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USER'S MANUAL FOR SEEK TALK
FULL SCALE ENGINEERING DEVELOPMENT
LIFE CYCLE COST (LCC) MODEL.
VOLUME II - MODEL EQUATIONS AND MODEL OPERATIONS.

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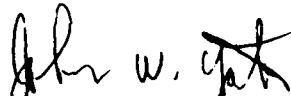
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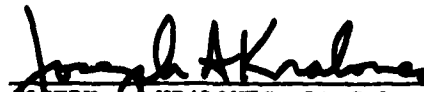
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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This document is a manual for the application of the computerized Life Cycle Cost (LCC) Model designed for the Full-Scale Engineering Development (FSED) Phase of the SEEK TALK Program. FSED contractors will use the model to perform cost estimates, identify cost drivers and make trade and other cost-related analyses. The manual assists users in establishing input parameter values, making LCC calculations and utilizing results. It also describes how to prepare computer inputs, and run the model in either the interactive or (over)		

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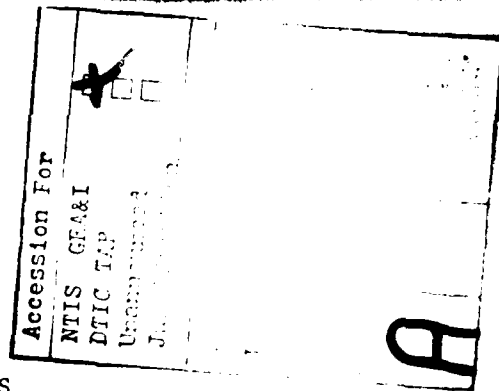
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batch mode. Volume I is entitled Life Cycle Cost Management, and Volume II, Model Equations and Model Operations.

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At MITRE, J. H. James provided guidance in structuring the Model and selecting data processing approaches. The model equations were largely based upon equations developed by R. A. Moynihan for the previous phase of SEEK TALK. R. V. D. Campbell provided the introductory section, the section on input parameters and the appendix on modification/installation parameters.

Also at MITRE, programming of the FSED model, including revisions to the program for the previous phase and development of several new capabilities, was done by M. J. Hayes for the RFP release. J. R. Calabro, S. L. Rawls and L. C. Record made updates to the program during recent months. Typing and computerized text input were done primarily by J. L. Day and M. E. Pagoaga.

PREFACE

The computerized Life Cycle Cost (LCC) Model for the Full Scale Engineering Development (FSED) Phase of SEEK TALK is a revised and extended version of the LCC Model for the Advanced Development Phase, which Model was itself an elaboration of the Model used in the first, or Design Studies, Phase of the program. This document is the User's Manual for the FSED LCC Model.

The Manual is contained in two volumes. Volume I, entitled Life Cycle Cost Management, covers LCC policies for SEEK TALK, the nature and application of the Model, and instructions to contractors for carrying out FSED LCC tasks. Volume II, entitled Model Equations and Model Operations, first describes the overall structure of the LCC Model, the cost element equations, the sensitivity analysis capability and the repair level analysis capability. Next it provides values for Air Force input parameters and instructions for contractor inputs, general operating characteristics of the Model and detailed operating procedures. Finally, four appendices contain a glossary of variables, illustrative computer runs, instructions for calculating modification/installation cost elements and instructions for using the Model for calculations involving Interim Contractor Support and Centralized Intermediate Maintenance Facilities.

An earlier version of this document was prepared by MITRE for the Air Force Electronic Systems Division, and issued by them as Attachment 15 to its FSED RFP for SEEK TALK, namely RFP No. F19628-80-R-0184, dated 21 July 1981.

TABLE OF CONTENTS

	<u>Page</u>
LIST OF FIGURES	7
LIST OF TABLES	8
Section 4, INTRODUCTION TO FSED PHASE LCC MODEL	11
4.1 Nature of This Document	11
4.1.1 Detailed Contents of Volume II	11
4.2 Assumptions Made in Structuring the FSED Phase LCC Model	12
4.2.1 General	12
4.2.2 RDT&E Costs	16
4.2.3 Production Costs	17
4.2.4 Modification/Installation Costs	17
4.2.5 Operations and Support Costs: Operations	18
4.2.6 Operations and Support Costs: Support	18
4.3 Components, Structure, and Interactive Operation of the Model	21
4.3.1 Major Components of the Model Computer Programs	21
4.3.2 Structure of the Model	22
4.3.3 Model Input Parameters	24
4.3.4 Model Outputs	27
4.3.5 Supplemental Instructions	28
4.3.6 Interactive Use of the Model	29
4.4 Comparison Between LCC Models for FSED Phase and AD Phase	30
Section 5, COST ELEMENT EQUATIONS	33
5.1 Auxiliary Calculations	33
5.1.1 Failure Rates	33
5.1.2 Pipeline Spares	35
5.1.3 Maintenance Manhour Requirements	39
5.1.4 Calculation of Repair Level Fractions	43
5.2 Cost Element Equations	47
5.2.1 Production Cost Element	47
5.2.2 Modification/Installation Cost Element	48
5.2.3 Operations Cost Elements	51
5.2.4 Investment Spares Cost Element	54
5.2.5 Replacement Spares Cost Element	56
5.2.6 On-Equipment Maintenance Cost Element	57
5.2.7 Off-Equipment Maintenance Cost Element	58
5.2.8 Support Equipment Cost Element	61
5.2.9 ITEM Inventory Management Cost Element	64
5.2.10 Technical Orders Cost Element	67
5.2.11 Maintenance Training Cost Element	71

TABLE OF CONTENTS (continued)

	<u>Page</u>
Section 6, LCC SENSITIVITY ANALYSIS CAPABILITY	77
6.1 LCC Sensitivity Due to Fractionally Incremented Data Parameters	77
6.1.1 Global Unit Cost - XUC Factor	81
6.1.2 Global Failure Rate - XFR Factor	81
6.1.3 Global False Pull Rate - XFPR Factor	82
6.1.4 Global Maintenance Repair Times - BMF/DMF Factors	82
6.1.5 Global Repair Materials Cost - XRM Factor	84
6.1.6 Program Lifetime - PIUP Factor	84
6.1.7 Modification/Installation Labor Man-Hours - XMIL Factor	86
6.1.8 ITEM Unit Cost - UP(I) Factor	86
6.1.9 ITEM Failure Rate - FR(I) Factor	87
6.1.10 ITEM False Pull Rate - FPR(I) Factor	88
6.1.11 ITEM Repair Materials Cost - RM(I) Factor	89
6.1.12 CHLCC - Change in LCC for Repair Level Sensitivity	89
6.1.13 ITEM Intermediate Repair Fraction - RTS(I) Factor	93
6.1.14 ITEM Depot Repair Fraction - NRTS(I) Factor	94
6.1.15 ITEM Condemnation Rate - COND(I) Factor	95
6.2 Simplified Repair Level Analysis Capability	96
6.3 LCC Sensitivity to Identify Which SRUs Should be LRUs	97
6.4 LCC Sensitivity Analysis through Global Multiplier Factors	102
Section 7, REPAIR LEVEL ANALYSIS CAPABILITY	104
7.1 Introduction	104
7.2 Calculation of ITEM Costs	106
7.3 Analytical Procedure	109
Section 8, INPUT PARAMETERS AND VARIABLES	116
8.1 Input Data Elements and General File Structures	116
8.2 Values for Parameters Furnished by the Air Force	122
8.2.1 Air Force Values for Input File (1) - System-Wide Scalar Parameters	122
8.2.2 Air Force Values for Input File (2) - Base Configuration Data	126

TABLE OF CONTENTS (continued)

	<u>Page</u>
8.2.3 Air Force Values for Input File (3) - Platform Operation Data	128
8.2.4 Air Force Values for Input File (4) - Platform Terminal Data and Non-Recurring Modification/Installation Data	128
8.2.5 Air Force Values for Input File (5) - Platform Recurring Modification/Installation Data	130
8.2.6 Air Force Values for Input File (6) - Platform Deployment at Bases	133
8.3 Ground Rules and Instructions for Contractor Established Input Parameters	133
8.3.1 Contractor Inputs to File (1) - System-Wide Scalar Parameters	135
8.3.2 Contractor Inputs to File (3) - Platform Operation Data	135
8.3.3 Contractor Inputs to File (4) - Platform Terminal Data and Non-Recurring Modification/Installation Data	136
8.3.4 Contractor Inputs to File (5) - Platform Recurring Modification/Installation Data	141
8.3.5 Contractor Inputs to File (7) - Support Equipment Data	141
8.3.6 Contractor Inputs to File (8A) - ITEM Equipment Data	143
8.3.7 Contractor Inputs to File (8B) - LRU/SRU Cross Reference Data	146
8.3.8 Contractor Inputs to File (9A) - ITEM Maintenance Data	147
8.3.9 Contractor Inputs to File (9B) - ITEM Technical Order, Training and SE Software Development Data	150
8.3.10 Contractor Inputs to File (10) - ITEM/Support Equipment Cross Reference Data	151
8.3.11 Contractor Inputs to File (11) - ITEM Configurations for Different Platforms	151
Section 9, OPERATING CHARACTERISTICS	153
9.1 General Properties of the LCC Model	153
9.1.1 Organization of the Model	153
9.1.2 Operation of the Model	154
9.1.3 Configuration of the Model	155
9.1.4 Operation of the LCC Program	155
9.1.5 Operation of the RLA Program	159
9.1.6 Performance Characteristics	159

TABLE OF CONTENTS (concluded)

	<u>Page</u>	
9.2	General Description of Inputs, Processing, and Outputs	160
9.2.1	Model Inputs	160
9.2.2	Processing: The Accounting Model Equations	164
9.2.3	Processing: The Sensitivity Analysis Equations	165
9.2.4	Processing: The Repair Level Analysis Procedure	166
9.2.5	Model Outputs	167
Section 10	OPERATING PROCEDURES	171
10.1	Input/Output Device Channel Numbers	171
10.2	Preparation of Data Input Files	173
10.2.1	System-Wide Scalar Parameters - Data File 1	174
10.2.2	Base Configuration Data - Data File 2	176
10.2.3	Platform Operation Data - Data File 3	178
10.2.4	Platform Terminal & Non-Recurring MOD/I Data - Data File 4	180
10.2.5	Platform Recurring Modification/Installation Data - Data File 5	182
10.2.6	Platform Deployment at Bases - Data File 6	184
10.2.7	Support Equipment Data - Data File 7	186
10.2.8A	ITEM Equipment Data - Data File 8A	188
10.2.8B	LRU/SRU Cross Reference Data - Data File 8B	190
10.2.9A	ITEM Maintenance Data - Data File 9A	192
10.2.9B	ITEM Technical Order, Training, and SE Software Development Data - Data File 9B	194
10.2.10	ITEM/SE Cross Reference Data - Data File 10	196
10.2.11	ITEM Configurations for Different Platforms - Data File 11	200
10.3	Data Input Error Messages	202
10.4	Operation of the LCC Program in Interactive Mode	205
10.5	Operation of the LCC Program in Batch Mode	216
10.6	Operation of the RLA Program	219
10.7	Description of Model Output Tables	221
APPENDIX I	GLOSSARY OF VARIABLES	227
APPENDIX II	ILLUSTRATIVE COMPUTER RUNS	255
APPENDIX III	INSTRUCTIONS FOR CALCULATING MODIFICATION/INSTALLATION COST ELEMENTS	323
APPENDIX IV	LCC CALCULATIONS WITH INTERIM CONTRACTOR SUPPORT AND WITH CENTRALIZED INTERMEDIATE MAINTENANCE FACILITIES	337

LIST OF FIGURES

<u>Figure Number</u>		<u>Page</u>
4-1	Cost Elements Used in the FSED Phase LCC Model	13
4-2	Structure for SEEK TALK Equipment	15
4-3	Simplified System Diagram of the LCC Computer Model	25
7-1	Process of the Repair Level Analysis	105
8-1	Logistic Structure for SEEK TALK Equipment	144
9-1	Operation of the LCC Model for One Design Study	156
9-2	Operation of the LCC Program	157
10-1	Generalized Example of Data File 1	174
10-2	Base Configuration - Data File 2	177
10-3	Platform Operation - Data File 3	179
10-4	Platform Terminal and Non-Recurring Mod/I- Data File 4	181
10-5	Platform Recurring Mod/I - Data File 5	183
10-6	Platform Deployment at Bases - Data File 6	185
10-7	Support Equipment Data - Data File 7	187
10-8A	ITEM Equipment - Data File 8A	189
10-8B	LRU/SRU Cross Reference Data - Data File 8B	191
10-9A	ITEM Maintenance - Data File 9A	193
10-9B	ITEM Technical Order, Training, and SE Soft- ware Development Data - Data File 9B	195
10-10	ITEM/SE Cross Reference - Data File 10	197
10-11	ITEM Configurations for Different Plat- forms - Data File 11	201
10-12	Sample User Terminal Interactive Session	212
10-13	Data File for Batch Mode Version of Figure 10-12	217

LIST OF FIGURES (concluded)

<u>Figure Number</u>		<u>Page</u>
10-14	Typical Data File for Batch Mode	218
10-15	Data File for Six LCC Runs for RLA	220
III-1	Conversion from Basis Estimates to Platform Grouping Estimates	326
III-2	Worksheet for Calculating NRM1(NP)	328
III-3	Structure for Calculating Recurring Variable Labor Hours MIMH(IA,M,NP)	332
III-4	Worksheet for Calculating AKIT(IA,NP)	334
III-5	Worksheet for Calculating MIMH(IA,M,NP) for M=2	335

LIST OF TABLES

<u>Table Number</u>		<u>Page</u>
5-I	Results of Different Values of RL(I)	44
5-II	Calculation of Repair Level Fractions	45
5-III	Results of Non-Zero Values of R	45
6-I	Sensitivity Analysis Data Parameters	78
7-I	Different Cases of Repairing	107
7-II	Model Specifications of Repairing Cases	108
7-III	Model Specifications of Repair Levels	115
8-I	Structure and Content of Input Data Files	118
8-II	Consolidated List of Data Elements in Input Files	119
8-III	Values for Air Force Inputs to Input File (1), System-Wide Scalar Parameters	123

LIST OF TABLES (concluded)

<u>Table Number</u>		<u>Page</u>
8-IV	Values for Air Force Inputs to Input File (2), Base Configuration Data	127
8-V	Values for Air Force Inputs to Input File (3), Platform Operation Data	129
8-VI	Values for Air Force Inputs to Input File (4), Platform Terminal Data and Non-Recurring Mod/Installation Data	131
8-VII	Values for Air Force Inputs to Input File (5), Platform Recurring Mod/Installation Data	132
8-VIII	Values for Air Force Inputs to Input File (6), Platform Deployment at Bases	134
8-IX	Cost Elements to be Included in Production Cost Estimate	138
8-X	Data for Calculations of Antenna Drag	140
8-XI	Operational Environment	148
10-I	LCC Input/Output Device Channel Numbers	172
10-II	RLA Input/Output Device Channel Numbers	173
10-III	System-Wide Scalar Parameters	175
IV-I	Cost Breakdown Structure for ICS	338
IV-II	Total Number of Deployed Bases	340
IV-III	Average Number of Deployed Bases	341
IV-IV	Additional Contractor Supplied Parameters for ICS	342

SECTION 4

INTRODUCTION TO FSED PHASE LCC MODEL

4.1 Nature of This Document

This is Volume II of a two-volume document dealing with Life Cycle Cost (LCC) controls for the Full Scale Engineering Development (FSED) phase of the SEEK TALK program. The document describes the application of LCC techniques to the FSED Phase of SEEK TALK, and the nature and use of an LCC Model in carrying out FSED Phase tasks. This document is a part of the Request for Proposal (RFP) package for the FSED phase, and is specifically a supplement to the Statement of Work (SOW) in that package.

Volume I of this document, entitled SEEK TALK LIFE CYCLE COST MANAGEMENT, is directed both to the FSED contractor management and to the contractor's LCC engineer or analyst. Volume I describes pertinent characteristics of the SEEK TALK program, its LCC controls, and the LCC Model which is used as a tool in the LCC control process. It also supplements the FSED SOW, and provides additional instructions to contractors concerning SOW tasks.

Volume II of this document, entitled SEEK TALK FSED PHASE MODEL EQUATIONS AND MODEL OPERATIONS, is directed to the contractor's LCC engineer or analyst, and also to persons preparing input data for the Model, or making computer runs with the Model.

4.1.1 Detailed Contents of Volume II

Volume II contains Sections 4 through 10, and four appendices.

Sections 4 through 8 describe the model equations and define how input parameters are determined. Section 4 (Introduction) describes the detailed ground rules and assumptions underlying the Model and summarizes its structure, components and operating modes. Section 5 (Cost Element Equations) describes the equations for all of the cost elements making up the basic LCC calculation (or the accounting Model), and identifies the parameters and variables involved. Section 6 (LCC Sensitivity Analysis Capability) provides equations for a supplementary capability of the Model, namely prestructured sensitivity analyses on both a global (system wide) basis and a by-equipment-ITEM basis. Section 7 (Repair Level Analysis Capability) describes a second supplementary capability of the Model, namely a methodology and the corresponding equations for investigating which

repair level approaches, by ITEM, should lead to lowest costs of maintenance. Section 8 (Input Parameters and Variables) identifies all inputs to the Model, provides values for inputs furnished by the Air Force, and gives instructions for the determination of contractor inputs.

Sections 9 and 10 provide operating instructions for the Model. Section 9 (Operating Characteristics) describes modes of operation, programming approach, equipment configuration required, performance parameters and nature of the data base. Section (8) (Operating Procedures) describes how inputs and outputs are structured, how input files are prepared, how operations are conducted in the interactive and the batch modes, and what output tables are generated.

Four appendices are provided, namely: I. Glossary of Variables; II. Illustrative Computer Runs; III. Guidelines for Calculating Modification/Installation Cost Elements; and IV. LCC Calculations with Interim Contractor Support and with Centralized Intermediate Maintenance Facilities.

There is also an attachment to Volume II containing a complete FORTRAN Program Listing.

4.2 Assumptions Made in Structuring the FSED Phase LCC Model

First the general or overall ground rules and assumptions are covered, and then those that apply to each top-level cost element: RDT&E, Production, Modification/Installation, Operation and Support.

