workload. However, before these analysis processes could begin, the raw data had to be processed into a form suitable for analysis. The techniques developed by DRC to process the data will be described here. Appendices B1 through B3 describe the analysis routines and programs developed by DRC to convert the processed data into meaningful inputs for the HARDMAN methodology.

Figure A2-1 portrays the flow of data through the required manipulation routines. The data were first converted to the format required by DRC's Honeywell mainframe computer. An extract routine (/CONVER.C) provided a tape of each maintenance incident described by the 23 information fields of interest to the ESPAWS study, rather than the 44 fields on the original tape. A sort routine separated the useable records from those that could not be used. Of the original records on tape, only 3209 were found to contain manhours information, which was needed to compute maintenance workload. The other records on the original tape indicated one of three circumstances: (1) a vehicle entering the SDC sample, indicated by "BASE", instead of the normal incident number; (2) a vehicle leaving the SDC sample indicated by a

Table A2-2 FA SAMPLE DATA COLLECTION (EXTRACT)

T2488 2108 M109A1 932 2219 932 23199 184.00 0710 B TRANSMISSION
 2520-735-4210 835 1099 BA 3.0 3.0 8.0 0.0 6.0 3.0 16.0 0.0
 63C 5 3 13B 5 3 13B 4 3 63H 5 8 63H 4 8 DS 8055 M Q N

INCIDENT NO.	:	T2488	EFFECT	:	B
VEHICLE SERIAL NO.	:	2108	ACTION	:	A
SYSTEM	:	M109A1	AMT	:	3.0 3.0 8.0 0.0
ROUNDS ON SYSTEM (CUM)	:	932	MMH	:	6.0 3.0 16.0 0.0
MILES ON SYSTEM (CUM)	:	2219	SPEC, GR, MH	:	63C 5 3
ROUNDS ON TUBE (CUM)	:	932			13B 5 3
TUBE SERIAL NO.	:	23199			13B 4 3
PART COST	:	184.00			63H 5 8
GG NO.	:	0710			63H 4 8
SUBSYSTEM	:	B	PART FROM	:	DS
PART NAME	:	TRANSMISSION	JULIAN DATE	:	8055
NSN	:	2520-735-4210	DEPENDENCY	:	M
PART NUMBER	:	8351099	FAILURE CODE	:	Q
			H/N	:	N

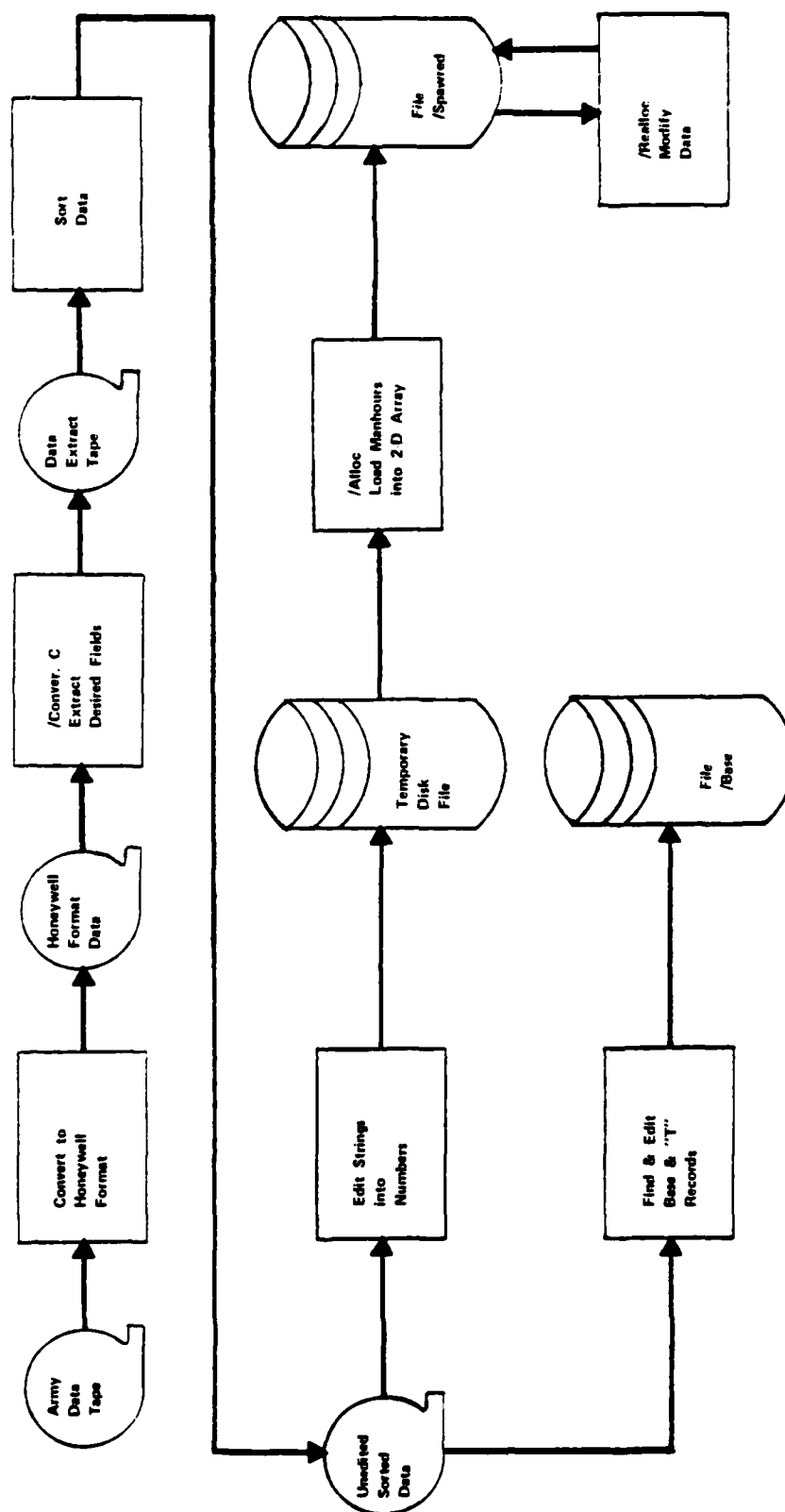
Table A2-3 DESCRIPTION OF SDC FIELDS

<u>Field</u>	<u>Description</u>
Incident No.	: First character is letter (or blank) indicating where the incident took place. Next four characters form a chronological incident number unique to that site. Sixth character has two possibilities: "S," if an incident is pursuant to another incident, and "T" if the particular system is leaving the SDC sample. "BASE" instead of the standard incident number format indicates an entry into the SDC sample.
Vehicle Serial No.	: Self-explanatory. A letter in the last position indicates vehicles that have transferred out of SDC and then reappear later.
System	: M109A1, all cases
Rounds on System (CUM)	: Cumulative rounds fired by the system since last rebuild
Miles on System (CUM)	: Cumulative miles driven by the system since last rebuild
Rounds on Tube (CUM)	: Cumulative rounds on tube since manufacture
Tube Serial No.	: Self-explanatory
Part Cost	: Standard price of part(s) replaced or used
GG No.	: Government Functional Grouping Code of the subsystem which was the root cause of the incident
Subsystem	: Same purpose as GG No. except alphabetic and less extensive functional breakdown.
Part Name	: Part name (of general type of maintenance) which was repaired or replaced (or performed) on the vehicle.
NSN	: National Stock Number of the replaced part(s)
Part No.	: Manufacturer's part number, listed in Technical Manuals
Effect	: Represents the effect of the malfunction on the vehicle's ability to perform. A: Critical/safety B: Mission Stop/Start C: Other
Action	: Type of maintenance action required to correct the malfunction A: Replace/unscheduled B: Repair/unscheduled C: Preventive/scheduled D: Adjust E: Other
AMT	: Active Maintenance Time: Clock or elapsed maintenance time between the start of a maintenance action and its completion. Four values, one each for the crew, organizational, direct support, and general support echelons of maintenance, respectively.
MMH	: Maintenance Manhours. Same format as AMT.

Table A2-3 (continued)

<u>Field</u>	<u>Description</u>
SPEC, GR, MMH	: A five variable array, each variable containing the specialty (MOS) and paygrade of an individual performing maintenance and the maintenance manhours he or she devoted to the task. Not arranged by echelon.
Part From	: Echelon of supply that supplied the part
Julian Date	: Date of the incident
Dependency	: Usage criteria to record malfunction against a particular subsystem. M: Miles driven R: Rounds fired
Failure Code	: Failure code (FCD) of the incident as judged by ARRCOM. The FCD alphabetic matrix combines two scoring criteria, the ARRCOM/TRADOC (SC), and the Joint Munitions Effectiveness Manual (JMEM).
H/N	: Failure chargeable to either hardware or non-hardware causes.

Figure A2-1 DRC DATA MANIPULATION ROUTINES



"T" suffix (for transferred) to the incident number; and (3) an incident pursuant to another incident, indicated by an "S" suffix (for supplementary record) to the normal incident numbers. (While the "BASE and T" records could not be used in calculating maintenance manhours, they were used to establish start and end points for each vehicle in the SDC, and to compute the Mean Metric (Miles, Rounds) Between Failure. This computation routine used the /BASE and /SPAWRED Files; however, the computational step itself is not shown on the flowchart.) An additional 100 records were excluded because they indicated they encompassed miscellaneous "NO TEST" conditions. Table A2-4 summarizes the derivation of records useable for computation of maintenance manhours from the original SDC data.

Another and more significant development in the data manipulation flow was the need to develop the REALLOC program. REALLOC allowed modification of the data (i.e., changing, adding, or deleting data element values). REALLOC was necessary because the SPEC, GR, and MMH field (see Table A2-2) was not arrayed by echelon. Although AMT and MMH were identified to a particular echelon, the design of ARRCOM Form 260, on which the data were collected, permitted only five entries for the SPEC, GR, and MMH field. Thus, data entry was haphazard, in some cases in descending or ascending numerical MOS order, in other cases by MMH quantity order. Standard sort and edit routines could match the MMH part of the SPEC, GR, and MMH field to the AMT and MMH fields for a provisional allocation of MOSs to echelons; in some cases, however, the results were clearly unsatisfactory, e.g., an MOS 13B (Cannon Crewmember) appearing at the general support echelon of maintenance, and a civilian wage grade worker appearing at the crew level.

Table A2-4 DERIVATION OF USABLE RECORDS

Description	Number
Total Records	6031
Less: Records with No Maintenance Manhours	2722
● "BASE": start SDC	(599)
● "T" Suffix: Complete SDC	(581)
● "S" Suffix: Supplementary Record	(1542)
Miscellaneous "No Test" Records	100
Total, Usable Records	3209
● Unscheduled Maintenance	(3623)
● Scheduled Maintenance	(586)

DRC developed /REALLOC as an interactive update program which allowed review of each maintenance incident. In cases where the provisional allocation of an MOS to a particular echelon appeared questionable, /REALLOC was used to reallocate the existing labor to echelons consistent with the TOE, insofar as possible. While /REALLOC was also developed with the capability to change, add, or delete data from the existing record, this capability was not exercised except to correct what appeared as obvious data entry errors.

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APPENDIX A3

EQUIPMENT LISTS

A3.1 Predecessor System Equipment List

A3.2 Reference System Equipment List

A3.3 Conceptual System Equipment List

A3.1 PREDECESSOR SYSTEM EQUIPMENT LIST

<u>Group Number</u>	<u>Component/Assembly</u>
0100	Engine, V8 diesel, model 8V71T, Detroit Diesel GMC; and Shock mounts
0101	Cylinder head
0102	Vibration damper
0103	Flywheel
0104	Pistons and connecting rods
0105	Valves and valve rockers
0106	Oil filter, oil cooler, and external lines/fittings
0108	Exhaust manifold
0109	Accessory drive mechanism
0301	Fuel injector
0302	Fuel pump and relief valve
0304	Air cleaner, filter pack, ducts, hoses, and dust exhaust motor
0305	Engine intake blower, blower drive shaft, turbo charger, air duct, and turbocharger regulator
0306	Fuel tank, fuel lines, and fittings
0308	Engine governor
0309	Primary and secondary fuel filter element and fuel filters
0311	Engine heater air box
0312	Injector rock control, control tube, accelerator and throttle control linkage, and rod end bearings
0401	Exhaust pipe
0501	Radiator
0502	Radiator shroud
0503	Water manifold, thermostat; hoses and pipes
0504	Water pump
0505	Fan drive assembly and fan drive housing; fan thermostat
0507	Unspecified cooling system parts
0601	Leece-Neville alternator, model A001-5504AA
0602	Voltage regulator and rectifier
0603	Starter and starter solenoid; field coil; starter drive
0607	Circuit breaker; instrument panel and wiring harness lamps; indicator light; accessory socket and switches

0608	Circuit breaker relay and switches; starter and master relays; motor relay
0609	Lamp and lamp units; lights and dome light
0610	Sending units and warning switches
0612	Batteries (12V-type 6TN) and battery cables
0613	Wiring harnesses (hull, cab and power plant)
0614	Electrical contact brushes and slip rings
0616	Ventillating blower
0617	Trailer electrical coupling
0618	Rammer control assembly; cab power relay box; gunner's selector switch box; rammer switches and wiring harness; intercom wiring harness
0710	Transmission (model XTG-411-2A, Allison Div., GMC) and transmission seals, coupling shaft, brake and control valve
0711	Shifting controls and linkage/rod end brearing
0714	Control valve
0719	Trainer
0721	Transmission oil pump and filter
0801	Power transfer and final drive assemblies
1103	Final drive
1201	Hand brakes
1206	Mechanical brakes
1301	Torsion bar
1302	Road wheel and arm; hub brearing; hub bearing seal
1303	Eccentric spindle control; spindle seal; track adjusting cylinder; idler arm and wheel; track idler support housing
1304	Drive sprocket and hubs
1305	Track and track shoes
1401	Steering controls
1503	Towing hooks; pintel
1604	Shock absorbers and road wheel arm bumper
1801	Cover plate and doors; travel lock
1802	Fender and track skirt
1803	Driver's hatch
1806	Seat
1808	Boxes, sockets and straps
1901	Turret race
1903	Doors and ports
1904	Traversing mechanism and controls
1906	Internal and external stowage
1909	Rammer and spade hoist assembly

1910	Equilibrating elevating mechanism and controls
2005	Spade and spade lock
2205	Bilge pump
2207	Personnel heater; heater fuel filter, igniter and flame detector switch
2210	Vehicle data plate
2604	Cannon bore brush assembly
2801	Sighting and fire control equipment:
	Commander's periscope (M42)
	Panoramic telescope (M117)
	Panoramic telescope mount (M145)
	Direct fire telescope (M118C and M11CA1)
	Direct fire telescope mount (M146)
	Elevation quadrant (M15)
	Trunion bracket ring
	Infinity aiming reference collimator (M1)
	Carrying case (M82)
3303	Winterization
3307	Deep water fording
3401	Cannon (M126A1/M185) 155mm and mount (M127)
3402	Machine gun .50 calibre (M2)
3403	RFire control
4309	Hydraulic equilibration system; primary and secondary accumulators
4701	Speedometer and speedometer drive components; tachometer and tachometer drive components
7639	Fixed (10 lb. bottle) system and portable (5 lb.) bottles
9501	Hardware supplied in bulk materials

A3.2 REFERENCE SYSTEM EQUIPMENT LIST

<u>Group Number</u>	<u>Component/Assembly</u>
0100	Engine, V8 diesel, model 8V71T, Detroit Diesel GMC; and Shock mounts
0101	Cylinder head
0102	Vibration damper
0103	Flywheel
0104	Pistons and connecting rods
0105	Valves and valve rockers
0106	Oil filter, oil cooler, and external lines/fittings
0108	Exhaust manifold
0109	Accessory drive mechanism
0301	Fuel injector
0302	Fuel pump and relief valve
0304	Air cleaner, filter pack, ducts, hoses, and dust exhaust motor
0305	Engine intake blower, blower drive shaft, turbo charger, air duct, and turbocharger regulator
0306	Fuel tank, fuel lines, and fittings
0308	Engine governor
0309	Primary and secondary fuel filter element and fuel filters
0311	Engine heater air box
0312	Injector rock control, control tube, accelerator and throttle control linkage, and rod end bearings
0401	Exhaust pipe
0501	Radiator
0502	Radiator shroud
0503	Water manifold, thermostat; hoses and pipes
0504	Water pump
0505	Fan drive assembly and fan drive housing; fan thermostat
0507	Unspecified cooling system parts
0601	Leece-Neville alternator, model A001-5504AA
0602	Voltage regulator and rectifier
0603	Starter and starter solenoid; field coil; starter drive
0607	Circuit breaker; instrument panel and wiring harness lamps; indicator light; accessory socket and switches
0608	Circuit breaker relay and switches; starter and master relays; motor relay

0609	Lamp and lamp units; lights and dome light
0610	Sending units and warning switches
0612	Batteries (12V-type 6TN) and battery cables
0613	Wiring harnesses (hull, cab and power plant)
0614	Electrical contact brushes and slip rings
0616	Ventillating blower
0617	Trailer electrical coupling
0618	Rammer control assembly; cab power relay box; gunner's selector switch box; rammer switches and wiring harness; intercom wiring harness
0710	Transmission (model XTG-411-2A, Allison Div., GMC) and transmission seals, coupling shaft, brake and control valve
0711	Shifting controls and linkage/rod end brearing
0714	Control valve
0719	Trainer
0721	Transmission oil pump and filter
0801	Power transfer and final drive assemblies
1103	Final drive
1201	Hand brakes
1206	Mechanical brakes
1301	Torsion bar
1302	Road wheel and arm; hub brearing; hub bearing seal
1303	Eccentric spindle control; spindle seal; track adjusting cylinder; idler arm and wheel; track idler support housing
1304	Drive sprocket and hubs
1305	Track and track shoes
1401	Steering controls
1503	Towing hooks; pintel
1604	Shock absorbers and road wheel arm bumper
1801	Cover plate and doors; travel lock
1802	Fender and track skirt
1803	Driver's hatch
1806	Seat
1808	Boxes, sockets and straps
1901	Tureet race
1903	Doors and ports
1904	Traversing mechanism and controls
1906	Internal and external stowage
1909	Rammer and spade hoist assembly
1910	Equilibrating elevating mechanism and controls

1920	Attitude Heading and Reference System: AN/ASN-107
1925	FM Radio: AN/VRC-12
1930	Ammunition Autoloader: FMC design configured from MK 42 Mod 10 5"/54 gun mount
2005	Spade and spade lock
2205	Bilge pump
2207	Personnel heater; heater fuel filter, igniter and flame detector switch
2210	Vehicle data plate
2604	Cannon bore brush assembly
2801	Sighting and fire control equipment: Commander's periscope (M42) Panoramic telescope (M117) Panoramic telescope mount (M145) Direct fire telescope (M118C and M11CA1) Direct fire telescope mount (M146) Elevation quadrant (M15) Trunion bracket ring Infinity aiming reference collimator (M1) Carrying case (M82)
2810	Fire Control Computer: AN/ASQ-155
3303	Winterization
3307	Deep water fording
3401	Cannon (M126A1/M185) 155mm and mount (M127)
3402	Machine gun .50 calibre (M2)
3403	RFire control
4309	Hydraulic equilibration system; primary and secondary accumulators
4701	Speedometer and speedometer drive components; tachometer and tachometer drive components
7639	Fixed (10 lb. bottle) system and portable (5 lb.) bottles
9501	Hardware supplied in bulk materials

A3.3 CONCEPTUAL SYSTEM EQUIPMENT LIST

<u>Group Number</u>	<u>Component/Assembly</u>
*0100	Engine, V8 diesel, model 8V71T, Detroit Diesel GMC; and Shock mounts
*0101	Cylinder head
*0102	Vibration damper
*0103	Flywheel
*0104	Pistons and connecting rods
*0105	Valves and valve rockers
*0106	Oil filter, oil cooler, and external lines/fittings
*0108	Exhaust manifold
*0109	Accessory drive mechanism
*0301	Fuel injector
*0302	Fuel pump and relief valve
*0304	Air cleaner, filter pack, ducts, hoses, and dust exhaust motor
*0305	Engine intake blower, blower drive shaft, turbo charger, air duct, and turbocharger regulator
*0306	Fuel tank, fuel lines, and fittings
*0308	Engine governor
*0309	Primary and secondary fuel filter element and fuel filters
*0311	Engine heater air box
*0312	Injector rock control, control tube, accelerator and throttle control linkage, and rod end bearings
0401	Exhaust pipe
*0501	Radiator
*0502	Radiator shroud
*0503	Water manifold, thermostat; hoses and pipes
*0504	Water pump
*0505	Fan drive assembly and fan drive housing; fan thermostat
*0507	Unspecified cooling system parts
*0601	Leece-Neville alternator, model A001-5504AA
*0607	Voltage regulator and rectifier
*0603	Starter and starter solenoid; field coil; starter drive
*0607	Circuit breaker; instrument panel and wiring harness lamps; indicator light; accessory socket and switches

* Improved RAM

*0608	Circuit breaker relay and switches;
	starter and master relays; motor relay
*0609	Lamp and lamp units; lights and dome
	light
*0610	Sending units and warning switches
*0612	Batteries (12V-type 6TN) and battery
	cables
*0613	Wiring harnesses (hull, cab and power
	plant)
*0614	Electrical contact brushes and slip rings
*0616	Ventillating blower
*0617	Trailer electrical coupling
*0618	Rammer control assembly; cab power relay
	box; gunner's selector switch box; rammer
	switches and wiring harness; intercom
	wiring harness
0710	Transmission (model XTG-411-2A, Allison
	Div., GMC) and transmission seals,
	coupling shaft, brake and control valve
0711	Shifting controls and linkage/rod end
	brearing
0714	Control valve
0719	Trainer
0721	Transmission oil pump and filter
0801	Power transfer and final drive assemblies
1103	Final drive
1201	Hand brakes
1206	Mechanical brakes
*1301	Torsion bar
*1302	Road wheel and arm; hub brearing; hub
	bearing seal
*1303	Eccentric spindle control; spindle seal;
	track adjusting cylinder; idler arm and
	wheel; track idler support housing
*1304	Drive sprocket and hubs
*1305	Track and track shoes
1401	Steering controls
1503	Towing hooks; pintel
1604	Shock absorbers and road wheel arm bumper
1801	Cover plate and doors; travel lock
1802	Fender and track skirt
1803	Driver's hatch
1806	Seat
1808	Boxes, sockets and straps
1901	Turret race
1903	Doors and ports
1904	Traversing mechanism and controls
1906	Internal and external stowage

* Improved RAM

1909	Rammer and spade hoist assembly
1910	Equilibrating elevating mechanism and controls
1920	Land Navigation System: Singer-Kearfott KHS-2100
1925	FM Radio: AN VRC-12
1930	Ammunition Autoloader: FMC design configured from MK 42 Mod 10 5"/54 gun mount (modified)
2005	Spade and spade lock
2205	Bilge pump
2207	Personnel heater; heater fuel filter, igniter and flame detector switch
2210	Vehicle data plate
2604	Cannon bore brush assembly
2801	Sighting and fire control equipment:
	Commander's periscope (M42)
	Panoramic telescope (M117)
	Panoramic telescope mount (M145)
	Direct fire telescope (M118C and M11CA1)
	Direct fire telescope mount (M146)
	Elevation quadrant (M15)
	Trunion bracket ring
	Infinity aiming reference collimator (M1)
	Carrying case (M82)
2810	Fire Control Computer: AN/AYK-14
3303	Winterization
3307	Deep water fording
3401	Cannon (M126A1/M185) 155mm and mount (M127)
3402	Machine gun .50 calibre (M2)
3403	RFire control
4309	Hydraulic equilibration system; primary and secondary accumulators
4701	Speedometer and speedometer drive components; tachometer and tachometer drive components
7639	Fixed (10 lb. bottle) system and portable (5 lb.) bottles
9501	Hardware supplied in bulk materials

APPENDIX A4
PERSONNEL DATA

This appendix describes the Army's Enlisted Master File (EMF) and the extract upon which the personnel analysis was based. The EMF contains current personnel data describing the status of all Army enlisted personnel. It is updated and maintained by the Army Military Personnel Center (MILPERCEN).

The extract from the EMF used for purposes of this study contains 43 data elements (the entire EMF contains approximately 225 elements) for each individual within 36 MOSs. Data were collected for these 36 MOSs prior to definitization of the group of eight MOSs which were to be analyzed for this study. Table A4-1 depicts the MOSs and data elements which comprise the EMF extract received from MILPERCEN.

Since MILPERCEN maintains historical snapshots of the EMF, it was possible to request four data extracts at once, for the current and previous three quarters. In addition, it was requested that there would be quarterly updates sent for the next year.

The data were, for the most part, complete and usable. The one exception is that the two fields of school history data were found to be incomplete. For example, for the Non-Commissioned Officer (NCO) Education System field, only 6% of all individuals had any code listed. A MILPERCEN EMF data base manager verified that the reason for this was that the information is not being reported to them by the

schools. Similary, Advanced Individual Training (AIT) graduation dates (1) do not contain the year of the graduation date, (2) are not properly reported, and (3) are incomplete in many cases. Because of these constraints, as mentioned in the text, career paths were dropped from the analysis at this point.

Table A4-1. Enlisted Master File Data Extract Received for ESPAWS Study.

MOS	Data Elements
05B	Social Security Number (SSN)
05C	Military Personnel Class
13B	Active-Inactive Indicator
13E	Sex of Service Member
13F	Service Component
13Y	Term of Service or Enlistment
13Z	Date of Expiration of Term of Service
26L	Basic Active Service Date
26Q	Date of Rank (Grade in which serving)
31E	Grade in which Serving - Abbreviation
31J	Grade in which Serving (Code)
31V	Type of Last Grade Change
31Z	Date of Last Grade Change
32Z	Armed Forces Qualification Test Percentile Score (AFQSC)
34G	Armed Forces Qualification Test Score Group (AFQG)
35B	NCO Education System
35E	Additional Skill Identifier
41C	Location Abbreviation, Current/Geopolitical
44B	Date of Last Permanent Change of Station
45D	Date Departed or Joined Current Command
45E	Location - Potential Gaining
45K	Paygrade
45L	Eligibility for Additional Pay
45N	PMOS - How Acquired
45R	Primary Military Occupational Specialty
45Z	Type of Last Change to PMOS
63B	Date of Last Change to PMOS
63C	PMOS - Evaluation Score
63D	Secondary Military Occupational Specialty
63E	Projected MOS
63F	Projected MOS Date (Year-Month)
63G	Movement Designator Code
63H	Year-Month Eligible to Return from Overseas
63N	Number of Times Enlisted/Reenlisted
63T	Year-Month Commenced Current Overseas Tour
63Z	AIT Graduation Date
	Progression Military Occupational Specialty - Primary
	Primary MOS in which Tested, SQ Designator
	PMOS Skill Qualification Test Score (SQT)
	Previous SSN Date of Change
	Social Security Number, Previous
	Control Date, SSN Change
	Unit Identification Code, O.M.

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APPENDIX B1
MAINTENANCE WORKLOAD DETERMINATION

B1.1 The Reliability, Maintainability, and Cost Model (RMCM)

The Reliability, Maintainability, and Cost Model (RMCM) was developed by DRC as part of the Life Cycle Cost Impact Model (LCCIM) Modeling System. DRC developed RMCM under contract to the Air Force Human Resources Laboratory at Wright-Patterson AFB, Ohio. The initial application of RMCM was in a study on the Digital Avionics Information Subsystem. It was also used in the Coordinated Human Resources Technology (CHRT) Study to evaluate the system ownership cost of the avionics and landing gear for the Advanced Medium Shortrange Transport (AMST) aircraft.

RMCM is actually a model within a model. It is composed of a Reliability and Maintainability (R&M) Model with its associated data bank, and a Cost Model which uses both inputs and outputs of the R&M Model and a cost data bank. The RMCM is an analytical accounting cost model which computes the life cycle cost of any proposed design for a system.

The R&M model portion of RMCM operates in conjunction with a computerized data bank containing historical reliability and maintenance data gathered from operational systems. This data is made relevant to new systems by factoring the historical data on the basis of system/subsystem comparability analyses. Inputs to the R&M Model include the frequency of maintenance actions by subsystem, and task/event data for each maintenance action such as type,

probability of occurrence, average time to complete and manpower type and skill requirements.

The computed outputs of this model are expected values since they are based on average input values rather than peak demands or other constraints. These outputs are principally measures of the maintenance manhour resource requirements which may be expected to result under a given set of conditions. For this reason, DRC intended to use the R&M model portion of RMCM to calculate the maintenance workload requirements of the ESPAWS reference and conceptual designs.

However, upon examination of the data element inputs required for R&M, it was ascertained that R&M could not be used for the ESPAWS study effort. This was due to several factors:

- R&M is service specific in that it was developed for the Air Force.
- R&M is equipment specific in that it was developed for aircraft and aircraft-related applications.
- R&M is thus a model of a certain set of circumstances: that of Air Force aircraft maintenance. This reality is wholly different than the circumstances that exist for Army ground combat vehicles. For example, the Air Force has three echelons of maintenance while the Army has at least four; the Air Force maintenance philosophy is generally one of remove and replace with off-equipment repair of replaceable

components, while the Army is more oriented to repair in place with repair parts, not components.

- The data input requirements for the R&M Model reflected the availability of maintenance data according to the management needs of the Air Force. These data were thus the quantitative expression of the Air Force maintenance philosophy.

These factors led to the conclusion that the R&M portion of RMCM, as it existed, was unsuitable for application to ESPAWS. In order for R&M to have been applied, it would have had to undergo extensive internal modifications for it to properly depict the maintenance circumstances and philosophy of the Army. It would also have required data elements to be created, assumed, or extrapolated to satisfy those input requirements of R&M for which the Army does not require data to be collected.

B 1.2 Determining Maintenance Workload

The Field Artillery Sample Data Collection (SDC) data provided an excellent alternative method for determining maintenance workload. As the development of RMCM was predicated on the existence of data of certain types and characteristics, the method developed relied upon the data elements contained in the SDC.

The principal advantage of SDC data over its counterparts in the Navy and the Air Force was that each SDC maintenance incident was characterized by the specialty (MOS), grade,

and manhours of the personnel who provided the maintenance services. In the Navy applications of HARDMAN, the probability of maintenance events must be melded with task data through extensive task/event networks, which are then manipulated to derive workload. The SDC data afforded the opportunity to derive workload without extensive networking analyses. However, networking proved to be a valuable tool for depicting and ordering maintenance task/event relationships, even though the workload calculations proved to be much simpler.