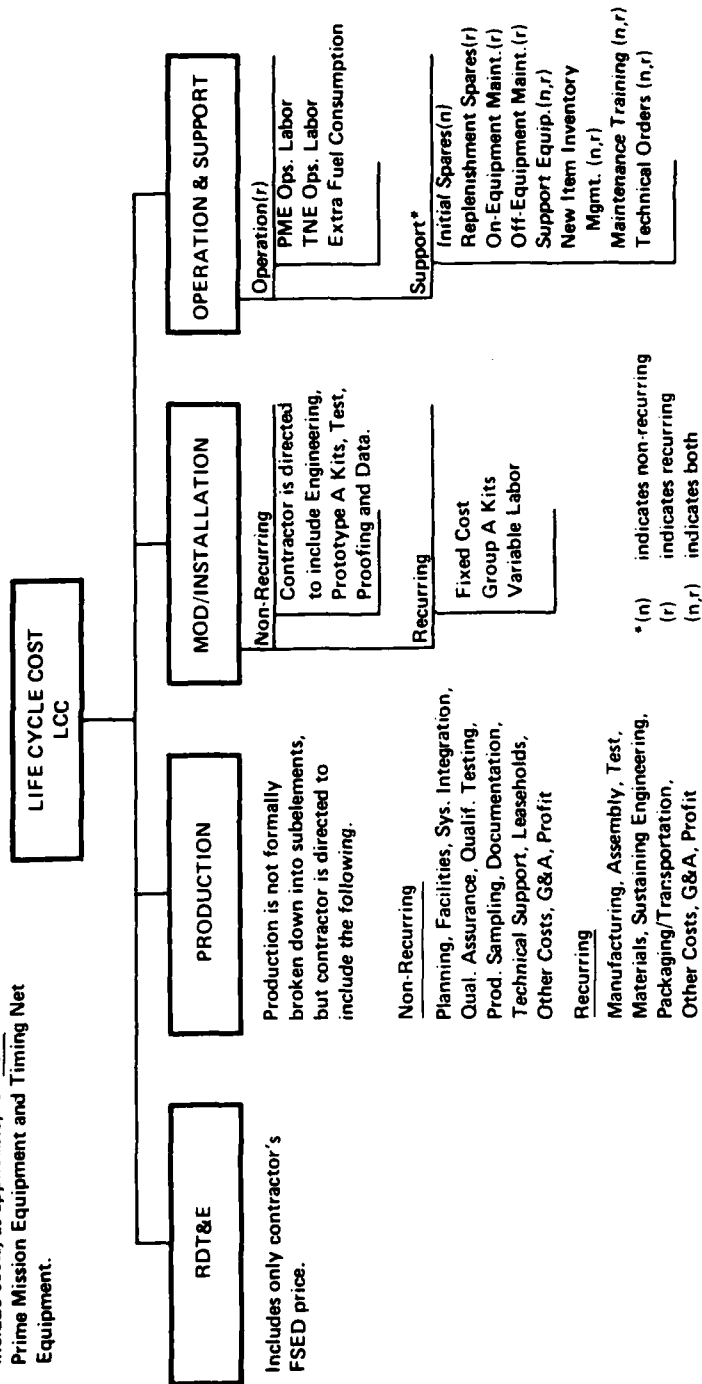
4.2.1 General

(1) The Model includes the cost elements and sub-elements shown in Figure 4-1. It should be noted that the "Life Cycle Cost" computed by the Model does not contain all cost elements. In particular, the following elements have been purposely omitted:

- . Most RDT&E costs. (Only the contractor's FSED contract price is included.)
- . System Enhancement Costs for correcting or enhancing the system after it is in operation. These are difficult to predict at this stage of the program. It is the intention of the Air Force, however, to encourage the production contractors to submit no-cost

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Note: All cost elements and subelements include costs, as applicable, for both Prime Mission Equipment and Timing Net Equipment.



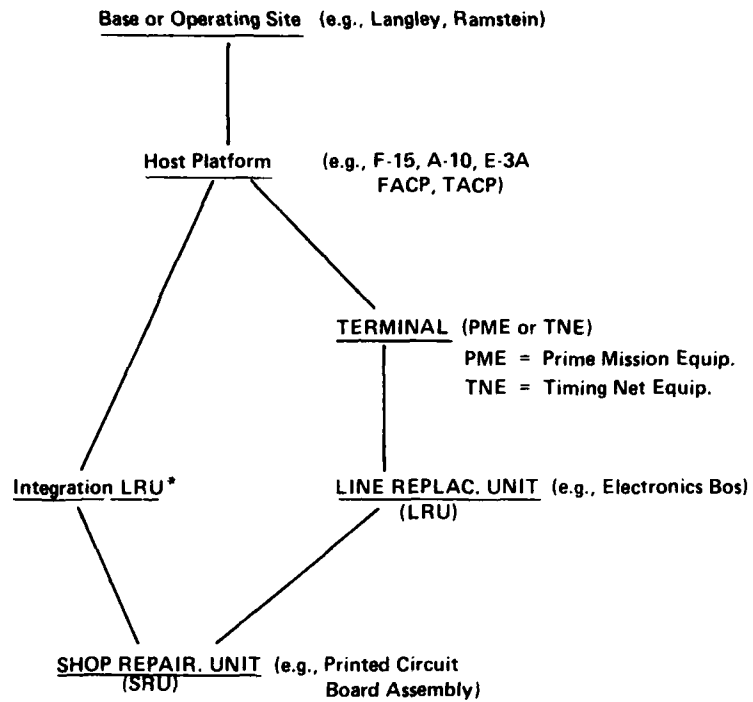
* (n) indicates non-recurring
(r) indicates recurring
(n,r) indicates both

Figure 4-1 Cost Elements Used in the FSED LCC Model

ECPs for correcting software/hardware errors and deficiencies which affect the system reliability.

- . Base operating and support costs, personnel movement costs, and other costs that are not directly attributable to the design characteristics of the SEEK TALK system.

- (2) SEEK TALK equipment is structured as shown in Figure 4-2. Equipment includes terminals composed of ITEMS, namely of LRUs which are in turn composed of SRUs. (LRU = Line Replaceable Unit; SRU = Shop Repairable Unit.) Terminals are of two general types: prime mission equipment (PME) terminals and timing net equipment (TNE) terminals. The contractor is responsible for establishing what LRUs and SRUs are required to implement the particular SEEK TALK system design, and what their properties will be. There is provision on each host platform for integration equipment as well as terminals. (Integration equipment refers to special LRUs that are not part of a terminal. An example would be integration and control equipment for multi-terminal installations on a host platform.) Some equipment that contractors may include in their SEEK TALK terminal designs are modified versions of equipment already in the Air Force inventory. The principal examples of such equipment are AM UHF radios such as the ARC-164 or the GRC-171. Modified versions of equipment already paid for are handled differently in the Model than are other ITEMS.
- (3) Terminal configurations for prime mission equipment are of three types as follows:
 - . Full-up or maximum (Type I), which has a "complete" adaptive antenna array and corresponding array processor.
 - . Partial or intermediate (Type II), which has a more limited adaptive array and array processor.
 - . Modem-only or minimum (Type III), which has no adaptive array or array processor.
- (4) SEEK TALK terminals and integration equipment are installed on airborne and surface-based host platforms, which are associated with sites (e.g., bases). See Figure 4-2. For convenience, and to reduce the amount of data inputs and the volume of data processing, both host



*An "Integration LRU" is an LRU which is installed on a platform, but is not part of a terminal. An example is an LRU used to switch among or coordinate functions in a multi-terminal installation, such as E-3A or FACP.

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Figure 4-2. Structure for SEEK TALK Equipment

platforms and operating bases are treated statistically; that is, they are aggregated into a small number of groups, and average properties used for group characteristics. In the FSED Phase Model (unlike the Advanced Development Phase), the host platform classification reflects both the type of platform (e.g., tactical aircraft) and the prime mission equipment terminal configuration (e.g., modem-only).

- (5) The Air Force specifies the fraction of platforms in each platform grouping that will have SEEK TALK terminals installed at the time of platform manufacture, and the fraction that will be installed as retrofits.
- (6) The core of the Model is a set of accounting type equations used to determine values for cost elements and subelements from the input parameters. There is also provision for both global (system-wide) and ITEM-specific sensitivity analyses, and a capability for Repair Level Analysis.
- (7) All equipment (including both airborne and surface based) are assumed to have the same Planned Inventory Utilization Period (PIUP).
- (8) There are separate logistic support systems for airborne and ground-based equipments; and separate logistic support systems for Air National Guard and Air Force Reserve units, even when they are collocated with each other or with active forces.
- (9) The cost equations do not explicitly contain time as a variable. The Air Force provides guidance to contractors regarding production quantities, mixes and rates (see Section 8). Costs are figured in constant 1981 dollars, and are not discounted.

4.2.2 RDT&E Costs

The contractor FSED contract price is included in the Model as a "pass-through". Other RDT&E costs are either sunk costs, or costs incurred by other participants in the SEEK TALK program, and hence are excluded.

4.2.3 Production Costs

The Model equation will simply sum unit costs over terminals, platforms and bases (sites). Terminal unit costs are contractor estimated and adjusted so as to include non-recurrent, recurrent and management cost elements, in accordance with Air Force-supplied quantities, mixes, production rates, and estimating ground rules. A list of costs that must be included in the terminal unit costs is given in Section 8 (Table 8-IX).

Terminals include both prime mission equipment (PME) terminals and timing net equipment (TNE) terminals. Spares and support equipment are not included in this cost element, but are included in "support". If a PME terminal design includes an AM radio, such as the ARC-164, the production cost contains only the cost of modifying the AM radio for incorporation into the system. (The cost of the unmodified radio is here considered a sunk cost.) If a TNE terminal design includes an AM radio, however, the production cost contains the full acquisition cost including the cost of modification.

4.2.4 Modification/Installation Costs

The Air Force provides accounting-type equations that break down Modification/Installation costs for each platform grouping into a number of non-recurring and recurring cost subelements. Non-recurring costs are incurred once for each type of platform, recurring costs are incurred once for each individual installation.

- (1) Non-recurring costs per platform type are a combination of five subelements: (a) Engineering, (b) Prototype Group A Kits, (c) Testing, (d) Proofing, and (e) Data.
- (2) Non-recurring costs depend upon an Air Force established factor characterizing the degree of diversity within each Platform grouping. They also depend upon other Air Force parameters: the average numbers of terminals being installed on the platform grouping, and the breakdown by mode of installation (in production, depot retrofit, field retrofit using depot team).
- (3) Recurring costs for an individual installation on each type of platform are broken down into three major cost components:
 - (a) Fixed (platform preparation and restoration) costs - broken down by mode of installation.

- (b) Group A-Kit cost - broken down by installation functional area. Installation functional areas: antennas, electronic box(es), control head, and cabling.
 - (c) Variable labor costs - broken down by both mode of installation and functional area.
- (4) The cost subelements defined in (1) and (3) above are established through contractor study of the specific platforms identified in the FSED SOW and the System Specifications. The Air Force in Section 8 and Appendix III of this Manual provides a method of analysis that the contractor shall use in developing the necessary data.

4.2.5 Operations and Support Costs: Operations

Equations are provided by the Air Force. Three elements are included:

- (1) Timing Net operating labor, figured on the basis of contractor estimates of manual minutes of effort per day for a timing net terminal.
- (2) Prime mission equipment operating labor, figured on the basis of contractor estimates of manual minutes of effort per mission for initial activation, synchronization, etc. of the terminal (or terminals) on a host platform.
- (3) Cost of added fuel consumption (airborne platforms only), figured using a drag to fuel consumption factor multiplied by the added drag due to all antennas added by SEEK TALK. The Air Force provides the drag to fuel consumption factor and nominal drag data for one type of antenna element, namely, a standard UHF blade. The contractor must estimate the drag for his element design if it is not a standard UHF blade. The effect on fuel consumption of the weight added by SEEK TALK terminals is not presently included in the Model, but will be added later if found to be a significant cost factor.

4.2.6 Operations and Support Costs: Support

Detailed equations are provided by the Air Force for the logistic cost elements shown in Figure 4-1. Both non-recurring and recurring cost components are included in these elements. Note that System Enhancement Cost is omitted from the Model. This is the cost of

making corrections or upgrades to hardware or software during the operating phase of the program.

The contractor is responsible for identifying the ITEMS (Line Replaceable Units or LRUs and Shop Repairable Units or SRUs) that are needed for his SEEK TALK system design and how many of each type are needed per platform. The contractor determines the maintenance characteristics of ITEMS, including predicted mean time between failures (PMTBF), where repair actions will be carried out, and times for the various maintenance actions. The contractor also determines requirements and unit costs for Support Equipment, and various parameters relating to Training, Inventory Management and Technical Orders. The Air Force provides maintenance labor rates and factors, pipeline times and other logistic parameters.

As noted in Section 4.2.1, contractor designs for prime mission equipment (PME) or timing net equipment (TNE) may include AM radios such as the ARC-164 or the GRC-171. Support costs for AM radio ITEMS incorporated in SEEK TALK are handled differently when used in TNE than they are when used in PME. For TNE the contractor is responsible for the full support cost of AM radio equipment. For PME, however, the contractor is responsible only for the difference between the cost of supporting the AM radio equipment as part of the SEEK TALK system, and the cost of supporting it as a free-standing radio. (The cost of supporting it as a free-standing radio is here considered to be a sunk cost.)

Specific assumptions embodied in the logistic equations are listed below.

- (1) The Model contains Air Force-supplied equations for eight logistics cost elements:
 - a. Initial Spares
 - b. Replacement Spares
 - c. On-Equipment Maintenance*
 - d. Off-Equipment Maintenance*
 - e. Support Equipment
 - f. New ITEM Inventory Management
 - g. Maintenance Training
 - h. Technical Orders

* "On-equipment" refers to maintenance performed on or at the host platform; "off-equipment" refers to maintenance performed at a base or depot shop.)

- (2) The model is structured assuming organic maintenance. Special instructions and operating procedures are required when contractor maintenance is investigated. Appendix IV provides the necessary information.
- (3) The model allows for three types of bases and for repair depots:
- a. Independent bases with repair capability which are supported only by the main depot (and which in turn do not support any other bases).
 - b. CIMFs - Bases with repair capability which provide maintenance support to satellite or secondary bases. CIMFs are supported only by the main depot. (CIMF = Centralized Intermediate Maintenance Facility).
 - c. Satellite bases with no repair capability other than removing and replacing LRUs, which bases are dependent on a CIMF base for maintenance support. (LRU = Line Replaceable Unit)
 - d. Repair depots or Technology Repair Centers (TRCs) - it is assumed that there is only one Air Force depot for a given LRU or SRU. (SRU=Shop Repairable Unit)
- (4) The basic LCC model assumes that any CIMFs utilized in the support system have the same capabilities as Independent bases. In Appendix IV, however, procedures are defined for circumventing this limitation.
- (5) All failures (and false pulls) which occur at a satellite base are first sent to the associated CIMF (even if the repair is eventually performed at the depot). Satellite bases also receive replacement spares from the CIMF. A satellite base does not possess the capability to identify false pulls. All false pulls are identified at the intermediate (e.g., CIMF) level. (A "false pull" is defined as a removal of an LRU from an installation because of a suspected failure, when that LRU, however, does not exhibit any fault in subsequent test in the shop.)
- (6) All failed and falsely pulled ITEMS are bench checked at the intermediate (e.g., CIMF) level (unless they are not removed from the next higher level indentured ITEM until the depot level).

- (7) Maintenance personnel at all bases and the depot are assumed to be non-dedicated to SEEK TALK, so that maintenance labor costs are accrued on an hours-per-repair basis.
- (8) The expected operating hours per month for equipment on each type of Platform is supplied by the Air Force. Average peacetime operating hours are used to determine Initial Spares and SE requirements. (SE = Support Equipment.)
- (9) No Initial Spares are costed at the depot for discard-on-failure ITEMS. It is assumed that Initial Spares at the depot will have been used up, as Replacement Spares, by the end of the life cycle of the system.
- (10) The Model does not cost preventive maintenance. (This capability could be added later if it proves to be important.)
- (11) The repair level decision for any specific ITEM does not depend on its base location (except when the procedures of Appendix IV are utilized in connection with CIMFs).
- (12) In the basic LCC model, a given SRU is assigned to only one LRU for the accounting calculations. (In the Repair Level Analysis calculation, however, this constraint is removed.)

4.3 Components, Structure, and Interactive Operation of the Model

4.3.1 Major Components of the Model Computer Programs

The SEEK TALK LCC Model computer program consists of three parts: one basic component and two supplementary ones.

The basic component implements an accounting model, to be detailed in Section 5, which model computes the Life Cycle Cost of the SEEK TALK system based on the values of the input parameters corresponding to a particular system design. The output of this first component gives the total LCC and also the LCC broken out into four top-level cost elements, and many subelements. The breakdown of Life Cycle Cost into various categories is intended to help the user identify areas in which design and cost trade-offs should be made.

The second component of the LCC computer program is a supplementary routine which provides a prestructured Sensitivity Analysis computation to be used as an additional aid in trade-off considerations. (These will be detailed in Section 6.) More specifically, for certain selected contractor parameter inputs, this program component computes the average change (either positive or negative) in total LCC which is produced by a fractional increase in the value of the given parameter. Sensitivity studies are of two types, those dealing with changes in global or system-wide parameters, and those dealing with changes on a per-ITEM basis.

The third component of the LCC computer program is a supplementary routine which carries out a Repair Level Analysis (RLA). The procedure and equations for RLA are described in Section 7. This routine determines the maintenance costs associated with each possible repair level decision on each ITEM (i.e., each Line Replaceable Unit or LRU and each Shop Repairable Unit or SRU). Possible repair level decisions are base repair, depot repair or discard. The routine then determines the repair level choice for each ITEM that will (approximately) minimize LCC.

4.3.2 Structure of the Model

The FSED Phase LCC Model is designed to represent the entire SEEK TALK system, worldwide, as its deployment is presently planned. To reduce the size of the files and the amount of calculations required, the Air Force has introduced simplifications in how the system is represented, particularly in regard to its deployment. Nevertheless, the Model does contain some unavoidable complications. These arise primarily from the following factors:

- o SEEK TALK equipment must be installed on a wide variety of airborne and surface host platforms, with varying SEEK TALK performance requirements and integration characteristics.
- o Equipment must interface with a number of different UHF AM voice radios, such as the ARC-164, ARC-171, GRC-171, GRC-206, etc.
- o There is an extensive timing net required as part of the system.
- o The model allows for alternative logistic support approaches, repair levels and approaches to training. The logistic support systems for airborne and surface-based equipments are separate, and may require different approaches for sparing and maintenance.

- o The model must be flexible enough to accept the different system design approaches taken by different contractors who may be competing in the FSED Phase effort.

The SEEK TALK FSED Phase LCC Model deals with four top-level cost elements, namely: RDT&E, Production, Modification/Installation, and Operation and Support. Within these top-level elements, it deals with the subelements shown in Figure 4-1. In the RDT&E cost area, only FSED cost is included, and this is treated as a simple "pass-through".

The manner in which the Model handles the different cost elements varies greatly.

There are no detailed equations provided for estimating production costs. Production costs represent prices for work that the development contractor will himself carry out if he is selected for production. Accordingly, production costs are estimated by the contractor using his own estimating method, but using also Air Force ground rules and general instructions.

The subelement of Modification/Installation cost depicts the kinds of tasks that must be carried out, first for initial integration engineering and test for each host platform type, and second, for the recurrent tasks of making installations on each individual platform. Both Air Force-furnished and contractor-furnished parameters are involved.

The fourth top-level cost element, Operation and Support, is broken down into eleven subelements. For each of these, the Model provides detailed equations that characterize the activities and procedures involved, and utilizes a combination of Air Force-furnished and contractor-furnished input parameters.

The Model characterizes the SEEK TALK system in terms of prime mission equipment (PME) terminals and timing net equipment (TNE) terminals installed on host platforms. Host platforms are deployed at operational sites or bases. PME and TNE installed on host platforms are broken down into Line Replaceable Units (LRUs) which in turn are broken down into Shop Repairable Units (SRUs). In addition to equipment installed on host platforms, there are initial and replacement spares for LRUs and SRUs. The model also provides for Support Equipment (both common and peculiar) that is used in the maintenance and test of ITEMS. It distinguishes between Support Equipment needed for repair, and that needed only for bench checks. Maintenance is performed at bases and at depots. To reduce the number of input parameters, the size of files and the amount of data

processing, both host platforms and operating bases have been aggregated into a small number of groupings. Only the average properties need to be specified for most of the parameters defining each group.

The Air Force establishes the identification and classification of host platforms and operational bases; the contractor structures the ITEMs and the support equipment. The overall functional characteristics of terminals are defined by Air Force requirements, but the determination of what ITEMs are needed in each type of terminal is a contractor function.

4.3.3 Model Input Parameters

A very simplified system diagram for the Model, identifying major inputs, processing and outputs, is shown in Figure 4-3. The figure also references sections of the Manual where detailed descriptions are provided.

The Model contains a large number of input parameters -- some furnished by the Air Force, and some developed by the contractor. These parameters are contained in eleven input data files, two of which are each subdivided into an A and B part. These are briefly described below. The source of the data is also indicated, namely: AF = Air Force, CN = Contractor. It should be noted that groupings of operational bases are identified by index NS; groupings of host platforms, by index NP.

- (1) System-Wide Scalar Parameters. Labor rates and factors, pipeline times, various costs and logistic factors, etc. (Sources: mostly AF, some CN)
- (2) Base Configuration Data. Classification, no. of sites for each base grouping NS. (Source: all AF)
- (3) Platform Operation Data. Classification and operating data for each platform grouping NP. (Sources: mostly AF, some CN)
- (4) Platform Terminal Data and Non-Recurring Modification/Installation Data for each platform grouping NP. (Sources: some AF, some CN):
 - (a) Average deployment of terminals per platform,
 - (b) Terminal costs and miscellaneous parameters.

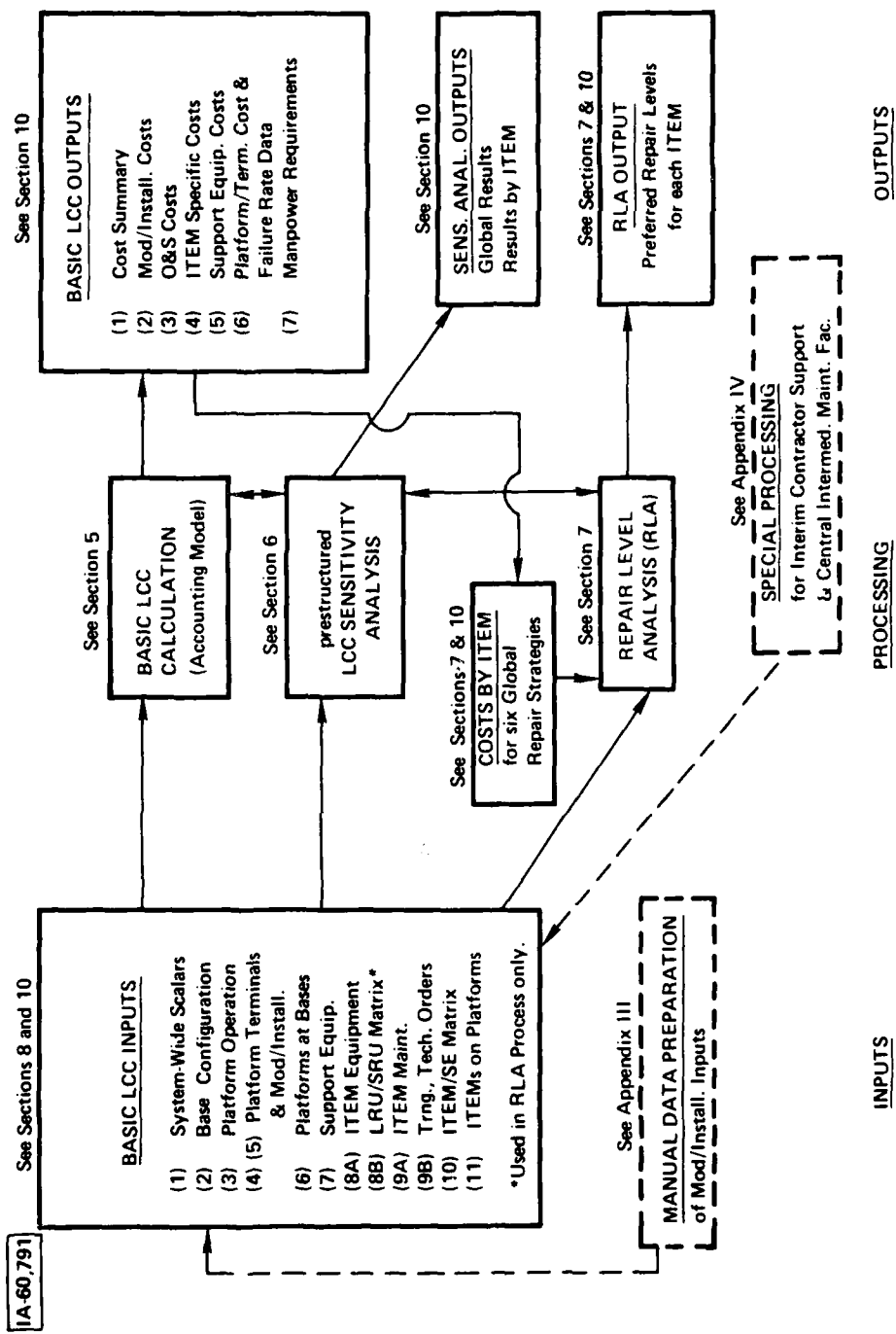


Figure 4-3. Simplified System Diagram of the LCC Computer Model

(c) Non-recurring modification/installation costs.

- (5) Platform Recurring Modification/Installation Data. Recurring modification/installation costs for each platform grouping NP. (Source: some AF, some CN)
- (6) Platform Deployment at Bases. Average deployment of platform groupings NP at each base grouping NS. (Source: all AF)
- (7) Support Equipment Data. Classification and cost factors for Support Equipment. (Source: all CN)
- (8A) ITEM Equipment Data. Definition, classification, properties, costs of ITEMS. (Source: all CN)
- (8B) LRU/SRU Cross Reference Data. Number of SRUs of each type contained in each LRU. (Source: all CN) (This table is used only in Repair Level Analysis.)
- (9A) ITEM Maintenance Data. Reliability and maintenance characteristics of ITEMS. (Source: all CN)
- (9B) ITEM Tech. Order, Training and Software Development Data. Tech. Order, Training and Software Development requirements by ITEM. (Source: all CN)
- (10) ITEM/Support Equipment Cross-Reference. Requirements by ITEM for Support Equipment. (Source: all CN)
- (11) ITEM Configurations for Different Platforms. Deployment of ITEMS per terminal or per platform in platform groupings NP. (Source: all CN)

It should be noted that the Air Force also furnishes ground rules and instructions for the contractors to use in determining their input parameters.

In addition to the eleven basic input files for the Model, as described above, there are inputs used with the supplementary features of the Model. These inputs are Air Force sensitivity analysis inputs that are used to generate desired increments in selected input parameters, and special parameters used only in Repair Level Analysis.

All of the input parameters are described in detail in subsequent sections of this Manual.

4.3.4 Model Outputs

There are several types of off-line printouts provided by the Model, as described briefly below.

The first type of printout is an "echoing" of the data inputs and their names, from the eleven standard input data files. This output allows the user to check that the data were input correctly into the Model.

The other types of printouts document the results obtained from running the Model. They are of three types as listed below and described subsequently.

- o Outputs of the basic LCC calculation, comprising seven different tables.
- o Outputs of the prestructured sensitivity analysis, contained in one multi-part table.
- o Outputs of the Repair Level Analysis, contained in a single table. (There is also a special table that is used in preparing for an RLA run.)

Basic LCC Calculation - The first of these result printouts gives the output of the basic LCC calculation. It contains the cost elements and subelements making up the total LCC of the contractor's SEEK TALK design, as well as quantities of spares, and support equipment and other significant supporting data. There are also costs, failures and other data per ITEM and per Terminal, and costs broken down by type of Platform. These results are displayed in seven different output tables, with the titles listed below:

- (1) Summary by Cost Element
- (2) Platform Modification/Installation Costs
- (3) Operation and Logistics Support Cost Elements
- (4) ITEM-Specific Costs & Maintenance Characteristics (three-part table)
- (5) Support Equipment Requirements and Costs
- (6) Platform/Terminal Cost and Failure Rate Data

(7) Manpower Requirements (for maintenance, data management and training)

All of the seven tables identified above are produced by the off-line printer, when the user calls for a full off-line printout. The user can also request a partial off-line printout, consisting of tables (1), (2) and (6) only. When the user requests terminal output, only Table (1) and a condensed version of Table (6) are provided in the interactive terminal display output. (See Section 10.4)

Sensitivity Analysis - The second type of result printout provides the outputs from a set of prestructured LCC sensitivity analyses. The set of outputs defines the approximate changes in total LCC due to prescribed increments in certain "global" or system-wide multiplying factors. These factors affect program operational lifetime, all ITEM costs, all ITEM failure rates, all ITEM maintenance times and repair materials and all "false pull" rates involved in maintenance. A second set of outputs is devoted to LCC changes due to increments in per ITEM unit costs, per ITEM failure rates, per ITEM repair materials, and per ITEM false pull rates. In addition, a very simple repair level calculation, in which each ITEM is considered independently of other ITEMS, is also presented. The result of each of these ITEM-specific investigations is printed in a format that ranks the first n ITEMS in accordance with the increments that they produce in total LCC.

Repair Level Analysis - The third type of result printout gives the output of the Repair Level Analysis. To prepare for Repair Level Analysis the user first makes six basic LCC runs for different global repair strategies. The resulting table of costs attributed to each ITEM for each repair strategy serves as an input to the RLA process itself. This latter process generates an output table containing the preferred Repair Level for each individual LRU and SRU. Repair level options for each item are (1) Repair at base, (2) Repair at depot, (3) Discard.

4.3.5 Supplemental Instructions

In addition to the model description and operating instructions contained in the body of Volume II, there are some supplemental instructions to users provided in Appendices III and IV.

Appendix III defines ground rules and detailed procedures for contractors to use in determining Modification/Installation parameters in Input Files (4) and (5). The appendix first defines how parameters are to be estimated for each of ten "basis"

platforms. It then defines how these "basis" values are to be converted to values for the platform groupings contained in the Model.

Appendix IV defines how the Model is to be used by the contractors in studying the cost consequences of Interim Contractor Support, and in investigating the use of Centralized Intermediate Maintenance Facilities.

4.3.6 Interactive Use of the Model

The SEEK TALK FSED Phase LCC Model is designed for interactive use via a time-shared capability. The LCC Model may, however, easily be used in the batch mode as well.

A brief description of the organization of the full LCC Model, in its interactive mode, is as follows: First, the nominal values of standard input data files (which include Air Force and Contractor data) are read into the model. Next, certain control parameters (e.g., instructions for output format) are input by the user from his terminal. At this point, the user may also over-write the nominal values of any selection of previous data inputs. Control is then transferred to the computer processor where the program calculates successively the Life Cycle Cost of the modelled SEEK TALK system and the related values of the Sensitivity Analyses. The output of these computations is then directed to two separate devices. If the appropriate control parameter indicates that an off-line copy of output data is required, then the complete set of program output is produced on the off-line printer, including the LCC broken out into various categories and the Sensitivity Analysis values of all designated input factors. In addition, the user's terminal may receive a subset of the LCC output and the values of the Sensitivity Analysis calculations for a selected number of "most significant" input factors.

The user is then asked at the terminal if another run is desired. A "NO" response terminates the program. A "YES" response transfers the user back to the second step in the system operation where the user may input new values for the control parameters and/or over-write the nominal values of a different selection of previous data inputs and then make a new run of the LCC Model. The user can make as many successive modifications of the data and reruns of the LCC Model in this interactive mode as are desired. Alternatively, if the user wishes to perform a detailed analysis of the LCC output and Sensitivity Analysis factors before the model is rerun, the user can terminate the program and use the off-line output as an aid in re-evaluating the SEEK TALK system design and maintenance concepts.

(See Sections 9 and 10 of this Manual for a full discussion of the LCC Model interactive capability.)

4.4 Comparison Between LCC Models for FSED Phase and AD Phase

The FSED Phase LCC Model is similar to the Advanced Development (AD) Phase LCC Model in its general structure, and in most other respects. Thus, for example, the deployment of terminals on platforms located at bases is handled in the same way, although the platform classification scheme has been changed. Also the partition of terminals into LRUs and SRUs is the same. There are, however, several differences, which are outlined below.

The major points of difference are as follows. The FSED Phase Model has one additional computing routine: a relatively sophisticated Repair Level Analysis. The FSED Phase Model also contains two additional cost elements (Maintenance Training and Technical Orders), but omits all RDT&E costs except those for the contract's FSED phase. These differences require in turn some changes (mostly additions) in parameters, some changes in basic LCC Model equations and some modifications in input and output tables and data. There are also a number of minor adjustments and updates to the Model.

The Air Force input parameters have been updated, including adjustments in deployment data, terminal configuration data, and labor rates and other price-related parameters. In addition, instructions for the preparation of Contractor inputs have been revised in several areas.

Specific characteristics of the FSED Phase Model that are different from those of its AD Phase predecessor are as follows:

1. The classification of host platforms has been changed to agree with the structure of the present system specifications. The classification now reflects both the type of platform and the overall terminal configuration. Platform groupings are:
 - (1) Tactical aircraft, Full-up (maximum or Type I) configuration
 - (2) Tactical aircraft, Partial array (intermediate or Type II) configuration
 - (3) Tactical aircraft, Modem-only (minimum or Type III) configuration
 - (4) Cargo/electronic aircraft, Modem-only (Note: this category includes primarily the airborne command/control aircraft.)

- (5) Fixed/transportable Ground Elements, Modem-only
 - (6) Mobile Ground Elements, Partial array
 - (7) Manpack Units, Modem-only
 - (8) Master Clock Sites
2. Two new cost elements - Maintenance Training and Technical Orders - have been added and most RDT&E costs have been eliminated. The new cost elements require a considerable number of new input parameters, some furnished by the Air Force and some by the contractor.
 3. A major Repair Level Analysis (RLA) capability has been added as a supplementary routine available to the model. This capability requires a new model input table: this is a matrix defining for each LRU the set of SRUs it contains, and in what multiplicities. In addition, a table summarizing the results of LCC runs for each of six global repair strategies is utilized as an RLA input. The RLA output is a table giving repair level decisions by ITEM (LRU and SRU).
 4. Major new outputs consist of RLA decisions and maintenance manpower requirements broken-out by site. Output Table 1 has been changed: it now partitions LCC in accordance with a standard cost breakdown structure.
 5. There are changes in the Modification/Installation parameters and in the instructions given for calculation of contractor inputs. Each parameter is designated either as an Air Force input, or as a contractor input - the "jointly determined" classification has been eliminated. The contractor now establishes non-recurring costs by platform type, and both recurring A-Kit costs and recurring variable installation labor hours by platform type. The non-recurring costs, previously comprising five elements (engineering, prototype A-Kits, test, proofing and data) have been coalesced into a single element.
 6. Computation of intermediate level maintenance time has been subdivided into base shop bench check time, and base shop repair time.
 7. In accordance with item 6 above, SL requirements must now be identified with the type of maintenance action (bench check, repair, or both) from which they result. Hence, it is no longer sufficient to state in Input File 10 what types of support equipment are needed for the maintenance of each type of ITEM. In addition, it must also be stated

whether the SE is required for repair (or bench check, or both) of the ITEM.

8. The development cost for peculiar support equipment must now be entered separately, instead of being figured into SE purchase price. SE development cost inputs are further subdivided into cost for hardware and for software. Also SE costs are presented separately for peculiar and for common in Output Table 3.
9. Special instructions are provided in Appendix IV to cover cost calculations for certain logistic alternatives, namely: use of contractor instead of organic maintenance, and use of Centralized Intermediate Maintenance Facilities.
10. The nature of the contractor parameters for Input File 11 has been changed, so that these parameters no longer depend upon the number of terminals per platform, an Air Force input in Input File 4.

SECTION 5

COST ELEMENT EQUATIONS

In this section the detailed equations for the Cost Elements listed in Section 4.1 are presented. The motivations and specific assumptions underlying the structure of each of these equations are also identified.

To avoid redundancy, the convention of defining variables which appear in these equations only on their first occurrence is followed. The Glossary in Appendix I provides a handy reference if the reader wishes to recheck the definition of variables on subsequent occurrences.

The letters used for the indices of variables which appear in the equations below adhere to the following additional convention:

I - ITEM type	NP - platform grouping
NS - base type	L - support equipment type
M - mode of modification/ installation on platforms	IA - equipment area on platforms for modification/installation

5.1 Auxiliary Calculations

First presented here are the equations for certain internally computed quantities (i.e., not direct data inputs) which appear frequently within the Cost Element and Sensitivity Analysis Equations. This format will serve both to emphasize the importance of these internally computed variables and to facilitate the presentation of the Cost Element and Sensitivity Analysis Equations in the following sections.

5.1.1 Failure Rates

First, the average failure rate for each ITEM at each base is defined by:

FAIL(I,NS) = the average number of failures (not including repairs in place or false pulls) of ITEM type I per month at each base of type NS (from all platforms NP deployed at the base), given by the equation:

$$\text{FAIL}(I,NS) = \sum_{NP} [\text{NITEM}(I,NP) * (1 - \text{RIP}(I)) * \text{NPLT}(NP,NS) * \text{APFH}(NP,LO(NS)) * \text{TFAC}(NP) * \text{KFAC}(LE(NP)) / \text{PMTBF}(I,LE(NP))] * \text{XFR}$$

where

$$\begin{aligned} \text{NITEM}(I,NP) &= \text{average number of ITEMS of type I in each platform within grouping NP} \\ &= [\text{INTEG}(I) + (1 - \text{INTEG}(I)) * (\text{NTRMP}(NP) + \text{NTRMT}(NP))] * \text{NITEMR}(I,NP) \end{aligned}$$

$\text{INTEG}(I) = 1$ if I is an integration ITEM; 0 otherwise.

$\text{NTRMP}(NP) =$ average number of PME terminals installed on each platform within grouping NP.

$\text{NTRMT}(NP) =$ average number of TNE terminals installed on each platform within grouping NP.

$\text{NITEMR}(I,NP) =$ average number of ITEMS of type I in each platform within grouping NP if I is an integration ITEM, i.e., $\text{INTEG}(I) = 1$; otherwise (i.e., $\text{INTEG}(I) = 0$), it is the average number of ITEMS of type I in each terminal (PME or TNE) on platforms within grouping NP.

$\text{RIP}(I) =$ fraction of maintenance incidents ITEM type I which are met by repair-in-place with piece parts.

$\text{NPLT}(NP,NS) =$ average number of platforms of type NP located at each base of type NS.

$\text{APFH}(NP,LO(NS)) =$ average operating hours per month for platform type NP operating at base location $LO(NS)$.

$\text{TFAC}(NP) =$ average fraction of operating time of platform type NP that SEEK TALK equipment is activated.

$\text{KFAC}(LE(NP)) =$ the reliability factor used to convert predicted failure rates to operational failure rates as a function of the environment $LE(NP)$ of platform NP. (See Section 8.2.1)

PMTBF(I,LE(NP)) = predicted mean operating hours between failures, over the life cycle, for an ITEM of type I operating in environment LE(NP), including maintenance actions involving repair-in-place with piece parts, e.g., replacing indicator lights. Should be calculated so as to represent the series, rather than system, failure rate of ITEM type I, including an adjustment for "duty cycle", as indicated in MIL HDBK 217C. (See Section 8.3.8)

XFR = failure rate multiplier factor (may be used to globally adjust all ITEM failure rates for system trade-off studies).

LO(NS) = location of base NS, defined as:
1, if base NS is within continental U.S.,
2, if base NS is a Pacific base,
3, if base NS is a European base.

LE(NP) = operating environment of platform NP, equals:
1, for Airborne-fighter platforms,
2, for Airborne-cargo platforms,
3, for Ground-fixed/transportable platforms,
4, for Ground-mobile/manpack platforms.

5.1.2 Pipeline Spares

Next, one can compute ITEM pipeline spares at the bases and at the depot, i.e., the average number of ITEMS of a given type I which are awaiting corrective maintenance action or replacement in supply at each location. These calculations are used to compute Initial Spares requirements, and are based on monthly failure rates.

NFB(I,NS) = expected number of failures of ITEM type I in base NS pipeline, given by the two cases:

(i) For a satellite base NS,

$$NFB(I,NS) = FAIL(I,NS) * LRU(I) * (1 + XFPR * FPR(I)) * OSTC$$

where

OSTC = average order & shipping time from a satellite base to its associated CIMF (in months)

LRU(I) = LRU (line replaceable unit) indicator, equals 1 if ITEM type I is an LRU and equals 0 otherwise.