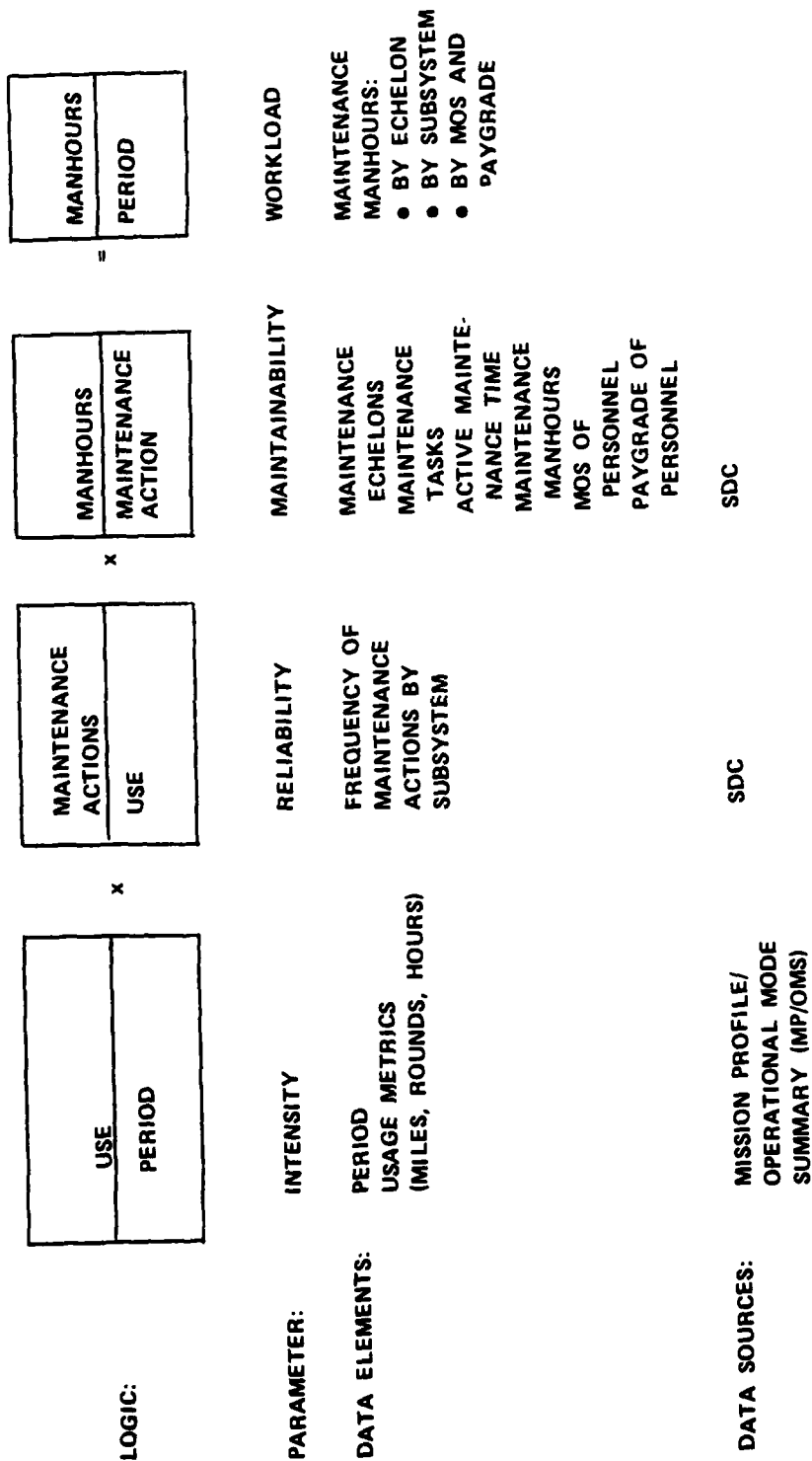
The principal disadvantage of the SDC data was that the maintenance tasks were not described in greater detail, not only in contrast to the Air Force and Navy systems but even to generally accepted Army practice. For example, the SDC encompasses five task or maintenance action types, but the maintenance manual for the M109A1 predecessor system describes ten types of discrete maintenance tasks. Thus maintenance workload could only be characterized to the task level contained in the SDC; more detailed task descriptions would have resulted in a more sophisticated analysis.

In summary, by relying on the SDC data it was easier to construct a new method for calculating maintenance workload than to have used the existing R&M portion of RCM. Figure B1-1 summarizes the logic of the DRC-developed maintenance workload calculations.

B1.3 DRC Modeling and Reporting Routines

Figure B1-2 depicts the DRC developed modeling and reporting routines which implements the logic for calculating

Figure B1-1 MAINTENANCE WORKLOAD CALCULATIONS



maintenance workload. The refined SDC data are contained in two files, /SPAWRED and /BASE. (See Appendix A2.4) These files are then manipulated (/GENMDL 1, 2, and 3) to create a model file for the predecessor M109A1 system. /GENMDL 4 allows application of percentage perturbation factors to the predecessor equipment to create temporary reference and conceptual system files. These files are then updated by adding or subtracting equipments by using the /MODMDL program. The resulting predecessor, reference, and conceptual system model files are input into the report generating routines (/MMHBYGG, /MMHBYMOS, and /AVLBYGG) to provide the desired outputs as shown. To generate a report, the user must input the file desired, the scenario in terms of the usage metrics of miles, rounds and hours, the maintenance type (scheduled or unscheduled) and whether a detailed or summary report is desired. Example outputs of the /MMHBYGG, /MMHBYMOS, and /AVLBYGG programs are shown in Tables B1-1, B1-2, and B1-3, respectively. A user's guide to the programs is contained in Appendix B2.

Figure B1.2 DRC MODELING AND REPORTING ROUTINES

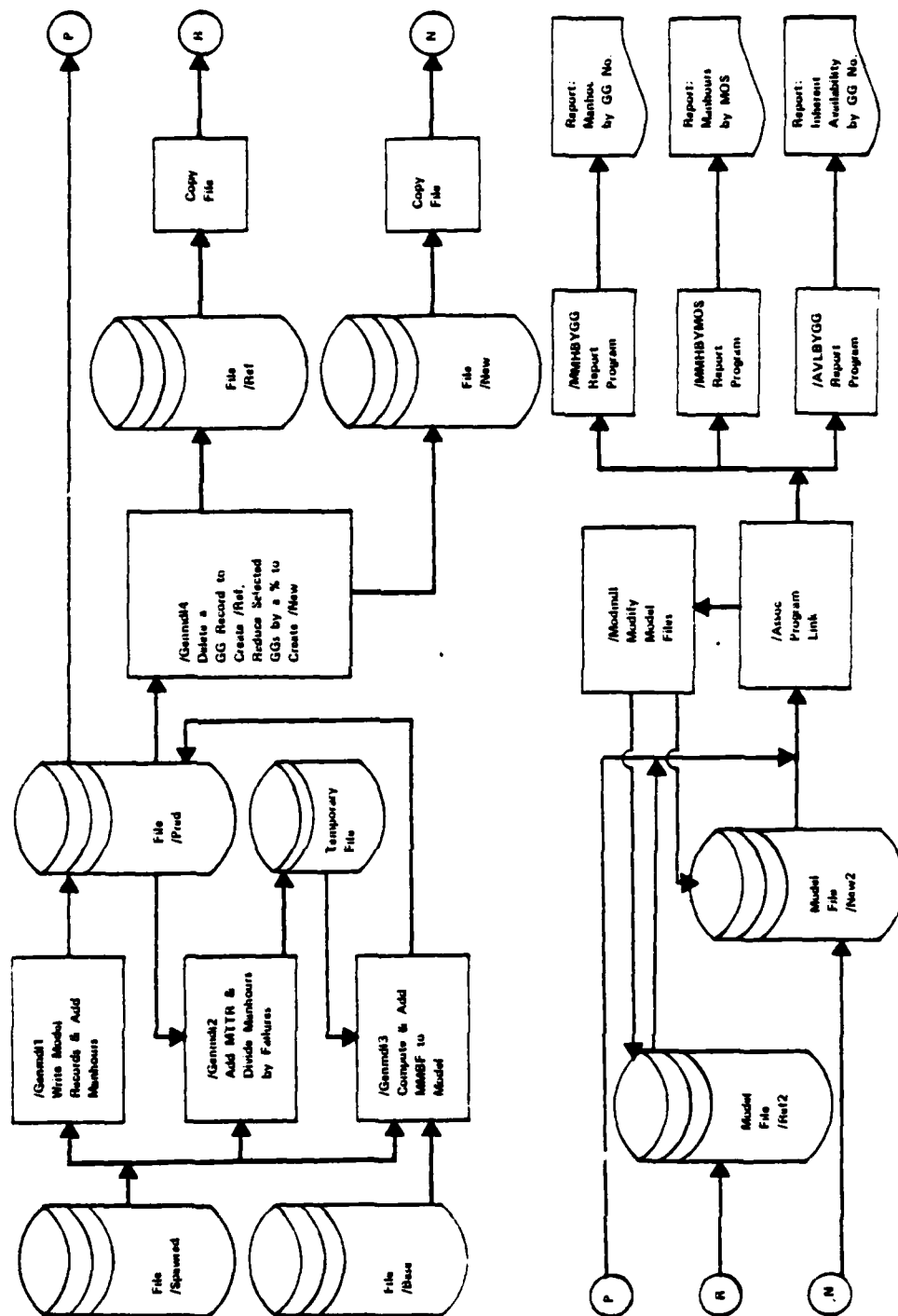


Table B1-1

EXAMPLE REPORT

MAINTENANCE MANHOURS ARRAYED BY GG NO. (MMHBYGG)

E S P A C E S									
P R E D E C E S S O R S Y S T E M									
R E Q U I R E D U N S C H E D U L E D M A I N T E N A N C E M A N H O U R S									
V I L E S = 15 R O U N D S = 300 H O U R S = 24									
	C R E W			O R G			D I R		
	MMH	FAILURES	AVE	MMH	FAILURES	AVE	MMH	FAILURES	AVE
T O T A L									
M M H F A I L U R E S A V E									
0614	000.08	000.07	01.1	000.15	000.07	02.1	000.04	000.07	00.5
0618	000.34	000.27	01.2	000.28	000.27	01.0	000.15	000.27	00.5
06 SUBTOTAL	000.42	000.34	01.2	000.43	000.34	01.2	000.19	000.34	00.5
1204	000.00	000.00	02.0	000.00	000.00	00.0	000.00	000.00	00.0
12 SUBTOTAL	000.00	000.00	02.0	000.00	000.00	00.0	000.00	000.00	00.0
1901	000.00	000.00	00.0	000.00	000.00	00.0	000.00	000.00	00.0
1904	000.93	000.58	01.6	001.26	000.58	02.1	000.58	000.58	01.0
1909	000.19	000.14	01.3	000.20	000.14	01.4	000.16	000.14	01.1
1910	000.39	000.10	01.9	000.89	000.10	06.9	000.23	000.10	02.3
19 SUBTOTAL	001.51	000.82	01.8	002.35	000.82	02.6	000.97	000.82	01.1
2005	000.11	000.04	02.7	000.05	000.04	01.2	000.00	000.04	00.0
20 SUBTOTAL	000.11	000.04	02.7	000.05	000.04	01.2	000.00	000.04	00.0
2604	000.05	000.03	01.6	000.03	000.03	01.0	000.02	000.03	00.6
26 SUBTOTAL	000.05	000.03	01.6	000.03	000.03	01.0	000.02	000.03	00.6
2800	000.05	000.06	00.8	000.06	000.06	01.0	000.08	000.06	01.3
2801	000.11	000.11	01.0	000.14	000.11	01.2	000.09	000.11	00.8
28 SUBTOTAL	000.16	000.17	00.9	000.20	000.17	01.1	000.17	000.17	01.0
3401	001.14	000.43	02.6	001.15	000.43	02.6	000.61	000.43	01.4
3405	000.01	000.04	00.2	000.03	000.04	00.7	000.03	000.04	00.7
34 SUBTOTAL	001.15	000.47	02.4	001.18	000.47	02.5	000.64	000.47	01.1

Table B1-2

EXAMPLE REPORT

MAINTENANCE MANHOURS ARRAYED BY MOS

(MMHBYMOS)

E S P A N S

REF2

REQUIRED			SCHEDULED		MAINTENANCE MANHOURS		
MILES =			15 ROUNDS =	300 HOURS =	24		
SPECIALTY	GRADE	CREW	ORG	DIR	GEN	TOTAL	
12J	4	*****	*****	*****	*****	*****	
12U		*****	*****	*****	*****	*****	
13B	3	*****387	*****	*****	*****	*****391	
13B	4	*****2,541	*****	*****	*****	*****2,553	
13B	5	*****692	*****	*****	*****	*****698	
13B	6	*****663	*****	*****	*****	*****665	
13B		*****3,683	*****	*****	*****	*****3,707	
16B	4	*****	*****	*****	*****	*****	
16B	6	*****	*****	*****	*****	*****	
16B		*****	*****	*****	*****	*****	
45K	4	*****	*****	*****185	*****	*****244	
45K	5	*****	*****	*****215	*****	*****275	
45K		*****	*****	*****400	*****	*****519	
45L	3	*****	*****	*****442	*****	*****442	
45L	4	*****	*****	*****452	*****	*****452	
45L	5	*****	*****	*****425	*****	*****425	
45L	6	*****	*****	*****54	*****	*****54	
45L		*****	*****	*****973	*****	*****973	
63C	3	*****	*****	*****	*****	*****	
63C	4	*****	*****	*****	*****	*****	
63C	5	*****	*****	*****	*****	*****	
63C	6	*****	*****	*****	*****	*****	
63C		*****	*****	*****	*****	*****	
63F	5	*****	*****	*****	*****	*****	
63F		*****	*****	*****	*****	*****	
TOTAL		*****3,688	*****606	*****1,373	*****	*****5,667	

Table B1-3

EXAMPLE REPORT: AVAILABILITY BY GG NO. (AVLBYGG)

E S P A S

I N H E R E N T A V A I L A B I L I T Y			
MILES =	15 ROUNDS =	300 HOURS =	24
GG #	PRED	REF	NEW
0100	0.996484	0.996484	0.998833
0101	0.999960	0.999960	0.999986
0102	0.999692	0.999692	0.999898
0103	0.999920	0.999920	0.999973
0105	0.999725	0.999725	0.999909
0106	0.999401	0.999401	0.999801
0108	0.999909	0.999909	0.999970
0109	0.999927	0.999927	0.999975
03	0.999996	0.999996	0.999996
0300	0.999971	0.999971	0.999975
0301	0.999786	0.999786	0.999818
0302	0.999694	0.999694	0.999741
0304	0.999569	0.999569	0.999635
0305	0.999407	0.999407	0.999497
0306	0.999273	0.999273	0.999384
0308	0.999951	0.999951	0.999958
0309	0.999759	0.999759	0.999796
0311	0.999981	0.999981	0.999984
0312	0.999858	0.999858	0.999880
0401	0.999833	0.999833	0.999833
05	0.999987	0.999987	0.999990
0501	0.998504	0.998504	0.998848
0503	0.999634	0.999634	0.999718
0504	0.999951	0.999951	0.999962
0505	0.998227	0.998227	0.998634
0507	0.999974	0.999974	0.999980
0601	0.998717	0.998717	0.999758
0602	0.998632	0.998632	0.999208
0603	0.998114	0.998114	0.998909
0607	0.999582	0.999582	0.999758
0608	0.998989	0.998989	0.999415
0609	0.999478	0.999478	0.999987
0610	0.999589	0.999589	0.999762
0612	0.998767	0.998767	0.999287
0613	0.999624	0.999624	0.999782
0614	0.990105	0.990105	0.990105
0618	0.975503	0.975503	0.975503
0701	0.999985	0.999985	0.999985

APPENDIX B2

ESPAWS HARDMAN MODEL

USER'S GUIDE

AUTHOR: Alan Pincus

ESPAWS HARDMAN MODEL

USER'S GUIDE

This document contains instructions for using the programs which maintain and report on the ESPAWS HARDMAN model.

The ESPAWS HARDMAN model consists of three primary files (Predecessor, Reference, and New), and as many secondary files as desired, using any filename, each holding a variation of the data contained in one of the primary files.

The data in all model files is organized by Government Functional Grouping Code (GG#). For a given GG#, there is one GG record containing name, number, and reliability information (MTTR, DEPENDENCY, and Mean Metric Between Failure) and multiple detail records, each specifying manhours required per associated GG failure, by Maintenance, Echelon, Maintenance Type, FCD, Specialty, and Grade.

This guide explains how to use three report programs (MMHBYGG, MMHBYMOS, AVLBYGG), a program to modify the model files (MODMDL), as well as descriptions of Time-Sharing-System (TSS) commands for file creation, deletion, and copying. For more complete explanations of TSS commands, see the TSS General Information Manual.

Creation of the three primary files is described separately. See ESPAWS HARDMAN MODEL PROGRAMMERS GUIDE.

SYSTEMS DIVISION

USER'S GUIDE

MANHOURS BY SPECIALTY REPORT (MMHBYGG)

1. Logon to accounts ESPAWS2.
2. /MMHBYGG filename,MILEs-nnn,ROUNDs-nnn,HOURs-nnn,RTYPE-{SCHEDULEd UNSCHEDULEd},RTYPE-{DETAIL SUMMARY}

A. **filename** - Required. Must be first argument after program name. It is not a file string, but a filename only, of a file in catalog ESPAWS2/DATA.

Arguments B thru F are optional and may be entered in any order.

- B. MILEs-nnn - miles travelled by one vehicle in one year.
Miles default = 1000
- C. ROUNDs-nnn - rounds shot by one vehicle in one year.
Rounds default = 750
- D. HOURs-nnn - operating hours of one vehicle in one year.
Hours default = 150
- E. MTYPE- { SChEduled
UNShEduled } - determines maintenance type of report
Mtype default = unscheduled
- F. RTYPE- { DETAIl
SUMMArY } - determines report type. Detail report presents hours by four-digit GG#. Summary report presents hours by two most significant GG# digits only.
Rtype default = detail

Upper case letters must be typed exactly as shown when the option is used.

Lower case are optional and may be omitted.

ESPAWS HARDMAN MODEL

USER'S GUIDE

MANHOURS BY SPECIALTY REPORT (MMHBYSMOS)

1. Logon to accounts ESPAWS2.
2. /MMHSYMS filename, MILES=nnn, ROUNDS=nnn, HOURS=nnn, MTYPE={SCHEDULED
UNSCHEDULED}, RTYPE={DETAIL
SUMMARY}

A. **filename** - Required. Must be first argument after program name. It is not a file string, but a filename only, of a file in catalog ESPAWS2/DATA.

Arguments B thru F are optional and may be entered in any order.

- B. MILES-nnn - miles travelled by one vehicle in one year.
Miles default = 1000
- C. ROUNds-nnn - rounds shot by one vehicle in one year.
Rounds default = 750
- D. HOURs-nnn - operating hours of one vehicle in one year.
Hours default = 150
- E. MTYPE- { SChEduled
UNShEduled } - determines maintenance type of
report.
Mtype default = unscheduled
- F. RTYPE- { DETaiL
SUMMary } - determines report type. Detail re-
port breaks specialties down by grade.
Summary report gives hours by special-
ty only.
Rtype default = detail

Upper case letters must be typed exactly as shown when the option is used.

Lower case are optional and may be omitted.

ESPAWS HARDMAN MODEL

USER'S GUIDE

INTERACTIVE UPDATE PROGRAMS (MODMDL)

1. Logon to account ESPAWS2.
2. CATA /DATA,s,a
3. CPY /DATA/source-filename;/DATA/destination-filename
4. /ASSOC name-of-file-to-be-modified
5. /MODMDL

EXPLANATIONS:

2. CATA is a TSS command that will list the files in a catalog. Since all model files must reside in ESPAWS2/DATA, by listing that catalog, you will get an instant inventory of all model files. This step is optional.
3. CPY is a TSS command which will copy the contents of one file into another. If the destination file does not exist, CPY will create it. This step is optional. Use it if you want to try some modifications without disturbing the files you already have. Use as a source file, the file which requires the fewest changes to be made into the hypothetical system you want to test.

ESPAWS HARDMAN MODEL

USER'S GUIDE

INHERENT AVAILABILITY BY GG# REPORT (AVLBYGG)

1. Logon to account ESPAWS2.
2. /AVLBYGG pred-filename,ref-filename,new-filename,MILEs-nnn,ROUNDs-nnn,HOURs-nnn

Arguments A thru C are required and must be entered in the order listed below.

- A. pred-filename - name of file to be used as Predecessor system for this report. The file must reside in catalog ESPAWS2/DATA.
- B. ref-filename - name of file to be used as Reference system for this report. The file must reside in catalog ESPAWS2/DATA.
- C. new-filename - name of file to be used as New system for this report. The file must reside in catalog ESPAWS2/DATA.

Arguments D thru F are optional and may be entered in any order.

- D. MILEs-nnn - miles travelled by one vehicle in one year.
Miles default = 1000
- E. ROUNDs-nnn - rounds shot by one vehicle in one year.
Rounds default = 750
- F. HOURs-nnn - operating hours of one vehicle in one year.
Hours default = 150

Upper case letters must be typed exactly as shown when the option is used.

Lower case are optional and may be omitted.

DYNAMICS RESEARCH CORPORATION

SYSTEMS DIVISION

4. /ASSOC is a command file which makes the association between the file code which the MODMDL program uses for I/O, and a real file residing on disc. By changing this association, the MODMDL program can be made to work with any file having the proper physical and logical organization, namely, any of the model files.

This step is required and must be taken immediately before invoking the MODMDL program. If the MODMDL program begins by printing "MI?", it means that no association has been made, and the program does not know which file to work on. If this happens, hit the break key, use /ASSOC, and re-invoke /MODMDL.

Make sure that you know which file is currently associated. If you want to make changes to file B, but file A is currently associated, when you run the MODMDL program, you will be making changes to file A.

DYNAMICS RESEARCH CORPORATION
SYSTEMS DIVISION

5. /MODMDL - The following is a description of the options available with this program.

- LIST(L) - Program will prompt for a GG#, and if found, will display its GG record, and all detail records, 20 at a time.
- SEARCH(S) - You may specify a record to be searched for which will become the current record, if found. You may specify only GG#, in which case the program will look for a GG-record. By answering "Y" to the DETAIL question, you may specify ECHELON, and/or MTYPE, and/or FCD, and/or SPECIALTY, and/or GRADE. The program will search for a Detail record with the values you have specified. If found, that record becomes the current record. If not found, the program will tell you which of the specified values could not be located.
- NEXT-REC(C/R) - The next record in the file will be displayed and will become the current record.
- ADD(A) - You may add a GG record only, a GG record and associated detail records, or detail records only. GG records are inserted in the file according to collating sequence. Detail records are appended immediately after their associated GG record.

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SYSTEMS DIVISION

- DELETE(D)** - If the record is a detail record, you will delete the current record only. If the current record is a GG Record, all detail records associated with that GG will be deleted in addition to the GG record itself.
- MODIFY(M)** - This option allows you to modify the current record. If the current record is a GG Record, you will be presented with a list of fields which may be altered. For detail records, you may change HOURS/FAILURE only. When prompted for the new value, typing C/R will leave the old value unchanged. If a new value is input, the record will be displayed and you may choose to update the file or leave it unchanged.

ESPAWS HARDMAN MODEL
USER'S GUIDE

OTHER USEFUL TSS COMMANDS

1. REMC - This TSS command removes all associations between files and file codes. If after using the CPY command or /ASSOC command file, you get a message saying a file is busy, use this command and try again.

2. ACCE PF,/DATA/name-of-file-to-be-purged

This TSS command will delete a file from the file system. You will have to use it if you run out of file space, but be careful. Once a file is deleted it is gone forever.*

3. ACCE MF,/DATA/name-of-file-to-be-changed,NEWNAME/new-name-of-file/

If you want to rename a file, this is how to do it.

You may name your files anything you'd like, but only the files named 'PRED', 'REF', or 'NEW' will have neatly centered headings on their reports.

*In an emergency, purged files can be restored by the operators.

APPENDIX B3
DESCRIPTION OF THE MINIMUM FLOW SOLUTION (MFS) MODEL

This appendix contains a description of the processes, use, and potential growth of the Minimum Flow Solution (MFS) model.

The MFS model is run interactively to determine personnel requirements and is based on two types of input:

1. Personnel flow characteristics as derived from the EMF and
2. Manpower requirements for all units.

It used the following procedure for this application to determine the initial fill and subsequent sustaining rate for meeting specific manpower requirements.

1. Compute percentage of individuals in each AFQT category group for each MOS. This represents the likelihood of an incoming individual being in a particular category, given the current distribution.
2. Compute the percentage of individuals who attrite and the percent who advance from each MOS/paygrade. This can be converted to a monthly value by dividing by the average length of time-in-paygrade.

3. Compute the average time-in-paygrade for each MOS/paygrade.
4. Assume that the input manpower requirements must now be met and begin to push individuals through, based on the derived flow characteristics for that MOS.
5. Once the highest level requirements are met, check to see that all below are met.
6. Compute the number of personnel which must be input per month to maintain the calculated values.

The MFS model allows for any number of paygrades within an MOS to be examined, and it provides for the elimination from consideration of paygrades which are non-existent or not to be analyzed. For example, all 13B personnel become 13Y at the E-8 level. Therefore, the model will be given orders to look at 13B only from E-1 to E-7. This can also be done if it is not desired to look beyond a particular paygrade. (Note: If there is a "0" requirement at the highest level and it is input to the model as such, there will be a value representing those personnel who are normally advanced to that paygrade simply because they cannot be held at a particular level indefinitely.)

Table B4-1 describes the prompts which occur during an execution of the model, and all of the appropriate responses which the user may provide. Most of the prompts are used for the purpose of sensitization of parameters.

Table B3-1

Instructions for the ESPAWS Minimum Flow Model:

In response to: Enter:

MOS= The desired MOS, or to end the program,
 enter nothing. An invalid MOS will
 cause the prompt to recur.

OUTPUT TYPE (1,2 OR BLANK) =
 1 - to execute only the minimum flow portion of
 the program, reporting monthly recruit rates.
 2 - to execute the attrite/advance percentages
 portion of the program on an annual basis.
 blank (or nothing) - to execute both 1 and 2.

CAT-PG= Two characters specifying the sensitization
 to perform. The valid first characters are:
 P - to perturb attrite probability
 T - to perturb attrite time-in-paygrade
 V - to perturb advance time-in-paygrade
 M - to perturb mentality distribution.
 Any other character will cancel the
 sensitization feature (including blank)
 For P,T, and V, the second character is optional
 and must be a digit specifying the paygrade to
 which the sensitization is restricted. If left
 blank, sensitization will be performed across all
 paygrades.
 Specifying a paygrade outside the range
 of paygrades being analyzed will produce
 a do-nothing sensitization.
 If the first character is M, the second character
 is not used.

FRAC= The fraction of sensitization. If .| is entered,
 the resulting sensitizations will be -10% and +10%.

#LEVELS= The number of paygrades which may "bleed down" in order
 to satisfy requirements of lower paygrades. If 0
 (or blank) is entered, the bleed-down feature is not used.

REQD= The list of manpower requirements. Nine values, separated
 by commas, specifying the requirements for each paygrade.
 A -1 deletes the paygrade from the analysis. Each number
 must be followed directly by a comma or contain a decimal
 point.

HEADER= A meaningful title for each of the two sensiti-
 zations of the mentality distribution "Alpha".

1= The fractions between zero and 1.0 which will be
2= used in place of Alpha for each of the two sensiti-
3= zations of the Mentality distribution.
4= The sum of the five new values for Alpha must sum
 to 1.0

There are many potential expansions and adaptations of the MFS model which could and/or may be done in the future.

- By using the entire EMF, any number of MOSs could be analyzed, including a potential aggregation of all systems that utilize the same MOSs.
- By supplementing personnel demand data with personnel projection data, impacts can be assessed.
- CONUS/overseas duty rotation patterns could be derived and analyzed for their unique flow characteristics.
- School career patterns could be derived if EMF elements were updated.
- Revision of the MFS model could produce a tool which could tell personnel managers the effects of varying policy prior to implementation.

It is important to stress that there are many potential uses of the EMF data base and the MFS model. A flexible, usable data base derived from the EMF could ultimately provide users with many types of information regarding assignment and management of personnel.

APPENDIX B4
MINIMUM FLOW SOLUTION (MFS) MODEL OUTPUTS

This appendix contains all of the outputs upon which Personnel Requirements Analysis was performed. Each run was done interactively by inputting the parameters described in Table B4-1, as necessary for the type of run.

The method for determining personnel differentials is as follows. For example, for the predecessor-conceptual comparisons, an initial run was made to determine the fill and sustaining requirements for the predecessor system. Then the difference between manpower requirements of the predecessor and conceptual systems was run through the model to determine only those extra or fewer required to support the conceptual system. The conceptual system requirements were determined through the addition or subtraction of the differential personnel requirements. This was the method used in the cases of MOSs with the same highest level requirement for the predecessor and conceptual systems. For cases where the highest level requirements differed, the actual conceptual system manpower values were used, since the result was the same as assessing the differential.

Included in this appendix is a page for each MOS within both comparisons: (1) predecessor-conceptual and (2) reference-conceptual.

Also included are outputs which demonstrate the capability of parameter sensitization. These outputs are primarily made to show how this analytic tool could ultimately be used

to identify ways of decreasing the personnel requirements, as well as allowing "what-if" types of questions to be answered.

The MOS 13B was used to demonstrate each type of sensitization currently performable. No in-depth attempt was made to analyze these results at this time since they would be part of Impact and Tradeoff Analyses. However, some points to note follow:

- Changing the attrition rate by a small fraction produces more of an impact than changing the time-in-paygrade by a small fraction.
- Changing the AFQT distribution produced a change in the distribution of personnel requirements and recruit rate. Eventually this fact could be used to determine optimum distribution.

B4.1

PREDECESSOR/CONCEPTUAL
COMPARISON

PREDECESSOR

MOS= 13B
OUTPUT TYPE (1,2 OR BLANK) = 1
CAT-PG=
#LEVELS=
REQD= 0,0,5832,3969,1944,1944,81,-1,-1.

MOS-13B REQUIRES 950.2/MO.

PYGD	REQ.	PERSONNEL
E1	0.	23582.1
E2	0.	23881.6
E3	5832.0	25593.4
E4	3969.0	11679.7
E5	1944.0	3585.3
E6	1944.0	1944.0
E7	81.0	452.5

-Δ CONCEPTUAL

MOS= 13B
OUTPUT TYPE (1,2 OR BLANK) = 1
CAT-PG=
#LEVELS=
REQD= 0,0,1863,1944,0,0,0,-1,-1.

MOS-13B REQUIRES 158.2/MO.

PYGD	REQ.	PERSONNEL
E1	0.	3925.1
E2	0.	3974.9
E3	1863.0	4259.8
E4	1944.0	1944.0
E5	0.	596.8
E6	0.	323.6
E7	0.	75.3

+Δ CONCEPTUAL

MOS= 13B
OUTPUT TYPE (1,2 OR BLANK) = 1
CAT-PG=
#LEVELS=
REQD= 0,0,0,0,81,0,0,-1,-1.

MOS-13B REQUIRES 21.5/MO.

PYGD	REQ.	PERSONNEL
E1	0.	532.8
E2	0.	539.6
E3	0.	578.2
E4	0.	263.9
E5	81.0	81.0
E6	0.	43.9
E7	0.	10.2

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PREDECESSOR/CONCEPTUAL

MOS= 31V
OUTPUT TYPE (1,2 OR BLANK) = 1
CAT-PG=
#LEVELS=
REQD= 0,0,81,81,0,0,0,0,-1.

MOS-31V REQUIRES 7.2/MO.

PYGD	REQ.	PERSONNEL
E1	0.	149.5
E2	0.	175.0
E3	81.0	218.5
E4	81.0	81.0
E5	0.	42.2
E6	0.	29.6
E7	0.	8.4
E8	0.	1.2

PREDECESSOR/CONCEPTUAL

MOS= 41C
OUTPUT TYPE (1,2 OR BLANK) =
CAT-PG=
#LEVELS=
REQD= 0,0,0,81,0,0,0,-1,-1.

MOS-41C REQUIRES 6.6/MO.

PYGD	REQ.	PERSONNEL
E1	0.	96.3
E2	0.	88.9
E3	0.	85.0
E4	81.0	81.0
E5	0.	33.3
E6	0.	1.8
E7	0.	0.

PREDECESSOR/CONCEPTUAL

MOS= 44B
OUTPUT TYPE (1,2 OR BLANK) =
CAT-PG=
#LEVELS=
REQD= 0,0,0,81,0,0,0,-1,-1.

MOS-44B REQUIRES 4.5/MO.

PYGD	REQ.	PERSONNEL
E1	0.	138.3
E2	0.	78.4
E3	0.	195.6
E4	81.0	81.0
E5	0.	51.8
E6	0.	22.8
E7	0.	6.8

PREDECESSOR

MOS= 45K
OUTPUT TYPE (1,2 OR BLANK) =
CAT-PG=
#LEVELS=
REQD= 0,0,81,324,243,0,-1,-1,-1.

MOS-45K REQUIRES 54.5/MO.

PYGD	REQ.	PERSONNEL
E1	0.	1160.9
E2	0.	1037.9
E3	81.0	1318.6
E4	324.0	545.9
E5	243.0	243.0
E6	0.	72.9

CONCEPTUAL

MOS= 45K
OUTPUT TYPE (1,2 OR BLANK) = 1
CAT-PG=
#LEVELS=
REQD= 0,0,81,486,324,0,-1,-1,-1.

MOS-45K REQUIRES 72.7/MO.