FPR(I) = false pull rate of ITEM type I; i.e., that multiple of actual failures which are removed but haven't failed.

FPR(I) should be calculated so as to satisfy the equation:

$$(\# \text{ of removals}) = (1 + \text{FPR}(I)) * (\# \text{ of failures of ITEM } I)$$

XFPR = false pull rate multiplier factor (may be used to globally adjust all ITEM false pull rates for system trade off studies)

(ii) For an Independent or CIMF base,

$$\begin{aligned} \text{NFB}(I, \text{NS}) = & \text{FAIL}(I, \text{NS}) * (\text{LRU}(I) + \text{RTS}(\text{NHI}(I))) * [(\text{FPR}(I) * \text{XFPR} + \\ & \text{RTS}(I)) * \text{BRCT} + (\text{NRTS}(I) + \text{COND}(I)) * \text{OST}(\text{LO}(\text{NS}))] \\ & + \text{CIMF}(\text{NS}) * \left\{ \sum_{\substack{B \\ \text{NHB}(B) = \text{NS}}} \text{FAIL}(I, B) * \text{NBC}(B) \right\} * (\text{LRU}(I) + \text{RTS}(\text{NHI}(I))) \\ & * [(\text{RTS}(I) + \text{FPR}(I) * \text{XFPR}) * \text{CRCT} + (\text{NRTS}(I) + \text{COND}(I)) \\ & * (\text{OST}(\text{LO}(\text{NS})) + \text{U}(\text{FPR}(I) * \text{XFPR}) * \text{CRCT})] \end{aligned}$$

where

RTS(I) = fraction of (removed) failures of ITEM type I which are repairable at the intermediate level

NRTS(I) = fraction of failures which must be repaired at the depot level

COND(I) = fraction of failures which are discarded, either due to wearout or on the basis of an RLA decision.

Note: The RTS(I), NRTS(I) and COND(I) fractions refer only to failures which are removed from the host platform and specifically do not apply to failures repaired-in-place or to false pulls. In addition, for each ITEM type I, these fractions must satisfy the identity:

$$RTS(I) + NRTS(I) + COND(I) = 1.$$

For the purposes of the automated repair level analysis capability, explained in Section 7, the value of COND(I) actually input by the user should represent only the fraction of failures discarded due to wearout (assuming that, if repair is possible, it is performed). The definition of COND(I) given in the Glossary (Appendix I) reflects this. However, the user has the option to input the discard-on-failure repair level decision for an ITEM via the repair level code variable, RL(I), defined in Section 5.1.4 and Appendix I.

OST(LO(NS)) = average order & shipping time in months from a base NS to the depot (dependent on the location of the base LO(NS))

BRCT = base repair cycle time, amount of time from removal of failed (or falsely pulled) ITEM at the base until repair at the (same) base and return of the ITEM to base inventory (in months).

CRCT = amount of time from removal of a failed ITEM at a satellite base until ITEM is shipped to and repaired at the associated CIMF base and returned to CIMF inventory (in months).

NHB(NS) = for satellite bases of type NS, equals the index of the CIMF base on which it is dependent and equals 0 if base NS is not a satellite base.

CIMF(NS) = CIMF base indicator, equals 1 if base NS is a CIMF base (i.e., if BTYPE(NS)=2) and equals 0 otherwise.

BTYPE(NS) = base type indicator; equals: 1, if base NS is an independent base; 2, if base NS is a CIMF; 3, if base NS is a satellite base.

NBC(NS) = for a satellite base NS, equals the number of bases of type NS which occur within the CIMF system which contains base NS and equals 0 if base NS is not a satellite base.

NHI(I) = for ITEM types I which are SRUs (shop repairable units), equals the index of the next higher level indentured ITEM in which ITEM I is contained (with the convention that NHI(I) = 0 if ITEM type I is an LRU).

Note: The use of the term RTS(NHI(I)) above allows for the fact that an SRU can only be repaired at the intermediate level if its next higher indentured ITEM, NHI(I), was repaired at that level. If ITEM type I is an LRU (so that NHI(I) = 0) then we set "RTS(0) = 0" and LRU(I) = 1 so that the above equation simplifies to a form suitable for LRUs. Thus, for both SRUs and LRUs, the expression "(LRU(I)+RTS(NHI(I)))" represents the fraction of the time that a failed ITEM of type I is available for repair (i.e., removed from its next higher assembly) at the base level. Hence, this expression is used as a "correction factor" throughout the equations which appear in Sections 4 and 5. In these equations we use the convention that RTS(0) = NRTS(0) = COND(0) = 0 to allow for the case when NHI(I) = 0.

Also above,

U = positive quantity indicator function, for any number X,
 $U(X) = 1$ if X is greater than zero and $U(X) = 0$ otherwise.

For the depot we have:

NFD(I) = expected number of failures of ITEM type I in the depot pipeline, given by:

$$\begin{aligned} \text{NFD(I)} = & \sum_{\text{NS}} \text{FAIL(I,NS)} * \text{TNB(NS)} \\ & * [(\text{LRU(I)} + \text{RTS(NHI(I)))} * \text{NRTS(I)} * \text{DRCT(LO(NS))} \\ & + \text{NRTS(NHI(I))} * (1 - \text{COND(I)}) * \text{DAD}] \end{aligned}$$

where,

TNB(NS) = total number of bases within the entire SEEK TALK system which are (treated as being) identical to base NS.

DRCT(LO(NS)) = amount of time in months from shipment of a failed ITEM from base NS to the depot until it is received

and repaired at the depot and returned to depot inventory (as a function of the location LO(NS) of base NS).

DAD = average depot handling and repair time in months from removal of a failed ITEM at the depot until it is repaired and placed in depot inventory.

Note: NFD(I) = 0 if COND(I) = 1; i.e., no sparing provision is made at the depot for discard-on-failure ITEMS (or "worn-out" condemnations).

5.1.3 Maintenance Manhour Requirements

The next set of "Auxiliary Calculations" deal with ITEM corrective maintenance manhour requirements at various locations and with related support equipment utilization. Specifically, we have

ERHBI(I,NS) = expected intermediate - level maintenance manhours per month expended at a base of type NS in maintenance of ITEM type I, computed by the conditions:

- (i) ERHBI(I,NS) = 0 if base NS is a satellite base, i.e., BTYPE(NS) = 3
- (ii) If base NS is an Independent (BTYPE(NS) = 1) or a CIMF base (BTYPE(NS) = 2), then

$$ERHBI(I,NS) = EBCBI(I,NS) + ERTBI(I,NS)$$

where

EBCBI(I,NS) = expected intermediate-level maintenance manhours per month expended at a base of type NS in bench checking of ITEM type I,

ERTBI(I,NS) = expected intermediate-level maintenance manhours per month expended at a base of type NS in repair of ITEM Type I,

and these two variables are computed as follows:

$$EBCBI(I,NS) = ERTBI(I,NS) = 0 \text{ if } BTYPE(NS) = 3, \text{ otherwise}$$

$$\begin{aligned}
\text{EBCBI}(I, \text{NS}) &= \text{FAIL}(I, \text{NS}) * (\text{LRU}(I) + \text{RTS}(\text{NHI}(I))) \\
&\quad * (1 + \text{XFPR} * \text{FPR}(I)) * \text{BCMHI}(I) * \text{BMF} \\
&\quad + \text{CIMF}(\text{NS}) * \left\{ \sum_{\substack{B \\ \text{NHB}(B) = \text{NS}}} \text{FAIL}(I, B) * \text{NBC}(B) \right\} * (\text{LRU}(I) + \text{RTS}(\text{NHI}(I))) \\
&\quad * [(\text{RTS}(I) + \text{NRTS}(I) + \text{FPR}(I) * \text{XFPR} \\
&\quad + \text{U}(\text{FPR}(I) * \text{XFPR}) * \text{COND}(I)) * \text{BCMHI}(I)] * \text{BMF}
\end{aligned}$$

and

$$\begin{aligned}
\text{ERTBI}(I, \text{NS}) &= \text{FAIL}(I, \text{NS}) * (\text{LRU}(I) + \text{RTS}(\text{NHI}(I))) * \text{U}(1 - \text{COND}(I)) \\
&\quad * \text{RTS}(I) * \text{BMHI}(I) * \text{BMF} \\
&\quad + \text{CIMF}(\text{NS}) * \left\{ \sum_{\substack{B \\ \text{NHB}(B) = \text{NS}}} \text{FAIL}(I, B) * \text{NBC}(B) \right\} * (\text{LRU}(I) + \text{RTS}(\text{NHI}(I))) \\
&\quad * \text{U}(1 - \text{COND}(I)) * \text{RTS}(I) * \text{BMHI}(I) * \text{BMF}
\end{aligned}$$

where

$\text{BCMHI}(I)$ = average manhours to perform a base shop bench check, screening and fault verification of the removed ITEM prior to initiating repair action or condemning the ITEM.

$\text{BMHI}(I)$ = average manhours at a base to perform intermediate-level corrective maintenance of a failed ITEM of type I, including fault isolation, repair and verification.

BMF = base repair maintenance factor, to be applied to repair times to allow for time to get test equipment, parts, etc.

At the depot, we have

ERHD(I) = expected manhours per month expended at the depot in repair of ITEM type I, calculated via the equation:

$$\begin{aligned} \text{ERHD}(I) = & \sum_{\text{NS}} \text{FAIL}(I, \text{NS}) * \text{TNB}(\text{NS}) \\ & * [(\text{LRU}(I) + \text{RTS}(\text{NHI}(I))) * \text{NRTS}(I) \\ & + \text{NRTS}(\text{NHI}(I)) * (1 - \text{COND}(I))] * \text{DMH}(I) * \text{DMF} \end{aligned}$$

where

DMH(I) = average manhours to perform depot-level corrective maintenance on a failed ITEM of type I, including bench check-out, screening, fault verification and isolation, repair action and repair verification.

DMF = depot repair maintenance factor, to be applied to repair times to allow for time to get test equipment, spare parts, etc.

For support equipment utilization, we then have

ERHAB(L, NS) = expected utilization of support equipment type L at a base of type NS in hours per month, computed by:

$$\text{ERHAB}(L, \text{NS}) = \sum_{\substack{I \\ \text{SECODE}(I, L) > 1}} \text{EBCBI}(I, \text{NS}) + \sum_{\substack{I \\ 0 < \text{SECODE}(I, L) < 3}} \text{ERTBI}(I, \text{NS})$$

where

SECODE(I, L) = requirement indicator for support equipment type L with respect to ITEM type I, equals

- 0 if SE type L not required for any maintenance of ITEM type I,
- 1 if SE type L required for repair but not base shop bench check of ITEM type I,
- 2 if SE type L required for both repair and base shop bench check of ITEM type I,
- 3 if SE type L required for base shop bench check but not repair of ITEM type I.

Also,

ERHAD(L) = expected utilization of support equipment type L at the depot in hours per month, computed by:

$$ERHAD(L) = \sum_I ERHD(I) \\ 0 < SECODE(I,L) < 3$$

The maximum number of units of each SE type required in any one maintenance action performed at a particular location is given by:

ISET(L,NS) = maximum number of copies of support equipment type L required for any maintenance action which will be performed at a base of type NS, calculated by the equation:

where

$$ISET(L,NS) = \text{Max}[A(I,L)] \text{ over all } I \text{ such that } ERHBI(I,NS) > 0.$$

where

A(I,L) = the number of pieces of support equipment (SE) type L required in the maintenance of ITEM type I

Similarly,

ISETD(L) = maximum number of copies of support equipment type L required for any maintenance action which will be performed at the depot, calculated by:

$$ISETD(L) = \text{Max}[A(I,L)] \text{ over all } I \text{ such that } ERHD(I) > 0.$$

Finally, the number of copies of each support equipment type required at each location is given by

NSEB(L,NS) = number of copies of support equipment type L required at each base of type NS, computed by the formula:

$$NSEB(L,NS) = \begin{cases} (ERHAB(L,NS)/BAA) * ISET(L,NS), & \text{if } L \text{ is common SE} \\ & \text{available on site (i.e., SETYPE(L)=1)} \\ + \\ [ERHAB(L,NS)/BAA] * ISET(L,NS), & \text{otherwise} \end{cases}$$

and

NSED(L) = number of copies of support equipment type L required at the depot, computed by the formula:

$$NSED(L) = \begin{cases} \lceil [ERHAD(L)/DAA] * ISFTD(L) \rceil, & \text{if L is common SE available} \\ & \text{at depot (SETYPE(L)=1)} \\ \lceil [ERHAD(L)/DAA] * ISETD(L) \rceil, & \text{otherwise} \end{cases}$$

where

BAA = total available active work time per maintenance man in hours/month at a base repair shop

DAA = total available active work time per maintenance man in hours per month at a depot repair shop

SETYPE(L) = support equipment acquisition indicator, equals
1 if SE type L is common and available on-site (refer to Air Force-provided list of this SE),
2 if SE type L is common but requires procurement for SEEK TALK use,
3 if SE type L is peculiar.

+

The operation $\lceil \]$ represents rounding up to the next integer (when the quantity in brackets is not itself an integer). Thus, common support equipment which is available at base sites may be prorated by utilization. Other support equipment must be purchased in whole units.

5.1.4 Calculation of Repair Level Fractions

The LCC Model is equipped with a short-cut mechanism for inputting ITEM repair levels. This mechanism is operated via the use of the repair level code variable, RL(I). RL(I) is a contractor input in Data File (9A). For each ITEM type I, RL(I) can be given one of four possible values: 0, 1, 2, or 3. The corresponding results of each of these values are outlined in Table 5-1. Basically, setting RL(I) equal to zero has no effect, while giving RL(I) a non-zero value will cause the input values of the repair level fractions, RTS(I), NRTS(I), and COND(I), to be overridden (replaced with internally calculated values).

Table 5-I

Results of Different Values of RL(I)

<u>RL(I)</u>	<u>Result</u>
0	Initially input values of RTS(I), NRTS(I), and COND(I) are used in the LCC Model.
1	Input values of RTS(I), NRTS(I), and COND(I) are replaced with internally calculated values representing base repair of ITEM type I.
2	Input values of RTS(I), NRTS(I), and COND(I) are replaced with internally calculated values representing depot repair of ITEM type I.
3	Input values of RTS(I), NRTS(I), and COND(I) are replaced with internally calculated values representing discard-on-failure of ITEM type I.

Given a non-zero value for RL(I), the LCC Program will calculate the corresponding values for RTS(I), NRTS(I) and COND(I) according to Table 5-II. Note that the entries of this table are determined by knowing that the value of COND(I) has to be at least WEAR(I), where

WEAR(I) = the fraction of (removed) failures of
ITEM type I which are condemned, due to
normal wear-out.

(Note that WEAR(I) gets its value from the initially input value of COND(I). Therefore, even if the user chooses to override the initially input repair level fractions via a non-zero value of RL(I), COND(I) must still be given a meaningful value. This value should represent the fraction of ITEM type I failures for which repair is infeasible due to wear-out (regardless of economic repair level decision).)

Also the value of NRTS(I) has to be at least $RTS(I) * BIRD$, where

BIRD = the fraction of base-repair-intended failures
which are actually repaired at the depot due
to insufficient base repair capability.

Finally, a largest possible fraction is assigned to RTS(I), NRTS(I), or COND(I) if ITEM type I is base-repaired, depot-repaired or

discarded on failure respectively. Of course, the condition that $RTS(I) + NRTS(I) + COND(I) = 1$ is maintained.

Table 5-II

Calculation of Repair Level Fractions

<u>RL(I)</u>	<u>RTS(I)</u>	<u>NRTS(I)</u>	<u>COND(I)</u>
1 (base)	$\frac{1-WEAR(I)}{1+BIRD}$	$RTS(I)*BIRD$	$WEAR(I)$
2 (depot)	0	$1-WEAR(I)$	$WEAR(I)$
3 (discard)	0	0	1

Note that if $RL(I) = 0$, then there will be no calculation of these fractions. Instead, the input values of $RTS(I)$, $NRTS(I)$, and $COND(I)$ will be used provided their sum is exactly 1.

The Model also provides the means for the user to input a global maintenance strategy by changing the value of only one variable. This is the scalar R whose possible values are the integers from 0 to 6 inclusive. Setting R equal to 0 has no effect and the input value of $RL(I)$ is still the determinant of the individual ITEM I's repair level. Giving R one of its non-zero values causes the internal setting of the variables $RL(I)$ as described in Table 5-III.

Table 5-III

Results of Non-Zero Values of R

Resulting values of $RL(I)$ if I is an LRU or SRU:

<u>R</u>	<u>An LRU</u>	<u>An SRU</u>
1	1	1
2	1	2
3	1	3
4	2	2
5	2	3
6	3	3

The interpretation of Table 5-III is that if R=1, both LRUs and SRUs are all designated for base repair; if R=2, all LRUs are base-repaired and all SRUs are depot-repaired; if R=3, LRUs are base-repaired and SRUs are discarded-on-failure; if R=4, both LRUs and SRUs are depot-repaired; if R=5, all LRUs are depot-repaired and SRUs are discarded-on-failure; and finally, if R=6, all LRUs (and hence their contained SRUs) are discarded-on-failure. For repair strategy other than the six described above, R value should be set at zero and RL(I)s need to be individually specified.

The capability provided by R was built into the Model for the main purpose of generating the ITEM cost input matrix TIAC(I,R) for the Repair Level Analysis Program described in Section 7. However, the user may choose to utilize the variable R for quickly inputting one of the six global maintenance strategies described above. In this event, he should be aware that a non-zero value of R will cause the computation and printing (on Output Table 4A described in Section 9.2.5) of TIAC(I,R) where

TIAC(I,R) = total repair-level-dependent cost attributed to
ITEM type I by global maintenance strategy R
(for non-zero values of R only).

This variable is computed by

$$\begin{aligned} \text{TIAC(I,R)} = & \text{ISCA(I)} + \text{RSCA(I)} + \text{ONMCA(I)} + \text{OFMCA(I)} + \text{SECI(I)} \\ & + \text{IIMCA(I)} + \text{TDC(I)} + \text{MTRCI(I)} \end{aligned}$$

Where the variables summed on the right-hand side are ITEM-specific parts of eight cost elements defined and computed in section 5.2.4 - 5.2.11 below.

5.2 Cost Element Equations

In this section the equation and an explanatory discussion for each of the eleven Cost Elements listed in Section 4.2 are presented. Free use will be made in these equations of the Auxiliary Calculations presented in the previous section. Each Cost Element will be treated in a separate sub-section below.

The total system-wide life cycle cost (LCC) is computed as the sum of the following eleven cost elements:

PRODC - Production	OFMC - Off-Equipment Maintenance
MIC - Modification/Installation Maintenance	SEC - Support Equipment
OC - Operations	IIMC - ITEM Inventory Management
ISC - Investment Spares	STDC - System-Wide Technical Orders
RSC - Replacement Spares	
ONMC - On-Equipment Maintenance	MTRC - Maintenance Training

5.2.1 Production Cost Element

The Production Cost of the SEEK TALK system will be taken as the sum of unit terminal costs for all terminals deployed, including both prime mission equipment (PME) terminals and timing net equipment (TNE) terminals.

Thus

$$\text{PRODC} = \sum_{\text{NS}} \sum_{\text{NP}} \text{TNB}(\text{NS}) * \text{NPLT}(\text{NP}, \text{NS}) \\ * [\text{NTRMP}(\text{NP}) * \text{TUPP}(\text{NP}) + \text{NTRMT}(\text{NP}) * \text{TUPT}(\text{NP})] * \text{XUC}$$

where

TNB(NS) = total number of bases in the SEEK TALK System which are (treated as being) identical to base NS

NPLT(NP,NS) = average number of platforms of type NP deployed at each base within grouping NS.

NTRMP(NP) = average number of PME terminals installed on platforms within type NP

TUPP(NP) = average unit cost in dollars of PME terminals installed on platforms of type NP, including Full-up, Partial, and Modem-only terminal configurations

NTRMT(NP) = average number of timing net terminals installed on platforms within type NP

TUPT(NP) = average unit cost in dollars of timing net terminals installed on platforms of type NP

XUC = unit cost multiplier factor. (May be used to globally adjust all ITEM and terminal unit costs in sensitivity analyses or system trade-off studies)

Note: PME terminals may be installed in either Full-up, Partial, or Modem-only configurations (in accordance with the instructions provided in Section 8.3.11). Each of these configurations counts as one terminal in the term NTRMP(NP). Thus the terminal unit cost TUPP(NP) should be the average unit cost over all Full-up, Partial, and Modem-only terminal configurations within platform grouping NP.

5.2.2 Modification/Installation Cost Element

This cost element is divided into a non-recurrent component; that is, the cost of developing the required modifications and installations to be performed in installing terminals on each different platform type, and a recurrent cost; that is, the unit cost of performing the developed modification/installation on each individual platform, including both production line modification/installations and retrofits.

The non-recurring development cost for each platform grouping NP, denoted IMICA(NP), is given by the equation

$$IMICA(NP) = PDIV(NP) * NRMI(NP)$$

where

PDIV(NP) = factor defining the total effective number of different types of platforms within platform grouping NP.

NRMI(NP) = average cost per platform type within group NP of non-recurring cost necessitated by development of the modification/installation required for the installation of SEEK TALK equipment in platforms of type NP.

Note: An individual platform grouping NP contains platform types which are similar, but not exactly the same. Platform groupings were made on the basis of functional similarities (e.g., supersonic fighter aircraft) and the likelihood of identical SEEK TALK equipment configurations. The contractor should make an estimate of the parameter NRMI(NP) for a single representative platform type within grouping NP, in accordance with the instructions in Section 8.3.3 and Appendix III. The Air Force - provided platform diversity factor PDIV(NP) will then adjust these estimates to account for the additional Modification/Installation development costs due to the differences in platform types within grouping NP.

The average recurrent modification/installation cost for a platform within grouping NP, denoted RMICA(NP), is given by the equation

$$RMICA(NP) = \sum_M FR(M, NP) * \left\{ MIFIX(M, NP) + \sum_{IA} [MIMH(IA, M, NP) * XMIL * MILR(M) + AKIT(IA, NP)] \right\}$$

where

FR(M, NP) = fraction of all platforms within grouping NP which undergo modification/installation in mode M

MIFIX(M, NP) = the fixed modification/installation cost for platform type NP in modification/installation mode M, meant to cover the cost of platform preparation for the modification/installation and the subsequent platform restoration

MIMH(IA,M,NP) = the average number of man-hours required to perform a modification/installation to area IA on platform type NP in mode M

XMIL = Modification/installation labor manhours multiplier factor (may be used to adjust all mod/installation manhour estimates by a uniform factor to measure LCC sensitivity or to perform system trade-off studies)

MILR(M) = modification/installation labor rate in dollars per manhour for modification/installations performed in mode M

AKIT(IA,NP) = unit cost for each "A-Kit" required for a modification/installation to area IA on platform type NP, to include all installation material cost not included in "terminal" costs

Note: Antennas are considered part of PME (B-kits), not part of A-kits. Thus antenna equipment costs should be averaged into unit terminal costs used in the Production Cost Element and not included in AKIT(IA,NP) costs.

M = mode in which platform Modification and Installation is performed, identified by
1, if MOD/I performed during platform production
2, if MOD/I performed in the field (by a depot team)
3, if MOD/I performed at the depot

IA = index for various modification/installation areas on platforms. Values are:
1, to indicate Antenna area
2, to indicate Electronics Box area
3, to indicate Control Head area
4, to indicate Cabling area

Note: the recurring, non-fixed mod/installation cost per platform is divided into costs due to the four areas: Antenna, Electronics Box, Control Head, and Cabling. Thus, again since any individual platform grouping NP contains platforms of somewhat different types, the contractor should make estimates of the manhours MIMH(IA,M,NP) required for mod/installations in areas on the basis of a single representative platform type within each grouping NP, in accordance with the instructions provided in Section 8.3.4 and Appendix III.

The total Modification/Installation Cost is then given by

$$MIC = \sum_{NP} [IMICA(NP) + \sum_{NS} TNB(NS) * NPLT(NP, NS) * RMICA(NP)]$$

Thus the initial, non-recurring cost of developing Modification/Installations is incurred only once for each platform grouping NP, whereas the recurring Modification/Installation cost is incurred for each individual platform within grouping NP, located at all the bases where these platforms are deployed.

5.2.3 Operations Cost Elements

This cost element consists of the sum of Operational Labor Cost, OLC, and Added Fuel Cost, AFC, so that we have

$$OC = OLC + AFC$$

Operational Labor Cost is meant to cover the cost of man-hours expended in routine operation of both Prime Mission Equipment Terminals and Timing Net Terminals. The Added Fuel Cost is due to additional drag created by SEEK TALK antenna elements. The added fuel consumption due to additional weight of SEEK TALK equipment is under study and will be incorporated if it is determined to be significant.

First, we consider Operational Labor Cost. It is assumed that there may be some operational (not maintenance) labor associated with each Timing Net Equipment Terminal, and that this consumes a number of labor minutes per TNE terminal operating day. Personnel are assumed to be non-dedicated.

It is further assumed that for each mission, there may be some operational labor associated with initial activation of a Prime Mission Equipment terminal. This is figured as labor minutes per mission, and also assumes non-dedicated personnel.

The equation for Operational Labor Cost is

$$OLC = OLCT + OLCP$$

where

$$OLCT = \text{timing net costs}$$

$$OLCP = \text{prime mission costs}$$

These two quantities are given by the equation below

$$OLCT = 365 * PIUP * TNLR * \sum_{NS} \sum_{NP} NPLT(NP, NS) * TNE(NS) * MMPD(NP, LO(NS))$$

and

$$OLCP = 12 * PIUP * PMLR * \sum_{NS} \sum_{NP} NPLT(NP, NS) * TNE(NS) * MMPM(NP) * \\ * AMPM(NP, LO(NS)) / 60$$

where

PIUP = planned inventory utilization period in years for the SEEK TALK system

TNLR = timing net operator labor rate in dollars per hour

PMLR = prime mission equipment operator labor rate in dollars per hour

AMPM(NP, LO(NS)) = average prime mission equipment missions per month for platform type np at location LO(NS)

MMPD(NP, LO(NS)) = timing net minutes of operator labor per day for platform type NP deployed at a base with location LO(NS)

MMPM(NP) = prime mission equipment minutes of operator labor per mission figured on a platform basis to cover initial activation of PME terminals.

Note: The parameter MMPM(NP) only applies to prime mission equipment platforms and should be entered as zero for timing net platforms. Similarly, MMPD(NP, LO(NS)) only applies to timing net platforms and should be entered as zero for prime mission equipment platforms.

Next we consider Added Fuel Cost. For each airborne platform, the SEEK TALK added antenna elements increase the drag of the airframe. Hence to maintain the same average speed more fuel must be consumed per hour, or if the rate of fuel consumption is unchanged the mission will take longer. In the calculations, it is assumed that the fuel consumption rate is increased to provide an increment in average engine thrust equal to the average antenna drag.

It is further assumed that we have, for Platform NP, a direct proportionality between drag added to NP, and added fuel consumption required for NP. Specifically, we set:

(Added fuel consumption for NP) = FUNCTION(NP)*(drag added to NP),
 where

$$\text{FUNCTION(NP)} = \text{FGH(NP)} / (\text{K(NP)} * \text{THRS(NP)}),$$

and FGH(NP) represents fuel consumption rate in the absence of extra drag, THRS(NP) represents average engine thrust utilized in the absence of extra drag, and K(NP) is a constant for each platform.

These considerations lead to the development of the following equation for Added Fuel Cost:

$$\text{AFC} = 12 * \text{PIUP} * \sum_{\text{NS}} \sum_{\text{NP}} \text{NPLT(NP,NS)} * \text{TNB(NS)} * \text{APFH(NP,LO(NS))} \\
 * \text{FGH(NP)} * \text{CFG(LO(NS))} * \text{NAE(NP)} * \text{DRAG(NP)} \\
 / [\text{K(NP)} * \text{THRS(NP)}]$$

where

FGH(NP) = average fuel consumption in gallons per operating hour (without extra drag) for platform type NP

CFG(LO(NS)) = cost per gallon of fuel at operating location LO(NS) in dollars

NAE(NP) = number of added antenna elements required for SEEK TALK installation on a platform of type NP

DRAG(NP) = average drag per new antenna element (in lbs.) for platform type NP

K(NP) = coefficient in thrust-fuel consumption equation for platform type NP

THRS(NP) = average thrust in pounds generated by platform type NP (without extra drag)

Note: Added Fuel costs clearly only apply to airborne platforms. Thus surface platforms will not be included when the above calculation is performed by the LCC Model.

5.2.4 Investment Spares Cost Element

It is assumed that each base and the depot require an initial supply of Investment Spares to be used for immediate replacement of operational ITEMS upon failure. The stock of Investment spares is maintained by either placing repaired ITEMS back in stock or by purchasing replacement spares for ITEMS which are non-repairable and hence discarded.

The number of Investment spares allotted to each location is set equal to the number of pipeline spares for that location (represented by the auxiliary calculations $NFB(I,NS)$ and $NFD(I)$), plus a safety stock. Here we use a standard Air Force stock control procedure* which has been shown to be numerically equivalent to the "expected number of backorders" criterion of the Air Force Logistic Support Cost Model**

Specifically, if $NFB(I,NS)$ equals the pipeline spares of ITEM type I at a base of type NS, then the number of investment spares allotted to that base, denoted $BS(I,NS)$, would be given by:

$$BS(I,NS) = F(NFB(I,NS))$$

where F is the function defined for any real number X by

$$F(X) = X + BF \cdot \sqrt{X}$$

The coefficient BF in the definition of the function F determines the confidence level of safety stock. For example, if $BF=1.65$ then the function F will yield a stock of Investment spares which guarantee an expected back order of less than 0.1 unit per ITEM.

Similarly, if $NFD(I)$ equals the pipeline spares of ITEM type I at the depot, then the number of investment spares of ITEM type I at the depot, denoted $DS(I)$, is given by

$$DS(I) = F(NFD(I))$$

* Stock Control at Bases, Chapter 11 of Air Force Manual AFM 67-1, Vol. II, Part One, 4 March 1974.

**Logistics Support Cost Model User's Handbook, Headquarters AFLC/AQML, August, 1976.

The total cost of investment spares of ITEM type I over all locations, denoted ISCA(I), is thus given by

$$ISCA(I) = [(\sum_{NS} TNB(NS)*BS(I,NS)) + DS(I)]*UP(I)*XUC$$

where

UP(I) = unit cost in dollars for ITEM type I

The total investment Spares Cost is then

$$ISC = \sum_I ISCA(I)$$

Notes: 1) The value for the function F is usually rounded off to the nearest integer number of spares, since it is most often used to compute the number of investment spares required at one particular location. However, in the SEEK TALK LCC Model we are dealing with groupings for similar bases which may not have exactly the same sparing requirements. Thus BS(I,NS) can be interpreted as the average number of initial spares of ITEM type I that are required at each base within grouping NS. For example, if there are 20 bases in a particular grouping NS, then BS(I,NS) = 1.5 could be interpreted as meaning that 10 of the bases require 2 spares of ITEM type I and the other 10 only require 1 spare for a total of 30 spares (=TNB(NS)*BS(I,NS)) within base grouping NS.

Not rounding spares off to the nearest integer also has the advantage of avoiding the possibility of having small increases in failure rates produce large fluctuations in total spares requirements. For example, a small increase in the failure rate of ITEM type I might increase BS(I,NS) up from say 1.48 to 1.53. For a grouping NS of 20 bases, this change represents an increase of only 1 spare over all 20 bases. However, if BS(I,NS) were rounded off to the nearest integer, a fluctuation of 1 spare per base or a total of 20 spares would occur. Given the fact that there is a range of uncertainty with regard to the ability of the LCC Model to accurately predict the numbers of investment spares which will actually be deployed, it is wise to minimize the impact of small fluctuations in failure rates (or in any other factor, for that matter). With this same point in mind and for consistency, the number of depot investment spares per ITEM is not rounded off to the nearest integer.

2) The pipeline spares quantities NFB(I,NS) and NFD(I), computed as auxiliary calculations in Section 5 1.2 are based on a fully deployed SEEK TALK system.

5.2.5 Replacement Spares Cost Element

This cost element is meant to cover the cost, over the SEEK TALK system lifetime, of the purchase of additional spares required to replace failed ITEMS which are discarded due to either normal wear-out or to discard-on-failure repair level decisions (i.e., the COND(I) fraction of failures). Also included is the cost of repair materials consumed in ITEM repair actions (i.e., for the (1-COND(I)) fraction of failures.

Thus the replacement spares cost due to an individual ITEM type I is given by

$$\begin{aligned}
 \text{RSCA}(I) = & 12 * \text{PIUP} * \left(\sum_{\text{NS}} \text{FAIL}(I, \text{NS}) * \text{TNB}(\text{NS}) \right) \\
 & * (1 - \text{COND}(\text{NHI}(I))) * [\text{COND}(I) + (1 - \text{COND}(I)) * \text{RM}(I)] \\
 & * \text{UP}(I) * \text{XUC}
 \end{aligned}$$

where

RM(I) = repair materials factor for ITEM type I, equals the fraction of UP(I) that is consumed (in piece parts below the ITEM indenture level) in the repair of ITEM type I.

Notes: 1) One should set RM(I) = 0 if ITEM type I is always repaired by the removal and replacement of other lower level parts which are also designated as ITEMS in the model input data. (This is to avoid double counting.)

2) If ITEM type I is an SRU contained in a higher indenture level ITEM (indexed NHI(I)) which is discarded at least for some fraction of its failures (indicated by COND(NHI(I))), then the replacement cost (or repair materials cost) of this SRU is covered or absorbed in the replacement spares cost of the higher indenture level ITEM. Thus, in the equation above, the replacement spares costs for such an SRU would only be incurred for that fraction of the time when its next higher level indentured ITEM is not discarded. This fraction is represented by the term (1-COND(NHI(I))).

Note that if ITEM type I is an LRU, then by convention $NHI(I)=0$ and $COND(0)=0$, so that effectively the term $(1-COND(NHI(I)))$ disappears. The total cost of Replenishment Spares is then given by

$$RSC = \sum_I RSCA(I)$$

5.2.6 On-Equipment Maintenance Cost Element

This cost element covers the system lifetime costs of all organizational level repair actions, including removal and replacement of failed (and falsely pulled) LRUs and all other corrective maintenance actions which are accomplished by repair-in-place without removal of equipment from the host platform.

The on-equipment maintenance cost due to ITEM type I is given by the equation

$$ONMCA(I) = 12*PIUP* \left\{ \sum_{NS} FAIL(I,NS)*TNB(NS) \right\} \\ *[(1+FPR(I)*XFPR)*LRU(I)*RMH(I)*BLR \\ + \frac{RIP(I)*IPCF(I)}{(1-RIP(I))}] *BMF$$

where

$IPCF(I)$ = average cost in dollars per failure of ITEM type I which is met by repair-in-place, including the costs of both manhours and replacement parts.

BLR = base maintenance labor rate in dollars per hour.

$RMH(I)$ = average number of manhours required to remove and replace an ITEM of type I, including time spent in isolating a failure to the ITEM, removing the ITEM, and in verifying restoration of the system to operational status upon replacement of the failed (or falsely pulled) ITEM.

Notes: 1) The quantity $FAIL(I,NS)$, computed as an auxiliary calculation in Section 5.1.1. represents the average number of removed failures of ITEM type I at a base of type NS per month. By referring to the formula for $FAIL(I,NS)$, it can be seen that the

quantity $RIP(I)*FAIL(I,NS)/(1-RIP(I))$ represents the number of repaired-in-place failures of ITEM type I. In the equation above this quantity is multiplied (in factored form) by the in-place cost per failure $IPCF(I)$. (If $RIP(I)=1$ so that division by zero would occur in the term above, then the number of repaired-in place failures of ITEM type I will be calculated directly by an appropriate formula within the LCC Model.)

2) Removal and replacement manhours $RMH(I)$ apply only to LRUs and may be input as zero for SRUs.

Total On-Equipment Maintenance cost is then given by

$$ONMC = \sum_I ONMCA(I)$$

5.2.7 Off-Equipment Maintenance Cost Element

This cost element covers all intermediate and depot-level corrective maintenance labor costs and associated packing and shipping and maintenance management data costs over the system lifetime.

First the off-equipment maintenance cost due to all ITEMS of type I, denoted $OFMCA(I)$, is given by the formula

$$OFMCA(I) = 12*PIUP* \sum_{NS} FAIL(I,NS)*TNB(NS)*ACF(I,NS)$$

where

ACF(I,NS) = average off-equipment maintenance cost in dollars per failure of ITEM type I at base NS, computed by the equation:

$$\begin{aligned} \text{ACF(I,NS)} = & (\text{LRU(I)} + \text{RTS(NHI(J))}) \\ & * [((1 + \text{FPR(I)} * \text{XFPR}) * \text{BCMH(I)} + \text{RTS(I)} * \text{BMH(I)}) * \text{BMF} * \text{BLR} \\ & + \text{NRTS(I)} * [\text{DMH(I)} * \text{DMF} * \text{DLR} + 2 * \text{CPPD(LO(NS))} * \text{WT(I)}] \\ & + \text{COND(I)} * \text{CPPD(LO(NS))} * \text{WT(I)}] \\ & + \text{NRTS(NHI(I))} * (1 - \text{COND(I)}) * \text{DMH(I)} * \text{DMF} * \text{DLR} \\ & + \text{SAT(NS)} * \text{LRU(I)} * (1 + \text{FPR(I)} * \text{XFPR}) * 2 * \text{CPPC} * \text{WT(I)} \\ & + [(\text{RIP(I)} / (1 - \text{RIP(I)})) * \text{MRO} + \text{MRF} + \text{SR} + \text{TR}] * \text{BLR} \end{aligned}$$

where

DLR = depot maintenance labor rate in dollars per manhour

CPPD(LO(NS)) = one-way packing and shipping cost per (net weight) pound from a base at location LO(NS) to the depot (including an adjustment to allow for the ratio of packaged weight to unpackaged weight).

WT(I) = net weight of ITEM type I in lbs.

CPPC = average one way packing and shipping cost per (net weight) pound from a satellite base to its associated CIMF (including an adjustment to allow for ratio of packaged weight to unpackaged weight).

SAT(NS) = satellite base indicator, equals 1 if base NS is a satellite base (i.e., BTYPE(NS)=3) and equals 0 otherwise

BTYP(NS) = base type indicator, equals:
1, for independent, non-CIMF bases
2, for CIMF bases
3, for satellite bases.

MRO = Average manhours per failure to complete on-equipment maintenance records.

MRF = Average manhours per failure to complete off-equipment maintenance records.

SR = Average manhours per failure to complete supply transaction records.

TR = Average manhours per failure to complete transportation transaction forms.