PYGD	REQ.	PERSONNEL
E1	0.	1547.9
E2	0.	1383.8
E3	81.0	1758.1
E4	486.0	727.9
E5	324.0	324.0
E6	0.	97.2

PREDECESSOR

MOS= 45L
OUTPUT TYPE (1,2 OR BLANK) =
CAT-PG=
#LEVELS=
REQD= 0,0,0,162,81,0,-1,-1,-1.

MOS-45L REQUIRES 27.6/MO.

PYGD	REQ.	PERSONNEL
E1	0.	621.6
E2	0.	579.9
E3	0.	622.8
E4	162.0	259.6
E5	81.0	81.0
E6	0.	8.4

+Δ CONCEPTUAL

MOS= 45L
OUTPUT TYPE (1,2 OR BLANK) =
CAT-PG=
#LEVELS=
REQD= 0,0,81,81,0,0,-1,-1,-1.

MOS-45L REQUIRES 8.6/MO.

PYGD	REQ.	PERSONNEL
E1	0.	194.0
E2	0.	180.9
E3	81.0	194.3
E4	81.0	81.0
E5	0.	25.3
E6	0.	2.6

PREDECESSOR/CONCEPTUAL

MOS= 63B
OUTPUT TYPE (1,2 OR BLANK) =
CAT-PG=
#LEVELS=
REQD= 0,0,0,0,0,81,-1,-1,-1.
MOS-63B REQUIRES 25.2/MO.

PYGD	REQ.	PERSONNEL
E1	0.	805.7
E2	0.	867.6
E3	0.	910.3
E4	0.	457.3
E5	0.	196.1
E6	81.0	81.0

PREDECESSOR

MOS= 63C
OUTPUT TYPE (1,2 OR BLANK) =
CAT-PG=
#LEVELS=
REQD= 0,0,0,81,81,81,0,-1,-1.

MOS-63C REQUIRES 95.8/MO.

PYGD	REQ.	PERSONNEL
E1	0.	1788.5
E2	0.	1636.2
E3	0.	2023.7
E4	81.0	702.0
E5	81.0	198.3
E6	81.0	81.0
E7	0.	24.1

+Δ CONCEPTUAL

MOS= 63C
OUTPUT TYPE (1,2 OR BLANK) =
CAT-PG=
#LEVELS=
REQD= 0,0,0,0,81,0,0,-1,-1.

MOS-63C REQUIRES 39.1/MO.

PYGD	REQ.	PERSONNEL
E1	0.	730.7
E2	0.	668.5
E3	0.	826.8
E4	0.	286.8
E5	81.0	81.0
E6	0.	33.1
E7	0.	9.8

B4.2

**REFERENCE-CONCEPTUAL
COMPARISON**

REFERENCE

MOS= 13B
 OUTPUT TYPE (1,2 OR BLANK) = 1
 CAT-PG=
 #LEVELS=
 REQD= 0,0,3888,2268,2025,1944,81,-1,-1.

MOS-13B REQUIRES 950.2/MO.

PYGD	REQ.	PERSONNEL
E1	0.	23582.1
E2	0.	23881.6
E3	3888.0	25593.4
E4	2268.0	11679.7
E5	2025.0	3585.3
E6	1944.0	1944.0
E7	81.0	452.5

+Δ CONCEPTUAL

MOS= 13B
 OUTPUT TYPE (1,2 OR BLANK) = 1
 CAT-PG=
 #LEVELS=
 REQD= 0,0,81,0,0,0,0,-1,-1.

MOS-13B REQUIRES 3.0/MO.

PYGD	REQ.	PERSONNEL
E1	0.	74.6
E2	0.	75.6
E3	81.0	81.0
E4	0.	37.0
E5	0.	11.3
E6	0.	6.2
E7	0.	1.4

-Δ CONCEPTUAL

MOS= 13B
 OUTPUT TYPE (1,2 OR BLANK) = 1
 CAT-PG=
 #LEVELS=
 REQD= 0,0,0,243,0,0,0,-1,-1.

MOS-13B REQUIRES 19.8/MO.

PYGD	REQ.	PERSONNEL
E1	0.	490.6
E2	0.	496.9
E3	0.	532.5
E4	243.0	243.0
E5	0.	74.6
E6	0.	40.4
E7	0.	9.4

REFERENCE

MOS= 31V
 OUTPUT TYPE (1,2 OR BLANK) = 1
 CAT-PG=
 #LEVELS=
 REQD= 0,0,81,1134,1134,0,0,0,-1.

MOS-31V REQUIRES 194.2/MO.

PYGD	REQ.	PERSONNEL
E1	0.	4020.4
E2	0.	4705.1
E3	81.0	5875.2
E4	1134.0	2178.1
E5	1134.0	1134.0
E6	0.	797.2
E7	0.	225.5
E8	0.	31.4

CONCEPTUAL

MOS= 31V
 OUTPUT TYPE (1,2 OR BLANK) = 1
 CAT-PG=
 #LEVELS=
 REQD= 0,0,81,81,0,0,0,0,-1.

MOS-31V REQUIRES 7.2/MO.

PYGD	REQ.	PERSONNEL
E1	0.	149.5
E2	0.	175.0
E3	81.0	218.5
E4	81.0	81.0
E5	0.	42.2
E6	0.	29.6
E7	0.	8.4
E8	0.	1.2

REFERENCE/CONCEPTUAL

MOS= 41C
OUTPUT TYPE (1,2 OR BLANK) =
CAT-PG=
#LEVELS=
REQD= 0,0,0,81,0,0,0,-1,-1.

MOS-41C REQUIRES 6.6/MO.

PYGD	REQ.	PERSONNEL
E1	0.	96.3
E2	0.	88.9
E3	0.	85.0
E4	81.0	81.0
E5	0.	33.3
E6	0.	1.8
E7	0.	0.

REFERENCE/CONCEPTUAL

MOS= 44B
OUTPUT TYPE (1,2 OR BLANK) =
CAT-PG=
#LEVELS=
REQD= 0,0,0,81,0,0,0,-1,-1.

MOS-44B REQUIRES 4.5/MO.

PYGD	REQ.	PERSONNEL
E1	0.	138.3
E2	0.	78.4
E3	0.	195.6
E4	81.0	81.0
E5	0.	51.8
E6	0.	22.8
E7	0.	6.8

REFERENCE/CONCEPTUAL

MOS= 45K
OUTPUT TYPE (1,2 OR BLANK) =
CAT-PG=
#LEVELS=
REQD= 0,0,81,486,324,0,-1,-1,-1.

MOS-45K REQUIRES 72.7/MO.

PYGD	REQ.	PERSONNEL
E1	0.	1547.9
E2	0.	1383.8
E3	81.0	1758.1
E4	486.0	727.9
E5	324.0	324.0
E6	0.	97.2

REFERENCE

MOS= 45L
 OUTPUT TYPE (1,2 OR BLANK) =
 CAT-PG=
 #LEVELS=
 REQD= 0,0,0,324,81,0,-1,-1,-1.
 MOS-45L REQUIRES 34.5/MO.

PYGD	REQ.	PERSONNEL
E1	0.	775.8
E2	0.	723.7
E3	0.	777.3
E4	324.0	324.0
E5	81.0	101.1
E6	0.	10.4

+Δ CONCEPTUAL

MOS= 45L
 OUTPUT TYPE (1,2 OR BLANK) = 1
 CAT-PG=
 #LEVELS=
 REQD= 0,0,81,0,0,0,-1,-1,-1.
 OS-45L REQUIRES 3.6/MO.

PYGD	REQ.	PERSONNEL
E1	0.	80.8
E2	0.	75.4
E3	81.0	81.0
E4	0.	33.8
E5	0.	10.5
E6	0.	1.1

-Δ CONCEPTUAL

MOS= 45L
 OUTPUT TYPE (1,2 OR BLANK) = 1
 CAT-PG=
 #LEVELS=
 REQD= 0,0,0,81,0,0,-1,-1,-1.
 MOS-45L REQUIRES 8.6/MO.

PYGD	REQ.	PERSONNEL
E1	0.	194.0
E2	0.	180.9
E3	0.	194.3
E4	81.0	81.0
E5	0.	25.3
E6	0.	2.6

REFERENCE/CONCEPTUAL

MOS= 63B
OUTPUT TYPE (1,2 OR BLANK) =
CAT-PG=
#LEVELS=
REQD= 0,0,0,0,0,81,-1,-1,-1.

MOS-63B REQUIRES 25.2/MO.

PYGD	REQ.	PERSONNEL
E1	0.	805.7
E2	0.	867.6
E3	0.	910.3
E4	0.	457.3
E5	0.	196.1
E6	81.0	81.0

REFERENCE/CONCEPTUAL

MOS= 63C
OUTPUT TYPE (1,2 OR BLANK) =
CAT-PG=
#LEVELS=
REQD= 0,0,0,81,162,81,0,-1,-1.

MOS-63C REQUIRES 95.8/MO.

PYGD	REQ.	PERSONNEL
E1	0.	1788.5
E2	0.	1636.2
E3	0.	2023.7
E4	81.0	702.0
E5	162.0	198.3
E6	81.0	81.0
E7	0.	24.1

B4.3

SENSITIZATION EXAMPLES

B-45

Alter attrition rate by 10%.

MOS= 13B
 OUTPUT TYPE (1,2 OR BLANK) = 1
 CAT-PG= P
 FRAC= .1
 #LEVELS= 0
 REQD= 0,0,50,40,30,20,10,-1,-1.

MOS-13B		NO SENSITIZATION	- 10.0%	+ 10.0%
		REQUIRES 21.0/MO.	REQUIRES 10.5/MO.	REQUIRES 50.6/MO.
PYGD	REQ.	PERSONNEL	PERSONNEL	PERSONNEL
E1	0.	521.2	293.4	1126.4
E2	0.	527.8	304.2	1113.1
E3	50.0	565.7	332.6	1169.3
E4	40.0	258.1	152.2	537.6
E5	30.0	79.2	61.9	114.8
E6	20.0	43.0	39.3	51.2
E7	10.0	10.0	10.0	10.0

Alter attrition rate for paygrade 5 by 10%.

MOS= 13B
 OUTPUT TYPE (1,2 OR BLANK) = 1
 CAT-PG= P5
 FRAC= .1
 #LEVELS= 0
 REQD= 0,0,50,40,30,20,10,-1,-1.

MOS-13B		NO SENSITIZATION	- 10.0%	+ 10.0%
		REQUIRES 21.0/MO.	REQUIRES 17.6/MO.	REQUIRES 25.9/MO.
PYGD	REQ.	PERSONNEL	PERSONNEL	PERSONNEL
E1	0.	521.2	437.9	643.6
E2	0.	527.8	443.5	651.8
E3	50.0	565.7	475.3	698.5
E4	40.0	258.1	216.9	313.3
E5	30.0	79.2	76.5	86.7
E6	20.0	43.0	42.9	43.0
E7	10.0	10.0	10.0	10.0

Alter attrite time-in-paygrade by 10%.

MOS= 13B
 OUTPUT TYPE (1,2 OR BLANK) = 1
 CAT-PG= T
 FRAC= .1
 #LEVELS= 0
 REQD= 0,0,50,40,30,20,10,-1,-1.

MOS-13B		NO SENSITIZATION	- 10.0%	+ 10.0%
		REQUIRES 21.0/MO.	REQUIRES 23.2/MO.	REQUIRES 19.2/MO.
PYGD	REQ.	PERSONNEL	PERSONNEL	PERSONNEL
E1	0.	521.2	573.4	478.2
E2	0.	527.8	582.2	483.0
E3	50.0	565.7	622.3	518.9
E4	40.0	258.1	268.3	249.8
E5	30.0	79.2	84.0	75.3
E6	20.0	43.0	45.2	41.1
E7	10.0	10.0	10.0	10.0

Alter attrite time-in-paygrade for paygrade 5 by 10%.

MOS= 13B
 OUTPUT TYPE (1,2 OR BLANK) = 1
 CAT-PG= T5
 FRAC= .1
 #LEVELS= 0
 REQD= 0,0,50,40,30,20,10,-1,-1.

MOS-13B		NO SENSITIZATION	- 10.0%	+ 10.0%
		REQUIRES 21.0/MO.	REQUIRES 21.0/MO.	REQUIRES 21.0/MO.
PYGD	REQ.	PERSONNEL	PERSONNEL	PERSONNEL
E1	0.	521.2	521.2	521.2
E2	0.	527.8	527.8	527.8
E3	50.0	565.7	565.7	565.7
E4	40.0	258.1	258.1	258.1
E5	30.0	79.2	75.9	82.6
E6	20.0	43.0	43.0	43.0
E7	10.0	10.0	10.0	10.0

Alter advance time-in-paygrade by 10%.

MOS= 13B
 TPUT TYPE (1,2 OR BLANK) = 1
 CAT-PG= V
 FRAC= .1
 #LEVELS= 0
 REQD= 0,0,50,40,30,20,10,-1,-1.

MOS-13B		NO SENSITIZATION	- 10.0%	+ 10.0%
		REQUIRES 21.0/MO.	REQUIRES 21.1/MO.	REQUIRES 20.9/MO.
PYGD	REQ.	PERSONNEL	PERSONNEL	PERSONNEL
E1	0.	521.2	473.8	568.2
E2	0.	527.8	478.5	576.8
E3	50.0	565.7	514.2	616.7
E4	40.0	258.1	248.9	267.3
E5	30.0	79.2	74.9	83.5
E6	20.0	43.0	41.0	45.0
E7	10.0	10.0	10.0	10.0

Alter advance time-in-paygrade for paygrade 5 by 10%.

MOS= 13B
 OUTPUT TYPE (1,2 OR BLANK) = 1
 CAT-PG= V5
 FRAC= .1
 #LEVELS= 0
 REQD= 0,0,50,40,30,20,10,-1,-1.

MOS-13B		NO SENSITIZATION	- 10.0%	+ 10.0%
		REQUIRES 21.0/MO.	REQUIRES 21.0/MO.	REQUIRES 21.0/MO.
PYGD	REQ.	PERSONNEL	PERSONNEL	PERSONNEL
E1	0.	521.2	521.2	521.2
E2	0.	527.8	527.8	527.8
E3	50.0	565.7	565.7	565.7
E4	40.0	258.1	258.1	258.1
E5	30.0	79.2	74.6	83.9
E6	20.0	43.0	43.0	43.0
E7	10.0	10.0	10.0	10.0

Change AFQT distribution.

MOS= 13B
 OUTPUT TYPE (1,2 OR BLANK) = 1
 CAT-PG= M
 #LEVELS= 0
 REQD= 0,0,50,40,30,20,10,-1,-1.

OLD ALPHA:

0.0138
 0.1008
 0.7368
 0.1471
 0.0016

FIRST SENS:

HEADER= MORE 1'S

1= .7368
 2= .1008
 3= .0138
 4= .1471
 5= .0016

LAST SENS:

HEADER= MORE 5'S

1= .0138
 2= .1008
 3= .0016
 4= .1471
 5= .7368

MOS-13B

NO SENSITIZATION
 REQUIRES 21.0/MO.

MORE 1'S
 REQUIRES 52.3/MO.

MORE 5'S
 REQUIRES 53.7/MO.

PYGD	REQ.	PERSONNEL	PERSONNEL	PERSONNEL
E1	0.	521.2	1398.2	427.7
E2	0.	527.8	1108.3	403.7
E3	50.0	565.7	2008.8	1416.1
E4	40.0	258.1	679.9	1013.8
E5	30.0	79.2	201.8	536.9
E6	20.0	43.0	101.9	225.3
E7	10.0	10.0	10.0	10.0

Change AFQT distribution.

MOS= 13B
 OUTPUT TYPE (1,2 OR BLANK) = 1
 CAT-PG= M
 #LEVELS= 0
 REQD= 0,0,50,40,30,20,10,-1,-1.

OLD ALPHA:

0.0138
 0.1008
 0.7368
 0.1471
 0.0016

FIRST SENS:

HEADER= HIGH 1'S

1= .4
 2= .15
 3= .15
 4= .15
 5= .15

LAST SENS:

HEADER= HIGH 5'S

1= .15
 2= .15
 3= .15
 4= .15
 5= .4

MOS-13B

NO SENSITIZATION
 REQUIRES 21.0/MO.

HIGH 1'S
 REQUIRES 36.3/MO.

HIGH 5'S
 REQUIRES 36.3/MO.

PYGD	REQ.	PERSONNEL	PERSONNEL	PERSONNEL
E1	0.	521.2	813.4	581.6
E2	0.	527.8	698.6	530.9
E3	50.0	565.7	1195.2	1044.6
E4	40.0	258.1	509.6	582.2
E5	30.0	79.2	186.2	262.0
E6	20.0	43.0	89.3	117.1
E7	10.0	10.0	10.0	10.0

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APPENDIX C1
EQUIPMENT PRESENTATION FORMATS

Figures C1-1, C1-2 through C1-4, and C1-5 through C1-7 display the hierarchical presentation formats developed for the ESPAWS predecessor, reference, and conceptual systems respectively. In the predecessor diagram, each major subsystem of the M109A1 is represented by an unshaded ellipse. In each reference format, equipments from the predecessor are indicated by unshaded ellipses and equipments from other existing systems are indicated by shaded ellipses. (By definition, the reference system must consist of existing equipments, either from the predecessor or other systems in the DoD/NATO inventory.)

The conceptual system format is similar to the reference format with two major changes: (1) equipments which are modifications of reference equipments are represented by circles and (2) "new" equipments (indicating use of an emerging technology) which were not present in the reference system are represented by squares. Existing equipments (i.e. is equipments taken directly from the reference system without modification) are again represented by unshaded ellipses (to indicate predecessor equipment) and shaded ellipses (to indicate other existing equipment).

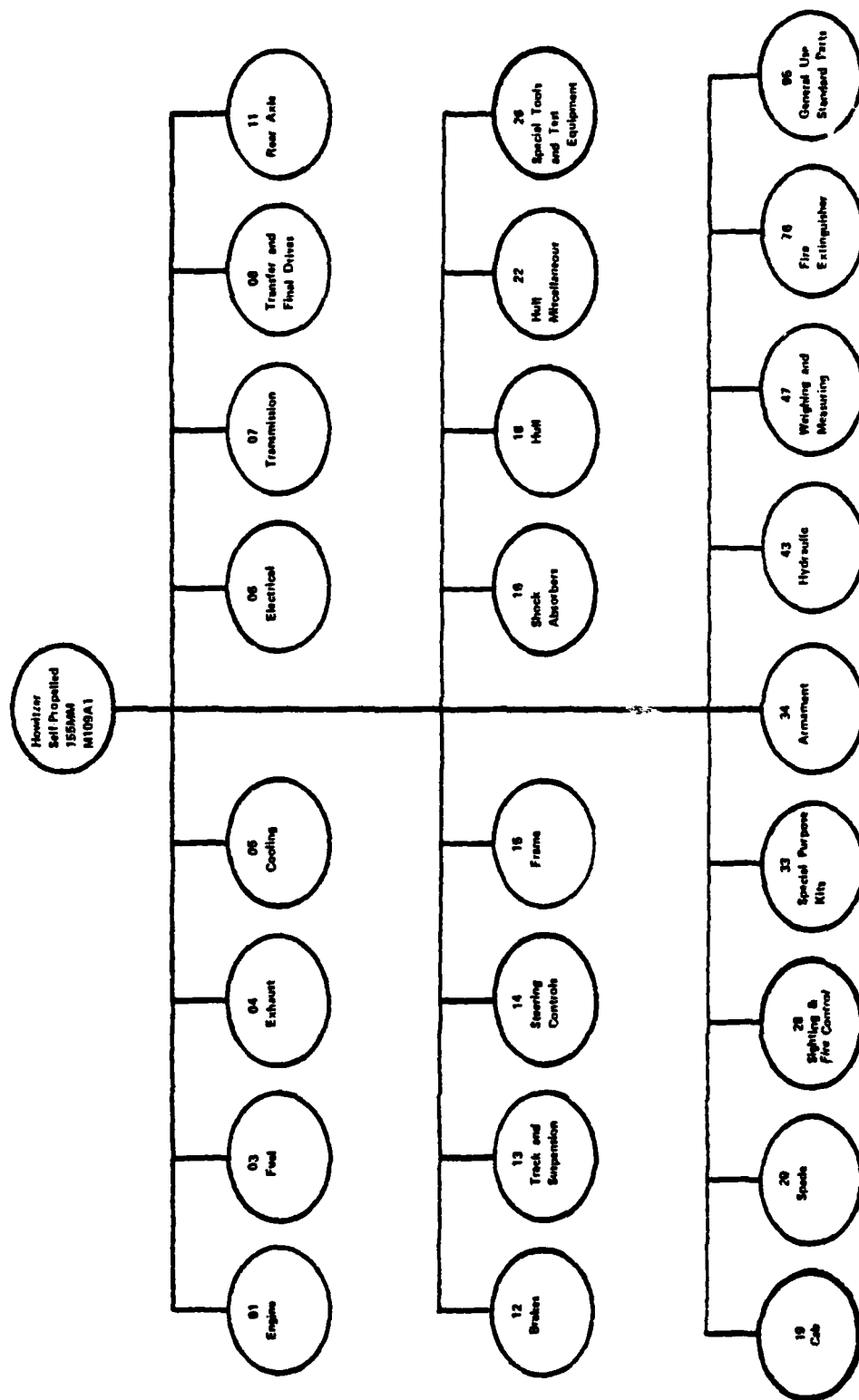


Figure C11 PREDECESSOR SYSTEM

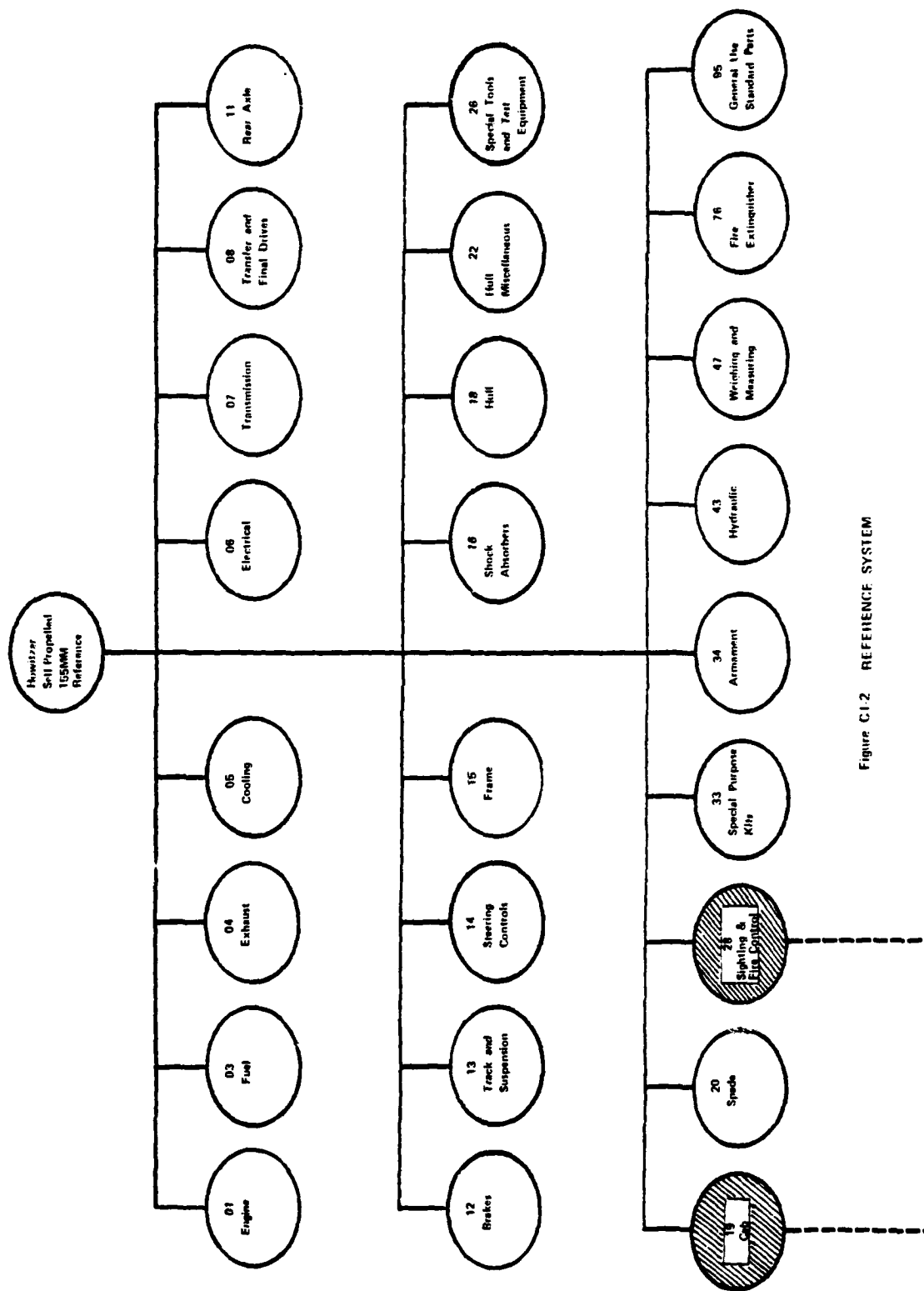


Figure C1.2 REFERENCE SYSTEM

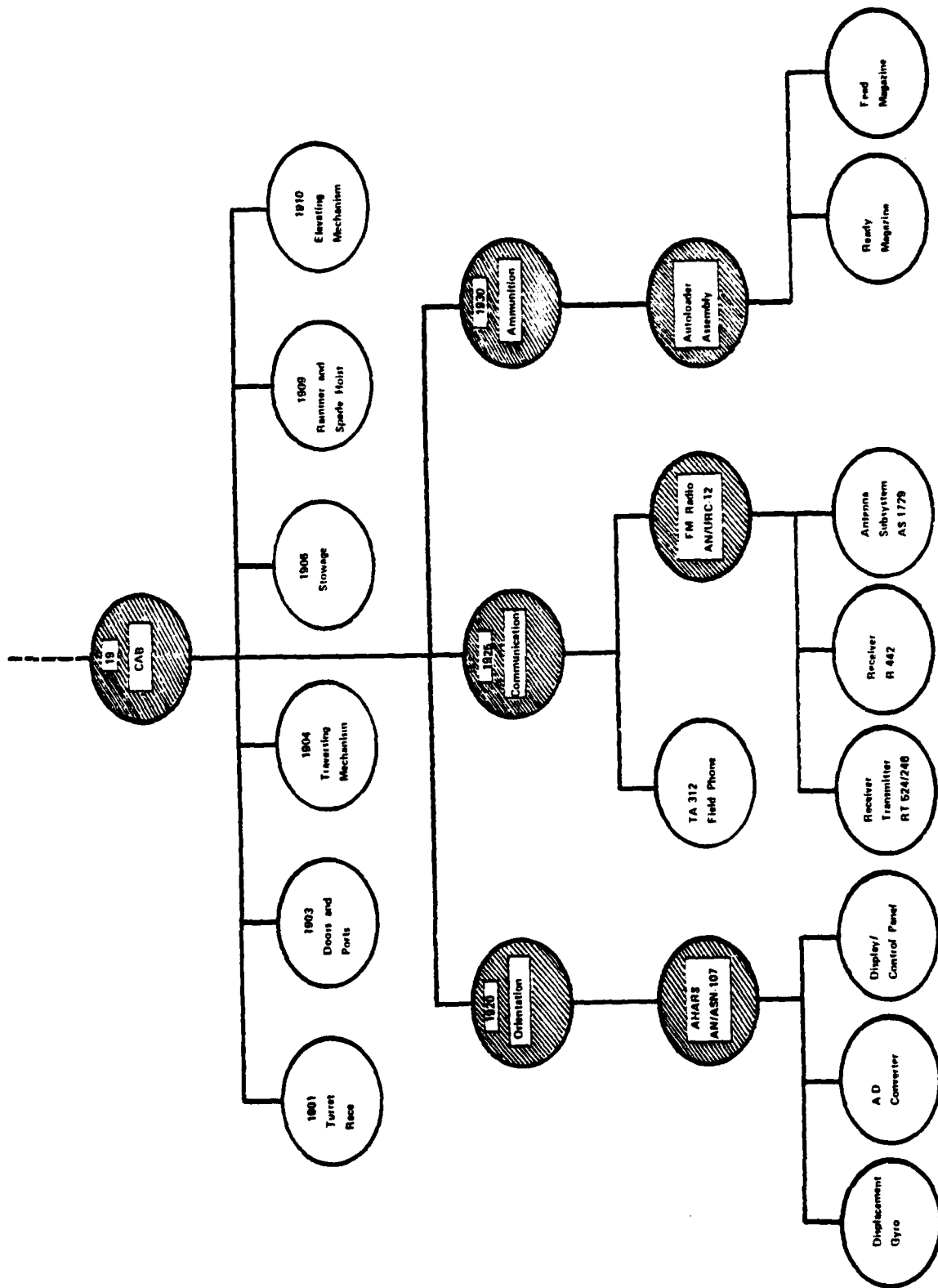


Figure C1.3 REFERENCE SYSTEM CAB

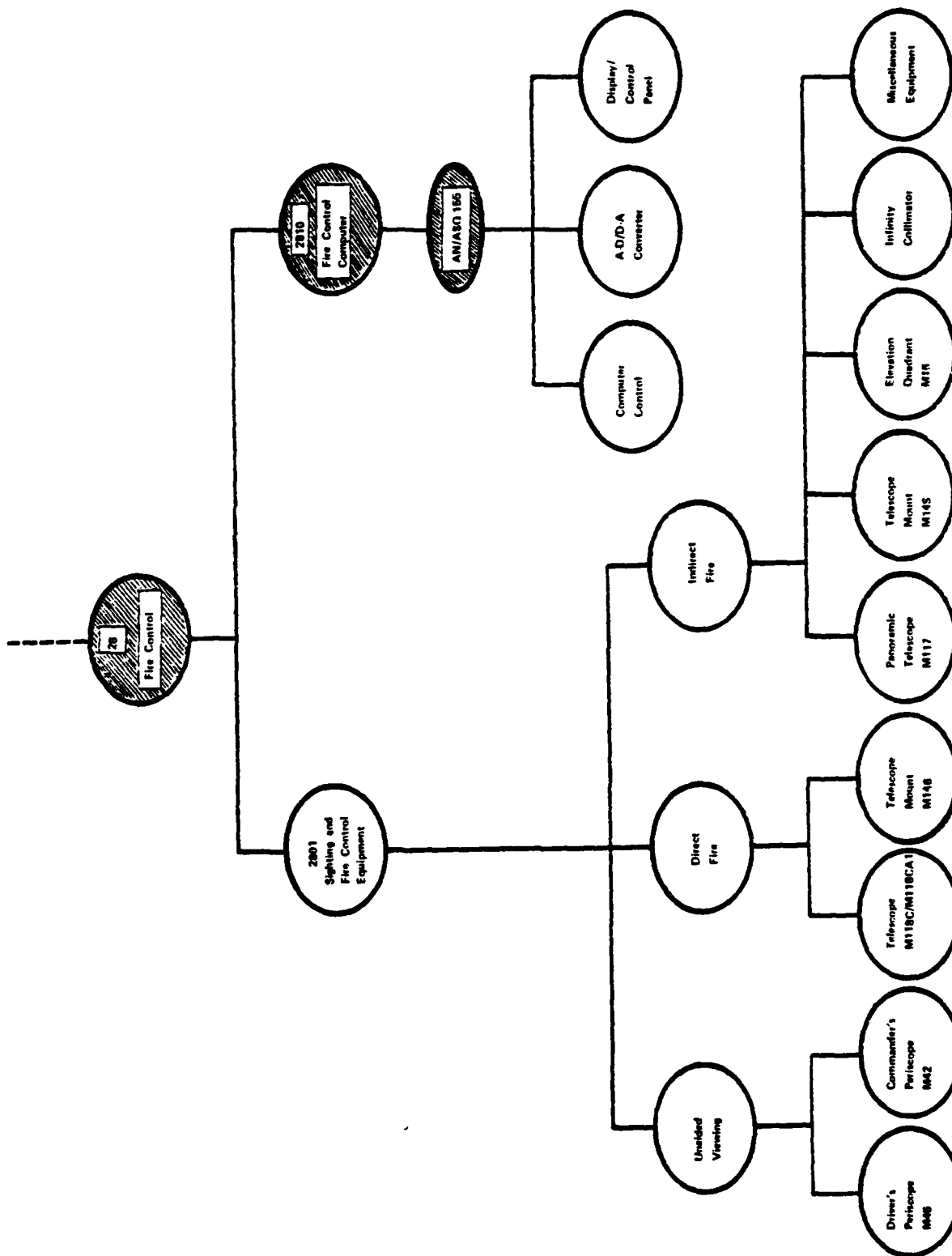


Figure C14 REFERENCE SYSREM FIRE CONTROL

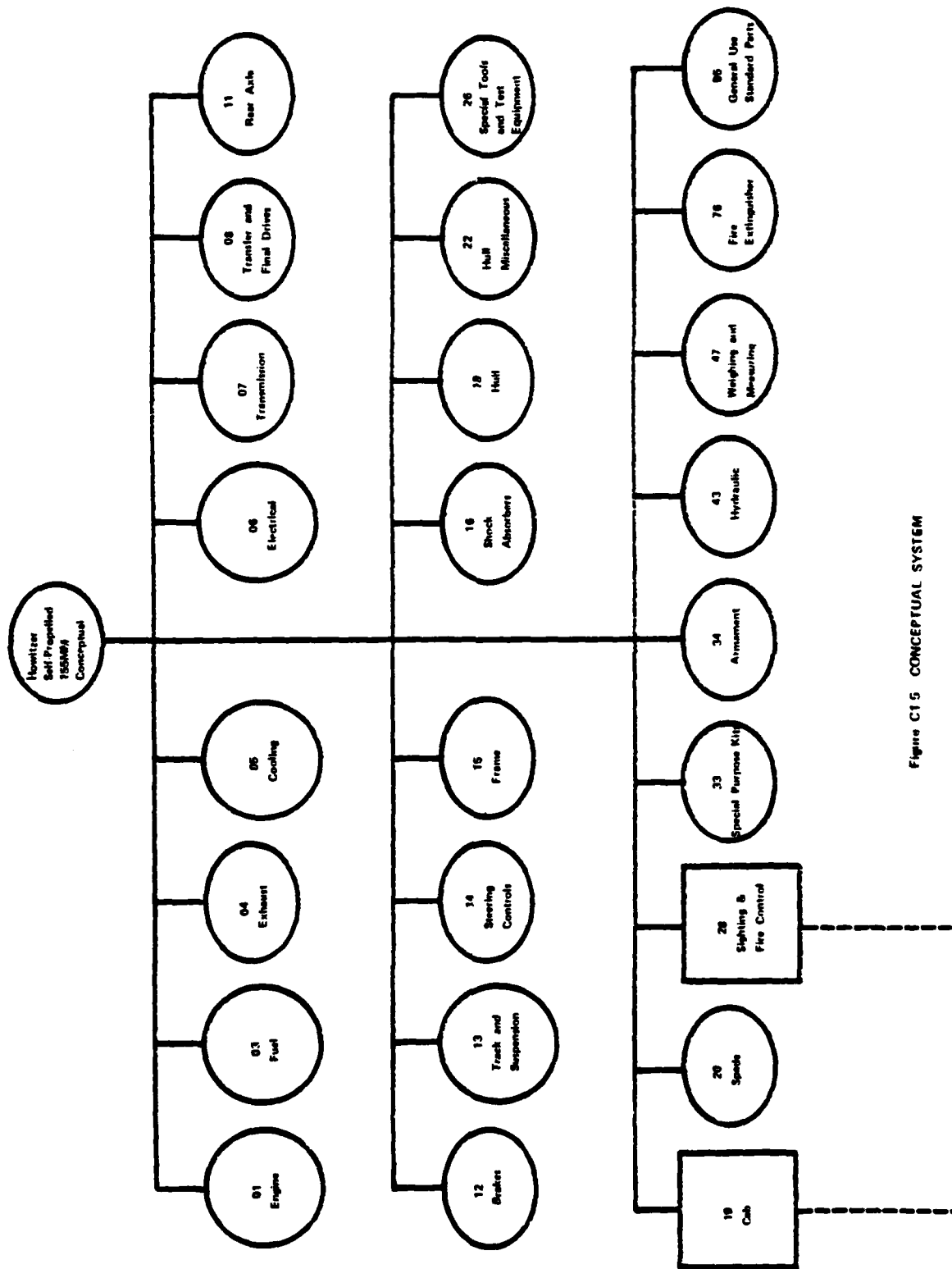


Figure C15 CONCEPTUAL SYSTEM

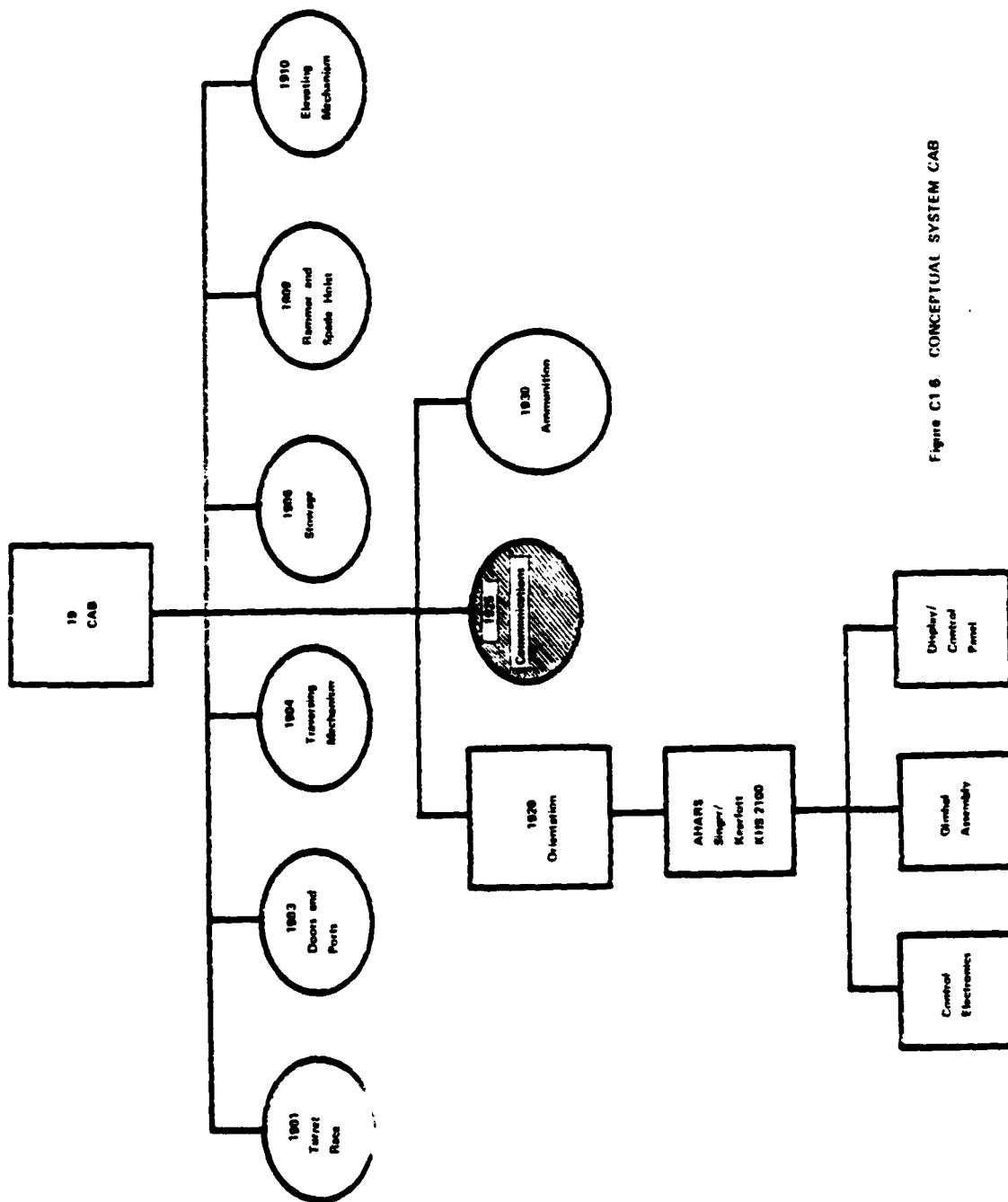


Figure C16. CONCEPTUAL SYSTEM CAB

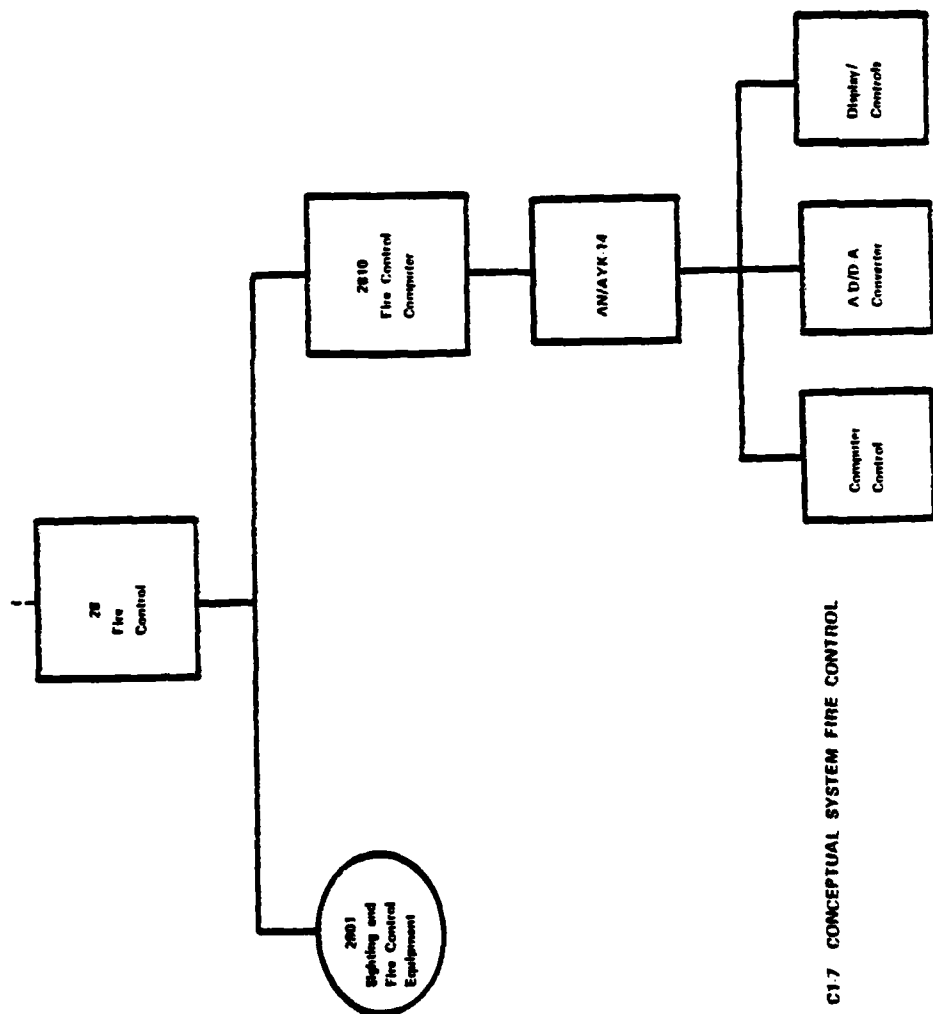


Figure C1.7 CONCEPTUAL SYSTEM FIRE CONTROL

APPENDIX C2

TASK DELETION/MODIFICATION AND TASK ADDITION WORKSHEETS

This appendix describes the worksheets that were used to describe the changes in task requirements associated with the ESPAWS reference and conceptual systems. These worksheets provide a documented audit trail for the reference task modification performed in Section 8.3.2.2 and the conceptual task modification performed in Section 8.3.2.3.

The appendix is divided into two sections. The first section describes the worksheets for modifications to existing tasks. The second section describes the worksheets for the additional tasks required by the ESPAWS reference and conceptual systems.

C2.1 Task Deletion/Modification Worksheets

Tables C2-1 to C2-6 display the worksheets for the modifications to the system-specific tasks associated with the reference equipments currently being maintained/operated by Army personnel. (Tasks associated with non-Army reference equipments are considered to be task additions) The worksheets indicate which of these system-specific tasks were deleted or modified and describe the type of task deletion or task modification associated with the task change. Task changes related to the conceptual system design changes are indicated by a "C" which is placed beside the task change code. Some tasks have two reference task change codes associated with them. This occurs when the same task must be performed both with the new automated

Table C2.1. EXISTING TASK DELETION/MODIFICATION WORKSHEET (continued)

MDS 130

COMMANDER'S MANUAL FM 6-120/CM

TASK NUMBER	TASK DESCRIPTION	PRIMARY TRAINING Materials	INITIAL TRAINING LEVEL	TRAINING RESPONSIBILITY										TASK MOD. CODE	TASK DELETION CODE	NEW SKILL LEVEL	EXIST. FREQ.	NEW FREQ.	SUBSYSTEM	DESIGN CHANGE NO.	ADDITIONAL MEDIA	REL. TASK CHAR. SHEET
				INSTITUTION								UNIT										
				BCT	AIT/OSUT	PNCO	BNCO	ANCO	SQMA	Service School	SOUT	Self Study	Schedule Training									
001 200 1702 (2 14)	Monitor/Relay and Record Five Commands	FM 6-60	1		Q									MAJ	-	-	-	-	System	-	R21 938-001-0100-F thru R21 938-001-0114-F P1 2 Writing down messages P1 3 Responding to messages P1 4 Preparing Messages to be sent P1 5 Sending and receiving messages P1 6 Enter and leave radio net P1 7 Portion 5 self explanation 1001-001-0100-F (111) laying for quadrant direction	100 R 4
001 200 1215 (2 15)	Set/Lay the Cannon for Quadrant with the Range Quadrant	FM 6-75 FM 6-80 FM 6-84 TEC Lesson 001-001-0100-F TEC Lesson 001-001-0104-F thru 001-001-0104-F TM 9-1015-234-12 TM 9-2300-210-10 TM 9-2250-217-1004 TM 9-1020-209-12	1					A	A		Q	A	A	REL	-	-	4	3	Range Quadrant	-		100 R 2
001 200 1216 (2 17)	Measure the Quadrant with the Range Quadrant	FM 6-75 FM 6-80 FM 6-81 FM 6-84	1					A	A		Q	A	A	REL	-	-	4	3	Range Quadrant	-		100 R 2

FREQUENCY CODE
 7 More than once a day
 6 Daily
 5 Weekly
 4 Monthly
 3 Three to Six times a year
 2 Once or twice a year
 1 Less than once a year

TASK DELETION CODE
 E11 Elimination of Subsystem
 A117 Task Automation
 M100 Increase in M100
 M101 Change in Maintenance Policy
 O Other
 M102 Computer Addition

TASK MODIFICATION CODE
 NC No Change in Task Required
 M100 More task modification task especially the same Only minor change in equipment/characteristics required
 M101 Full level change task essentially the same but assigned to different skill level
 REL Frequency change same task but task is performed more often frequently due to change in reliability, etc.
 MAJ Major task modification task characteristics (e.g. difficulty, importance) change
 (C) Conceptual Modification

Table C2-1. EXISTING TASK DELETION/MODIFICATION WORKSHEET (continued)

MOS 12B

COMMANDER'S MANUAL FM 6 13B/CM

COMMANDER'S MANUAL FM 6 130/CM																						
MOS 130																						
TASK NUMBER	TASK DESCRIPTION	PRIMARY TRAINING Materials	INITIAL TRAINING LEVEL	TRAINING RESPONSIBILITY										TASK MOD. CODE	TASK DELETION CODE	NEW SKILL LEVEL	EXIST. FREQ.	NEW FREQ.	SUBSYSTEM	DESIGN CHANGE NO.	ADDITIONAL MEDIA	REL. TASK CHAIR SHEET
				INSTITUTION				UNIT														
				BCT	AIT/OSUT	PHCOC	BNOCOC	ANCOC	SGMA	Service School	SOJT	Self Study	Scheduled Training									
001.206.1217 (2.10)	Sight on a Target with a Direct Fire/Ebony Telescope (Excerpt 001.206.1217)	FM 6-75	1				A	A			C	A	A									
		FM 6-88																				
		FM 6-84																				
		TM 9-1015-234-12																				
		TM 9-1004																				
001.206.1218 (2.10)	Fire the Cannon	FM 6-75	1	C							A	A	A									
		FM 6-81																				
		TM 9-1015-234-12																				
		TM 9-2300-216-10																				
		TM 9-2350-217-1004																				
001.206.1219 (2.20)	Clear Powder Chamber After Firing	FM 6-75	1	C							A	A	A									
		FM 6-81																				
		FM 6-88																				
		FM 6-90																				
		FM 6-84																				
001.206.1517 (2.21)	Unload the Cannon (Separate Loading Ammunition)	TM 9-1015-234-12																				
		FM 6-90	1									C	A	A								
		FM 6-81																				
		FM 6-88																				
		FM 6-84																				
		TM 9-1025-200-12																				
		TM 9-2300-216-10																				
		TM 9-2350-217-10																				
Continued																						

TASK DELETION CODE

011 Elimination of Subsystem
AUT Task Automation
MTBF Increase in MTBF
MP Change in Maintenance Policy
D Other
IC1 - Conceptual Addition

TASK MODIFICATION CODE

NC No Change in Task Required
MMN Minor task modification task essentially the same Only minor change in equipment/instrumentation required
SK1 Skill level change task essentially the same but assigned to different skill level
REL Frequency change same task but task is performed more often frequently due to change in reliability, etc.
MA1 Major task modification task characteristics (e.g. difficulty, importance) change
IC1 Conceptual Modification

FREQUENCY CODE

7 More than once a day
6 Daily
5 Weekly
4 Monthly
3 Three to six times a year
2 Once or twice a year
1 Less than once a year

Table C2.1. EXISTING TASK DELETION/MODIFICATION WORKSHEET (continued)

MOS 138

COMMANDER'S MANUAL FM 8-138/CM

MOS
138

COMMANDER'S MANUAL
FM 8 138/CM

TASK NUMBER	TASK DESCRIPTION	PRIMARY TRAINING Materials	INITIAL TRAINING LEVEL	TRAINING RESPONSIBILITY										TASK MOD. CODE	TASK DELETION CODE	NEW SKILL LEVEL	EXIST. FRQ.	NEW FRQ.	SUBSYSTEM	DESIGN CHANGE NO.	ADDITIONAL MEDIA	REL. TASK CHAR. SHEET
				INSTITUTION																		
				SCT	AIT/OSUT	PWCOC	BNCCOC	ANCCOC	SGMA	Service School	SOFT	Self Study	Scheduled Training									
081 205 1270 (2 73)	Command "Check Firing" when Unsafe Condition Exit	FM 8-50	1																			
081 205 1401 (2 74)	Communications Maintenance Inspect and Clean Collimator	TM 8-1015-234-12 TM 8-1025-205-12 TM 8-2300-216-10 TM 8-2300-217-10W TEC Lesson 041-081-0081-J	1																			
081 205 1402 (2 75)	Inspect and Clean Aiming Posts and Night Lighting Devices	TM 8-1025-205-12 TM 8-2300-216-10 TM 8-3004 TEC Lesson 041-081-0081-J	1																			
081 205 1403 (2 76)	Clean Cannon Tube and Chamber	LO 8-1015-203-10 LO 8-1025-205-10 LO 8-1030-203-10 LO 8-2300-216-12 LO 8-2300-217-12W LO 8-2350-304-12 TM 8-3004 TM 8-1015-234-12 TEC Lesson 041-081-0082-J	1																			

(continued)

TASK DELETION CODE

ELI Elimination of Subsystem
AUT Task Automation
MTBF Increase in MTBF
MP Change in Maintenance Policy
O Other
ICI - Conceptual Addition

TASK MODIFICATION CODE

NC - No Change in Task Required
MIN Minor task modification task essentially the same. Only minor change in equipment/instruction required
SK1 Skill level change task essentially the same but assigned to different skill level
REL Frequency change same task but task is performed more (less) frequently due to change in reliability, etc.
MAJ Major task modification task characteristics (e.g., difficulty, importance) change
ICI - Conceptual Modification

FREQUENCY CODE

7 More than once a day
6 Daily
5 Weekly
4 Monthly
3 Three to Six times a year
2 Once or twice a year
1 Less than once a year

Table C2.1. EXISTING TASK DELETION/MODIFICATION WORKSHEET (continued)

MOS 138		COMMANDER'S MANUAL FM 9 138/CM		TRAINING RESPONSIBILITY												TASK MOD. CODE	TASK DELETION CODE	NEW SKILL LEVEL	EXIST. FREQ	NEW FREQ	SUBSYSTEM	DESIGN CHANGE NO	ADDITIONAL MEDIA	REL. TASK CHAR. SHEET
TASK NUMBER	TASK DESCRIPTION	PRIMARY TRAINING Materials	INITIAL TRAINING LEVEL	INSTITUTION							UNIT													
				BCT	AIT/OSUT	PNCO	BNCO	ANCO	SGMA	Service School	SOJT	Self Study	Scheduled Training											
561 721 1878 (2 27)	Ammunition - Operate the Material Handling Unit on the M548 Cargo Carrier	TM 9 2350-247-10	1	A	A	A	A	A	A	A	A	A	A	NC	-	-	-	M548 Cargo Carrier	-	1 041 081-8140 F (111) Introduction to Artillery Ammunition				
081 208 1501 (2 28)	Transport Cannon Ammunition on Vehicle	FM 6-50 TM 9-1300-208	1	A	A	A	A	A	A	A	A	A	A	NC	-	-	-	System	-					
081 208 1502 (2 28)	Prepare Cannon Ammunition for Helicopter Recovery	TM 9-460-11 TM 9-550-12	1			A		A			Q	A	A	NC	-	-	-	System	-					
081 208 1504 (2 31)	Store Cannon Ammunition at a Cannon Position	FM 6-50 FM 6-75 TM 43 0001-28 TM 9-1300-208 TEC Lesson 041-081-8140 F	1	A		A		A			Q	A	A		AUT	-	-	System	-		DEL.			
081 208 1506 (2 33)	Prepare Separate Loading Ammunition for Firing	TM 9-1625-200-12 TM 43-0001-28 TM 9 2300-216-10 TM 9-2350-217 10M TM 9-3004 TEC Lesson 041-081-8140 F TEC Lesson 041-081-8141 F TEC Lesson 041-081-8143 F TEC Lesson 041-081-8144 F	1	Q		A		A			A	A	A	MAJ	-	-	-	System	-	1041 081 8140 F (111) Intro to Artillery Ammunition 1041 081 8144 F Prep. Load Fire Heavy Artillery Ammunition	138-R-6			

TASK DELETION CODE
 ELI - Elimination of Subsystem
 AUT - Task Ammunition
 MTBF - Increase in MTBF
 MP - Change in Maintenance Policy
 O - Other
 IC - Conceptual Addition

TASK MODIFICATION CODE
 NC - No Change in Task Required
 MIN - Minor task modification task essentially the same. Only minor change in equipment/requirements required
 SKI - Skill level change task essentially the same but assigned to different skill level
 REL - Frequency change same task but task is performed more (less) frequently due to change in reliability, etc.
 MAJ - Major task modification task characteristics (e.g., difficulty, important) change
 (C) - Conceptual modification

FREQUENCY CODE
 7 - More than once a day
 6 - Daily
 5 - Weekly
 4 - Monthly
 3 - Three to Six times a year
 2 - Once or twice a year
 1 - Less than once a year

Table C2.1. EXISTING TASK DELETION/MODIFICATION WORKSHEET (continued)

COMMANDER'S MANUAL												FM 136/CM		MOS		13B						
TASK NUMBER	TASK DESCRIPTION	PRIMARY TRAINING Materials	INITIAL TRAINING LEVEL	TRAINING RESPONSIBILITY										TASK MOD CODE	TASK DELETION CODE	NEW SKILL LEVEL	EXIST FREQ	NEW FREQ	SUBSYSTEM	DESIGN CHANGE NO	ADDITIONAL MEDIA	REL TASK CHAR. SHEET
				INSTITUTION							UNIT											
				BCT	AIT/OSUT	PNCOC	BNOCOC	ANOCOC	SGMA	Service School	SOJT	Self Study	Scheduled Training									
061 270 1514 (3 68)	Load a Prepared Round for Firing in the M109/M109A1	TM 9-2350-217-10N	1	Q									A	A	A				MAJ + REL		1041 061 6133 J (111) Prefire Checks M109/M109A1 1041 061 6144 F Prep. Load Fire Heavy Artillery Ammunition 1041 061 6146 F Intro to Artillery Ammunition 1041 061 6141 F Artillery Fuses	13B R 2 13B R 2
061 270 1405 (3 70)	Clean Chamber Evacuator, Valves, and Muzzle Brake on the M109/M109A1	TM 9-2350-217-10N LO 9-2350-217-12N	1	A									Q	A	A				MIN		1041 061 6022 J M109 Evacuator Valves and Muzzle Brake	
061 270 1410 (3 72)	Assemble/Disassemble Breach and Firing Mechanism on the M109/M109A1	TM 9-2350-217-10N	1										Q	A	A				MIN		1041 061 6026 S (111) Breach Mechanism	
061 270 1407 (3 74) (continued)	Operate an M109/M109A1 Under Unusual Conditions	FM 31-70 FM 9-207 TM 9-2350-217-10N	1										Q	A	A				MIN			System

TASK DELETION CODE
 E11 Elimination of Subsystem
 A11 Task Automation
 M11 Increase in MTRF
 M2 Change in Maintenance Policy
 O Other
 (C) - Conceptual Addition

TASK MODIFICATION CODE
 NC No Change in Task Required
 MIN Minor task modification task essentially the same Only minor change in equipment/nomenclature required
 SK1 Skill level change task essentially the same but assigned to different skill level
 REL Frequency change same task but task is performed more (less) frequently due to change in reliability, etc.
 MAJ Major task modification task characteristics (e.g., difficulty, importance) change
 (C) Conceptual Modification

FREQUENCY CODE
 7 More than once a day
 6 Daily
 5 Weekly
 4 Monthly
 3 Three to Six times a year
 2 Once or twice a year
 1 Less than once a year

Table C2.1 EXISTING TASK DELETION/MODIFICATION WORKSHEET (continued)

NWS 136		COMMANDER'S MANUAL FM 13B/CM										REL. TASK CHAR. SHEET										
TASK NUMBER	TASK DESCRIPTION	PRIMARY TRAINING Materials	INITIAL TRAINING LEVEL	TRAINING RESPONSIBILITY										TASK MOD CODE	TASK DELETION CODE	NEW SKILL LEVEL	EXIST FREQ	NEW FREQ	SUBSYSTEM	DESIGN CHANGE NO	ADDITIONAL MEDIA	
				INSTITUTION								UNIT										
				BCT	AIT/OSUT	PNCOC	BNCOC	ANCOG	SGMA	Service School	SOJT	Self Study	Scheduled Training									
113-587 1004 (3 117)	Radio/Telephone Operator Install Radio Set AN/VRC 46 (AN/VRC 12 Series)	TM 11-5820-401-12 TC 11-4 TC 11-6	1									Q	A	A				AN/VRC 12				
113-587 2003 (3 121)	Operate Radio Set AN/VRC 46 (AN/VRC 12 Series)	TM 11-5820-401-12 TEC Lesson 201 113-4545 A TEC Lessons 201 113-4550 E/A thru 201 113-4557 E/A TC 11-4 TC 32-11	1									Q	A	A				AN/VRC 12				
113-587 3004 (3 123)	Perform Operator Maintenance on Radio Sets AN/VRC 46 and AN/VRC 47	TM 11-5820-401-12 TM 38-750	1									Q	A	A				AN/VRC 12				
551 721 1002 (3 163)	Prepare DA Form 2404 (Equipment Inspection and Maintenance Worksheet)	FM 21-305 TM 38-750	1									Q	A	A				System				
551 721 1003 (3 166)	Prepare DA Form 2408 1 (Equipment Dealer or Monthly Log) Daily	FM 21-305 TM 38-750	1									Q	A	A				System				
(continued)																						

FREQUENCY CODE

7 More than once a day
6 Daily
5 Weekly
4 Monthly
3 Three to Six times a year
2 Once or twice a year
1 Less than once a year

TASK MODIFICATION CODE

NC No Change in Task Required
MIN Minor task modification task essentially the same Only minor change in equipment/nomenclature required
SKI Skill level change task essentially the same but assigned to different skill level
REL Frequency change same task but task is performed more (less) frequently due to change in reliability, etc.
MAJ Major task modification task characteristics (e.g. difficulty, importance) change
(C) Conceptual Modification

TASK DELETION CODE

ET Elimination of Subsystem
AUT Task Automation
MTBF Increase in MTBF
MP Change in Maintenance Policy
O Other
(C) Conceptual Addition

Table C2.1. EXISTING TASK DELETION/MODIFICATION WORKSHEET (continued)

WCOS 1.38		COMMANDER'S MANUAL		FMS 1.39/CM																		
TASK NUMBER	TASK DESCRIPTION	PRIMARY TRAINING Materials	INITIAL TRAINING LEVEL	TRAINING RESPONSIBILITY										TASK MOD CODE	TASK DELETION CODE	NEW SKILL LEVEL	EXIST FREQ	NEW FREQ	SUBSYSTEM	DESIGN CHANGE NO	ADDITIONAL MEDIA	REL TASK CHAR. SHEET
				INSTITUTION								UNIT										
				BCT	AIT/OSUT	PNCOG	BNCOC	ANCOG	SGMA	Service School	SOJT	Self Study	Scheduled Training									
551 721 1007 (3 108)	Perform Before Operation Maintenance	Appropriate TM	1								Q	A	A					System				
551 721 1008 (3 170)	Perform During Operation Maintenance	Appropriate TM	1								Q	A	A					System				
551 721 1009 (3 172)	Perform After Operation Maintenance	Appropriate TM	1								Q	A	A					System				
551 721 1013 (3 174)	Operate Vehicle in Snow	FM 21 305	1								Q	A	A					System				
551 721 1014 (3 176)	Operate Vehicle in Sand	FM 21 305	1								Q	A	A					System				
551 721 1015 (3 177)	Drive Vehicle Off Road	FM 21 305	1								Q	A	A					System				
551 721 1016 (3 178)	Drive Vehicle in Motor March or Convoy	FM 21 305 FM 55 31	1								Q	A	A					System				
551 721 1018 (3 180)	Drive Vehicle Under Blackout Conditions	FM 21 305	1								Q	A	A					System				
551 721 1019 (3 193)	Drive Vehicle Through Contaminated Area	FM 21 305	1								Q	A	A					System				
551 721 1824 (3 195)	Operate the Winch on a Wheeled Vehicle	Appropriate TM	1								Q	A	A					System				
551 721 1817 (3 197)	Operate a Winch on an M548 Cargo Carrier	TM 9 2350 247 10	1								Q	A	A					System				

(continued)

TASK DELETION CODE

ELL Elimination of Subsystem
 AUT Task Automation
 MTBF Increase in MTBF
 MP Change in Maintenance Policy
 O Other
 (C) - Conceptual Addition

TASK MODIFICATION CODE

NC No Change in Task Required
 MIN Minor task modification task essentially the same Only minor change in equipment/instrumentation required
 SKI Skill level change task essentially the same but assigned to different skill level
 REL Frequency change same task but task is performed more (less) frequently due to change in reliability, etc.
 MAJ Major task modification task characteristics (e.g., difficulty, importance) change
 IC Conceptual Modification

FREQUENCY CODE

7 More than once a day
 6 Daily
 5 Weekly
 4 Monthly
 3 Three to six times a year
 2 Once or twice a year
 1 Less than once a year

Table C2.1. EXISTING TASK DELETION/MODIFICATION WORKSHEET (continued)