Thus total Off-Equipment Maintenance cost is given by

$$OFMC = \sum_I OFMCA(I)$$

The terms in the equation for ACF(I,NS) have the following interpretation: The first term (LRU(I)+RTS(NHI(I))) represents that fraction of failures of ITEM type I which are available for intermediate repair at the base level as a function of the ITEM's indenture level. For example, if ITEM type I is an LRU, then LRU(I)=1, NHI(I)=0, and RTS(0)=0, so that this term equals 1, i.e., all LRUs are available for intermediate level repair at the base level. On the other hand, if ITEM type I is an SRU, then LRU(I)=0 and NHI(I) is the index number of the next higher indenture level ITEM which contains ITEM type I. Thus, in this case, the term equals RTS(NHI(I)), i.e., an SRU is available (i.e., removed) for intermediate repair at the base level only when its next higher indenture ITEM is base repaired.

For those failures of ITEM type I which are available for repair at the base level, the next three lines in the equation indicate the repair action implemented. Specifically, all failures and false pulls receive a base-level bench check, the RTS(I) fraction of failures are base repaired, the NRTS(I) fraction are sent to the depot for repair (and incur two-way packing and shipping costs) and the COND(I) fraction are discarded (incurring only a one-way packing and shipping cost for a replacement spare).

The fifth line in the equation for $ACF(I,NS)$ accounts for those ITEMS which are not removed from their next higher assembly until they reach the depot (i.e., the $NRTS(NHI(1))$ fraction). These ITEMS are then repairable (at the depot) the fraction $(1-COND(I))$ of the time.

The sixth line applies only to satellite bases (i.e., $SAT(NS)=1$) and covers the cost of shipping all failed and falsely pulled LRUs to the associated CIMF for repair action (and the cost of shipping replacement spares or repaired ITEMS from the CIMF to the satellite base). Note that SRUs are not removed at satellite bases by definition, so that they do not incur a separate shipping charge.

Finally, the last line accounts for the labor cost associated with the completion of maintenance management data.

5.2.8 Support Equipment Cost Element

The cost of support equipment (SE) consists of three parts: (1) the cost of acquisition and maintenance; (2) the cost of SE hardware development; and (3) the cost of SE software development.

5.2.8.1 SE Acquisition and Maintenance

The numbers of support equipment (SE) of each type L required at each base of type NS and at the depot, denoted by $NSEB(L,NS)$ and $NSED(L)$, respectively, were computed as auxiliary calculations in Section 5.1.3. This calculation was based on estimated monthly hours of SE utilization at each location and the number of available work hours per month per maintenance man. It is usually assumed in determining SE requirements that one piece of SE cannot be utilized any more hours per month than one maintenance man (see, for example, the Air Force Logistic Support Cost Model, User's Handbook).

As noted in Section 5.1.3, common SE which is available at base sites is charged in the LCC Model on a prorated basis, depending on the fractional utilization of available hours. Other SE must be purchased in whole units, i.e., any utilization of this SE will incur its full unit cost. (See the Air Force-provided list of common SE which is available at base sites.)

Thus, the life cycle cost of support equipment is computed by:

$$SEC = \sum_L \left\{ \left| \sum_{NS} NSEB(L,NS) * TNB(NS) \right| + NSED(L) \right\} * CSE(L) * (1 + PIUP * MSE(L))$$

where

CSE(L) = unit cost of SE type L in dollars (including an allowance for initial spares); it should not include a pro rata portion of development cost or a pro rata portion of the cost of any new programming required.

MSE(L) = the yearly cost of maintaining a piece of SE of type L (considering both labor and replacement spares), expressed as a fraction of its unit cost CSE(L).

For the Repair Level Analysis program, described in Section 7, it is necessary to prorate the cost of support equipment among individual ITEM types. For this reason, we define the variable

SECI(I) = pro rata part of SEC attributed to ITEM type I,

which is calculated according to the formula

$$SECI(I) = \sum_L \left\{ \frac{SECB(L) * ERHB(I) * A(I,L)}{TERHB(L)} + \frac{SECD(L) * ERHD(I) * A(I,L)}{TERHD(L)} \right\}$$

where

$$SECB(L) = \left\{ \sum_{NS} NSEB(L,NS) * TNB(NS) \right\} * CSE(L) * (1 + PIUP * MSE(L)),$$

$$SECD(L) = NSED(L) * CSE(L) * (1 + PIUP * MSE(L)),$$

$$ERHB(I) = \sum_{NS} ERHBI(I,NS) * TNB(NS),$$

$$\text{TERHB}(L) = \sum_I \text{ERHB}(I) * A(I, L),$$

$$\text{TERHD}(L) = \sum_I \text{ERHD}(I) * A(I, L).$$

5.2.8.2 SE Hardware Development

Associated with each SE type L, there is a hardware development cost SED(L). The development cost should be set to zero if the equipment is common, i.e., SED(L) = 0 if SETYPE(L) = 1 or 2. Also, the cost will be incurred only if the equipment is used at all for maintenance. Thus the total cost of SE hardware development is calculated by:

$$\text{SEDC} = \sum_L U(\text{TNSE}(L)) * \text{SED}(L)$$

$$\text{where TNSE}(L) = \sum_{\text{NS}} \text{NSEB}(L, \text{NS}) + \text{NSED}(L)$$

$$\text{and } U(X) = 1 \text{ if } X > 0 \\ 0 \text{ if } X \leq 0$$

For the Repair Level Analysis Program, the total SE hardware development cost SEDC is prorated among individual ITEM types as follows: Let SEDCI(I) be the pro rata part of SEDC attributed to ITEM type I, and

$$\text{SEDCI}(I) = \sum_L \text{PPSE}(I, L) * \text{SED}(L)$$

where

$$\begin{aligned} \text{PPSE}(I, L) = & U(A(I, L)) * \{ U(3 - \text{SECODE}(I, L)) * \text{ERHD}(I) \\ & + U(\text{SECODE}(I, L) - 1) * \text{TEBCBI}(I) \\ & + U((3 - \text{SECODE}(I, L)) * \text{SECODE}(I, L)) * \text{TERTBI}(I) \} \\ & * 1 / (\text{ERHAD}(L) + \text{TERHAB}(L)) \end{aligned}$$

$$\text{TERTBI}(I) = \sum_{\text{NS}} \text{TNB}(\text{NS}) * \text{ERTBI}(I, \text{NS})$$

$$\text{TEBCBI}(I) = \sum_{\text{NS}} \text{TNB}(\text{NS}) * \text{EBCBI}(I, \text{NS})$$

$$TERHAB(L) = \sum_{NS} TNB(NS) * ERHAB(L, NS),$$

5.2.8.3 SE Software Development

Software development may be required when using certain SE in repairing any given ITEM. Let SESW(I) be the cost of SE software development for ITEM type I, then the total SE software development cost is

$$SESWC = \sum_I U(1-COND(I)) * SESW(I)$$

Note this cost is only incurred when the ITEM is repaired.

After presenting the three parts of the SE cost element above, we now define the total pro rata part of the SE cost attributed to ITEM type I to be

$$TSECI(I) = SECI(I) + SEDCI(I) + U(1-COND(I)) * SESW(I).$$

5.2.9 ITEM Inventory Management Cost Element

This cost element accounts for the management (administrative) cost to introduce new assemblies and parts into the Air Force inventory system, together with the recurring supply inventory management costs associated with such inventories.

The equation for Inventory Management costs incorporates the following basic assumptions:

- 1) All major ITEMS among the SEEK TALK equipment will be new to the Air Force inventory system.
- 2) ITEMS incur an Inventory Management cost at the base level if and only if they are stocked at the given base.
- 3) Piece parts of an ITEM incur Inventory Management costs wherever the ITEM is repaired.

The number of bases which stock spares of ITEM type I, denoted BIS(I), is calculated by:

$$BIS(I) = \sum_{NS} W(BS(I,NS)) * TNB(NS)$$

where the function W is defined for any number X by

$$W(X) = \begin{cases} 0, & \text{if } X \text{ is less than } 0 \\ X, & \text{if } X \text{ is between } 0 \text{ and } 1 \\ 1, & \text{if } X \text{ is greater than } 1 \end{cases}$$

Recall that the number of spares of ITEM type I at base NS, denoted BS(I,NS), is not rounded off to an integer, but instead represents the average number of spares of ITEM type I over all bases within grouping NS. Thus BS(I,NS)=.5 would mean half of the bases within group NS have 1 spare of ITEM type I and the other half have no spares of the ITEM. If BS(I,NS) is greater than 1, then we assume that all bases within group NS have at least one spare of ITEM type I and hence all incur Inventory Management costs.

The number of bases which perform Intermediate level repair of ITEM type I (and hence require an inventory of ITEM piece parts) is denoted by BCIS(I) and calculated by the equation

$$BCIS(I) = \sum_{NS} (1-SAT(NS)) * U(RTS(I)) * NFB(I,NS) * TNB(NS)$$

The conditions in the above equation for a base to require an inventory of piece parts of ITEM type I are thus: (i) Base NS must not be a satellite base, (ii) ITEM type I must be repairable, at least some of the time, at the intermediate level, i.e., $RTS(I) > 0$, and (iii) the pipeline of ITEM type I at base NS, denoted NFB(I,NS), must be positive, i.e., failures of ITEM type I must occur at base NS.

Thus the Inventory Management cost incurred by ITEM of type I is given by

$$IIMCA(I) = IUT(I) * (1+CPA(I)) * U(1-COND(NHI(I))) * (IMC+PIUP*RMC) \\ + PIUP * (BIS(I) + BCIS(I) * CPA(I)) * SA$$

where

IUT(I) = equals 1 if a spare of ITEM type I is ever required anywhere in the SEEK TALK system, i.e., if it ever fails, and equals 0 otherwise. Computed by

$$IUT(I) = U\left(\sum_{NS} FAIL(I,NS)\right)$$

IMC = initial depot-level inventory, management cost in dollars to introduce a new procurable part into the Air Force inventory system

RMC = recurring annual depot-level inventory management cost in dollars to maintain an ITEM or piece part in the Air Force inventory system

PA(I) = number of lower indenture (below ITEM level) piece parts or assemblies which would be added to the Air Force inventory system if ITEM type I were repaired in the system

CPA(I) = corrected piece part count, i.e., equals PA(I) unless ITEM type I is designated as discard-on-failure (i.e., COND(I)=1) in which case CPA(I) is set equal to zero.

SA = recurring annual cost in dollars to maintain a line item or piece part in a base-level inventory system

Finally, the total ITEM Inventory Management cost is

$$IIMC = \sum_I IIMCA(I)$$

Note: PA(I) may be zero for some higher indenture level ITEMS to avoid double counting of SRUs which are listed as ITEMS. Thus if ITEM type I is an LRU which is repaired by removing and replacing SRUs (which are also listed as ITEMS), then PA(I) = 0. In other words, PA(I) should only count parts lower than the ITEM level. By the same token, new piece parts included in the PA(I) value of the SRU should not also be counted in the PA(I) value of the higher level LRU.

In addition, if some new piece parts are common components in several different ITEMS then their number should be averaged over the corresponding PA(I) values. For example, if 4 new piece parts are all components in each of 5 different ITEM types then the PA(I) value of each ITEM should be 0.8 so that the sum of the PA(I) equals 4. This action will avoid over-counting of piece parts.

5.2.10 Technical Orders Cost Element

The cost accounted for in this Element is that which can be attributed directly to the requirement for creating pages containing specific guidance to support maintenance of SEEK TALK equipment. Various types of technical orders are possible. Technical orders can be of a system level nature, not specific to any particular ITEM type. An example would be a theoretical description of the system's operation intended to assist a person performing maintenance. Secondly, there may be ITEM-specific technical orders required for repair or bench check of particular equipment ITEMS. Also conceivable are technical orders written to explain the operation of specific pieces of support equipment in the maintenance of ITEMS. The equation for this Cost Element is hence structured to accommodate these three types of technical orders.

The equation also accounts for three types of technical order costs: (1) acquisition cost of original negatives dependent only on the total number of distinct pages; (2) reproduction cost dependent on the total number of copies made; (3) upkeep cost dependent on the number of distinct pages and the system life-time (PIUP).

The formula for computing Technical Orders Cost necessitates the following additional Air Force inputs:

ACPP = average acquisition cost per page for original negatives of technical orders. This is an Air Force input in order to make it uniform among the submitting contractors. In this way the contractor is more equitably held accountable for the size of the tech. order package his design generates.

RCPP = technical order reproduction cost per copy per page.

UCPP = technical order upkeep cost per distinct page.

The formula also necessitates the following additional contractor inputs:

- DDATA = number of distinct pages of system level technical orders intended for depot maintenance only.
- BDATA = number of additional distinct pages of system level technical orders written for base level maintenance.
- DATAD(I) = number of additional distinct pages of technical orders required for repair of ITEM type I and written for depot use only.
- DATAB(I) = number of additional distinct pages of technical orders required for base repair of ITEM type I.
- DATAS(L) = number of additional distinct pages of technical orders required for use of support equipment type L and not including any documentation which may be included in the unit cost of L.

Note that the five sets of pages counted by the five variables listed above are assumed to be mutually disjoint. For example, there should be no overlap between the pages counted by DATAD(I) and those counted by DATAB(I). However, it is expected that the user may wish to set one or more of the page count variables equal to 0. The wide variety of page count inputs is intended to provide the Model with the capability to accommodate a wide variety of technical order configurations.

The cost of system-wide technical orders, denoted by STDC, is then computed according to the following equations

STDC =

$$\begin{aligned}
 & [DDATA + BDATA + \sum_I (DATAD(I) + U(\sum_{NS} ERTBI(I,NS)) * DATAB(I)) \\
 & + \sum_L U(TNSE(L)) * DATAS(L)] * (ACPP + RCPP + PIUP * UCPP) + \\
 & RCPP * \sum_{NS} TNB(NS) * [BDATA + \sum_I U(ERTBI(I,NS)) * DATAB(I) + \\
 & \sum_L U(NSEB(L,NS)) * DATAS(L)]
 \end{aligned}$$

where

$$TNSE(L) = \sum_{NS} NSEB(L,NS) + NSED(L)$$

and

$$\begin{aligned}
 U(X) &= 1 \quad \text{if } X > 0 \\
 &= 0 \quad \text{if } X \leq 0
 \end{aligned}$$

Note that the formula for STDC is composed of two major terms. The first represents acquisition of original negatives, printing of one copy of each page for the depot, and upkeep cost for each year. The second represents reproduction costs for all base copies necessitated by given repair levels.

For the repair Level Analysis program, described in Section 7, it is necessary to prorate the cost of technical orders among individual ITEM types. For this reason we define the variable

TDC(I) = the pro rata part of STDC attributed to ITEM type I, which is calculated according to the formula

$$\begin{aligned}
TDC(I) = & \\
& [PPTM(I)*(DDATA + BDATA) + DATAD(I) + U(TERTBI(I)) * DATAB(I) \\
& + \sum_L PPSE(I,L)*DATAS(L)] *(ACPP + RCPP + PIUP*UCPP) \\
& + RCPP* \sum_{NS} TNB(NS)* [PPTM(I)*BDATA + U(ERTBI(I,NS))*DATAB(I) \\
& + \sum_L PPSE(I,L)*U(NSEB(L,NS))*DATAS(L)]
\end{aligned}$$

where

$$PPTM(I) = (ONMCA(I) + OFMCA(I))/(ONMC + OFMC)$$

$$\begin{aligned}
PPSE(I,L) = & U(A(I,L))*[U(3-SECODE(I,L)) * ERHD(I) \\
& + U(SECODE(I,L)-1) * TEBCBI(I) \\
& + U((3-SECODE(I,L))*SECODE(I,L)) * TERTBI(I)] \\
& *1/(ERHAD(L) + TERHAB(L))
\end{aligned}$$

$$TERTBI(I) = \sum_{NS} TNB(NS)*ERTBI(I,NS)$$

$$TEBCBI(I) = \sum_{NS} TNB(NS)*EBCBI(I,NS)$$

$$TERHAB(L) = \sum_{NS} TNB(NS)*ERHAB(L,NS),$$

and, again,

$$\begin{aligned}
U(X) = & 1 \quad \text{if } X > 0 \\
& 0 \quad \text{otherwise.}
\end{aligned}$$

ONMCA(I), OFMCA(I), ONMC, OFMC, A(I,L), ERHD(I), ERHAD(L), TNB(NS), ERTBI(1,NS), ERHAB(L,NS), NSEB(L,NS) are all defined previously.

5.2.11 Maintenance Training Cost Element

The equation for this Cost Element is based on the following assumptions:

1. Cost is incurred for training of maintenance personnel only. There is no operations training cost included.
2. The cost estimated is that of additional training necessitated by SEEK TALK, and the cost of basic avionics training is assumed sunk.
3. Three types of training are modeled:
 - Type 1 is in-plant training by the production contractor;
 - Type 2 is Air Force service training performed by Type 1 trainees;
 - Recurring training is that necessitated by attrition among Air Force maintenance personnel.
4. On-the-job-training (OJT), if employed, does not involve any cost.
5. The number of persons requiring recurring training is determined by the number of avionics maintenance people expected to leave the Air Force each year and not by those who are merely transferred among bases.
6. Depot personnel are trained for maintenance of any item not always discarded on failure.
7. All base personnel are trained for maintenance of any item to be given intermediate maintenance at any base.
8. The cost of training includes the entire pay and any additional allowance paid to personnel while they are being trained. This is because training time is time away from jobs which may have to be filled by replacement personnel. The cost to compensate for this should be represented in the AF parameters PAL1, PAL2D, and PAL2B defined below.

The formula to compute maintenance training cost necessitates the following additional AF inputs:

- CPD2 = cost per class per day for type 2 training.
- HPD2 = number of in-class hours per day for a type 2 training class.
- PAL1 = average daily pay and allowance during training for type 1 trainee.
- PAL2B = average daily pay and allowance during training for a type 2 base trainee.
- PAL2D = average daily pay and allowance during training for a type 2 depot trainee.
- QTYP1 = number of trainees for type 1 training.
- QTYP2B = initial number of base trainees for type 2 training.
- QTYP2D = initial number of depot trainees for type 2 training.
- SPC2 = maximum number of students per type 2 training class.
- TORB = turnover rate for base avionics maintenance personnel; the fraction of this work force leaving the AF (and replaced) per year.
- TORD = turnover rate for depot avionics maintenance personnel; the fraction of this work force leaving the AF (and replaced) per year.
- TRAV1D = average round trip travel expense for travel of type 1 and type 2 depot trainees to and from the relevant training facilities.
- TRAVB = average round trip travel expense for travel of type 2 base trainees to and from the type 2 training facility.
- TYP2TF = ratio of type 2 training time to type 1 training time when the same course material is covered in both.

The following additional contractor inputs are also required:

- CPD1 = cost per class per day for type 1 training.

- HPD1 = number of in-class hours per day for a type 1 training class.
- SPC1 = maximum number of students per type 1 training class.
- TEFM = cost in dollars of equipment, facilities, and manuals required for all training and not accounted for by any other element of the SEEK TALK LCC Model.
(Facilities considered are for type 1 training only.)
- TIME1(I) = number of additional hours of type 1 training required for repair of ITEM type I.

Prior to presentation of the Maintenance Training equation, a few preliminary computations are performed to facilitate the reader's understanding:

$$T1 = \sum_I TIME1(I),$$

$$T2DA = TYP2TF * \sum_I TIME1(I) * U(1-COND(I)),$$

$$T2BA = TYP2TF * \sum_I TIME1(I) * U(\sum_{NS} ERTB1(I,NS)).$$

The three variables, T1, T2DA, and T2BA may be interpreted as follows. T1 represents the total number of type 1 training hours per type 1 trainee necessitated by the contractor's design. T2DA represents the total number of hours of type 2 training required for a depot trainee. T2BA is the analogous total for a base trainee. Computation of T2DA is based on the assumption that any ITEM which will be discarded on failure will not increase the type 2 training time. Similarly, for T2BA, only ITEMS which are expected to undergo base repair will necessitate additional type 2 training.