MOS		COMMANDER'S MANUAL		FM 6 13B/CM		REL TASK CHART SHEET		ADDITIONAL MEDIA		DESIGN CHANGE NO		SUBSYSTEM		NEW FREQ		EXIST FREQ		NEW SKILL LEVEL		TASK DELETION CODE		TASK MOD. CODE					
TASK NUMBER		TASK DESCRIPTION		PRIMARY TRAINING Materials		INITIAL TRAINING LEVEL		TRAINING RESPONSIBILITY										NEW FREQ		EXIST FREQ		NEW SKILL LEVEL		TASK DELETION CODE		TASK MOD. CODE	
								INSTITUTION							UNIT												
								BCT	AIT/OSUT	PNCOC	BNOCOC	ANCOC	SGMA	Service School	SOJT	Self Study	Scheduled Training										
061 276 1468 (3 298)	Replace the Manual Elevation Accumulator Assembly in the M109/M109A1 Howitzer	TM 9-2350-217-200-2 TM 9-2350-217-200-2 TM 9-2350-217-259/2	1																				MIN				
061 276 1470 (3 301)	Repair Gunner's Control or Cab Power Pack Tubes and Fittings to Gunner's Control on the M109/M109A1 Howitzer	TM 9-2350-217-200-1 TM 9-2350-217-200-2 TM 9-2350-217-259/2	1																				MIN				
061 276 1471 (3 303)	Check the Main Accumulator Nitrogen Precharged Pressure in the M109/M109A1 Howitzer	TM 9-2350-217-200-1	1																				MIN				
061 276 1472 (3 304)	Replace Solenoid or Combined Solenoid and Elevation Selector Valve in the M109/M109A1 Howitzer	TM 9-2350-217-200-1 TM 9-2350-217-200-2 TM 9-2350-217-259/2	1																				MIN				
061 276 1473 (3 308)	Repair Hydraulic Tubes and Fittings to Elevation and Equilibrator Systems on the M109/M109A1 Howitzer	TM 9-2350-217-200-1 TM 9-2350-217-200-2 TM 9-2350-217-259/2	1																				MIN				

TASK DELETION CODE
 EL1 Elimination of Subsystem
 AUT Task Automation
 M18F Increase in M18F
 MP Change in Maintenance Policy
 Q Other
 IC1 Conceptual Addition

TASK MODIFICATION CODE
 MC No Change in Task Required
 MIN Minor task modification task essentially the same. Only minor change in equipment/terminology required
 SK1 Skill level change task essentially the same but assigned to different skill level
 REL Frequency change same task but task is performed more (less) frequently due to change in reliability, etc.
 MA1 Major task modification task characteristics (e.g., difficulty, importance) change
 IC1 Conceptual Modification

FREQUENCY CODE
 7 More than once a day
 6 Daily
 5 Weekly
 4 Monthly
 3 Three to Six times a year
 2 Once or twice a year
 1 Less than once a year

Table C2.1. EXISTING TASK DELETION/MODIFICATION WORKSHEET (continued)

MOS 13B

COMMANDER'S MANUAL FM 13B/CM

MOCS 13B COMMANDER'S MANUAL FM 130/CM

TASK NUMBER	TASK DESCRIPTION	PRIMARY TRAINING Materials	INITIAL TRAINING LEVEL	TRAINING RESPONSIBILITY										TASK MOD. CODE	TASK DELETION CODE	NEW SKILL LEVEL	EXIST. FREQ.	NEW FREQ.	SUBSYSTEM	DESIGN CHANGE NO.	ADDITIONAL MEDIA	REF. TASK CHAR. SHEET									
				INSTITUTION							UNIT																				
				BCT	AIT/OSUT	PNOCOC	BNCOC	ANOCOC	SGMA	Service School	SOJT	Self Study	Scheduled Training																		
001 270 1474 (3.307)	Repair the Cab/Turret Wiring Harness of the M108A1 Howitzer	TM 9-2360-217-200 TM 9-2360-217-200-2 TM 9-2360-217-200-2	1							O	A	A	A	A	MIN RELIC	-	-	3	2	Cab/Turret Wiring Harness	NO6 4	1041 001 6026 J (211) Breech Mechanization	130 C.1								
001 270 1481 (3.308)	Repair the Cannon Breech Mechanism on the M108A1 Howitzer	TM 9-2360-217-200 TM 9-2360-217-200-2 LO 9-2360-217-12N	1							O	A	A	A	A	MIN	-	-	-	Breech Mechanism	-	-	-									
001 286 2221 (2.30)	Gunner Lay the Cannon for Initial Direction of Fire	FM 6-50 FM 6-76 FM 6-81 FM 6-88 FM 6-90 FM 6-94 TM 9-1015-234-12 TEC Lesson 041 001 6106 F TEC Lesson 041 001 6103 F TEC Lesson 041 001 6100 F	1						A		O	A	A	A	REL	-	-	4	3	System	-	-	130 R.2								

(continued)

(continued)

TASK DELETION CODE

EL1 Elimination of Subsystem
AUT Task Automation
M/BF Increase in M/BF
MP Change in Maintenance Policy
O Other
(C) Conceptual Addition

TASK MODIFICATION CODE

NC No Change in Task Required
MIN Minor task modification task essentially the same Only minor change in equipment/instruction required
SKI Skill level change task essentially the same but assigned to different skill level
REL Frequency change same task but task is performed more (less) frequently due to change in reliability, etc.
MAJ Major task modification task characteristics (e.g., difficulty, importance) change
(C) Conceptual Modification

FREQUENCY CODE

7 More than once a day
6 Daily
5 Weekly
4 Monthly
3 Three to Six times a year
2 Once or twice a year
1 Less than once a year

Table C2.1. EXISTING TASK DELETION/MODIFICATION WORKSHEET (continued)

MOS 138		COMMANDER'S MANUAL		FM 6 138/CM																		
TASK NUMBER	TASK DESCRIPTION	PRIMARY TRAINING Materials	INITIAL TRAINING LEVEL	TRAINING RESPONSIBILITY										TASK MOD. CODE	TASK DELETION CODE	NEW SKILL LEVEL	EXIST. FREQ.	NEW FREQ.	SUBSYSTEM	DESIGN CHANGE NO.	ADDITIONAL MEDIA	REL. TASK CHAR. SHEET.
				INSTITUTION					UNIT													

FREQUENCY CODE
 7 More than once a day
 6 Daily
 5 Weekly
 4 Monthly
 3 Three to Six times a year
 2 Once or twice a year
 1 Less than once a year

TASK MODIFICATION CODE
 NC - No Change in Task Required
 MIN - Minor task modification task essentially the same. Only minor change in equipment/instrumentation required
 SKI - Skill level change task essentially the same but assigned to different skill level
 REL - Frequency change same task but task is performed more (less) frequently due to change in reliability, etc.
 MAJ - Major task modification task characteristics (e.g., difficulty, importance) change
 (C) - Conceptual Modification

TASK DELETION CODE
 ELI - Elimination of Subsystem
 AUT - Task Automation
 MTBF - Increase in MTBF
 MP - Change in Maintenance Policy
 O - Other
 (C) - Conceptual Addition

Table C2.1. EXISTING TASK DELETION/MODIFICATION WORKSHEET (continued)

COMMANDER'S MANUAL FM 138/CM																							
ACJS 138																							
TASK NUMBER	TASK DESCRIPTION	PRIMARY TRAINING Materials	INITIAL TRAINING LEVEL	TRAINING RESPONSIBILITY										TASK MOD. CODE	TASK DELETION CODE	NEW SKILL LEVEL	EXIST. FREQ.	NEW FREQ.	SUBSYSTEM	DESIGN CHANGE NO.	ADDITIONAL MEDIA	REL. TASK CHAR. SHEET	
				INSTITUTION				UNIT															
				BCT	AIT/OSUT	PNOCOC	BNOCOC	ANOCOC	SGMA	Service School	SOJT	Self Study	Scheduled Training										
061 266-2231 (2-48)	Refer the Piece	FM 6-50 FM 6-75 FM 6-81 FM 6-88 FM 6-90 FM 6-94 TEC Lesson 041-081-6113-F	2					A			O	A	A		REL	-	-	4	3	System	-	138 R 2	
061 270-2275 (3-77)	Boreight the Panoramic Telescope on the M109/ M109A1 Using a Distant Aiming Point (DAP)	FM 6-88 TM 9-2350-217-10N	2								O	A	A		REL	-	-	4	3	Panoramic Telescope	-	R21 041 081-6170E Boreighting M109/ M109A1	138 R 2
061 270-2278 (3-78)	Boreight the Panoramic Telescope on the M109/ M109A1 Using the Testing Target	FM 6-88 TM 9-2350-217-10N TEC Lesson 041-081-6118-F	2								O	A	A		REL	-	-	4	3	Panoramic Telescope	-	R21 041 081-6170E Boreighting M109/ M109A1	138 R 2
(continued)																							

TASK DELETION CODE

E11 Elimination of Subsystem
 AUT Task Automation
 MTBF Increase in MTBF
 MP Change in Maintenance Policy
 O Other
 IC - Conceptual Addition

TASK MODIFICATION CODE

NC No Change in Task Required
 MIN Minor task modification task essentially the same Only minor change in equipment/nomenclature required
 SKI Skill level change task essentially the same but assigned in different skill level
 REL Frequency change same task but task is performed more (less) frequently due to change in reliability, etc.
 MAI Major task modification task characteristics (e.g., difficulty, importance) change
 (C) - Conceptual Modification

FREQUENCY CODE

7 More than once a day
 6 Daily
 5 Weekly
 4 Monthly
 3 Three to Six times a year
 2 Once or twice a year
 1 Less than once a year

Table C2.1. EXISTING TASK DELETION/MODIFICATION WORKSHEET (continued)

TASK NUMBER		TASK DESCRIPTION	PRIMARY TRAINING Materials	INITIAL TRAINING LEVEL	TRAINING RESPONSIBILITY										TASK MOD. CODE	TASK DELETION CODE	NEW SKILL LEVEL	EXIST. FREQ.	NEW FREQ.	SUBSYSTEM	DESIGN CHANGE NO.	ADDITIONAL MEDIA	REL. TASK CHAR. SHEET
					INSTITUTION																		
					UNIT																		
					SCHEDULED TRAINING																		
					Self Study																		
					SOJT																		
					Service School																		
					SGMA																		
					ANCOG																		
					BNCOC																		
					PNCOC																		
					AIT/OSUT																		
					BCT																		
061 262 1002 (2 13)		Camouflage/Control Equipment	FM 5-20 FM 7-7 TEC Lesson 837 081 0030 F	3												NC				System		R21937 081 0030F R21937 081 0031F R21937 081 0032F Cover, Camouflage and Concealment	
061 266 3313 (2 15)		Prepare a Range Card for a Cannon	FM 6-50 FT 106-H-7, C-2 FT 155 AM-1, C-2	3												MIN				System			
061 266 3314 (2 17)		Direct the Personnel of the Cannon Section During Indirect Fire Missions	FM 6-50 FM 6-75 FM 6-81 FM 6-88 FM 6-90 FM 6-94 TM 6-1015 234-12 ARTEP 6-165 ARTEP 6-295	3												MAJ				System			130 B-14
061 266 3315 (2 19)		Determine that the Weapon is Safe to Fire	FM 6-50 TEC Lesson 041 081 0019 A	3												NC				System		1041 081 4019A Determine Weapon Safe to Fire	
061 266 3316 (2 21)		Conduct Fire on Prearranged Targets	FM 6-50	3												MIN				System			

TASK DELETION CODE

ELI Elimination of Subsystem
AUT Task Automation
MTBF Increase in MTBF
MP Change in Maintenance Policy
O Other
(C) - Conceptual Addition

TASK MODIFICATION CODE

NC No Change in Task Required
MIN Minor task modification task essentially the same. Only minor change in equipment/nomenclature required
SKI Skill level change task essentially the same but assigned to different skill level
REL Frequency change same task but task is performed more (less) frequently due to change in reliability, etc.
MAJ Major task modification task characteristics (e.g., difficulty, importance) change
(C) - Conceptual Modification

FREQUENCY CODE

7 More than once a day
6 Daily
5 Weekly
4 Monthly
3 Three to Six times a year
2 Once or twice a year
1 Less than once a year

Table C2.1. EXISTING TASK DELETION/MODIFICATION WORKSHEET (continued)

MDS 139

COMMANDER'S MANUAL

FM 138/DM

TASK NUMBER	TASK DESCRIPTION	PRIMARY TRAINING Materials	INITIAL TRAINING LEVEL	TRAINING RESPONSIBILITY										TASK MOD CODE	TASK DELETION CODE	NEW SKILL LEVEL	EXIST FREQ	NEW FREQ	SUBSYSTEM	DESIGN CHANGE NO	ADDITIONAL MEDIA	REL TASK CHAR. SHEET								
				INSTITUTION	UNIT																									
					BCT	AIT/OSUT	PWCOC	BNCOC	ANCOC	SGMA	Service School	SOJT	Self Study	Scheduled Training																
061 266 3317 (2 22)	Execute Zone and Sweep Fire Missions	FM 6-50 TEC Lesson 041 061 8014-A TEC Lesson 041 061 8015-A TEC Lesson 041 061 8016-A	3				0					A	A	A	NC	-	-	-	System	-	1041 061 8014 A 1041 061 8015 A 1041 061 8016 A Compute Zone Fire Mission Compute Sweep Fire Mission Compute Sweep and Fire Mission	138 R.2								
061 266 3110 (2 23)	Perform Gunner's Quadrant Micrometer Test	FM 6-75 FM 6-81 FM 6-88 FM 6-90 FM 6-94 TM 9-1015-234-12 TM 9-2300-216-10 TEC Lesson 041 061 8101-F	3				0 A					A	A	A	REL	-	-	3	System	-	1041 061 8101 F & 1041 061 8102 F Test of Gunner's Quadrant, Part 1 & 2									
061 266 3111 (2 24)	Perform Gunner's Quadrant End for End Test	FM 6-75 FM 6-81 FM 6-88 FM 6-90 FM 6-94 TM 9-1015-234-12 TM 9-2300-216-10 TM 9-2350-217-10M TEC Lesson 041 061 8102-F	3				0 A					A	A	A	REL	-	-	3	System	-		138 R.2								

(continued)

(continued)

TASK DELETION CODE

E11 Elimination of Subsystem
AUT Task Automation
WIBF Increase in WIBF
MP Change in Maintenance Policy
O Other
IC1 Conceptual Addition

TASK MODIFICATION CODE

NC No Change in Task Required
MIN Minor task modification task essentially the same. Only minor change in equipment/nomenclature required
SK1 Skill level change task essentially the same but assigned in different skill level
REL Frequency change same task but task is performed more (less) frequently due to change in reliability, etc.
MAJ Major task modification task characteristics (e.g., difficulty, importance) change
(C) Conceptual Modification

FREQUENCY CODE

7 More than once a day
6 Daily
5 Weekly
4 Monthly
3 Three to Six times a year
2 Once or twice a year
1 Less than once a year

Table C2.1. EXISTING TASK DELETION/MODIFICATION WORKSHEET (continued)

MOS 138		COMMANDER'S MANUAL FM 138/CM																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
TASK NUMBER	TASK DESCRIPTION	PRIMARY TRAINING Materials	INITIAL TRAINING LEVEL	TRAINING RESPONSIBILITY										TASK MOD. CODE	TASK DELETION CODE	NEW SKILL LEVEL	EXIST FREQ	NEW FREQ	SUBSYSTEM	DESIGN CHANGE NO	ADDITIONAL MEDIA	REL. TASK CHAR. SHEET																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
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				BCT	AIT/OSUT	PNCOC	BNCOC	ANCOC	SGMA	Service School	SQJT	Self Study	Scheduled Training																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
081 266 3318 (2 26)	Set/Lay for Quadrant with the Gunner's Quadrant	FM 6-75 FM 6-81 FM 6-88 FM 6-94 TEC Lesson 041-081-8130 F	3																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																

TASK SELECTION CODE

FLU Elimination of Subsystem
AUJ Task Automation
MTBF Increase in MTBF
AP Change in Maintenance Policy
O Other
(C) Conceptual Addition

TASK MODIFICATION CODE

NC No Change in Task Required
MN Minor task modification task essentially the same but minor change in equipment/instrumentation required
SK Skill level change task essentially the same but assigned to different skill level
REL Frequency change same task but task is performed more (less) frequently due to change in reliability, etc.
MAJ Major task modification task characteristics (e.g., difficulty, importance) change
(C) Conceptual Modification

FREQUENCY CODE

7 More than once a day
6 Daily
5 Weekly
4 Monthly
3 Three in Six times a year
2 Once or twice a year
1 Less than once a year

Table C2.1. EXISTING TASK DELETION/MODIFICATION WORKSHEET (continued)

COMMANDER'S MANUAL FM 6 13B/CM										TASK MOD. CODE	TASK DELETION CODE	NEW SKILL LEVEL	EXIST FREQ	NEW FREQ	SUBSYSTEM	DESIGN CHANGE NO	ADDITIONAL MEDIA	REL TASK CHAR. SHEET
PRIMARY TRAINING Materials										TRAINING RESPONSIBILITY								
										INITIAL TRAINING LEVEL			INSTITUTION					
TASK NUMBER	TASK DESCRIPTION																	
061 265 3323 (2.39)	Maintain DA Form 2408-4	TM 38 750	3															
061 305 6004 (2.41)	Perform Crater and Shell Fragment Analysis	FM 6 121	3														1243 061 0700F 1243 061 0102F Crater Analysis Parts 1 & 2	
061 270 3310 (3.42)	Verify Borelight Performed on th M109/ M109A1 with the Testing Target	FM 6 88 TM 9 2350-217 10N TEC Lessons 041 061 6117 F thru 041 061 6119 F TEC Lesson 061 061 6170 F	3														R21041 061 6170E Boreighting M109/ M109A1	
061 270 3427 (3.44)	Perform Preventive Maintenance Checks and Services on the M109/ M109A1	TM 9 2350 217 10N LO 9 2350 217 12N	3														1041 061 6022 thru 1041 061 6036 M109/M109A1 Crew Maintenance	134 6 15
061 270 3424 (3.46)	Prepare the M109/M109A1 for Operations Under Unusual Conditions	FM 9 207 TM 9 2350-217 10N FM 31 79 TEC Lesson 045 171 0101	3														Almost All Design Changes Are Relieved	

(Continued)

FREQUENCY CODE

7 More than once a day
6 Daily
5 Weekly
4 Monthly
3 Three to Six times a year
2 Once or twice a year
1 Less than once a year

TASK MODIFICATION CODE

NC No Change in Task Required
MIN Minor task modification task essentially the same. Only minor change in equipment/manufacture required
SKI Skill level change. task essentially the same but assigned to different skill level
REL Frequency change. same task but task is performed more (less) frequently due to change in reliability, etc.
MAJ Major task modification. task characteristics (e.g. difficulty, importance) change
(C) Conceptual Modification

TASK DELETION CODE

ELI Elimination of Subsystem
AUT Task Automation
MTBF Increase in MTBF
MP Change in Maintenance Policy
O Other
(C) Conceptual Addition

Table C21. EXISTING TASK DELETION/MODIFICATION WORKSHEET (Continued)

TASK NUMBER		TASK DESCRIPTION	PRIMARY TRAINING Materials	INITIAL TRAINING LEVEL	TRAINING RESPONSIBILITY								TASK MOD CODE	TASK DELETION CODE	NEW SKILL LEVEL	EXIST FREQ	NEW FREQ	SUBSYSTEM	DESIGN CHANGE NO	ADDITIONAL MEDIA	REF TASK CHART SHEET						
				INSTITUTION																							
				UNIT																							
				SCHEDULED TRAINING																							
				Self Study																							
				SOJT																							
				Service School																							
				SGMA																							
				ANCOC																							
				BNCOC																							
				PNCOC																							
				AIT/OS.T																							
				BCT																							
061 270 3429 (3.48)	Adjust the Equilibrator on the M109/M109A1		TM 9-2350 217.10N	3																							
061 270 3430 (3.49)	Perform Profile Checks on the M109/M109A1		TM 9-2350 217.10N TEC Lesson 041 061 6132.J	3																							
061 270 3307 (3.41)	Verify Bore-sight Performed on the M109/M109A1 Using a Distant Aiming Point (DAP)		FM 9-88 TM 9-2350 217.10N	3																							
(Continued)																											

TASK DELETION CODE
 E11 Elimination of Subsystem
 AUT Task Automation
 M1BF Increase in M1BF
 MAF Change in Maintenance Policy
 O Other
 (C) Conceptual Addition

TASK MODIFICATION CODE
 NC No Change in Task Required
 MN More task modification task essentially the same Only minor change in equipment/nomenclature required
 SKI Skill level change task essentially the same but assigned to different skill level
 FEE Frequency change same task but task is performed more (less) frequently due to change in reliability, etc.
 MAJ Major task modification task characteristics (e.g. difficulty, importance) change
 (C) Conceptual Modification

FREQUENCY CODE
 7 More than once a day
 6 Daily
 5 Weekly
 4 Monthly
 3 Three to Six times a year
 2 Once or twice a year
 1 Less than once a year

Table C2.1. EXISTING TASK DELETION/MODIFICATION WORKSHEET (continued)

MOS		13B		COMMANDER'S MANUAL		FMS 13B/CM																
TASK NUMBER	TASK DESCRIPTION	PRIMARY TRAINING Materials	INITIAL TRAINING LEVEL	TRAINING RESPONSIBILITY										TASK MOD CODE	TASK DELETION CODE	NEW SKILL LEVEL	EXIST FREQ	NEW FREQ	SUBSYSTEM	DESIGN CHANGE NO	ADDITIONAL MEDIA	REL TASK CHAR SHEET
				INSTITUTION							UNIT											

TASK DELETION CODE

E11	Elimination of Subsystem	NC	No Change in Task Required
AUT	Task Automation	MIN	Minor task modification task essentially the same Only minor change in equipment/instrumentation required
MTBF	Increase in MTBF	SK1	SK1 Skill level change task essentially the same but assigned to different skill level
MP	Change in Maintenance Policy	REL	frequency change same task but task is performed more (less) frequently due to change in reliability, etc.
O	Other	MAJ	Major task modification task characteristics (e.g. difficulty, importance) change
(C)	Conceptual Addition	(C)	Conceptual Modification

TASK MODIFICATION CODE

7	More than once a day
6	Daily
5	Weekly
4	Monthly
3	Three to Six times a year
2	Once or twice a year
1	Less than once a year

FREQUENCY CODE

Table C2. EXISTING TASK DELETION/MODIFICATION WORKSHEET

MJS 31V		COMMANDER'S MANUAL FM11.31V/CM		REL TASK CHART SHEET									
TASK NUMBER	TASK DESCRIPTION	PRIMARY TRAINING Materials	INITIAL TRAINING LEVEL	TRAINING RESPONSIBILITY	TASK MOD. CODE	TASK DELETION CODE	NEW SKILL LEVEL	EXIST. PRIO	NEW PRIO	SUBSYSTEM	DESIGN CHANGE NO	ADDITIONAL MEDIA	
				INSTITUTION	UNIT								
				BT/AT/OSUT	PLC	ANCOG	SPT SCH	USA SMA	SOJT	Self-Study	SCD TNG	TCC	
113 574 2058	Operate Radio Test Set AN/VRC 12 to Test Modules in AN/VRC 12 Series Radio Set	TM 11 5820 401 12 Task 113 587 3028 Task 113 823 3022	1	O								2101 113 7146 A (046) Test Operate AN/VRC 12	
113 587 0027	Systems Troubleshoot Radio Set AN/VRC 12 including Control Frequency Selector C-2742/VRC to a Defective Component, Cable, or Accessory	TM 11 5820 401 12 Task 113 587 3028 Task 113 823 3022	1	O								3101 113 7147 A (046) Sys. Troubleshoot Radio in a Wheeled Vehicle	
113 587 1019	Verify Installation of Radio Set AN/VRC 12 in a Tracked Vehicle	TM 11 5820 401 12 Task 113 823 3022	1	O								2101 113 7148 A (046) Install AN/VRC 12	
113 587 3028	Evaluate the Operation of Radio Set AN/VRC 12	TM 11 5820 401 12 Task 113 823 3022	1	O								2101 113 7146 A (046) Test Operate AN/VRC 12	
113 587 3029	Perform Organizational Quarterly Preventive Maintenance on Radio Set AN/VRC 12	TM 11 5820 401 12 DA PAM 310.7 Task 113 823 3022	1									2101 113 7148 A (046) Perform Organizational QTRLY PM	

TASK MODIFICATION CODE

NC No Change in Task Required
MIN Minor task modification task essentially the same Only minor change in equipment/nomenclature required
SKL Skill level change task essentially the same but assigned to different skill level
REL Frequency change same task but task is performed more often frequency due to change in reliability, etc
MAJ Major task modification task characteristics (e.g., difficulty, importance) change
(C) Conceptual Modification

TASK DELETION CODE

E11 Elimination of Subsystem
AUT Task Automation
MIBF Increase in MIBF
MP Change in Maintenance Policy
O Other
(C) Conceptual Addition

FREQUENCY CODE

7 More than once a day
6 Daily
5 Weekly
4 Monthly
3 Three in Six times a year
2 Once or twice a year
1 Less than once a year

Table C2.2. EXISTING TASK DELETION/MODIFICATION WORKSHEET (continued)

TASK NUMBER		TASK DESCRIPTION	PRIMARY TRAINING Materials	INITIAL TRAINING LEVEL	TRAINING RESPONSIBILITY						TASK MOD. CODE	TASK DELETION CODE	NEW SKILL LEVEL	EXIST. FREQ.	NEW FREQ.	SUBSYSTEM	DESIGN CHANGE NO.	ADDITIONAL MEDIA	REL. TASK CHAR. SHEET	
					INSTITUTION															
					UNIT															
					Self-Study															
					TCC															
					SCD TNG															
					BT/AIT OSUT															
113 587 7029		Check Performance of Operator's Preventive Maintenance on AN/VRC-12 12 Series Radio Sets	Task 113 823-3022 TM 38-750 SSO 712 TM 11-5820-401 12	2															2101 113 7146 A (046) Perform Organizational QTRLY PM	
113 587 7040		Check Performance of Organizational Preventive Maintenance on AN/VRC-12 12 Series Radio Sets	Task 113 823-3022 TM 38-750 SSO 712 SSO 734 Task 113 587 3029 Task 113 823-3022	2														2101 113 7146 A (46) Perform Organizational QTRLY PM		

TASK DELETION CODE

ELU Elimination of Subsystem
AUT Task Automation
MTBF Increase in MTBF
AP Change in Maintenance Policy
O Other
IC Conceptual Addition

TASK MODIFICATION CODE

NC No Change in Task Required
MIN Minor task modification task essentially the same Only minor change in equipment/instrumentation required
SKL Skill level change task essentially the same but assigned to different skill level
REL Frequency change same task but task is performed more (less) frequently due to change in reliability, etc.
MAJ Major task modification task characteristics (e.g., difficulty, importance) change
IC Conceptual Modification

FREQUENCY CODE

7 More than once a day
6 Daily
5 Weekly
4 Monthly
3 Three to Six times a year
2 Once or twice a year
1 Less than once a year

Table C2.3 EXISTING TASK DELETION/MODIFICATION WORKSHEET

COMMANDEER'S MANUAL F489 41C/CM																				
WOS 41C																				
TASK NUMBER	TASK DESCRIPTION	PRIMARY TRAINING Materials	INITIAL TRAINING LEVEL	TRAINING RESPONSIBILITY								TASK MOD. CODE	TASK DELETION CODE	NEW SKILL LEVEL	EXIST. FREQ.	NEW FREQ.	SUBSYSTEM	DESIGN CHANGE NO.	ADDITIONAL MEDIA	REL. TASK CHG. SHEET
				INSTITUTION				UNIT												
				BCT	AJT	PLC/PTT				FOJT	TEC/CORR									
TECHNICAL TASKS																				
OFF CARRIAGE FIRE CONTROL INSTRUMENTS																				
081 41C 1401	Perform Torque Inspection of Infinity Collimator M1	TM 9 1240 324 35	1		1											4	3	Infinity Collimator		41C C1
081 41C 1403	Charge Infinity Collimator M1 With Nitrogen	TM 9 1240 324 35 TM 750 116	1		1											4	3	Infinity Collimator		41C C1
091 41C 2404	Replace Hicount in Remote Control Light Source of a Collimator	TM 9 1240 324 35 TM 750 116	2		1											4	3	Infinity Collimator		41C C1
091 41C 1445	Repair Aiming Post Light M14	TM 9 6015	1		1											4	3	Aiming Post		41C C1
091 41C 1571	Troubleshoot Cross Level Mechanism in Fire Control Quadrant M15	TM 9 1250 322 35	1		1											4	3	M15 Fire Control Quadrant		41C C1
091 41C 2572	Replace Bent Wormshaft in Fire Control Quadrant	TM 9 1250 322 35	2		1											4	3	M15 Fire Control Quadrant		41C C1

FREQUENCY CODE

- 7 More than once a day
6 Daily
5 Weekly
4 Monthly
3 Three to Six times a year
2 Once or twice a year
1 Less than once a year

TASK MODIFICATION CODE

- NC No Change in Task Required
MIN Minor task modification task essentially the same Only minor change in equipment/instrumentation required
SKL Skill level change task essentially the same but assigned to different skill level
REL Frequency change same task but task is performed more often frequently due to change in reliability, etc.
MAJ Major task modification task characteristics (e.g. difficulty, importance) change
IC Conceptual Modification

TASK DELETION CODE

- E11 Elimination of Subsystem
AUT Task Automated
MIBF Increase in MIBF
MR Change in Maintenance Policy
O Other
IC3 Conceptual Addition

Table C2.3. EXISTING TASK DELETION/MODIFICATION WORKSHEET (continued)

BMJ5 41C

COMMANDER'S MANUAL

FM 9 11C/LM

TASK NUMBER	TASK DESCRIPTION	PRIMARY TRAINING Material	TRAINING RESPONSIBILITY										TASK MOD. CODE	TASK DELETION CODE	NEW SKILL LEVEL	EXIST. FREQ.	NEW FREQ.	SUBSYSTEM	DESIGN CHANGE NO.	ADDITIONAL MEDIA	REL. TASK CHAR. SHEET									
			INITIAL TRAINING LEVEL	INSTITUTION						UNIT																				
				BCT	AIT	PLC/PTT				FOJT	TEC/CORR																			
001 41C 1580	Troubleshoot Panoramic Telescope M115	TM 9 1240 282 34	1	1							R		REL			4	3	M115 Panoramic Telescope			41C-C1									
001 41C 1581	Charge Panoramic Telescope M115 With Nitrogen	TM 9 1240 282 34 TM 9 1240 282 50	1	1						R			REL			4	3	M115 Panoramic Telescope			41C-C1									
001 41C 1582	Replace Cracked Lens in Eyepiece of Panoramic Telescope M115	TM 9 1240 282 34 TM 9 1240 282 50	1	1						R			REL			4	3	M115 Panoramic Telescope			41C-C1									
001 41C 1808	Install Telescope Mount M105 in SP Mount M109	TM 9 2350 217 20	1	1						R			REL			4	3	Telescope Mount			41C-C1									
001 41C 1803	Synchronize Telescope Mount M105 in SP Mount M109	TM 9 2350 217 20	1	1						R			REL			4	3	Telescope Mount			41C-C1									
001 41C 2680	Separate Field Inspection of Panoramic Telescope M115	TM 9 1240 282 34	3	1						R			NC					Panoramic Telescope												
001 41C 3681	Supervise Synchronization of M105 Telescope Mount in	TM 9 2350 217 20	3	1						R			NC					Panoramic Telescope												

FREQUENCY CODE

- 7 More than once a day
 6 Daily
 5 Weekly
 4 Monthly
 3 Three to Six times a Year
 2 Once or twice a year
 1 Less than once a year

TASK MODIFICATION CODE

- NC No Change in Task Required
 MN Minor task modification task essentially the same Only minor change in equipment/nomenclature required
 SK Skill level change task essentially the same but assigned to different skill level
 REL Frequency change same task but task is performed more (less) frequently due to change in reliability, etc.
 MAJ Major task modification task characteristics (e.g., difficulty, importance) change
 (C) Conceptual Modification

TASK ACTION CODE

- ELI Elimination of Subsystem
 AUT Task Augmentation
 MTF Increase in MTF
 MP Change in Maintenance Policy
 O Other
 (C) Conceptual Addition

Table C2.5. EXISTING TASK DELETION/MODIFICATION WORKSHEET

TASK NUMBER		TASK DESCRIPTION	INITIAL TRAINING LEVEL	TRAINING RESPONSIBILITY						TASK MOD. CODE	TASK DELETION CODE	NEW SKILL LEVEL	EXIST. FREQ.	NEW FREQ.	SUBSYSTEM	DESIGN CHANGE NO.	ADDITIONAL MEDIA	REL. TASK CHAR. SHEET
				INSTITUTION														
				BCT	AIT	PLC/PTT												
				UNIT														
				TEC/CORR														
PRIMARY TRAINING Materials																		
HAWITZER, MEDIUM, SELF PROPELLED, 155MM, M109A1																		
Cannon Assembly																		
091 451 1551	Remove and Install Components of Breech Mechanism	OS 451207, Medium Self-Propelled Artillery Maintenance; TM 9-2350 217 20	1															
091 451 2552	Inspect Cannon Tube Using M2 Bore Scope	OS 451202, Fundamentals of Artillery Systems and Components; TM 9-1000 202 35, TM 9-2350 217 34/2, TM 9-4933 200 35, TM 38 750	2														1643 091 5707 F (118) Cannon Bore and Powder Chamber Eval	
091 451 7553	Determine Serviceability of Cannon Tube Using Puller Gauge	OS 451202, Fundamentals of Artillery Systems and Components; TM 9-1000 202 35, TM 9-2350 217 34/2, TM 9-4933 200 35, TM 38 750	2														1643 091 5708 F (118) Measuring and evaluating gun tube wear	

(Continued)

TASK DELETION CODE

E11 Elimination of Subsystem
 A11 Task Automation
 M11F Increase in MTBF
 M11 Change in Maintenance Policy
 O Other
 (C) - Conceptual Addition

TASK MODIFICATION CODE

NC No Change in Task Required
 MIN Minor task modification task essentially the same Only minor change in equipment/nomenclature required
 SKI Skill level change task essentially the same but assigned to different skill level
 REL Frequency change same task but task is performed more (less) frequently due to change in reliability, etc.
 MAJ Major task modification task characteristics (e.g., difficulty, importance) change
 (C) - Conceptual Modification

FREQUENCY CODE

7 More than once a day
 6 Daily
 5 Weekly
 4 Monthly
 3 Three to Six times a year
 2 Once or twice a year
 1 Less than once a year

Table C2.5. EXISTING TASK DELETION/MODIFICATION WORKSHEET (continued)

MOS 451		COMMANDER'S MANUAL FMB 461/CM										TRAINING RESPONSIBILITY										TASK MOD. CODE	TASK DELETION CODE	NEW SKILL LEVEL	EXIST. FREQ.	NEW FREQ.	SUBSYSTEM	DESIGN CHANGE NO.	ADDITIONAL MEDIA	REF. TASK CHAR. SHEET																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
TASK NUMBER	TASK DESCRIPTION	PRIMARY TRAINING Materials	INITIAL TRAINING LEVEL	INSTITUTION						UNIT				MIN.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TASK DELETION CODE
 E11 Elimination of Subsystem
 AIT Task Automation
 MTBF Increase in MTBF
 MP Change in Maintenance Policy
 O Other
 (C) Conceptual Addition

TASK MODIFICATION CODE
 MC No Change in Task Required
 MIN Minor task modification task essentially the same Only minor change in equipment/instructions required
 SK1 Skill level change task essentially the same but assigned to different skill level
 REL Frequency change same task but task is performed more frequently due to change in reliability, etc.
 MAJ Major task modification task characteristics (e.g. difficulty, improved) change
 (C) Conceptual Modification

FREQUENCY CODE
 7 More than once a day
 6 Daily
 5 Weekly
 4 Monthly
 3 Three to six times a year
 2 Once or twice a year
 1 Less than once a year

Table C2.5 EXISTING TASK DELETION/MODIFICATION WORKSHEET (continued)

COMMANDER'S MANUAL FM 9-45/GM																			
MOS 451																			
TASK NUMBER	TASK DESCRIPTION	PRIMARY TRAINING Methods	INITIAL TRAINING LEVEL	TRAINING RESPONSIBILITY							TASK MOD. CODE	TASK DELETION CODE	NEW SKILL LEVEL	EXIST. FREQ.	NEW FREQ.	SUBSYSTEM	DESIGN CHANGE NO.	ADDITIONAL MEDIA	REL. TASK CHAR. SHEET
				INSTITUTION				UNIT											
				BCT	A/T	PLC/PTT			FOJT	TEC/CORR									
091 451 1560	Disassemble, Repair, and Assemble Rammer Assembly	OS 461207, Medium Self-Propelled Artillery Maintenance; TM 9-2350 217 34/2	1	1						R	R					Rammer Assembly			
091 451 1561	Isolate and Repair Cab Electrical System by Tracing Circuits on Electrical Diagram and Using a Multimeter to Measure Voltage and Resistance	OS 461207, Medium Self-Propelled Artillery Maintenance; TM 9-2350 217 20	1	1						R	R		5	5		Cab Electrical	N064		
091 451 1562	Remove and Install Hydraulic Powerpack	OS 461207, Medium Self-Propelled Artillery Maintenance; TM 9-2350 217 34/2	1	1						R	R					Hydraulic Powerpack			
091 451 1563	Remove and Install Gunner's Control	OS 461207, Medium Towed Artillery Maintenance; TM 9-2350 217 34/2	1	1						R	R					Gunner's Control			
091 451 2564	Disassemble, Repair, and Assemble Elevating Equilibrator Assembly	OS 461207, Medium Self-Propelled Artillery Maintenance; TM 9-2350 217 34/2 TM 38 750	2		1					R	R					Equilibrator Assembly			
091 451 2565	Remove, Repair, and Install Components of Cab Race	OS 461207, Medium Self-Propelled Artillery Maintenance; TM 9-2350 217 34/2, TM 38 750	2		1					R	R					Cab Race			
(continued)																			

TASK DELETION CODE

ELU Elimination of Subsystem
 AIT Task Automation
 MIBF Increase in MIBF
 MP Change in Maintenance Policy
 O Other
 (C) Conceptual Addition

TASK MODIFICATION CODE

NC No Change in Task Required
 MIN Minor task modification task essentially the same Only minor change in equipment/non-equipment required
 SKI Skill level change task essentially the same but assigned to different skill level
 REL Frequency change same task but task is performed more (less) frequently due to change in reliability, etc.
 MAJ Major task modification task characteristics (e.g., difficulty, importance) change
 (C) Conceptual Modification

FREQUENCY CODE

7 More than once a day
 6 Daily
 5 Weekly
 4 Monthly
 3 Three to Six times a year
 2 Once or twice a year
 1 Less than once a year

Table C2.6. EXISTING TASK DELETION/MODIFICATION WORKSHEET

TASK NUMBER		TASK DESCRIPTION	PRIMARY TRAINING Materials	INITIAL TRAINING LEVEL				TRAINING RESPONSIBILITY				TASK MOD. CODE	TASK DELETION CODE	NEW SKILL LEVEL	EXIST. FREQ.	SUBSYSTEM	DESIGN CHANGE NO.	ADDITIONAL MEDIA	REF. TASK CHAR. SHEET
Technical Task Maintenance of Tracked Vehicle Engines								INSTITUTION											
								BCT	AIT	PLC/PTT	FQJT								
091 63C 1685		Remove on M109 Howitzer Powerplant		1	1	1	1					MIN				3	Powerplant	N01.2	63C C1
091 63C 1697		Service Engine Fuel Filters on M109 Howitzer		1	1	1	1					MIN					Fuel Filter		
091 63C 1693		Remove and Replace a Fuel Supply Pump on an M109 Howitzer		1	1	1	1					MIN					Fuel Pump		
091 63C 1694		Perform a Fuel Flow Test on an BV11T Engine Fuel Pump in an M109 Howitzer		1	1	1	1					MIN					Fuel Pump		
091 63C 1712		Remove and Replace Condant Radiator on an M109A1 Howitzer Engine		1	1	1	1					MIN					Radiator	N05.1 N05.2	63C C1
091 63C 1696		Remove and Replace Air Cleaners on an M109A1 Howitzer		1	1	1	1					MIN					Air Cleaners	N03.1	63C C1

TASK DELETION CODE

F11 Elimination of Subsystem
A111 Task Automation
M1B1 Increase in MTRF
M1P Change in Maintenance Policy
O Other
(C) Conceptual Addition

TASK MODIFICATION CODE

NC No Change in Task Required
MIN Minor task modification task essentially the same Only minor change in equipment/instrumentation required
SK1 Skill level change task essentially the same but assigned to different skill level
RE1 Frequency change same task but task is performed more (less) frequently due to change in reliability, etc.
MA1 Major task modification task characteristics (e.g. difficulty, importance) change
(C) Conceptual Modification

FREQUENCY CODE

7 More than once a day
6 Daily
5 Weekly
4 Monthly
3 Three to Six times a year
2 Once or twice a year
1 Less than once a year

Table C2 6. EXISTING TASK DELETION/MODIFICATION WORKSHEET (continued)

MOS				63C		COMMANDER'S MANUAL		FM 93C/CM														TASK MOD CODE	TASK DELETION CODE	NEW SKILL LEVEL	EXIST FREQ	NEW FREQ	SUBSYSTEM	DESIGN CHANGE NO	ADDITIONAL MEDIA	REL TASK CHAR SHEET																							
TASK NUMBER		TASK DESCRIPTION		PRIMARY TRAINING Materials		INITIAL TRAINING LEVEL		TRAINING RESPONSIBILITY																																													
								INSTITUTION		UNIT																																											
								BCT	AIT	PLC/PTT	FOJT																																										
091 63C 1729		Remove and Replace Starter on an 8V71T Engine		TM 9-2300 216 20. TM 9-2350 217 20. TM 9-2350 238 20.		1	1								R										4	3	Engine Starter	N08 1				63C C 1																					
Maintenance of Tracked Vehicle Track and Suspension Systems																																																					
091 63C 1771		Troubleshoot Suspension System on a Tracked Vehicle		Applicable vehicle TM, TM 38 750		1	1								R											5	5	Suspension System	N13 1																								
091 63C 1772		Inspect a Tracked Vehicle Suspension System		Applicable vehicle TM, TM 38 750		1	1								R																																						
091 63C 1773		Repair Tracked Vehicle Suspension System		Applicable vehicle TM, TM 38 750		1	1								R											5	5	Suspension System	N13 1																								
091 63C 1775		Remove and Replace a Torsion Bar on an M109A1 Howitzer		TM 9-2350 217 10. TM 9-2350 217 20		1	1								R													Torsion Bar																									
091 63C 1776		Remove and Replace Drive Sprockets on an M109 Howitzer		TM 9-2350 217 10. TM 9-2350 217 20		1	1								R													Drive Sprockets																									
091 63C 1778		Adjust Track		TM 9-2320 222 10		1	1								R													Track																									
091 63C 1779		Remove Track		TM 9-2320 222 10		1	1								R													Track																									
091 63C 1780		Install Track		TM 9-2320 222 10		1	1								R													Track																									
(continued)																																																					

TASK MODIFICATION CODE

NC No Change in Task Required
 MIN Minor task modification task essentially the same Only minor change in equipment/nomenclature required
 SKI Skill level change task essentially the same but assigned to different skill level
 REL Frequency change same task but task is performed more (less) frequently due to change in reliability, etc.
 MAJ Major task modification task characteristics (e.g., difficulty, importance) change
 (C) Conceptual Modification

TASK DELETION CODE

E11 Elimination of Subsystem
 AUT Task Automation
 MTBF Increase in MTBF
 MP Change in Maintenance Policy
 O Other
 (C) Conceptual Addition

FREQUENCY CODE

7 More than once a day
 6 Daily
 5 Weekly
 4 Monthly
 3 Three to Six times a year
 2 Once or twice a year
 1 Less than once a year

Table C26. EXISTING TASK DELETION/MODIFICATION WORKSHEET (continued)

equipment projected for ESPAWS and in the current manual mode (when the automated equipment breaks down). The manual performance of the task will not have to be performed as frequently as it currently is being performed; hence, it is marked by the "REL" code indicating only a change in task frequency is required. The automated performance of the task will be substantially different from the manual; hence it is marked by the "MAJ" code indicating a major task modification is required.

In addition to the task deletion/modification codes, the following information is listed for each task: (1) the initial skill level for which the task is trained; (2) the initial and advanced training locations for the task (3) the existing and projected new frequency for the task (this information is only listed for tasks which require a change in task frequency) (4) the subsystem associated with the task, (5) the design change number associated with the task (this information is only listed for conceptual system task modifications), and (6) the number of the task characteristic worksheet(s) associated with the tasks. The task characteristic worksheets are used to provide more detailed descriptions of the tasks requiring major task modifications (i.e., the MAJ tasks) and the tasks with significant changes in task frequency (i.e., REL tasks which have different existing and projected task frequencies)¹.

¹ It is possible for a task to be marked REL and still have no difference between the listed, existing, and new task frequency. This reflects the fact that the frequency scale provides only gross classifications and does not capture small changes in task frequency.

Task characteristic worksheets related to reference task modifications are coded with an XXX-R-XX number. Task characteristic worksheets related to conceptual task modifications are coded with an XXX-C-XX number.

C2.2 Task Addition Worksheets

Tables C2-7 to C2-11 display the task addition worksheets which were used to describe the additional tasks, not currently being performed by Army personnel, which will be required for the ESPAWS reference and conceptual systems. The sheets list the projected additional tasks required for the ESPAWS reference/conceptual systems and the comparable task from which the projected task was based. In addition, the following information is listed for each additional task and its associated comparable task: (1) task number (2) initial skill level performing the task (3) initial and advanced training locations and (4) related task characteristic numbers².

All of the additional tasks have associated task characteristic worksheets which provide more detailed information on the characteristics (e.g., skills and knowledges associated with the task. Since all of the additional tasks are utilized in the reference system, each additional task has a reference task characteristic

² For comparable tasks, the task number is taken directly from the commander's manual. For added tasks the first six digits are taken directly from the comparable task. These digits indicate the career field and location associated with the task. The next digit is identical to the skill level assigned to perform the task. The last three digits are used to distinguish the individual task from one another.

worksheet (marked by XXX-R-XX). In addition, those tasks which are associated with conceptual design changes also have a related conceptual task characteristic worksheet (marked by XXX-C-XX)³.

³ The only type of task modification associated with the conceptual system were changes in task frequency (that is REL type task modifications).

Table C2-7. Task Addition Worksheet.

LAND NAVIGATION SYSTEM/
ESPANS FIRE CONTROL COMPUTER

Component

MOS 13B

Task	Task Number	Task Description	Skill Level	Training Setting	Related Task Characteristic Worksheet
Task (Comp Task)	(061-270-1X08) (061-281-1000) (Note 13E Task)	Perform Operational Check of Land Navigation System Prepare FADAC for Operation	1 1	Q = AIT A = ANCOC, SELF, SCH Q = SOJT A = ANCOC, SELF, SCH	13B-R-18
Task (Comp Task)	(061-270-1X09) (061-281-1001) (Note 13E Task)	Operate Land Navigation System Enter Known Data into FADAC	1 1	Q = AIT A = ANCOC, SELF, SCH Q = SOJT A = ANCOC, SELF, SCH	13B-R-19
Task (Comp Task)	(061-270-1X10) (061-281-1001) (Note 13E Task)	Operate ESPANS Fire Control Computer Enter Known Data into FADAC	1 1	Q = AIT A = ANCOC, SELF, SCH Q = SOJT A = ANCOC, SELF, SCH	13B-R-20
Task (Comp Task)	(061-270-1X11) (061-281-1000) (Note 13E Task)	Prepare ESPANS Fire Control Computer for Operation Prepare FADAC for Operation	1 1	Q = AIT A = ANCOC, SELF, SCH Q = SOJT A = ANCOC, SELF, SCH	13B-R-21
Task (Comp Task)					

Table C2-8. Task Addition Worksheet

ESPAWS LAND NAVIGATION SYSTEM (LNS)

Component

MOS 31V-1

Task	Task Number	Task Description	Skill Level	Training Setting	Related Task Characteristic Worksheet
Task (Comp Task)	113-80X-1X01	Test LNS Equipment Interface and Signal Flow	1	Q = 31VXZ A = SOJT, SELF, TCC	31V-R-1
	(113-574-2058)	Operate Radio Test Set to Test Modules in AN/URC-12 to a Defective Component, Cable or Accessory	1	Q = AIT A = SOJT, SELF, TCC	
Task (Comp Task)	113-80X-1X02	Test Attitude Control Loop/Outputs (As Above)	1	Q = 31VXZ A = SOJT, SELF, TCC	31V-R-2
	(113-574-2058)		1	Q = AIT A = SOJT, SELF, TCC	
Task (Comp Task)	113-80X-1X03	Test LNS Modes/Operation and Outputs (As Above)	1	Q = 31VXZ A = SOJT, SELF, TCC	31V-R-3
	(113-574-2058)		1	Q = AIT A = SOJT, SELF, TCC	
Task (Comp Task)	113-80X-1X04	Calibrate LNS Compass	1	Q = 31VXZ A = SOJT, SELF, TCC	31V-R-4
	(113-574-3036)	Evaluate Operation of Radio Set MN/VRC-46	1	Q = 31VXZ A = SOJT, SELF, TCC	
Task (Comp Task)	113-80X-1X05	Troubleshoot LNS and System Displays	1	Q = 31VXZ A = SOJT, SELF, TCC	31V-R-5
	(113-609-0099)	System Troubleshoot COMSEC Security Equipment TSEC/KY-52 with an AN/VRC-12 or AN/VRC-47 Radio	1	Q = AIT A = SOJT, SELF, TCC	

Table C2-8. Task Addition Worksheet (continued)

MOS 31V-1

Component

ESPAWS LAND NAVIGATION SYSTEM (LNS)

Task	Task Number	Task Description	Skill Level	Training Setting	Related Task Characteristic Worksheet
Task (Comp Task)	113-80X-1X06 113-609-1034	Remove and Replace LNS Install COMSEC Equipment TSEC/KY-57	1 1	Q = 31VX2 A = SOJT, SELF, SCH Q = AJT A = SOJT, SELF, SCH	31V-R-6
Task (Comp Task)	113-80X-1X107 (113-587-3020)	Inspect LNS Evaluate the Operation of UF Radio Set AN/VRC-12		Q = 31VX2 A = SOJT, SELF, SCH Q = AJT A = SOJT, SELF, SCH	31V-R-7
Task (Comp Task)					
Task (Comp Task)					
Task (Comp Task)					

Table C2-9. Task Addition Worksheet

MOS 31V-2 _____ Component _____ ESPAWS FIRE CONTROL COMPUTER _____

Task	Task Number	Task Description	Skill Level	Training Setting	Related Task Characteristic Worksheet
Task (Comp Task)	111-70X-1X08 (091-34G-1440) (Note 34G Task)	Evaluate the Operation of the ESPAWS Computer Test M18 Gun Direction Computer Using Test Tape B	1 1	Q = 101ASIX1 A = SOJT, SELF, SCH Q = AIT A = SOJT, SELF, TCC	31V-R-8
Task (Comp Task)	111-70X-1X09 (111-609-1034)	Remove and Replace Communication Data Link of ESPAWS Computer Install COMSEC Equipment TSRC/KY-57	1 1	Q = 101ASIX1 A = SOJT, SELF, TCC Q = AIT A = SOJT, SELF, TCC	31V-R-9
Task (Comp Task)	111-70X-1X10 (111-609-1034)	Remove and Replace Wind Velocimeter and Other Sensors Associated with ESPAWS Computer Install COMSEC Equipment TSRC/KY-57	1 1	Q = ASIX1 A = SOJT, SELF, TCC .	31V-R-10
Task (Comp Task)	111-70X-1X11 111-609-1034	Remove and Replace ESPAWS Computer Install COMSEC Equipment TSRC/KY-57	1 1	Q = ASIX1 A = SELF, SOJT, SCH Q = AIT A = SELF, SOJT, SCH	31V-R-11
Task (Comp Task)	111-70X-1X12 (111-594-0011)	Repair ESPAWS Computer Terminal and Displays Repair Switchboard Telephone Manual SB 33/PT	1 1	Q = ASIX1 A = SELF, SOJT, SCH Q = AIT/OSOT A = SOJT, SELF, TCC	31V-R-12

Table C2.9. Task Addition Worksheet (continued)

MOS 31V-2 Component ESPAWS FIRE CONTROL COMPUTER

Task (Comp Task)	Task Number	Task Description	Skill Level	Training Setting	Related Task Characteristic Worksheet
	(113-70X-1X13)	Isolate Faulty Module of ESPAWS Computer Using Built-in Fault Isolation Subroutine	1	Q = ASIX A = SELF, SOIT, SCH	31V-R-13
	(091-14G-1440) (Note 34G Task)	Test M18 Gun Direction Computer Using Test Tape B	1	Q = ATY A = SOIT, SELF, TCC	
Task (Comp Task)					
Task (Comp Task)					
Task (Comp Task)					
Task (Comp Task)					

Table C2-10. Task Addition Worksheet

MOS 45D (13B06)

Component

ESPAMS AUTOLOADER

Task	Task Number	Task Description	Skill Level	Training Setting	Related Task Characteristic Worksheet
Task (Comp Task)	061-272-1X01 (061-270-3429)	Adjust ESPAMS Autoloader Adjust the Equilibrator on the M109/M109A1	1 3	Q = 643-45D10 (MOD) A = BNCC, SELF, SCH Q = SOJT A = BNCC, SELF, SCH	45D-R-1
Task (Comp Task)	061-272-1X02 (061-270-1473)	Repair Hydraulic Components of the HK XXX Autoloader Repair Hydraulic Tubes and Fittings to Elevation and Equilibrator Systems (M109/M109A1)	1 1	Q = 643-4510 (MOD) A = SOJT, SELF, SCH Q = 13B06 A = SOJT, SELF, SCH	45D-R-2
Task (Comp Task)	061-272-1X03 (061-270-1466)	Repair Electrical and Electronic Components of the ESPAMS Autoloader Repair Components of the M109/M109A1 Howitzer Cab Electrical System	1 1	Q = 643-45D10 (MOD) A = SOJT, SELF, SCH Q = 13B06 A = SOJT, SELF, SCH	45D-R-3
Task (Comp Task)	061-272-1X04 (061-270-1465)	Adjust/Align Autoloader Loader Drum Clutch and Index Rack Bleed and Charge Elevating/Equilibrating Mechanisms of M109/M109A1	1 1	Q = 643-4510 (MOD) A = SOJT, SELF, SCH Q = 13B06 A = SOJT, SELF, SCH	45D-R-4
Task (Comp Task)	061-272-1X05 (061-270-1462)	Adjust Upper Hoist Shutters and Carrier Ejectors for Proper Action Adjust Rammer Control Assembly on M107	1 1	Q = 643-45D10 A = SOJT, SELF, SCH Q = 13B06 A = SOJT, SELF, SCH	45D-R-5

Table C2-10. Task Addition Worksheet (continued)

MOS 45D (13Bu6)

Component

ESPANS AUTOLOADER

Task	Task Number	Task Description	Skill Level	Training Setting	Related Task Characteristic Worksheet
Task (Comp Task)	061-272-1X06 061-272-1466	Inspect Autoloader BITE Components Repair Components of M109/M109A1 Howitzer Lab Electrical System		Q = 643-4510 (MOD) A = SOJT, SELF, SCH Q = 13Bu6 A = SOJT, SELF, SCH	45D-R-6
Task (Comp Task)					
Task (Comp Task)					
Task (Comp Task)					
Task (Comp Task)					

Table C2-11. Task Addition Worksheet

MOS 45LX1

Component

ESPAMS AUTOLOADER

Task	Task Number	Task Description	Skill Level	Training Setting	Related Task Characteristic Worksheet
Task (Comp Task)	001-452-7X01	Operate the ESPAMS Autoloader in Load Mode	1	Q = 642 AST X1 A = SOJT, SELF, SCH	45L-R-1
	N/A	Operate Gun Mount 5"/54 MK 42 MOD 98 10 Gun Loading System in Load Mode	2	Q = MK 42 Gunners Mate School A-113-0044	
Task (Comp Task)	001-451-1X02	Perform Preventive Maintenance on the MK XXX Hoist, Cradle, Transfer Trays, Rammer, and Slide	1	Q = 642 AST X1 A = SOJT, SELF, SCH	45L-R-2
	N/A	Perform Planned Maintenance on the 5"/54 MK42 MOD10 upper gun loading system	2	Q = MK 42 Gunners Mate School A-113-0044	
Task (Comp Task)	001-451-1X03	Isolate and Correct Faults in the MK XXX Loader Drums	1	Q = 642 AST X1 A = SOJT, SELF, SCH	45L-R-3
	N/A	Troubleshoot the 5"/54 MK 42 MOD 10 Loader Drums	2	Q = MK 42 Gunners Mate School A-113-0044	
Task (Comp Task)	001-451-1X04	Isolate and Correct Faults in the Hoist of the MK XXX Autoloader	1	Q = 642 AST X1 A = SOJT, SELF, SCH	45L-R-4
	N/A	Troubleshoot the 5"/54 MOD 10 upper Hoist MK 2	2	Q = MK 42 Gunners Mate School A-113-0044	
Task (Comp Task)	001-451-1X05	Isolate and Correct Faults in the MK XXX Autoloader Cradles	1	Q = 642 AST X1 A = SOJT, SELF, SCH	45L-R-5
	N/A	Troubleshoot the 5"/54 MK 42 MOD 10 Cradles	2	Q = MK 42 Gunners Mate School A-113-0044	

Table C2-11. Task Addition Worksheet (continued)

MDS 45LXL

Component

ESPAWS AUTOLOADER

Task	Task Number	Task Description	Skill Level	Training Setting	Related Task Characteristic Worksheet
Task (Comp Task)	091-45L-1X06 N/A	Isolate and Correct Faults in the MK XXX Autoloader Transfer Trays Troubleshoot the 5"/54 MK 42 MOD 10 Transfer Trays	1 2	Q - 642 ASIXI A - SOFT, SELF, SCH Q - MK 42 Gunners Mate School A-113-0044	45L-R-6
Task (Comp Task)	091-45L-1X07 N/A	Isolate and Correct Faults in the MK XXX Autoloader Rammer Troubleshoot the 5"/54 MK 42 MOD 10 Rammer MK 2 MOD 3	1 2	Q - 642 ASIXI A - SOFT, SELF, SCH Q - MK 42 Gunners Mate School A-113-0044	45L-R-7
Task (Comp Task)	091-45L-1X08 N/A	Isolate and Correct Faults in the MK XXX Autoloader Slide Troubleshoot the 5"/54 MK 42 MOD 10 Slide MK 3 MOD 3	1 2	Q - 642 ASIXI A - SOFT, SELF, SCH Q - MK 42 Gunners Mate School A-113-0044	45L-R-8
Task (Comp Task)	091-45L-1X09 091-45L-1401	Test the Operation of the Ball Effect Proximity Switches Used in the ESPAWS Autoloader. Perform a Continuity Test of an Electrical Circuit Using a Multimeter	1 1	Q - 642 ASIXI A - SOFT, SELF, SCH Q - ATT A - SOFT, SELF, SCH	45L-R-9 45L-C-1
Task (Comp Task) *	091-45L-1X010	Test the Operation of the Latching Relay Circuit, Logic Circuit, and Solenoid Driver Circuit Cards with the Circuit Card Tester TS XX2	1 *	Q - 642 ASIXI A - SOFT, SELF, SCH	45L-R-10 45L-C-2

*Continued on next page.

Table C2-11. Task Addition Worksheet (continued)

MOS 451X1

Component

ESPANG AUTLOADER

	Task Number	Task Description	Skill Level	Training Setting	Related Task Characteristic Worksheet
(Comp Task)	091-451-3411	Use Electric Drive Control Test Set to Isolate Malfunctioning Components of Current Electrical System of AR/AAU 551	3	Q = PLC PPT A = GOTT, SELF, SCH	
Task (Comp Task)					
Task (Comp Task)					
Task (Comp Task)					
Task (Comp Task)					
Task (Comp Task)					

APPENDIX C3

TASK CHARACTERISTIC WORKSHEETS

This appendix describes the task characteristic worksheets that were used to describe the characteristics of the modified and additional tasks identified in the task modification/addition worksheets listed in Appendix C2.

The appendix is divided into two sections. The first section describes the task characteristic worksheets which were used with tasks which only required a change in task frequency. The second section describes the task characteristic worksheets which were used with tasks requiring major modification or where new tasks were developed specifically for ESPAWS.

C3.1 Task Characteristic Worksheets A

A separate set of worksheets (task characteristic worksheets A) were used to describe the characteristics of the tasks which only required a change in task frequency (the tasks identified by the code "REL" in the task description worksheets in Appendix C2). Since only the frequency with which these tasks are performed changes, and not any other essential features of the task, a detailed description of the skills and knowledges of these tasks is not required. Hence, these tasks do not require the detailed description that the other modified and additional tasks require.