Then, the cost of training, denoted by MTRC, is computed according to the following equation:

$$\begin{aligned}
\text{MTRC} = & \left[\frac{T1}{\text{HPD1}} \right] * \left[\frac{\text{QTYP1}}{\text{SPC1}} \right] * \text{CPD1} \\
& + \text{QTYP1} * \left(\left[\frac{T1}{\text{HPD1}} \right] * \text{PAL1} + \text{TRAV1D} * \text{U}(T1) \right) + \\
& \left[\text{T2DA} * \text{QTYP2D} * (1 + \text{PIUP} * \text{TORD}) \right. \\
& \left. + \frac{\text{T2BA} * \text{QTYP2B} * (1 + \text{PIUP} * \text{TORB})}{(\text{HPD2} * \text{SPC2})} \right] * \text{CPD2} \\
& + (1 + \text{PIUP} * \text{TORD}) * \text{QTYP2D} * \left(\left[\frac{\text{T2DA}}{\text{HPD2}} \right] * \text{PAL2D} + \text{TRAV1D} * \text{U}(\text{T2DA}) \right) \\
& + (1 + \text{PIUP} * \text{TORB}) * \text{QTYP2B} * \left(\left[\frac{\text{T2BA}}{\text{HPD2}} \right] * \text{PAL2B} + \text{TRAVB} * \text{U}(\text{T2BA}) \right) \\
& + \text{TEFM}
\end{aligned}$$

where

$$\begin{aligned}
& + \\
& [X] \text{ means the smallest integer greater than or equal to } X, \\
& \text{and } \text{U}(X) = 1 \text{ if } X > 0 \\
& \quad \quad \quad 0 \text{ otherwise.}
\end{aligned}$$

Notice that the right hand side of the training equation consists of three main terms. The first accounts for type 1 training, the second for type 2 (initial and recurring), and the third is merely TEFM. In the type 1 term, the number of days of instruction and the number of classes are each computed separately, and their product is the number of class-days. In the type 2 term, to account for the possibility of depot and base personnel receiving some of their training concurrently, the total number of trainee-hours is computed and divided by trainee-hours per class-day before the rounding up process takes place.

As for support equipment and tech. orders, the cost of training must be prorated among ITEMS to accommodate the Repair Level Analysis program. To satisfy this need we define the variable

MTRCI(I) = the pro rata part of MTRC attributed to ITEM type I, calculated by

MTRCI(I) =

$$\begin{aligned} & \text{ITPF1(I)} * \left(\frac{\text{T1}}{\text{HPD1}} \right) * \left(\frac{\text{QTYP1}}{\text{SPC1}} \right) * \text{CPD1} \\ & + \text{QTYP1} * \left(\frac{\text{T1}}{\text{HPD1}} \right) * \text{PAL1} + \text{TRAV1D} * \text{U(T1)} \end{aligned} +$$

$$\begin{aligned} & \text{ITPF2(I)} * \left[(\text{T2DA} * \text{QTYP2D} * (1 + \text{PIUP} * \text{TORD})) \right. \\ & \left. + \text{T2BA} * \text{QTYP2B} * (1 + \text{PIUP} * \text{TORB}) \right] \\ & * \frac{1}{(\text{HPD2} * \text{SPC2})} * \text{CPD2} + \end{aligned}$$

$$\begin{aligned} & \text{ITPF3(I)} * (1 + \text{PIUP} * \text{TORD}) * \text{QTYP2D} \\ & * \left(\frac{\text{T2DA}}{\text{HPD2}} \right) * \text{PAL2D} + \text{TRAV1D} * \text{U(T2DA)} \end{aligned} +$$

$$\begin{aligned} & \text{ITPF4(I)} * (1 + \text{PIUP} * \text{TORE}) * \text{QTYP2B} \\ & * \left(\frac{\text{T2BA}}{\text{HPD2}} \right) * \text{PAL2B} + \text{TRAV1D} * \text{U(T2BA)} \end{aligned} +$$

$$\text{ITPF5(I)} * \text{TEFM}$$

where the ITPFX(I) variables (for x=1, ..., 5) are itemized training

proration factors defined as follows:

$$\text{ITPF1(I)} = \text{TIME1(I)}/\text{TI}$$

$$\text{ITPF2(I)} = \text{TYP2TF} * \text{TIME1(I)}$$

$$* (\text{QTYP2D} * \text{U}(1 - \text{COND(I)}) + \text{QTYP2B} * \text{U}(\sum_{\text{NS}} \text{ERTBI(I,NS)}))$$

$$* 1 / (\text{QTYP2D} * \text{T2DA} + \text{QTYP2B} * \text{T2BA})$$

$$\text{ITPF3(I)} = \text{TYP2TF} * \text{TIME1(I)} * \text{U}(1 - \text{COND(I)}) / \text{T2DA}$$

$$\text{ITPF4(I)} = \text{TYP2TF} * \text{TIME1(I)} * \text{U}(\sum_{\text{NS}} \text{ERTBI(I,NS)}) / \text{T2BA}$$

$$\text{ITPF5(I)} = \text{TIME1(I)} * [\text{QTYP1} + \text{TYP2TF} * (\text{QTYP2D} * \text{U}(1 - \text{COND(I)})$$

$$+ \text{QTYP2B} * \text{U}(\sum_{\text{NS}} \text{ERTBI(I,NS)}))]$$

$$* 1 / (\text{QTYP1} * \text{T1} + \text{QTYP2D} * \text{T2DA} + \text{QTYP2B} * \text{T2BA})$$

SECTION 6

LCC SENSITIVITY ANALYSIS CAPABILITY

This section presents the methods used in the LCC Model to address the sensitivity of Life Cycle Cost to changes in various input data parameters. This sensitivity analysis capability serves several purposes. First, it provides a measure of the fluctuation in LCC which may be experienced due to uncertainty in the estimates of various input parameters. Secondly, the sensitivity analysis calculations help to identify the significant cost drivers among the various input parameters. Thirdly, the LCC sensitivity analysis capability may be used as a tool to perform system trade-off analyses.

The primary component of the LCC sensitivity analysis capability is presented in Section 6.1 below, where, for selected data input parameters, a set of equations is exhibited which calculate the estimated changes in LCC which would be produced by a given fractional change to each particular parameter.

Section 6.2 discusses how the LCC Model user can perform a simplified repair level analysis (RLA) by utilizing the LCC sensitivity analysis calculations in Section 6.1 with respect to the repair level fractional allocations RTS(I), NRTS(I) and COND(I). This is not to be confused with, and is not a replacement for, the RLA Program described in Section 7.

Section 6.3 presents a sensitivity analysis calculation which tries to identify those SRUs in the contractor's equipment design which might be worth redesigning as LRUs in order to reduce life cycle costs.

Finally, Section 6.4 shows how the LCC Model user may also perform LCC sensitivity and trade-off analyses by utilizing the global multiplier factors on unit costs, failure rates, false pull rates, and MOD/I labor hours. In particular, these global multiplier factors can be used as a supplement to and in conjunction with the detailed sensitivity analysis calculations presented in Section 6.1.

6.1 LCC Sensitivity Due to Fractionally Incremented Data Parameters

This section presents LCC sensitivity equations which are used in the LCC Model to estimate the changes in LCC that would result from fractional changes in the values of each of certain selected input data parameters. These parameters are divided into global (system-wide) parameters and ITEM-specific parameters in Table 6-1 below:

TABLE 6-1
SENSITIVITY ANALYSIS DATA PARAMETERS

Global Parameters

Unit Cost - XUC Factor
Failure Rate - XFR Factor
False Pull Rate - XFPR Factor
Maintenance Repair Times - BMF and DMF Factors
Repair Materials Cost - XRM Factor (*)
Program Lifetime - PIUP Factor
Modification/Installation Labor Man-hours - XMIL Factor

ITEM - Specific Parameters

Unit Cost - UP(I) Factor
Failure Rate - FR(I) Factor (*)
False Pull Rate - FPR(I) Factor
Repair Materials Cost - RM(I) Factor
Intermediate Repair Fraction - RTS(I) Factor
Depot Repair Fraction - NRTS(I) Factor
Condemnation Rate - COND(I) Factor

(*)Note: The factors XRM and FR(I) are not direct inputs from the data files. In fact, they are not used directly in any equations within the LCC Model. The "symbols" XRM and FR(I) are utilized here merely to indicate the relevant sensitivity analysis calculation.

For each of the data parameters listed above (and for each ITEM type I if the factor is ITEM-specific), the LCC Model computes the average change (either positive or negative) in Life Cycle Cost which is produced by a fractional increase in the value of the given factor.

Below the variable FINC stands for the fractional increase in the factor under consideration. This increase is implemented in two different ways depending on the particular factor. For the factors XUC, XFR, XFPR, BMF/DMF, XRM, PIUP, XMIL, UP(I), FR(I), FPR(I), and RM(I), the equations compute the change in LCC which results from increasing the given factor by a multiple of FINC. For example, if FINC=.25 and the factor under consideration is UP(I), the equations compute the change in LCC which would result from changing UP(I) to $UP(I) + (.25)*UP(I) = 1.25*UP(I)$. However, for the factors RTS(I), NRTS(I) and COND(I) (which are themselves fractions), FINC stands for the absolute increase in the factor. Thus, if FINC=.25 and the factor under consideration is RTS(I), then the equations compute the

change in LCC which would result from changing $RTS(I)$ to $(RTS(I) + .25)$. (Actually it takes the minimum of $(RTS(I) + .25)$ and 1.)

In the equations below the notation TDXXX is used to stand for the change in LCC which is produced by a fractional increase of FINC in the factor XXX, where XXX may be any one of the factors listed in Table 6-I. Thus TDUP(I) stands for the change in LCC produced by a fractional change of FINC in the factor UP(I). One will, in addition, refer to TDXXX as the change in LCC with respect to the factor XXX.

Note that if XXX is one of the "global" parameters listed in Table 6-I, then TDXXX is a single value and will be printed in the Sensitivity Analysis Output Table of an LCC Model computer run. On the other hand, if XXX is one of the "ITEM-specific" parameters, then there is a value of TDXXX for each different ITEM index I; e.g., if XXX is UP(I) then TDUP(I) will be calculated for each different index number I. In this case the LCC Model will print out the most significant TDUP(I) values first; i.e., the most significant TDUP(I) over all different I indices will be printed first, the second most significant TDUP(I) will be printed second, and so on. This "sorting" method thus effectively identifies those ITEMS for which a given ITEM-specific parameter is most cost-sensitive. In this context, since most LCC sensitivity calculations are "two-sided" (see Caution (2) below), the term "most-significant" for these calculations means largest in absolute value. By exception, for the terms $RTS(I)$, $NRTS(I)$, and $COND(I)$, one is most interested in those changes in repair levels which produce savings in LCC. Thus for these three factors "most significant" means largest in negative value. In other words, $TDRTS(I)$, $TDNRTS(I)$, and $TDCOND(I)$ will be sorted in order of greatest predicted savings in LCC. (A sample Sensitivity Analysis Output Table appears at the end of the Illustrative LCC Model Computer Run contained in Appendix II.1.)

CAUTIONS: There are several important considerations which should be kept in mind when using the sensitivity analysis calculations. These are:

- (1) In general, the sensitivity analysis calculations attempt to present average estimated changes in LCC, i.e., the continuous "trend" in LCC. Step increases in costs, such as for peculiar support equipment are averaged out. Thus, for example, the sensitivity analysis calculations will prorate the cost of additional support equipment utilization (say, due to an increase in ITEM failure rates), regardless of whether or not the increased

utilization necessitates the purchase of a new piece of support equipment.

For this reason, the increased LCC predicted by the sensitivity analysis calculation on, say, the NFK factor with a FINC value of .20, may not exactly equal the increase in the LCC value which is calculated by a re-run of the LCC Model in which the data input NFK has been increased by 20 percent. For example, the increase in failure rates may not have been quite significant enough to necessitate buying another \$100,000 piece of peculiar support equipment, so no change in the support equipment (SE) cost would be visible in a re-run of the LCC Model. This gives the impression that SE costs, at that point, are very insensitive to changes in failure rates, whereas, in fact, the next slightest increase in failure rates will have a \$100,000 impact on LCC. The sensitivity analysis calculation, on the other hand, may have included, say, 8 percent of the potential \$100,000 added SE cost, indicating the "trend" of SE costs as a function of increased failure rates.

- (2) The user should keep in mind that if a fractional increase in a particular factor produces an increase in Life Cycle Cost, then a fractional decrease in that factor should produce a comparable decrease in LCC. In this case, one should view the LCC sensitivity calculations as being two-sided.
- (3) The sensitivity analysis calculations exhibit the estimated change in LCC due to a fractional change in only one data parameter at a time. Since there may be some "interactive" effect on LCC of changing two different parameters, say UP(I) and FR(I), at the same time, the combined change in LCC may not equal the sum of the LCC changes predicted by the sensitivity analysis calculations for each data parameter separately. The combined change can best be measured by altering both data input parameters in a re-run of the LCC Model. As noted in Section 6.4, the global multiplier factors XUC, NFK, NPPK and XMIL can also be used in this manner to measure global interactive effects on LCC.

It is possible to perform sensitivity analysis on the parameters ETS(I), NRTS(I) and COND(I), all of which are used in the model for any repair level decision. The user should be aware of the model. For example, even

if depot repair is not intended for ITEM type I, the user should still input a non-zero, realistic value for DMH(I), so that the LCC sensitivity calculation which corresponds to changing NRTS(I) from 0 to, say, .20 will be meaningful. Even in the extreme case where COND(I) = 1, the user must input realistic values for BCMH(I), BMH(I), DMH(I), RM(I), A(I,L), SECODE(I,L), DATAB(I), DATAD(I) and TIME1(I) in order for the LCC sensitivity calculations on RTS(I) and NRTS(I) to represent accurate cost changes.

6.1.1 Global Unit Cost - XUC Factor

The average increase in LCC produced by a fractional increase of FINC in all prime mission and timing net equipment unit costs (both for ITEMS and Terminals) is denoted by TDXUC and computed via the equation:

$$TDXUC = FINC*(PRODC + ISC + RSC)$$

where PRODC, ISC, and RSC are the total life cycle costs of the Production, Initial Spares, and Replacement Spares Cost Elements, respectively.

6.1.2 Global Failure Rate - XFR Factor

The expected change in LCC produced by a fractional increase of FINC in the failure rates of all ITEMS system wide is given by

$$TDXFR = \sum_I TDFR(I)$$

where TDFR(I) is the LCC sensitivity calculation with respect to the ITEM-specific failure rate FR(I). (See Section 6.1.9 for the equation which calculates TDFR(I).)

In words, LCC sensitivity with respect to the global failure rate factor XFR is just the sum of the changes in LCC produced by increasing the individual ITEM failure rates FR(I) by the same fractional amount FINC.

REMARK: Failure rates are directly proportional to operating hours. Thus, a fractional increase of FINC in operating hours will produce a fractional increase of FINC in the global failure rate, and hence an increase of TDXFR in LCC. Clearly then, sensitivity analysis on

the global failure rate XFR also represents sensitivity analysis on global operating hours.

6.1.3 Global False Pull Rate - XFPR Factor

The estimated change in LCC produced by a fractional increase of FINC in all LRU false pull rates FPR(I) is given by:

$$TDXFPR = \sum_I TDFPR(I)$$

where TDFPR(I) is the LCC sensitivity calculated with respect to the ITEM-specific false pull rate FPR(I) (presented in Section 6.1.1.1).

It is assumed here that only LRUs have positive false pull rates. Thus, LCC sensitivity with respect to XFPR is given by the sum of the changes in LCC produced by increasing the individual false pull rates of each LRU by the fractional amount FINC.

6.1.4 Global Maintenance Repair Times - BMF DMF Factors

Here one considers the change in LCC produced by increasing both the base maintenance factor BMF and the depot maintenance factor DMF by a fractional amount FINC. If the LCC Model user wishes to perform sensitivity analysis on only one of these two factors, the user can change its value interactively in the appropriate NAMELIST and make consecutive runs of the model. (See section 10.4 for a discussion of interactive inputs.) The resulting change in LCC is thus given by:

$$TDMF = FINC * ONMC$$

$$\begin{aligned}
 & + 12 * PIUP * FINC * \left\{ \sum_I \left| \sum_{NS} EKHP(I, L, NS) * (TNEB(NS) * WLEP \right. \right. \\
 & \qquad \qquad \qquad \left. \left. + EBHD(I) * WLR) \right\} \\
 & + FINC * \sum_L \left\{ \sum_{NS} [USE(L, NS) * EKHB(L, NS) * (SET(L, NS) * TNEB(NS) * EAM) \right. \\
 & \qquad \qquad \left. + USE(D, L) * ERHAD(L) * (SETD(L), DAA) * (CSET(L) * (1 + PIUP * SF(L)) \right.
 \end{aligned}$$

where

$$USE(L,NS) = \begin{cases} 0, & \text{if SE type L is not common/on-site and} \\ & 0 < ERHAB(L,NS) < MUSE*BAA \\ 1, & \text{otherwise} \end{cases}$$

and

$$USED(L) = \begin{cases} 0, & \text{if SE type L is not common/on-site and} \\ & 0 < ERHAD(L) < MUSE*DAA \\ 1, & \text{otherwise} \end{cases}$$

where

MUSE = minimum fractional utilization threshold for considering additional SE costs; i.e., if a peculiar or common/requiring procurement SE unit is utilized less than the fraction MUSE of its available hours, then additional use of this SE unit will produce no predicted added cost in sensitivity analysis calculations.

Thus TDMF measures the increase in LCC that would occur if all maintenance repair times were increased by a fractional amount FINC (for example to measure the LCC impact of potentially underestimated repair times). The terms in the equation for TDMF above cover, respectively, the increased costs for on-equipment maintenance, intermediate repair manhours at the base level, depot repair manhours, and added support equipment (SE) costs at the base and depot level.

Note that if a peculiar SE unit or a common SE unit which requires procurement is already deployed at a location and is being under-utilized (i.e., used less than MUSE of its available time), then added utilization of this SE to meet increased repair times will produce no predicted added cost in the sensitivity calculation of TDMF. However, if this SE unit is being utilized a fair percentage of its available time, then a prorated portion of its unit cost will be incurred in the sensitivity calculation for additional usage. This indicates a "trend" in LCC in the sense that a continued increase in repair manhours will soon require the purchase of an additional unit of this SE type. The common/on-site SE costs are always pro-rated for fractional utilization. (See the calculations of NSEB(L,NS) and NSED(L) in Section 5.1.3.)

6.1.5 Global Repair Materials Cost - XRM Factor

A fractional increase of FINC in all ITEM repair materials cost factors RM(I) will produce an expected increase in LCC equal to:

$$TDXRM = \sum_I TDRM(I),$$

where TPRM(I) is the ITEM-specific increase in LCC due to a fractional increase of FINC in the value of RM(I) (calculated in Section 6.1.11.)

Note: As noted previously, XRM is not a direct data input to the LCC Model, hence it must not appear in Data File 1 and may not be input interactively in NAMELIST /G02/.

6.1.6 Program Lifetime - PIUP Factor

This section measures the impact on LCC of considering a longer program lifetime. Of course, a shorter program lifetime would produce a comparable decrease in projected LCC.

First the increase in PIUP is rounded to the nearest integer number of years by letting

$$CPIUP = \lfloor FINC * PIUP + .5 \rfloor$$

where the bars represent truncation of the fractional part.