Table C3-1 lists the task characteristic worksheets which were developed for the ESPAWS REL tasks. Each one of these worksheets lists all of the reference or conceptual tasks

Table C3.1 Task Characteristic Worksheets - A

Task Characteristic Worksheet No. 138 R.2

Task Type REF System Associated with REF

MOS 138

Task Number	Task	Exst. Freq.	New Freq.	Diff. culty	Importance	Initial Training Location		Advanced Training Location	
						Exst.	New	Exst.	New
061 266 1101	Emplice/recover collimator	4	3	NOT	YES	AIT/OSUT	AIT/OSUT	SOJT, SELF, SCH	SOJT, SELF, SCH
061 266 1103	Emplice/recover aiming posts	4	3	NOT	YES	AIT/OSUT	AIT/OSUT	SOJT, SELF, SCH	SOJT, SELF, SCH
061 266 1215	Set/lay the crane for quadrant with the range quadrant	4	3	MOD	YES	SOJT	SOJT	BNCOC, ANCOG	BNCOC, ANCOG
061 266 1216	Measure the quadrant with range quadrant	4	3	MOD	YES	SOJT	SOJT	BNCOC, ANCOG	BNCOC, ANCOG
061 266 2108	Fire the cannon (manual)	4	3	MOD	YES	AIT/OSUT	SOJT*	SOJT, SELF	SELF, SCH
061 266 1219	Clean the powder chamber after firing	4	3	NOT	YES	AIT/OSUT	SOJT*	SOJT, SELF	SELF, SCH
061 266 1401	Inspect and clean the collimator	4	3	NOT	YES	AIT/OSUT	AIT/OSUT	SCH	SOJT, SELF
061 266 1402	Inspect and clean aiming posts and night lighting devices	4	3	NOT	YES	AIT/OSUT	AIT/OSUT	SCH	SCH
061 270 1514	Load a prepared round for firing in M109/M109 A1 (manual)	4	3	MOD	YES	AIT/OSUT	AIT/OSUT	SELF, SCH	SELF, SCH
061 266 1452	Pump and charge fire control equip.	4	4	VERY	YES	138UB	SOJT*	SOJT, SELF, SCH	SELF, SCH
061 266 2221	Lay the cannon for initial direction of fire	4	3	VERY	YES	SOJT	SOJT	ANCOG, SELF, SCH	ANCOG, SELF, SCH
061 266 2723	Align collimator/aiming posts	4	3	VERY	YES	SOJT	SOJT	ANCOG, SELF, SCH	ANCOG, SELF, SCH
061 266 2729	Set/lay the cannon for deflection (manual)	4	3	VERY	YES	SOJT	SOJT	ANCOG, SELF, SCH	ANCOG, SELF, SCH
061 266 2231	Refer the piece	4	3	MOD	YES	SOJT	SOJT	ANCOG, SELF, SCH	ANCOG, SELF, SCH
061 270 2225	Borelight the panoramic telescope using distant aiming point	4	3	VERY	YES	SOJT	SOJT	SELF, SCH	SELF, SCH
061 270 2228	Borelight the panoramic telescope using testing target	4	3	VERY	YES	SOJT	SOJT	SELF, SCH	SELF, SCH
061 266 3304	Verify emplacement of aiming points and recording of deflections	4	3	MOD	YES	BNCOC	BNCOC	ANCOG, SOJT, SELF, SCH	ANCOG, SOJT, SELF, SCH
061 266 3110	Perform gunner's micrometer test	4	3	VERY	YES	BNCOC	BNCOC	SELF, SCH	SELF, SCH
061 266 3110	Perform gunner's quadrant end to end test	4	3	VERY	YES	BNCOC	BNCOC	SELF, SCH	SELF, SCH
061 266 3318	Set/lay for quadrant with gunner's quadrant	4	3	VERY	YES	BNCOC	BNCOC	ANCOG, SOJT, SELF, SCH	ANCOG, SOJT, SELF, SCH
061 266 3319	Measure the quadrant with gunner's quadrant	4	3	VERY	YES	BNCOC	BNCOC	ANCOG, SOJT, SELF, SCH	ANCOG, SOJT, SELF, SCH
061 270 3307	Perform fire control alignment tests on M109/M109 A1	4	3	VERY	YES	SOJT	SOJT	BNCOC, SELF, SCH	BNCOC, SELF, SCH

*New training assignments different from previous assignment

Task Characteristic Worksheet No. 138

MOS 130

System Associated with CONCEPTUAL

Task Type REL

Task Number	Task	Exist Freq	New Freq	Difficulty	Importance	Initial Training Location		Advanced Training Location	
						Exist	New	Exist	New
061270 1468	Replace solenoid or combined solenoid and rammer control valve	3	2	MOD	YES	138U6	45D10	SOJT, SELF, SCH	SOJT, SELF, SCH
061270 1474	Repair cab/turret wiring harness	3	2	MOD	YES	138U6	45D10	SOJT, SELF, SCH	SOJT, SELF, SCH

*New training assignments different from previous assignment

Table C3.1 Task Characteristic Worksheets - A (continued)

Task Characteristic Worksheet No. 41C-1

Task Type REL System Associated with CONCEPTUAL

MOS 41C

Task Number	Task	Exit Freq.	New Freq.	Difficulty	Importance	Initial Training Location		Advanced Training Location	
						Exist	New	Exist	New
091 41C 1401	Perform torque inspection of collimator M1	4	3	MOD	YES	AIT	AIT	FOJT	FOJT
091 41C 1403	Charge infinity collimator M1 with nitrogen	4	3	MOD	YES	AIT	AIT	FOJT	FOJT
091 41C 2404	Replace rheostat in remote control light source of collimator	4	3	MOD	YES	AIT	AIT	FOJT	FOJT
091 41C 1445	Repair aiming posts	4	3	MOD	YES	AIT	AIT	FOJT	FOJT
091 41C 1571	Troubleshoot cross-level mechanism in fire control quadrant	4	3	VERY	YES	AIT	AIT	FOJT	FOJT
091 41C 2572	Replace bent wormshaft in fire control quadrant M15	4	3	MOD	YES	AIT	AIT	FOJT	FOJT
091 41C 1580	Troubleshoot panoramic telescope	4	3	VERY	YES	AIT	AIT	FOJT	FOJT
091 41C 1581	Charge panoramic telescope M115 with nitrogen	4	3	MOD	YES	AIT	AIT	FOJT	FOJT
091 41C 1582	Replace cracked lens in eye piece of panoramic telescope	4	3	MOD	YES	AIT	AIT	FOJT	FOJT
091 41C 1600	Install telescope mount M145 in M109	4	3	MOD	YES	AIT	AIT	FOJT	FOJT
091 41C 1601	Synchronize telescope mount M145 in M109	4	3	MOD	YES	AIT	AIT	FOJT	FOJT

*New training assignments different from previous assignment

Table C31 Task Characteristic Worksheets - A (continued)

Task Characteristic Worksheet No 45L C1

Task Type REL System Associated with CONCEPTUAL

MODS 45C

Task Number	Task	Exist. Freq.	New Freq.	Diffi- culty	Import- ance	Initial Training Location		Advanced Training Location	
						Exist	New	Exist	New
091 45L 1X09	Operate the Hall Effect proximity switches in ESPAWS autolander	4	3	MOD	YES	(NAVY)	642ASIX1	(NAVY)	SOJT, SELF, SCH
091 45L 1X10	Test operation of latching relay circuit, and solenoid driver circuit cards	4	3	MOD	YES	(NAVY)	642ASIX1	(NAVY)	SOJT, SELF, SCH

*New training assignments different from previous assignment

Table C-3: Task Characteristic Worksheets - A (concluded)

Task Characteristic Worksheet No. 83C-C-1

MOS 63C

System Associated with CONCEPTUAL

Task Type REL

Task Number	Task	Exist. Freq	New Freq	Diffi- culty	Import- ance	Initial Training Location		Advanced Training Location	
						Exist	New	Exist	New
041 63C 1685	Remove an M109 howitzer power plant	4	3	VERY	YES	AIT	AIT	FOJT	FOJT
041 63C 1712	Remove and replace coolant radiator on M109 A1 howitzer	4	3	MOD	YES	AIT	AIT	FOJT	FOJT
041 63C 1696	Remove and replace air cleaners on M109 A1 howitzer	5	4	MOD	YES	AIT	AIT	FOJT	FOJT
041 63C 1729	Remove and replace starter on an SV71T engine	4	3	MOD	YES	AIT	AIT	FOJT	FOJT

*New training assignments different from previous assignment

associated with a particular MOS. For each REL task, the following information is listed: (1) task number (2) the existing frequency with which the task is performed, (3) the estimated difficulty of the task (4) the estimated importance of the task, (5) the initial and advanced training locations for the existing task and (6) the initial and advanced training locations for the task with its new frequency.¹

C3.2 Task Characteristic Worksheets B

Table C3-2 provides an example of the type of detailed worksheets that were used to describe the task characteristics of the additional tasks or the tasks requiring major modification. To save space, only one example of these worksheets is provided. (The number of these worksheets is quite large.) Each worksheet has two pages. The first page lists the modified or additional task being described and the comparable existing task used in deriving this new task. For both the new and comparable task, the following information is listed (1) task number (2) skill level, (3) initial and advanced training locations, (4) associated media, (5) the frequency, difficulty, importance and duration (optional) of the task and (6) special support equipment, tools, etc., associated with the task.²

¹ The term "existing frequency" only refers to the current Army frequency when one is dealing with reference REL tasks, however, for conceptual REL tasks, it refers to the frequency with which the reference tasks were performed. This latter frequency may not be equal to the current task frequency if the frequency of the reference task itself changed.

Table C3-2. Task Characteristic Worksheet B – Example.

Task Characteristic Worksheet No.	46L R/A			
Task Type	REL	MOD	ADD	X
System Associated with	REF	X		
Associated Design Change Numbers	NA		Conceptual	X
Associated Subsystem	MOS			
ESPAMS Autoloader	46L			

Task Number	Task	Skill Level	Initial Training Location	Additional Training Location	Associated Media	Frequency	Difficulty	Importance	Duration (Optional)	Associated Support/Task Equip., Tools
091 451 1200	Isolate faults in the host of the MK-200 Autoduplex	1	042/ASIX1	SOJT Self. Sch.	TBD	MOD.	MOD.	Yes	-	Multimeter

COMPARABLE TASK DATA

N/A	TroubleShoot the 5'75d MK42 MOD 10 Upper Noisi MK2	2	Navy Course A 113 0044	OJT		MOD.	MOD.	Yes		Multimeter
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Table C3.2 (continued)

Task Characteristic Worksheet B -- Example

SKILLS AND KNOWLEDGES ASSESSMENT

- 1 Relevant skills and knowledges from comparable task:
 - 1.1 Perform voltage checks with a multimeter
 - 1.2 Perform circuit continuity checks with a multimeter
 - 1.3 Describe Principles of hydraulic operation
 - 1.4 Describe general safety precautions
- 2 Additional skills and knowledges required:
 - 2.1 Describe mechanical functioning of the hoist
 - 2.2 Describe hydraulic functioning of the hoist
 - 2.3 Describe control circuits functioning of the hoist
 - 2.4 Identify the steps and step sequence for testing the hoist
 - 2.5 Identify correct test results
 - 2.6 Analyze the hoist test results
 - 2.7 Identify hoist information in the MKxxx autoloader reference manuals
 - 2.8 Identify relevant circuit card inputs and outputs
 - 2.9 Identify autoloader hoist specific safety precautions
 - 2.10 Perform parts replacement and removal

Page two of the task characteristics worksheets-B lists the relevant skills and knowledges required by the new task. These skills and knowledges are broken down into categories: (a) those which are equivalent to the skills and knowledges associated with the comparable task and (b) the additional skills and knowledges required by the new task.

² The media associated with each task are not listed in the example because the media associated with the modified or additional tasks were not identified in this phase of the ESPAWS study.

APPENDIX C4

COURSE MODIFICATION/DEVELOPMENT WORKSHEETS

This appendix describes the worksheets that were used in modifying existing courses and developing new courses. The appendix is divided into two sections. The first section describes the worksheets used in modifying existing courses while the second section describes the worksheets used in developing new courses.

C4.1 Course Modification Worksheets

Three courses were modified for the ESPAWS reference/conceptual systems: Field Artillery Crewman Course (041-13B10); the FADAC Course (101-ASIF7) which was modified to develop the ESPAWS computer course (101-ASIX1); and the Field Artillery Turret Mechanic Course (643-45D10). The modified course developed for the reference system were again used in the conceptual system without further modification because no significant difference between the reference and conceptual system tasks was projected. Tables C4-1, C4-2, and C4-3 list the course modification worksheets for each of the three modified courses.

Each of the course modification sheets lists all of the course modules/elements from the existing course and the additional course modules/elements required to meet the task, skill, and knowledge requirements of the equipments associated with the projected course. For each course element, the following information is listed (1) hours of instruction for the course element in the projected course, (2) hours of instruction for the course element in the

Table C4 1 Course Modification Worksheet
Reference: Conceptual

Course 041:13810 MOS 13B

Proposed Course/Elements	Hours	Type of Instruction	Current Hours	Current Types of Instruction	Modifies/Courses Used to Project Added Modules	Related Tasks
School of Soldier	78		78			
Weapon Training	65		65			
Combat Skills and Tech	117		117			
Artillery Common	70		70			
Self-Propelled Track						
o Intro to Self Prop	(1)	1C	(1)	1C		
o Prepare Cannon Ammunition for Firing*	(2)	2PE1	(2)	2PE1	Prepare cannon ammunition for firing	061 266 1506 (MOD) 061 266 1504 (ADD)
o Introduction to PM/LO	(2)	2SC, 175PE1	(2)	2SC, 175PE1		061 270 1514 (MOD), 061 266 1218 (IMX)
o Operation of Power/Ranger Breach*	0		0	2.0 PE1	Operation/Function of Autoloader	061 266 1218 Manual (DEL)
o Operation/Function of Autoloader*	(2)	2.0PE1	0	0		
o Fire Control Equip	(2)	2.0PE1	(2)	2.0PE1		
o Missile Break and Chamber	(2.5)	2.5PE1	(2.5)	2.5PE1		
o Duties of Gunner*	(3.0)	3.0PE1	(4)	4.0PE1		061 270 1514 (MOD), 061 266 1219 (DEL)
o Intro to 50 CAL MG	(2.0)	2.0PE1	(2.0)	2.0PE1		061 270 1514 Manual (DEL)
o FAM Firing 50 CAL	(6.0)	6.0PE1	(6.0)	6.0PE1		
o Safety Procedures	(1.0)	1.0C	(1.0)	1.0C		
o RSUP*	(9)	9.0C	(11)	11.0C		
o Maintenance*	(22)	22PE1	(20)	20PE1		
o Operation of Land Navigation System and Fire Control Comp*	(3)	3PE1	(0)			061 266 1101 (IMX), 061 266 1701 (IMX), 061 266 1702 (IMX)
o M110	(57)	9.3C, 47.7PE1	(57)	9.3C, 47.7PE1		016 270 1X08 (ADD), 061 270 1X 1 (ADD)
Exam	(3.5)	3.5E1	(3)	3.0E1		061 270 1X08 (ADD), 061 270 1X11 (ADD)
Subtotal (SP Track)	78.5		76			
Non-academic	51		51.0			
Total	500.0		497.5			
Training Time (week)	12.5 weeks		12.4 weeks			
		Instructional Breakdown C/E3 - 50.75 PE1 - 396.75		Instructional Breakdown C/E3 - 50.25 PE1 - 396.75		

Table C42. Course Modification Worksheet
Reference: Conceptual

Reference, Conceptual	Course	101 ASIX1	MOS	31V		
Projected Course Elements	Hours	Type of Instruction	Current Hours	Current Type of Instruction	Module(s)/Courses Used to Properly Address Modules	Related Tests
CR271W Introduction to digital computers	1.7	14D, 3F	1.7	14D, 3F	Introduction to digital computers	113 70X 1X08 113 70X 1X11 net 113 70X 1X12
CR27AC Introduction to M18 Gun* Direction Computer Maintenance	0		8.4	1C, 24TV, 5PE1	CR27AC	Delete
Introduction to ESPAWS Computer Field Maintenance*	8.4	1C, 24TV 5PE1	8.4	1C, 24TV, 5PE1	Introduction to M18 Gun Direction Computer Maintenance	113 70X 1X08 113 70X 1X10 113 70X 1X11
CR27AD M18 Computer Power* Control Circuits Repair of Communications* Data Link to ESPAWS Computer	0 10	18C, 82PE1	5 5	9C, 41PE1 9C, 41PE1	CR27AD M18 Computer Power Control Circuits	Delete 113 70X 1X08 113 70X 1X10 and 15 hrs
CR27AU Operational Check of M18 Computer* Proper removal and replacement* procedures of an ESPAWS Computer	0 7.5	8C, 67PE1	7.5 7.5	8C, 67PE1 8C, 67PE1	CR27AU Operational Check of M18 Computer	113 70X 1X11
CR27AO Diagnostic Logic Troubleshooting	9	9D	.9	9D	CR27AO Diagnostic Logic Troubleshooting	113 70X 1X12 Net
CR27AS ESPAWS Computers Troubleshooting*	22.9	9D, 27PE1	22.9	9D, 27PE1	CR27AS M18 Computer Troubleshooting	113 70X 1X13 Net
CR2702 Examination	7.5	75E1	7.5	75E1	CR2702 Examination	Examination
Sub Arms A2 M18 Radar Chromograph Maintenance	0					
Total Academic	58.9		95.4			
Hypertraining	8.0		8.0			
Outprocessing	8.0		8.0			
Commandant's Time	6		6			
Total Nonacademic Time	18.6		18.6			
Total	75.5		112			
Training Time 1+ Weeks	189 weeks		2.8 weeks			
		Instructional Breakdown PE1 - 41.9 TV - 2.4 D - 3.2 C - 3.6 F - 3 PI - 7.5		Instructional Breakdown PE1 - 57.8 TV - 2.6 D - 5.4 C - 7.7 F - 3 PI - 19.2 PI - 2.4		

Table C4.3 Course Modification Worksheet
Reference: Conceptual

Course 643 4510 MOS 460 (13846)

Projected Course/Elements	Hours	Type of Instruction	Current Hours	Current Types of Instruction	Modules/Courses Used to Project Affiliated Modules	Related Tasks
Organizational Maintenance	23	8 TC, 14TV, 16PE1, 78PE3, 10PE2, 100D, 2E1, 4TF	23	8 TC, 14TV, 16PE1, 78PE3, 10PE2, 20E1, 4TF		
M110 Series Howitzer	29	32C, 204PE1, 20PE3, 3E1, 4TV	29	32C, 204PE1, 20PE3, 3E1, 4TV		
Miscellaneous Subjects	13	25C, 10PE1, 5TF	13	25C, 10PE1, 5TF		
ESPANS Howitzer						
Perform Main of Breach Mech	(6)	6C, 52PE1, 2PE3	(6)	6C, 52PE1, 2PE3		
Remove/Install Breach Block	(6)	5C, 53PE1, 2PE3	(6)	5C, 53PE1, 2PE3		
Adjust Operating CAM	(4)	4C, 34PE1, 2PE3	(4)	4C, 34PE1, 2PE3		
Pure Fire Control Inst *	(1)	10C	(5)	5C, 42PE1, 3PE3		061 266 1452(DEL)
Remove/Install Tel Mount (M145)	(6)	5C, 52PE1, 3PE3	(6)	5C, 52PE1, 3PE3	Perform Fire Control (M109) 643 4510	
Adjust Telescope Mount	(10)	15C, 4TV, 78PE1, 3PE3	(10)	15C, 4TV, 78PE1, 3PE3	Replace Hydraulic Comp (M109) 643 4510	061 272 1X02(ADD)
Replace Hydraulic Components *	(10)	13C, 82PE1, 5PE3	(4)	5C, 33PE1, 2PE3		
Perform Slip Ring Contact Maint	(10)	15C, 4TV, 78PE1, 3PE3	(10)	15C, 4TV, 78PE1, 3PE3		
Troubleshoot Elec Systems *	(20)	19C, 178PE1, 5PE3	(18)	15C, 14 PE1, 4PE3	Troubleshoot Elec Systems (M109) 643 4510	061 270 1488(MOD), 061 272 1X03(ADD)
Repair Antilaser *	(8)	8C, 67PE1, 5PE3			Replace Rammer Trav Mech (M110) 643 4510	061 270 3436(MOD), 061 272 1X01(ADD)
Exam *	(11)	11E1	(9)	9E1		061 272 1X04(ADD), 061 272 1X05(ADD)
Subtotal (M109)	92		76	16E1		061 272 1X06(ADD)
End of Course Exam *	170	170E1	16			
Total Academic	174		157			
In/Output Processing	8		8			
Physical Cond	12		12			
Threat Time	8		8			
Commandant's Time	8		8			
Total Nonacademic	36	36				
Total	210		192			
Training Time Weeks	52 wks		48 wks			
		Instruction Time Breakout			Instruction Time Breakout	
		C 238			C 213	
		D 10			D 10	
		F 8			F 8	
		PE1 995			TV 26	
		PE2 10			PE1 886	
		PE3 122			PE2 10	
		E1 330			PE3 118	
					E1 300	

projected course broken down by instructional method, (3) hours of instruction for the course element in the existing course, and (4) hours of instruction for the course element in the existing course broken down by instructional method. In addition, for all modified, or additional course elements (identified by stars in the table), the sheets list the existing modules used to develop these modules, the courses associated with these existing modules, and the reference/conceptual tasks related to these modules.

At the bottom of each sheet, total academic hours, nonacademic hours, and total training time both in hours and weeks, are listed along with a breakdown of the total academic hours by instructional method for both the existing and projected course.

C4.2 Course Development Sheets

Two completely new courses were developed for the ESPAWS reference/conceptual system: ESPAWS Land Navigation Computer Maintenance Course (101-ASIX2) and the ESPAWS Autoloader Maintenance Course (642-ASIX1). As with the modified courses, the new courses developed for the reference system were used again in the conceptual system without modification. Tables C4-4 and C4-5 list the course development worksheets for each of the two new courses.

The course development worksheets list the course elements/modules projected for the new courses. Along with the following information associated with each course module: (1) The total instructional hours for each module, (2) the instructional hours for each element broken down by instructional method, (3) the student instructor ratio

Table C4.4. Course Development Worksheet

Course 042 ASIX1 ESPAWS Autoloader

Course Module	Hours	Type Instruction	S/I Ratio	Relevant Modules from Existing Course				Reference	Conceptual	X
				Module	Hours	Type Inst	S/I Ratio			
1 Identify Autoloader Components	1.7	BC 1.2D	1.20 1.20	MK42 MOD941G Gunner's Mate School Operate Gun Mount 5'64 MK42 Mod 9 & 10 Gun Loading System in Load Mode.	NA	NA	NA	A 113 0044 (Navy Course)	091 451 1X01.2.3.4.5. 6.7.8.9 091 451 1X01.2.3.4.5.6. 7.8.9.10 091 452 1X01 091 452 1X03	
2 Follow Ammunition Handling, Electrical Personnel, and Hydraulic Safety Procedures	1.9	1.0C	1.20							
3 Identify the control panel switches and indicators and describe their purpose/function	1.4	1.4D	1.20							
4 Operate the MK42 Automatic Loading System	2.8	8D 1PE1 1E1	1.20 1.6 1.6							
5 Perform Preventive Maintenance	11.5	2.3PE1 2.3PE1 2.3PE1 2.3PE1 2.3PE1	1.6 1.6 1.6 1.6 1.6	MK42 MOD9610 Gunner's Mate School Perform planned maintenance on gun mount 5'64 MOD9610	NA	NA	NA	A 113 0044	091 451 1X010	
6 Test the operation of the Hall Effect proximity switches used in the MK42 control circuits	2.3	4C 1PE1 9E1	1.20 1.6 1.6	MK42 MOD9610 Gunner's Mate School Describe the operation of the Hall Effect proximity switches	NA	NA	NA	A 113 0044	091 451 1X010	
7 Test the operation of the latching relay circuit, surge circuit, and driver circuit each with the circuit load tester 13xxx	3.4	5D 2PE1 9E1	1.20 1.6 1.6	09 451 3412 Use electric drive control test set to isolate malfunctioning components of turret electrical system of AR(AU)651	NA	NA	NA	A 113 0044	091 451 1X011	
8 Diagnose faults in the automatic loader MK42 Loader Drums	2.1	25PE1 2E1 4C	1.6 1.6 1.20	MK42 MOD9610 Gunner's Mate School Troubleshoot the 5'64 MK42 MOD10 loader drums	NA	NA	NA	A 113 0044	091 451 1X03	
9 Identify and correct mechanical faults in the loader drum components	1.6/	1.2D 2E1	1.20							
10 Identify and correct faults in the MK42 loader drum hydraulic circuits	3.1	1C 21PE1	1.20 1.6							
11 Identify and correct faults in the electrical control circuits	4.1	1C 31PE1	1.20 1.6							
12 Diagnose faults in the MK42 Host	7.03	2.5PE1 2E1 1C 1.53PE1	1.6 1.6 1.20 1.6	Troubleshoot the 5'64 MK MOD10 upper host MK2	NA	NA	NA	A 113 0044	091 451 1X04	
13 Identify and correct faults in the host		1C	1.20							
14 Identify and correct faults in the MK42 host electrical control circuits	2.53	1C	1.20							
15 Identify and correct faults in the MK42 host hydraulic functions	2.83	83C 20PE1	1.6 1.6							

Table C4.4. Course Development Worksheet.

Course 642 ASIX1 FSPAWS Antitank

MOS 45LX1 Reference X Conceptual X

Course Module	Hours	Type Instruction	S/I Ratio	Relevant Modular from Existing Course			S/I Ratio	Course	Related Task Numbers
				Module	Hours	Type Inst			
10 Isolate faults in the automatic loader MK4xx and cradle a. Identify and correct mechanical faults in the loader components b. Identify and correct faults in the cradle hydraulic circuits c. Identify and correct faults in the cradle electrical control circuits	4.0 3.0 4.15 3.33	2SPE1 2E1 1C 1PE1 9C 3.25PE1 83C 2.5PE1	1:6 1:6 1:20 1:6 1:20 1:6 1:20 1:6	MK42 MOD98/10 Gunner's Mate School Troubleshoot the 5"/54 MK42 MOD10 cradles	NA	NA	NA	A 113 0044	091 451 1X06
11 Isolate faults in the automatic loader MK4xx transfer trays a. Identify and correct mechanical faults in the transfer tray b. Identify and correct faults in the transfer tray hydraulic circuits c. Identify and correct faults in the transfer tray electronic control circuits	4.5 3.3 3.34 3.33	2SPE1 2DE1 83C 2.47PE1 2.0C 1.34PE1 83C 2SPE1	1:6 1:6 1:20 1:6 1:20 1:6 1:20 1:6	MK42 MOD98/10 Gunner's Mate School Troubleshoot the MK42 MOD10 transfer trays	NA	NA	NA	A 113 0044	091 451 1X06
12 Isolate faults in the automatic loader MK4xx Rammer a. Identify and correct faults in the rammer hydraulic circuits b. Identify and correct faults in the rammer electronic control circuits	4.5 3.34 3.33	2SPE1 2DE1 85C 2SPE1 2.0C 1.34PE1 83C 2SPE1	1:6 1:6 1:20 1:6 1:20 1:6 1:20 1:60	MK42 MOD98/10 Gunner's Mate School Troubleshoot the 5"/54 MK42 MOD10 rammer MK2 MOD3	NA	NA	NA	A 113 0044	091 451 1X07
13 Isolate faults in the MK4xx Slide a. Identify and correct mechanical faults in the slide components b. Identify and correct faults in the slide hydraulic circuits c. Identify and correct faults in the slide electronic control circuits d. Identify the functions of the slide pneumatic circuits	6.93 1.66 1.66 1.66 9	2SPE1 2DE1 83C 1.8PE1 83C 83PE1 83C 5C 4PE1	1:6 1:6 1:20 1:6 1:20 1:6 1:20 1:6 1:6	MK42 MOD98/10 Gunner's Mate School Troubleshoot the 5"/54 MK42 MOD10 Slide MK31 MOD3	NA	NA	NA	A 113 0044	091 451 1X08
Academic Total	105								
14 Improving	8								
15 Outfitting	8								
16 Commander's Time	12.6								
Practical Time	133.6								
Training Time in Weeks	3 weeks 2 days								
Instruction Type Breakdown									
C 20.8									
D 3.8									
PE1 66.3									
ET 14.1									

Table C4.5 Course Development Worksheet

Course Module	Hours	Type Instruction	S/N Ratio	Relevant Modules from Existing Course				Reference	Conceptual	Y
				Module	Hours	Type Init.	S/N Ratio			
Introduction to the principles of the Land Navigation System	1.0	1C	-	Course Introduction	1.0	1C	-	101 31V10		113 80X 1X01 thru 113 80X 1X07
Introduction to the LNSX Test Set	4.5	3.8PE1 .7PE3	1:8 1:20	CR26 HE Evaluate Operation of AN/VRC-12 Radio Set	4.5	3.8PE1 .7PE3	1:8	101 31V10		113 80X 1X01 thru 113 80X 1X06
Test LNS Equipment Signal Flow with the LNSX Test Set	8	2SP 8PE2 1E2	1:20 1:8 1:8	34G10L-2 Student will trace FADAC wiring	8	2SP 8PE2 1E2	1:20 1:8 1:8	113 34G10		113 80X 1X01 thru 113 80X 1X07
Test LNS Altitude Control Loop/Controls	5.3	4.5PE1 .8PE3	1:8 1:20	CR28HC Troubleshoot AN/VRC-12 Series Radio Power Input Circuit	5.3	4.5PE1 .7PE3	1:8 1:20	101 31V10		113 80X 1X02
Test LNS Operational Modes	10.0	3.0SP 6.0PE2 1.0E2	1:20 1:8 1:8	34G10L-4 FADAC Power Supplies, functional diagrams, function, inputs	10.0	3SP 6PE2 1E2	1:20 1:8 1:8	113 34G10		113 80X 1X03
LNSX Test Set Troubleshooting and Inspection Laboratory	66.0	4.0SP 57.5PE1 4.5E1	1:20 1:8 1:8	34G10K6 FALK Test Set Troubleshooting Laboratory	66.0	4.0SP 57.5PE1 1.6E1	1:20 1:8 1:8	113 34G10		113 80X 1X04 113 80X 1X06 113 80X 1X07
Total Academic	94.8									
Imaging	8.0									
Outprocessing	8.0									
Commandant's Time	1.2									
Total Training Time	112.0									
	2.8 weeks									
Instructional Breakdown										
SP 9.0										
C 1.0										
PE1 65.8										
PE2 11.0										
PE3 1.5										
E1 4.5										
E2 2.0										

associated with each instructional method, (4) relevant course modules from existing courses used in developing the projected course module, (5) instructional hours for the existing modules broken down by instructional method along with their associated student instructor ratios, where applicable, and (6) the course(s) from which existing module(s) were taken¹.

¹ Instructional hours and student instructor ratios were not listed for the Navy course modules used in developing the 642-ASIX1 course since the Navy classification scheme for instructional methods is different from that used in the Army. The Navy version of this course uses conference or C1 as the primary type of instruction. DRC has noted a tendency for the Army training to be performance based to a greater extent than comparable Navy courses. Adjustments were made for this tendency in assigning the number of hours for each type of instruction in the 642-ASIX1 course.

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APPENDIX C5
DETERMINATION OF NUMBER OF INSTRUCTORS

Estimation of the number of instructors associated with the system-specific ESPAWS courses was determined by applying a modified version of the instructor determination algorithm listed in the Staffing Guide for U.S. Army Service Schools (DA PAM 570-558). Basically, this algorithm was modified to make total instructor contacts hours a direct function of the number of students taking the course (which is determined by the number of students taking the course and the optimum class size).

C5.1 Instructor Determination Algorithm

The final modified algorithm used to determine ESPAWS instructor requirements was as follows.

$$NINS = \left(\frac{ICH}{OC} \times NREP \right) \div 1250$$

where NINS is the number of instructors required for the course; ICH is the total instructor contact hours associated with the course, OC is the optimum class size for the course, NREP is the number of personnel taking the course and 1250 is the annual amount of instructor contact specified for an instructor in DA PAM 570-558.

Tables C5-1, C5-2, and C5-3 display the input values and calculations associated with the determination of instructors for each of the system-specific courses in the

Table C5-1. Predecessor Instructor Determination Worksheet

MDS	Course Number	Course	(A) Total ICH per Class	(B) Optimum Class Size	(C) ICH Per Student (A - B)	(D) Number of Students	(E) Total ICH (C) x (D)	Number of Instructors (E) - 1250
13B (45D)	041-13B10	Field Artillery Crewman	2741.5	40*	68.5	9243	633145.5	506.5
31V	643-45D10 (MOD)	Field Artillery Turret Mechanic	479.2*	20*	24	N/A	-	-
	101-31V10	Tactical Communications Systems Operator	2166.7	35	61.9	N/A	-	-
41C	670-41C10	Fire Control Instrument Repair	2116.4	14	151.1	39	5892.9	4.7
44B	700-44B10	Metalworker	1326.0	18	73.7	47	3463.9	2.8
45K	643-45K10	Tank Turret Repair	1166.8	18	64.8	333	21578.4	17.3
45L	642-45L10	Artillery Repair	914.3	14	65.3	114	7444.2	6
45L	642-ASIX1	ESPAWS Autoloader	291.5	20*	14.6	NA	-	-
31V	101-ASIX1	ESPAWS Computer	172.45	20*	8.6	NA	-	-
31V	101-ASIX2	ESPAWS Land Navigation System	286.39	20**	14.3	NA	-	-
63B	610-63B10	Power Generation and Vehicle Mech.	991.9	20*	49.6	NA	-	-
63C	611-63010	Track Vehicle Mechanic	347.9*	20*	17.4	62	1078.8	.9
13B	041-ASIU6	Field Artillery Weapons Mechanic Course	1253.2	40	31.33	73	2287.09	1.8
13B	041-13B10 (MOD)	Field Artillery Crewmen (MOD)	2756	40*	68.9	NA	-	-

Table C5-2. Reference Instructor Determination Worksheet

MOS	Course Number	Course	(A) Total ICH per Class	(B) Optimum Class Size	(C) ICH Per Student (A - B)	(D) Number of Students	(E) Total ICH (C) x (D)	Number of Instructors (E) - 1250
13B (45D)	041-13B10	Field Artillery Crewman	2741.5	40*	68.5	NA	-	-
31V	643-45D10 (MOD)	Field Artillery Turret Mechanic	479.2*	20*	23.96	832	19934.72	15.9
	101-31V10	Tactical Communications Systems Operator	2166.7	35	61.9	NA	-	-
41C	670-41C10	Fire Control Instrument Repair	2116.4	14	151.1	39	5892.9	4.7
44B	700-44B10	Metalworker	1326.0	18	73.7	47	3463.9	2.8
45K	643-45K10	Tank Turret Repair	1166.8	18	64.8	450	29160	23.3
45L	642-45L10	Artillery Repair	914.3	14	65.3	228	14888.4	11.9
45L	642-ASIX1	ESPAWS Autoloader	291.5	20*	14.6	66	963.6	.8
31V	101-ASIX1	ESPAWS Computer	172.45	20*	8.6	798	6862.8	5.5
31V	101-ASIX2	ESPAWS Land Navigation System	286.39	20**	14.3	798	11411.4	9.1
63B	610-63B10	Power Generation and Vehicle Mech.	991.9	20*	49.6	NA	-	-
63C	611-63C10	Track Vehicle Mechanic	347.9*	20*	17.4	62	1078.8	.9
13B	041-ASIU6	Field Artillery Weapons Mechanic Course	1253.2	40	31.3	NA	-	-
13B	041-13B10 (MOD)	Field Artillery Crewmen (MOD)	2756	40*	68.9	5112	352216	281.8

Table C5-3. Conceptual Instructor Determination Worksheet

MOS	Course Number	Course	(A) Total ICH per Class	(B) Optimum Class Size	(C) ICH Per Student (A - B)	(D) Number of Students	(E) Total ICH (C) x (D)	Number of Instructors (E) - 1250
13B (45D) 31V	041-13B10 643-45D10 (MOD) 101-31V10	Field Artillery Crewman Field Artillery Turret Mechanic Tactical Communications Systems Operator	2741.5* 479.2* 2166.7	40* 20* 35	68.5 24. 61.9	NA 160 152	- 3840 9408.8	- 3.1 7.5
41C 44B 45K 45L 45L 31V 31V	670-41C10 700-44B10 643-45K10 642-45L10 642-ASIX1 101ASIX1 101ASIX2	Fire Control Instrument Repair Metalworker Tank Turret Repair Artillery Repair ESPAWS Autoloader ESPAWS Computer ESPAWS Land Navigation System	2116.4 1326.0 1166.8 914.3 291.5* 172.45* 286.39*	14 18 18 14 20* 20* 20**	151.1 73.7 64.8 65.3 14.6 8.6 14.3	39 47 450 271 37 798 578	5892.9 3463.9 29160 176963 540.2 6862.8 8265.4	4.7 2.7 23.3 14.2 .4 5.5
63B	610-63B10	Power Generation and Vehicle Mech	991.9*	20*	49.6	NA	-	-
63C 13B	611-63C10 041-ASIU6	Track Vehicle Mechanic Field Artillery Weapons Mechanic Course	347.9* 1253.2	20* 40	17.4 31.3	62 NA	1078.8 -	9 -
13B	041-13B10 (MOD)	Field Artillery Crewmen (MOD)	2756*	40*	68.9	5741	395554.9	316.4

ESPAWS predecessor reference, and conceptual systems respectively. The number of replacement personnel on these sheets was obtained directly from the analyses conducted in Section 8.3.3. For existing courses with readily available data, instructor contact hours per class (ICH) and optimum class size were obtained from the instructor contact hour summary on the TRADOC Form 377-R associated with the course.

Forms for some of the existing courses were not received in time to be utilized in this study. For existing course with missing data and for newly developed or modified courses, the optimum class size was assumed to be twenty except for the 13B AIT/OSUT course where a class size of forty was used. The value of twenty for the optimum class size was selected for most courses because it appeared to be about the average optimum class size (based on the rather small sample which DRC had available). A larger value of forty was selected for the 13B AIT/OSUT course because it was an OSUT course and these courses tended to have higher optimum class sizes. Actually, the selection of optimum class size is arbitrary since it is cancelled out by the optimum class size factor in the instructor contact hour determination algorithm described below. It is included to provide results that more closely resemble the step-by-step results listed in DA PAM 520-558.

Instructor contact hours for the modified or newly developed courses or existing courses with missing data were determined utilizing the algorithm determined in the next section.

C5.2 Instructor Contact Hours Determination

The algorithm used to determine contact hours for a given course was as follows

$$\sum_{I=1}^T H_i \times \frac{OC}{SI_i}$$

where T is the number of different types of instructional methods used in the course; H_i is the number of hours associated with the i th method, OC is the optimum class size and SI is the student instructor ratio for the i th instructional type.

Using the formula described above, instructor contact hours for both the modified or newly developed ESPAWS courses and the existing courses which lacked available data were determined. Table C5-4 summarizes the calculations associated with the application of this algorithm. The student instructor ratio for the instructional types were taken directly from the recommended values listed in DA PAM 570-558. The hours associated with each instructor type were either taken directly from the POI (for existing courses) or the course development/modification worksheets (for modified or newly developed courses).

Table C5-4. Determination of Instructor Contact Hours

<u>Course</u>	<u>Inst. Type</u>	<u>S/I Ratio</u>	<u>Optimum Class Size</u>	<u>Hours</u>	<u>ICH per Type</u>
643-45D10	C	20	20	23.8	23.8
	D	20	20	1.0	1.0
	F	20	20	.9	.9
	TV	20	20	2.6	2.6
	PE1	6	20	99.5	326.7
	PE2	6	20	1.0	3.3
	PE3	20	20	12.2	12.2
	E1	6	20	33.0	108.9
					479.4
611-63C10	C	20	20	.5	.5
	F	20	20	.5	.5
	TV	20	20	.5	.5
	PE1	6	20	11.5	37.9
	SP	20	20	251.7	251.7
	E1	20	20	57.3	57.3
					347.9
611-63B10	C	20	20	17.5	17.5
	D	20	20	1.0	1.0
	PE1	6	20	189.3	625.7
	PE2	6	20	3.5	11.5
	PE3	20	20	4.0	40.0
	E1	6	20	51.3	171.0
	E2	6	20	2.5	8.3
	E3	20	20	.7	.7
	F	20	20	.5	.5
	SP	20	20	115.7	115.7
					991.9
041-13B10	C/E3	20	40	50.75	101.5
	PE1	6	40	398.25	2655.0
					2756
041-13B10 (MOD)	C/E3	20	40	50.25	100.5
	PE1	6	40	396.25	2641.0
					2741.5
101ASIX1	PE1	6	20	41.9	138.2
	TV	20	20	2.4	2.4
	D	20	20	3.2	3.2
	C	20	20	3.6	3.6
	F	20	20	.3	.3
	E1	6	20	7.5	24.75
					172.45

Table C5-4 (continued)

<u>Course</u>	<u>Inst. Type</u>	<u>S/I Ratio</u>	<u>Optimum Class Size</u>	<u>Hours</u>	<u>ICH per Type</u>
101ASIX2	SP	20	20	9	9.0
	C	20	20	1.0	1.0
	PE1	6	20	65.8	217.14
	PE2	6	20	11.0	36.3
	PE3	20	20	1.5	1.5
	E1	6	20	4.5	14.85
	E2	6	20	2.0	6.6
					<u>286.39</u>
642-ASIX1	C	20	20	20.8	20.8
	D	20	20	3.8	3.8
	PE1	6	20	66.8	220.44
	E1	6	20	14.1	46.5
					<u>291.54</u>

APPENDIX C6

COURSE COSTING WORKSHEETS

This appendix describes the procedures and input data which were utilized to determine training course costs for the ESPAWS predecessor, reference, and conceptual systems. The first section describes the specific calculations used in developing estimates of the cost per student for each individual course. The second section describes the specific calculations that were used to determine three additional measures of training course cost (average individual training cost, replacement personnel training cost, and cumulative personnel training cost).

C6.1 Determination of Individual Course Costs

Estimates of the cost per student for existing courses were determined directly from MOS Training Cost Handbook. Estimates of the cost per student for modified or newly developed courses were determined by identifying a comparable existing course, obtaining relevant cost data on the existing course from the MOS Training Cost Handbook, and modifying this cost data to reflect differences between the course lengths of the existing and projected course. Table C6-1 displays the algorithm that was used in modifying the cost data of the comparable course. Basically, this algorithm reduces (increases) the variable Military Personnel, Army (MPA) appropriation portion of the existing course costs in direct proportion to percentage decrease (increase) in course length associated with the projected

Table C8-1. Algorithm Used in Determining Course Cost per Student for Modified Courses.

$$\frac{CL(NEW)}{CL(EXIST)} \times \frac{VMFA(EXIST) - VMFA(EXIST) + CPS(EXIST) = CPS(NEW)}{CL(EXIST)}$$

CL(NEW)	=	Course length for modified or newly developed course
CL(EXIST)	=	Course length for existing course
VMFA(EXIST)	=	Variable military pay and allowances for existing course
OCPs(EXIST)	=	Overall cost per student for the individual course
CPS(NEW)	=	Overall cost per student for the modified or newly developed course

course. It then adds (subtracts) the obtained difference between the existing and projected variable MPA costs to the overall cost of the existing course¹.

Table C6-2 lists the specific calculations used in determining course cost per student for each of the modified or newly developed ESPAWS courses.

C6.2 Training Course Cost Measures

Four different training course cost measures were calculated: Individual Student Cost Per Course - the cost to train an individual in an particular course (the procedures for determining this measure were described in C6.1).

Average Individual Training Cost - the average individual provides an estimate of what it would cost to train one individual who completed all of the courses contained in the training path for a particular MOS. It is determined by the following equation:

$$\sum_{i=1}^n CPS_i W_i$$

where n is the number of courses in the training path; CPS is the cost per student for the ith course, and W_i is the percentage of personnel in the MOS taking that course within

¹ More sophisticated procedures for modifying existing course costs are currently being developed.

Table C6-2. Course Cost Modification Sheet.

Course: 642-ASIX1 Existing course used in estimation: 041-ASIU6 - Field Artillery Weapons Mechanic

$$\frac{CL(NEW)}{CL(EXIST)} = \frac{3.4}{5.0} \times \frac{MPA(EXIST) 1110 - VMFA 1110 + Course Cost (EXIST) 2274}{2274} = \text{New Course Cost } 1918.8$$

Course: 041-13B10 (MOD) Existing course used in estimation: 041-13B10

$$\frac{CL(NEW)}{CL(EXIST)} = \frac{12.5}{12.4} \times \frac{MPA(EXIST) 1537 - VMFA 1537 + Course Cost (EXIST) 4344}{4344} = \text{New Course Cost } 4356$$

Course: 101ASIX2 Existing course used in estimation: 101-ASIF7 - FADAC Mechanic

$$\frac{CL(NEW)}{CL(EXIST)} = \frac{2.8}{2.8} \times \frac{MPA(EXIST) 920 - VMFA 920 + Course Cost (Exist) 2351}{2351} = \text{New Course Cost } 2351$$

Course: 101-ASIX1 Existing course used in estimation: 101-ASIF7 - FADAC Mechanics

$$\frac{CL(NEW)}{CL(EXIST)} = \frac{1.89}{2.8} \times \frac{MPA(EXIST) 920 - VMFA 920 + Course Cost (EXIST) 2351}{2351} = \text{New Course Cost } 20.52$$

Course: 643-45D10 Existing course used in estimation: 642-45L10 - Artillery Repair

$$\frac{CL(NEW)}{CL(EXIST)} = \frac{5.2}{10.4} \times \frac{VMFA (exist) 3379 - VMFA 3324 + Course Cost (Exist) 9865}{9865} = \text{New Course Cost } 8200.5$$

the skill level in which the course is located. W_i will generally be one except for special system specific courses (e.g., ESPAWS computer course) which are only taken by a portion of the individuals in an MOS.

Replacement Personnel Training Cost - replacement personnel training cost for an MOS determined by the following equation:

$$\text{Replacement Cost} = \sum_{i=1}^n (\text{CPS}_i \times \text{NREP}_i)$$

Where CPS_i is the cost per student for the i th course and NREP is the number of replacement personnel taking that course.

Cumulative Personnel Training Costs - the cumulative personnel training cost for each course (CPER_i) provides an estimate of what it has cost to train all the individuals at a particular point in the career path from basic training up to, and including, that course. It is determined by the following equation:

$$\text{CPER}_i = \left(\sum_{j=1}^i \text{CPS}_j \times W_j \right) \times \text{NREP}_i$$

where CPER_i is the cumulative training cost for the i th course in the career path; CPS_j is the cost per student for j th course in the career path; W_j is the percentage of personnel in the MOS taking the j th course within the skill

level in which the i th course is located; and $NREP_i$ is the number of replacement personnel taking the i th course.

Table C6-3 displays the worksheets used to develop the four cost measures described above for the ESPAWS predecessor, reference, and conceptual systems. For each course in the training path, the following is listed: (a) the cost per student (CPS) - weighted costs are listed in parentheses, (b) the number of replacement personnel taking the course (NREP), (c) the replacement personnel costs for that path (axb), (d) the cumulative course costs (the sum of the course costs for that and all previous paths), and (e) the cumulative personnel training cost per course (bxd).

The Average Individual Training Cost is the sum of the weighted CPS costs in column A. The Replacement Personnel Training Cost is the sum of the costs in column C.

Table C6-3. Training Cost Worksheet.

MHS 128		Predecessor		Reference		Conceptual	
TRAINING COURSE COST							
(A) Paygrade/ Skill Level	(B) Course Number	(C) Course	(D) Course Cost	(E) No. of Replacement Personnel	(F) Replacement Personnel Training Cost (D) x (E)	(G) Cumulative Course Cost	(H) Cumulative Personnel Training Cost (F) x (G)
1	SCT	Basic Training	2999	9243	27,719,767	2999	27,719,767
1	Rec.	Recruits	261	9243	2,412,423	3260	30,132,190
1	041-13-010	Field Artillery Crewman	4344	9243	40,161,592	7604	70,283,772
1	LV-AD1	Leave/Administration	724	9243	6,691,932	8328	76,975,704
1	041 ASIUG	Field Artillery Weapons Mechanic	(2274)	73	166,002	(10602)	816,354
			18	(73) .008	(1314)	8346	(609,268)
2	04113630	Primary NCO	6209	1116	6,929,244	14555	16,243,390
3	BNOC88	Basic NCO	4114	640	2,632,960	18669	76,894,266
4	013C42	Advanced NCO	8864	28	250,712	27823	773,444
TOTAL			27,623		86,964,622		

Table C8-3. Training Cost Worksheet. (continued)

MOS	138	Professor	Reference	X	Conceptual	TRAINING COURSE COST		
(A) Paygrade/ Skill Level	(B) Course Number	(C) Course	(D) Course Cost	(E) No. of Replacement Personnel	(F) Replacement Personnel Training Cost (D) x (E)	(G) Cumulative Course Cost	(H) Cumulative Personnel Training Cost (E) x (G)	
1	BCT	Basic Training	2890	5112	15,330,888	2899	15,330,888	
1	Rec.	Recruits	261	5112	1,334,232	3260	16,665,120	
1	041-13810* (MOD)	Field Artillery Crewman	4356*	5112	22,267,872	7616	38,932,992	
1	LV-AD1	Leave/Administration	724	5112	3,701,088	8340	6,038,160	
2	041-13830	Primary NCO	6209	1116	6,923,035	14549	16,222,135	
3	BNOC0136	Basic NCO	4114	640	2,632,960	18663	11,944,320	
4	0-13-C42-ADV	Advanced NCO	8954	0	0	27617	0	
TOTAL			27,617		52,190,075			

Table C6-3. Training Cost Worksheet. (continued)

MOS	138	Predecessor	Reference	Conceptual	X		
TRAINING COURSE COST							
(A) Paygrade/ Skill Level	(B) Course Number	(C) Course	(D) Course Cost	(E) No. of Replacement Personnel	(F) Replacement Personnel Training Cost (D) x (E)	(G) Cumulative Course Cost	(H) Cumulative Personnel Training Cost (E) x (G)
1	BCT	Basic Training	2999	5741	172,117,259	2999	172,117,259
1	Rec.	Recaptee	261	5741	1,498,401	3260	18,716,660
1	041:13 B10* (MOD)	Field Artillery Crewman	4356*	5741	25,007,796	7616	43,723,456
1	LV-AD1	Leads/Administration	724	5741	4,156,484	8340	47,876,940
2	041:13B30	Primary NCO	6209	1115	6,923,035	14549	16,222,135
3	BNCO013B	Basic NCO	4114	640	2,632,960	18683	11,944,320
4	0-13-C42 ADV	Advanced NCO	6954	0	0	27617	0
TOTAL			27,617		57,430,401		

Table C-6.3. Training Cost Worksheet. (continued)

MYS 31V		Prefecture	X (none)	Reference	Conceptual		
TRAINING COURSE COST							
(A) Paygrade/ Skill Level	(B) Course Number	(C) Course	(D) Course Cost	(E) No. of Replacement Personnel	(F) Replacement Personnel Training Cost (D) x (E)	(G) Cumulative Course Cost	(H) Cumulative Personnel Training Cost (E) x (G)
1	BCT	Basic Training	2899	0	0	2899	0
1	REC	Recaptee	261	0	0	3260	0
1	100-31V10 (100-101-31V 10)	Tactical Communication Systems Operator	2898	0	0	6158	0
1	LV/ADI	Leave/Administration	724	0	0	6882	0
2	PLC	Primary Leadership Training	2893	0	0	9775	0
3	110V31V30	Tactical Electronic Equipment Basic NCO	4872	0	0	14847	0
4	IEE C428	Tactical Electronic Equipment Advanced NCO	8953	0	0	21600	0
TOTAL			21,800		0		

Table C6.3. Training Cost Worksheet. (continued)

MOS	31V	Prefessor	Reference	X	Conceptual	TRAINING COURSE COST		
(A) Paygrade/ Skill Level	(B) Course Number	(C) Course	(D) Course Cost	(E) No. of Replacement Personnel	(F) Replacement Personnel Training Cost (D) x (E)	(G) Cumulative Course Cost	(H) Cumulative Personnel Training Cost (E) x (G)	
1	BCT	Basic Training	2999	798	2,393,202	2999	2,393,202	
1	REC	Receptee	261	798	208,278	3260	850,860	
1	160-31V10	Tactical Communication System Operator	2898	798	2,312,604	6158	4,914,084	
1	LV/ADI	Leave/Administration	724	798	577,752	6882	5,491,836	
1	101ASIX1* (new)	ESPAWS Computer	2351*	798	1,876,098	9233	7,367,934	
2	PLC	Primary Leadership Training	2883	578	1,672,154	12126	7,008,828	
2	101ASIX2*	ESPAWS Land Navigation System	2052*	578	1,186,056	14178	8,194,884	
3	10V31V30	Tactical Electronic Equipment Basic NCO	4872	0	0	19050	0	
4	IEE C42B	Tactical Electronic Equipment Advanced NCO	6953	0	0	28003	0	
TOTAL			28,003		10,226,144			

Table C8-3. Training Cost Worksheet. (continued)

MYS 31V		Prefecture	Reference	Conceptual	X		
TRAINING COURSE COST							
(A) Paygrade/ Skill Level	(B) Course Number	(C) Course	(D) Course Cost	(E) No. of Replacement Personnel	(F) Replacement Personnel Training Cost (D) x (E)	(G) Cumulative Course Cost	(H) Cumulative Personnel Training Cost (F) x (G)
1	BCT	Basic Training	2999	152	455,848	2999	455,848
1	REC	Receipt	281	152	39,872	3280	495,520
1	180-31V10 (180-101-31V 10)	Tactical Communication System Operator	2898	152	440,496	6158	936,016
1	LV/ADI	Learn/Administration	724	152	110,048	8882	1,046,064
1	101ASIX1* (new)	ESPAWS Computer	2351*	152	357,352	9233	1,403,416
2	PLC	Primary Leadership Training	2893	0	0	12126	0
2	101ASIX2*	ESPAWS land Navigation System	2052	0	0	14178	0
3	10V31V30	Tactical Electronic Equipment Basic NCO	4872	0	0	19050	0
4	IEE C428	Tactical Electronic Equipment Advanced NCO	6953	0	0	26003	0
TOTAL			26,003		1,403,416		

Table C83. Training Cost Worksheet. (continued)

MOS 41C		Professor	X	Reference	X	Conceptual	X
TRAINING COURSE COST							
(A) Paygrade/ Skill Level	(B) Course Number	(C) Course	(D) Course Cost	(E) No. of Replacement Personnel	(F) Replacement Personnel Training Cost (D) x (E)	(G) Cumulative Course Cost	(H) Cumulative Personnel Training Cost (E) x (G)
1	BCT	Basic Training	2999	30	116,981	2999	116,981
1	REC	Reception	261	30	10,179	3260	127,140
1	570-41C20 (070-41C10)	File Control Instrument Repair	29815	30	1,154,985	32875	1,282,125
1	LV/ADM (41C20)	Level/Administration	724	30	33,599	33599	1,310,381
2	PLC (41C20)	Primary Leadership Training	2893	0	0	36492	0
3	6-MM-C40 (41C30)	Mech. Maint. Basic NCO Course	10872	0	0	47164	0
4	6-63-C42 (41240)	Mech. Maint. Advanced NCO	7898	0	0	55160	0
TOTAL			55,160		1,310,381		

Table C6.3. Training Cost Worksheet. (continued)

MOS	440	Proficiency	X	Reference	X	Conceptual	X
TRAINING COURSE COST							
(A) Paygrade/ Skill Level	(B) Course Number	(C) Course	(D) Course Cost	(E) No. of Replacement Personnel	(F) Replacement Personnel Training Cost (D) x (E)	(G) Cumulative Course Cost	(H) Cumulative Personnel Training Cost (E) x (G)
1	BCT	Basic Training	2999	47	140,953	2999	140,953
1	REC	Recptce	261	47	12,267	3260	153,220
1	LV/ADI	Leave/Administration	724	47	34,028	3984	187,248
1	704-44820 (44810)	Metal Worker	8506	47	402,802	12550	589,850
2	PLC (44820)	Primary Leadership Training	2893	0	0	15443	0
3	9-995 C-40 (44830)	Mech. Maint. Basic NCO Course	10672	0	0	26115	0
TOTAL			26,115			589,850	

Table C8-3. Training Cost Worksheet. (continued)

M75 45D (138U6)		Preceptor	Reference	X	Conceptual	TRAINING COURSE COST				
(A) Paygrade/ Staff Level	(B) Course Number	(C) Course	(D) Course Cost	(E) No. of Replacement Personnel	(F) Replacement Personnel Training Cost (D) x (E)	(G) Cumulative Course Cost	(H) Cumulative Personnel Training Cost (F) x (G)			
1	BCT	Basic Training	2999	832	2,495,168	2999	2,495,168			
1	REC.	Receptive	261	832	217,152	3260	2,712,320			
1	643-45D18*	Field Artillery Turret* Mechanic	8200*	832	6,822,400	11480	9,534,720			
1	LV-AD1	Lunar Administration	724	832	602,368	12184	10,137,088			
2	941-13838	Primary NCO	6209	47	291,823	18393	864,471			
3	BHOC138	Basic NCO	4114	0	0	22507	0			
4	6-13-C42 ADV	Advanced NCO	8954	29	259,666	31461	912,309			
TOTAL			31,461		10,888,577					

Table C8-3. Training Cost Worksheet. (continued)

6878	45D (139U4)	Professor	Reference	Conceptual	X		
TRAINING COURSE COST							
(A) Program/ Skill Level	(B) Course Number	(C) Course	(D) Course Cost	(E) No. of Replacement Personnel	(F) Replacement Personnel Training Cost (D) x (E)	(G) Cumulative Course Cost	(H) Cumulative Personnel Training Cost (F) x (G)
1	BCT	Basic Training	2909	180	479,840	2909	479,840
1	REC	Reception	261	180	41,780	3260	521,600
1	943-45D18" (MDD)	Field Artillery* Target Mechanics	8200*	180	1,312,000	11460	1,833,600
1	LV-AD1	Learn/Administration	724	180	115,940	12184	1,849,440
2	941-13838	Primary MCO	6209	47	291,823	18383	901,257
3	BMCOC138	Basic MCO	4114	0	0	22507	0
4	6-13-C42-ADV	Advanced MCO	8954	29	259,666	31461	912,369
TOTAL			31,461		2,500,929		

Table C6-3. Training Cost Worksheet. (continued)

M735 45K		Predessor	X	Reference	Conceptual		
TRAINING COURSE COST							
(A) Paygrade/ Skill Level	(B) Course Number	(C) Course	(D) Course Cost	(E) No. of Replacement Personnel	(F) Replacement Personnel Training Cost (D) x (E)	(G) Cumulative Course Cost	(H) Cumulative Personnel Training Cost (F) x (G)
1	BCT	Basic Training	2999	333	998,667	2999	998,667
1	REC	Reception	261	333	86,913	3260	1,085,580
1	643-45K20 (643-65K10)	Tank Turret Repairer	13748	333	4,578,064	17008	5,843,864
1	LV/ADN (45K10)	Leave/Administration	724	333	241,092	17732	5,904,766
2	PLC (45K20)	Primary Leadership Training	2893	109	315,337	20625	2,248,125
3	8-984-C40 (45K30)	Mech. Maint. Basic NCO	10672	0	0	31297	0
TOTAL			31,297		6,220,093		

Table C-3. Training Cost Worksheet. (continued)

MTS 45K		Predecessor		Reference		X		Conceptual		X	
TRAINING COURSE COST											
(A) Paygrade/ Skill Level	(B) Course Number	(C) Course	(D) Course Cost	(E) No. of Replacement Personnel	(F) Replacement Personnel Training Cost (D) x (E)	(G) Cumulative Course Cost	(H) Cumulative Personnel Training Cost (E) x (G)				
1	BCT	Basic Training	2909	450	1,349,550	2909	1,349,550				
1	REC	Recruits	281	450	117,450	3260	1,467,000				
1	843-45K20 (843-85K10)	Tank Turret Repairer	13748	450	6,186,600	17008	7,653,600				
1	LV/ADH (45K10)	Levee/Administration	724	450	325,800	17732	7,979,400				
2	PLC (45K20)	Primary Leadership Training	2893	146	422,378	20625	3,011,260				
3	6-88K-C40 (45K30)	Mech. Maint. Basic NCO	10672	0	0	31297	0				
TOTAL			31,297		9,401,778						

Table C8.3. Training Cost Worksheet. (continued)

MOS		46L	Predominate	X	Reference	Conceptual	TRAINING COURSE COST			
(A) Paygrade/ Skill Level	(B) Course Number	(C) Course	(D) Course Cost	(E) No. of Replacement Personnel	(F) Replacement Training Cost (D) x (E)	(G) Cumulative Course Cost	(H) Cumulative Personnel Training Cost (F) x (G)			
1	BCT	Basic Training	2009	114	34,006	2009	341,896			
1	REC	Reception	261	114	29,764	3260	371,840			
1	042 46L19	Artillery Repair	9006	114	1,124,610	13125	1,466,250			
1	LV/ADN (46L16)	Leave/Administration	724	114	82,536	13649	1,578,766			
2	PLC (46L20)	Primary Leadership Training	2093	50	144,850	10742	837,100			
3	0-008-C08 (46L30)	Mech. Maint. Basic MCO Course	10672	0	0	27414	0			
4	0-03-C42 (46L40)	Mech. Maint. Advanced MCO Course	7998	0	0	35410	0			
TOTAL			35,410		1,415,536					

Table C83. Training Cost Worksheet. (continued)

46L		Predecessor	Reference	X	Conceptual	TRAINING COURSE COST			
(A) Paygrade/ Skill Level	(B) Course Number	(C) Course	(D) Course Cost	(E) No. of Replacement Personnel	(F) Replacement Personnel Training Cost (D) x (E)	(G) Cumulative Course Cost	(H) Cumulative Personnel Training Cost (F) x (G)		
1	BCT	Basic Training	2099	228	683,772	2099	683,772		
1	REC	Reception	261	228	59,508	3260	743,280		
1	642-46L20 (642-46L10)	Artillery Repair	9605	228	2,249,220	13125	2,992,500		
1	LV/ADN (46L20)	Leavel/Administration	724	228	165,072	13049	3,157,572		
1	642AS1X1	ESPANS Autoloader	(1918) 555	68 (68).28	126,508	(15787)	1,040,822		
2	PLC (46L20)	Primary Leadership Training	2893	50	144,650	17298	864,900		
3	8-488 C46 (46L30)	Mech. Maint. Basic MCO Course	10072	0	0	27970	0		
4	8-83-C42 (46L40)	Mech. Maint. Advanced MCO Course	7996	0	0	35966	0		
TOTAL			35,906		3,428,810				

Table C8.3 Training Cost Worksheet. (continued)

MPS		45L		Product		Reference		Conceptual		X	
TRAINING COURSE COST											
(A) Paygrade/ Skill Level	(B) Course Number	(C) Course	(D) Course Cost	(E) No. of Replacement Personnel	(F) Replacement Personnel Training Cost (D) x (E)	(G) Cumulative Course Cost	(H) Cumulative Personnel Training Cost (E) x (G)				
1	BCT	Basic Training	2800	271	812,720	2800	812,720				
1	REC	Reception	261	271	70,731	3200	860,960				
1	642-45L10	Artillery Repairs	9005	271	2,673,415	13125	3,556,875				
1	LV/ADP (45L10)	Leads/Administration	724	271	196,204	13849	3,763,079				
1	642ASIX1	ESPAWS Auto-loader	(1918) 200	37 (37) .14	70,866 (6916)	(15787) 14117	583,379 (622,329)				
2	PLC (45L20)	Primary Leadership Training	2803	50	144,850	17010	860,500				
3	6-MMA C40 (45L30)	Mech. Maint. Basic MCO Course	10872	0	0	27882	0				
4	6-3-C42 (45L40)	Mech. Maint. Advanced	7996	0	0	35678	0				
TOTAL			35,878		3,908,695						

Table C-3. Training Cost Worksheet. (continued)

MOS	638	Prefessor	TRAINING COURSE COST					Conceptual	X	X	(H)	(I)	(J)	(K)	(L)	(M)	(N)
			(A)	(B)	(C)	(D)	(E)										
Paygrade/ Skill Level				Course Number	Course	Course Cost	No. of Replacement Personnel	Replacement Training Cost (D) x (E)	Cumulative Course Cost	Cumulative Personnel Training Cost (E) x (G)							
1				BCT	Basic Training	2999	0	0	2999	0							
1				REC	Reception	261	0	0	3260	0							
1				918-63820	Power Generation and Vehicle Mech.	3967	0	0	7127	0							
1				LV/ADN (63810)	Leads/Administration	724	0	0	7851	0							
2				PLC (63820)	Primary Leadership Training	2893	0	0	10744	0							
3				646-65406 (63830)	Mech. Maint. Basic MCO Course	7871	29	228,259	19615	639,835							
4				643 C42 (63840)	Mech. Maint. Primary MCO	7996	0	0	26611	0							
TOTAL						26,611		228,259									

Table (3.3. Training Cost Worksheet (continued)

MYS	GSC	Predecessor	Reference	TRAINING COURSE COST							Encumbrance
(A) Paygrade/ Skill Level	(B) Course Number	(C) Course	(D) Course Cost	(E) No. of Replacement Personnel	(F) Replacement Personnel Training Cost (D) x (E)	(G) Cumulative Course Cost	(H) Cumulative Personnel Training Cost (F) x (G)				
1	BCT	Basic Training	2099	62	130,138	2099	135,938				
1	REC	Recruits	261	62	16,182	3760	202,120				
1	811 GSC20 (811 GSC10)	Truck Vehicle Mechanic	12802	62	781,324	15862	983,444				
1	LV/ADI (83C10)	Leave/Administration	724	62	44,888	16586	1,028,332				
2	PLC (83C20)	Primary Leadership Training	2893	42 *	121,506	18479	818,118				
3	8488 C40 (83C30)	Mech. Maint Basic NCO Course	10672	27	288,144	30151	814,077				
4	843 C42 (83C40)	Mech. Maint Advanced NCO	7996	0	0	38147	0				
TOTAL			38147		1,437,962						

Table C6.3 Training Cost Worksheet (continued)

MPS	GSC	Production	Reference	X	Conceptual	X	
TRAINING COURSE COST							
(A) Paygrade/ Skill Level	(B) Course Number	(C) Course	(D) Course Cost	(E) No of Replacement Personnel	(F) Replacement Personnel Training Cost (D) x (E)	(G) Cumulative Course Cost	(H) Cumulative Personnel Training Cost (F) x (G)
1	BCT	Basic Training	2999	62	185,928	2999	185,938
1	REC	Recapitol	261	62	161,182	3260	202,120
1	611.63C20 (611.63C10)	Track Vehicle Mechanic	12602	62	781,324	15862	983,444
1	LV/ADN (63C10)	Lease/Administration	724	62	44,888	16586	1,028,312
2	PLC (63C20)	Primary Leadership Training	2883	84	243,012	19479	1,636,236
3	6 MM C40 (63C30)	Mech Maint Basic NCO	10672	27	288,144	30151	814,077
4	6 B3 C42 (63C40)	Mech Maint Advanced NCO	7986	0	0	38147	0
TOTAL			38,147		1,704,488		