The change in LCC due to a change of CPIUP years in the value of PIUP is then given by:

$$TDPIUP = (CPIUP/PIUP) * (OC + RSC + ONMC + OFMC + SECR + IMCR + STDCK + RNTRC)$$

where OC, RSC, ONMC, and OFMC are, respectively, the total cost for the Operations, Replenishment Spares, On-Equipment Maintenance, and Off-Equipment Maintenance Cost Elements. SECR represents the recurring maintenance cost of support equipment, given by the equation:

$$SECR = PIUP * \sum_L \left(\sum_{NS} NSEB(L, NS) * TNB(NS) + NSED(L) \right) * MSE(L) * CSE(L)$$

IIMCR represents the recurrent cost of ITEM Inventory Management, given by

$$\text{IIMCR} = \text{PIUP} * \sum_I [\text{IUT}(I) * (1 + \text{CPA}(I)) * \text{U}(1 - \text{COND}(\text{NHI}(I))) * \text{RMC} \\ + (\text{BIS}(I) + \text{BCIS}(I) * \text{CPA}(I)) * \text{SA}]$$

STDCR represents the recurrent cost of technical orders, computed according to the formula:

$$\text{STDCR} = [\text{DDATA} + \text{BDATA} + \sum_I (\text{DATAD}(I) + \text{U}(\sum_{\text{NS}} \text{ERTBI}(I, \text{NS})) * \text{DATAB}(I)) \\ + \sum_L \text{U}(\text{TNSE}(L)) * \text{DATAS}(L)] * \text{PIUP} * \text{UCPP}$$

RMTRC represents the recurrent cost of maintenance training, computed as

$$\text{RMTRC} = \text{MTRC} - \text{IMTRC}$$

where MTRC is the total cost of maintenance training, and IMTRC, the initial training cost, is given by

$$\text{IMTRC} = [\text{T1}/\text{HPD1}] * [\text{QTYP1}/\text{SPC1}] * \text{CPD1} \\ + \text{QTYP1} * ([\text{T1}/\text{HPD1}] * \text{PAL1} + \text{TRAV1D} * \text{U}(\text{T1})) + \\ \{(\text{T2DA} * \text{QTYP2D} + \text{T2BA} * \text{QTYP2B}) / (\text{HPD2} * \text{SPC2})\} * \text{CPD2} \\ + \text{QTYP2D} * ([\text{T2DA}/\text{HPD2}] * \text{PAL2D} + \text{TRAV1D} * \text{U}(\text{T2DA})) \\ + \text{QTYP2B} * ([\text{T2BA}/\text{HPD2}] * \text{PAL2B} + \text{TRAVB} * \text{U}(\text{T2BA})) \\ + \text{TEFM}$$

6.1.7 Modification/Installation Labor Man-hours - XMIL Factor

Modification/Installation labor manhours are difficult to estimate with high accuracy. This section measures the increase in LCC that would occur if all Mod/I manhours were to increase by (or were underestimated by) a fractional amount FINC. This resulting increase in LCC is denoted by TDXMIL and given by the equation:

$$TDXMIL = FINC * \sum_{NS} \sum_{NP} NPLT(NP, NS) * TNB(NS) * \left\{ \sum_M FR(M, NP) * MILR(M) * \left(\sum_{IA} MIMH(IA, M, NP) * XMIL \right) \right\}$$

6.1.8 ITEM Unit Cost - UP(I) Factor

The estimated increase in LCC produced by a fractional increase of FINC in the unit cost of ITEM type I, UP(I), is calculated via the equation:

$$TDUP(I) = FINC * \sum_{NS} \sum_{NP} TNB(NS) * NPLT(NP, NS) * NITEM(I, NP) * UP(I) * XUC + FINC * (ISCA(I) + RSCA(I))$$

where ISCA(I) and RSCA(I) are, respectively, the costs for Investment Spares and Replenishment Spares of ITEM type I, as calculated in Sections 5.2.4 and 5.2.5, respectively.

The first term in the equation for TDUP(I) above is meant to cover the increased production cost that can be inferred from an increased unit cost of ITEM type I. However, since the Production Cost Element in the LCC Model is calculated on the basis of unit costs for complete terminals (see Section 5.2.1), a re-run of the model with an increased value of UP(I) only will not capture this implicit increase in production costs. Thus the sensitivity calculation and a re-run of the LCC Model will not exhibit the same increase in LCC.

Recall that the LCC sensitivity calculation with respect to the global unit cost factor XUC does account for the increase in the Production Cost of complete terminals (see Section 6.1.1).

6.1.9 ITEM Failure Rate - FR(I) Factor

As noted previously, the ITEM failure rate factor FR(I) is not a direct data input to the LCC Model, but merely represents the average number of failures per million operating hours for ITEM type I. Thus, although FR(I) is not calculated directly within the LCC Model, it may be thought of as being given by the equation

$$FR(I) = 1000000/PMTBF(I),$$

where PMTBF(I) represents an "average predicted mean time between failures over the various PMTBF(I,LE(NP)) values for platforms NP in which ITEM type I is installed. This approach is taken because it is easier to interpret the meaning of (for example) a 20 percent increase in failure rate than a 20 percent increase in mean time between failures.

The expected change in LCC produced by a fractional increase of FINC in the overall failure rate of ITEM type I, denoted TDFR(I), is given by the equation:

$$\begin{aligned} TDFR(I) = & FINC * RSCA(I) \\ & + \sum_{NS} TNB(NS) * [F((1+FINC) * NFB(I,NS)) - F(NFB(I,NS))] * UP(I) * XUC \\ & + [F((1+FINC) * NFD(I)) - F(NFD(I))] * UP(I) * XUC \\ & + FINC * (ONMCA(I) + OFMCA(I)) \\ & + FINC * \sum_L \left\{ \sum_{NS} [USE(L,NS) * \frac{ERHB(I,NS)}{BAA} * U(A(I,L)) * ISET(L,NS) * TNB(NS)] \right. \\ & \left. + \frac{USED(L) * ERHD(I)}{DAA} * U(A(I,L)) * ISETD(L) \right\} * CSE(L) * (1 + PIUP * MSE(L)) \\ & + \sum_{NS} \left| \min[F((1+FINC) * NFB(I,NS)), 1] - \min[F(NFB(I,NS)), 1] \right| \\ & * TNB(NS) * PIUP * SA \end{aligned}$$

The terms in the equation above represent the increases in LCC produced in, respectively, Replenishment Spares, base Initial Spares, depot Initial Spares, On and Off-Equipment Maintenance, base Support Equipment, depot Support Equipment, and base-level inventory Management.

6.1.10 ITEM False Pull Rate - FPR(I) Factor

The estimated change in LCC resulting from a fractional increase of FINC in the false pull rate FPR(I) of ITEM type I is given by:

- (i) If ITEM type I is not an LRU, i.e., LRU(I)=0, the TDFPR(I)=0.

(Recall that it is assumed that only LRUs have positive false pull rates.)

- (ii) If ITEM type I is an LRU, i.e., LRU(I)=1, then

$$\begin{aligned}
 \text{TDFPR}(I) = & \sum_{NS} \text{TNB}(NS) * [F(\text{NFB}(I,NS) + \text{CHNFB}(I,NS)) - F(\text{NFB}(I,NS))] * \text{UP}(I) * \text{X} \\
 & + 12 * \text{PIUP} * \sum_{NS} \text{TNB}(NS) * \text{FAIL}(I,NS) * \text{FINC} * \text{FPR}(I) * \text{XFPR} * \text{RMH}(I) * \text{BMF} * \text{BLR} \\
 & + 12 * \text{PIUP} * \sum_{NS} \text{TNB}(NS) * \text{FAIL}(I,NS) * \text{FINC} * \text{FPR}(I) * \text{XFPR} \\
 & \quad * [\text{BCM}(I) * \text{BMF} * \text{BLR} + \text{SAT}(NS) * 2 * \text{CPPC} * \text{WT}(I)] \\
 & + \sum_{NS} (1 - \text{SAT}(NS)) * [\text{FAIL}(I,NS) + \text{CIMF}(NS) * \sum_{\substack{B \text{ such} \\ \text{that } \text{NHB}(B)=NS}} \text{FAIL}(I,B) * \text{NBC}(B)] \\
 & \quad * \text{FINC} * \text{FPR}(I) * \text{XFPR} * \text{BCM}(I) * \text{BMF} / \text{BAA} \\
 & \quad * [\sum_L \text{U}(A(I,L)) * \text{USE}(L,NS) * \text{ISET}(L,NS) * \text{CSE}(L) \\
 & \quad \quad * (1 + \text{PIUP} * \text{MSE}(L))] \\
 & + \sum_{NS} \text{TNB}(NS) * \text{PIUP} * \text{SA} * \left(\min[F(\text{CHNFB}(I,NS) + \text{NFB}(I,NS)), 1] \right. \\
 & \quad \quad \left. - \min[F(\text{NFB}(I,NS)), 1] \right)
 \end{aligned}$$

where the change in the base NS pipeline of ITEM type I which is due to the increased false pull rate is denoted by CHNFB(I,NS) and is determined as follows:

- (i) If NS is a satellite base, i.e., BTYPE(NS)=3, then

$$\text{CHNFB}(I,NS) = \text{FAIL}(I,NS) * \text{LRU}(I) * \text{FINC} * \text{FPR}(I) * \text{XFPR} * \text{GSTC}$$

(ii) If NS is an independent or CIMF base, then

$$\begin{aligned} \text{CHNFB}(I, \text{NS}) &= \text{FAIL}(I, \text{NS}) * \text{LRU}(I) * \text{FINC} * \text{FPR}(I) * \text{XFPR} * \text{BRCT} \\ &+ \text{CIMF}(\text{NS}) * \sum_{\substack{B \text{ such} \\ \text{that NHB}(B)=\text{NS}}} \text{FAIL}(I, B) * \text{NBC}(B) * \text{LRU}(I) * \text{FINC} * \text{FPR}(I) * \text{XFPR} * \text{CRCT} \end{aligned}$$

The terms in the equation for TDFPR(I) above account for increases in LCC produced in, respectively, base Initial Spares, LRU removal and replacement manhours, bench checkout manhours and packing and shipping costs, Support Equipment, and base Inventory Management.

6.1.11 ITEM Repair Materials Cost - RM(I) Factor

The change in LCC produced by a fractional increase of FINC in the ITEM repair materials cost factor RM(I) is given by the equation:

$$\begin{aligned} \text{TDRM}(I) &= 12 * \text{PIUP} * \text{FINC} * \sum_{\text{NS}} \text{FAIL}(I, \text{NS}) * \text{TNB}(\text{NS}) \\ &* (1 - \text{COND}(\text{NHI}(I))) * (1 - \text{COND}(I)) * \text{RM}(I) * \text{UP}(I) * \text{XUC} \end{aligned}$$

The equation above was derived from the repair materials cost portion of the Replacement Spares Cost Element equation given in Section 5.2.5.

6.1.12 CHLCC - Change in LCC for Repair Level Sensitivity

This section presents a basic equation which can be used to compute LCC sensitivity with respect to each of the ITEM repair level parameters RTS(I), NRTS(I), and COND(I). The fact that one basic equation is sufficient to compute LCC sensitivity with respect to these three different factors is due to the following circumstances. First, changes in any of these three parameters will impact exactly the same components of LCC. Secondly, for any particular ITEM type I, the three factors RTS(I), NRTS(I), and COND(I) cannot be increased or decreased independently of one another in any case. This is because the basic identity

$$\text{RTS}(I) + \text{NRTS}(I) + \text{COND}(I) = 1$$

must always be maintained for each value of I. For example, an increase of .25 in RTS(I) must be accompanied by an off-setting decrease of .25 in the sum of NRTS(I) and COND(I).

For these reasons, the equation below presents the change in LCC produced by any possible combination of changes among the parameters RTS(I), NRTS(I), and COND(I). Thus, for a particular ITEM type I, if CR(I), CN(I), and CC(I) represent numerical changes to the parameters RTS(I), NRTS(I), and COND(I), respectively, then the resulting change in LCC, denoted CHLCC, is estimated via the following equation (which is actually a function of CR(I), CN(I), CC(I), and I):

$$\begin{aligned}
 & \text{CHLCC}(\text{CR}(\text{I}), \text{CN}(\text{I}), \text{CC}(\text{I}), \text{I}) \\
 &= \left[\sum_{\text{NS}} (1 - \text{SAT}(\text{NS})) * \text{TNB}(\text{NS}) * \{ \text{F}(\text{CNFB}(\text{I}, \text{NS}) + \text{NFB}(\text{I}, \text{NS})) - \text{F}(\text{NFB}(\text{I}, \text{NS})) \} \right. \\
 &\quad \left. + \{ \text{F}(\text{CNFD}(\text{I}) + \text{NFD}(\text{I})) - \text{F}(\text{NFD}(\text{I})) \} \right] * \text{UP}(\text{I}) * \text{XUC} \\
 &+ 12 * \text{PIUP} * \sum_{\text{NS}} \text{FAIL}(\text{I}, \text{NS}) * \text{TNB}(\text{NS}) * (1 - \text{COND}(\text{NHI}(\text{I}))) \\
 &\quad * [\text{CC}(\text{I}) + (1 - \text{CC}(\text{I})) * \text{RM}(\text{I})] * \text{UP}(\text{I}) * \text{XUC} \\
 &+ 12 * \text{PIUP} * \sum_{\text{NS}} \text{FAIL}(\text{I}, \text{NS}) * \text{TNB}(\text{NS}) * \left\{ (\text{LRU}(\text{I}) + \text{RTS}(\text{NHI}(\text{I}))) \right. \\
 &\quad * [\text{CR}(\text{I}) * \text{BMH}(\text{I}) * \text{BMF} * \text{BLR} \\
 &\quad + \text{CN}(\text{I}) * (\text{DMH}(\text{I}) * \text{DMF} * \text{DLR} + 2 * \text{CPPD}(\text{LO}(\text{NS})) * \text{WT}(\text{I})) \\
 &\quad + \text{CC}(\text{I}) * \text{CPPD}(\text{LO}(\text{NS})) * \text{WT}(\text{I}) \} \\
 &\quad \left. - \text{NRTS}(\text{NHI}(\text{I})) * \text{CC}(\text{I}) * \text{DMH}(\text{I}) * \text{DMF} * \text{DLR} \right\} \\
 &+ \sum_{\text{L}} \text{U}(\text{A}(\text{I}, \text{L})) * \text{CSE}(\text{L}) * (1 + \text{PIUP} * \text{NSE}(\text{L})) * \left\{ \left(\sum_{\text{NS}} \text{TNB}(\text{NS}) * \text{CHSE}(\text{L}, \text{NS}) \right) + \text{CHSED}(\text{L}) \right\}
 \end{aligned}$$

$$+ \sum_{NS} \left\{ (1 - \text{SAT}(NS)) * \text{TNB}(NS) * \text{PIUP} * \text{SA} \right. \\ \left. * \left(\min[\text{F}(\text{CNFB}(I, NS) + \text{NFB}(I, NS)), 1] - \min[\text{F}(\text{NFB}(I, NS)), 1] \right) \right. \\ \left. + \text{CPP}(I, NS) * \text{PA}(I) \right\}$$

The terms in the above equation (i.e., each summation) accounts, respectively, for the changes in the cost of Investment Spares, Replenishment Spares, Maintenance, Support Equipment, and ITEM Inventory Management.

Also, in the above equation $\text{CNFB}(I, NS)$ represents the resulting change in the base NS pipeline of ITEM type I, computed via the equation:

$$\text{CNFB}(I, NS) = \text{FAIL}(I, NS) * (\text{LRU}(I) + \text{RTS}(\text{NHI}(I))) \\ * [\text{CR}(I) * \text{BRCT} + (\text{CN}(I) + \text{CC}(I)) * \text{OST}(\text{LO}(NS))] \\ + \text{CIMF}(NS) * \sum_{\substack{B \text{ such} \\ \text{that } \text{NHB}(B) = NS}} [\text{FAIL}(I, B) * \text{NBC}(B)] * (\text{LRU}(I) + \text{RTS}(\text{NHI}(I))) \\ * [\text{CR}(I) * \text{CRCT} + (\text{CN}(I) + \text{CC}(I)) * (\text{OST}(\text{LO}(NS)) + \text{U}(\text{FPR}(I)) * \text{XFPR}) * \text{CRCT}]$$

Similarly, $\text{CNFD}(I)$ represents the resulting change in the depot pipeline of ITEM type I, given by:

$$\text{CNFD}(I) = \sum_{NS} \text{FAIL}(I, NS) * \text{TNB}(NS) * [(\text{LRU}(I) + \text{RTS}(\text{NHI}(I))) \\ * \text{CN}(I) * \text{DRCT}(\text{LO}(NS)) - \text{NRTS}(\text{NHI}(I)) * \text{CC}(I) * \text{DAD}]$$

The terms $\text{CHSE}(L, NS)$ and $\text{CHSED}(L)$ in the equation for CHLCC represent resulting changes in support equipment requirements at the base and depot level, respectively. To calculate these changes in SE, we must first calculate the changes in repair manhours expended on ITEM type I at both the base and depot level. The change in repair manhours at each base of type NS is denoted by $\text{CRH}(I, NS)$ and determined as follows:

- (i) If NS is a satellite base, $\text{CRH}(I, NS) = 0$
- (ii) If NS is an independent or CIMF base, then

$$\begin{aligned}
\text{CRH}(I,NS) &= \text{FAIL}(I,NS) * (\text{LRU}(I) + \text{RTS}(\text{NHI}(I))) * \text{CR}(I) * \text{BMH}(I) * \text{BMF} \\
&+ \text{CIMF}(NS) * \sum_{\substack{B \text{ such} \\ \text{that NHB}(B)=NS}} \text{FAIL}(I,B) * \text{NBC}(B) * (\text{LRU}(I) + \text{RTS}(\text{NHI}(I))) \\
&* [(\text{CR}(I) + \text{CN}(I) + \text{U}(\text{FPR}(I) * \text{XFPR}) * \text{CC}(I)) * \text{BCMH}(I) + \text{CR}(I) * \text{BMH}(I)] * \text{BMF}
\end{aligned}$$

The change in repair manhours expended on ITEM type I at the depot is denoted by CRHD(I) and is given by the formula:

$$\begin{aligned}
\text{CRHD}(I) &= \sum_{NS} \text{FAIL}(I,NS) * \text{TNB}(NS) * [(\text{LRU}(I) + \text{RTS}(\text{NHI}(I))) * \text{CN}(I) \\
&- \text{NRTS}(\text{NHI}(I)) * \text{CC}(I)] * \text{DMH}(I) * \text{DMF}
\end{aligned}$$

The change in SE requirements at the base level is then determined as follows:

- (i) If $\text{CRH}(I,NS) = 0$ then $\text{CHSE}(L,NS) = 0$ for all SE types L.
- (ii) If $\text{CRH}(I,NS) > 0$ then, for each SE type L,
$$\text{CHSE}(L,NS) = \text{USE}(L,NS) * [\text{CRH}(I,NS) / \text{BAA}] * \max\{\text{ISET}(L,NS), \text{A}(I,L)\}$$
- (iii) If $\text{CRH}(I,NS) < 0$ then, for each SE type L,
$$\text{CHSE}(L,NS) = [\text{CRH}(I,NS) / \text{ERHAB}(L,NS)] * \text{NSEB}(L,NS)$$

The change in SE requirements at the depot is determined in a similar fashion, i.e.,:

- (i) If $\text{CRHD}(I) = 0$ then $\text{CHSED}(L) = 0$ for all SE types L.
- (ii) If $\text{CRHD}(I) > 0$ then
$$\text{CHSED}(L) = \text{USED}(L) * [\text{CRHD}(I) / \text{DAA}] * \max\{\text{ISETD}(L), \text{A}(I,L)\}$$
- (iii) If $\text{CRHD}(I) < 0$ then
$$\text{CHSED}(L) = [\text{CRHD}(I) / \text{ERHAD}(L)] * \text{NSED}(L)$$

Finally, the term $\text{CPP}(I,NS)$ in the equation for CHLCC represents the change in the inventory of piece parts at the base level and is determined as follows:

(i) If $RTS(I)*NFB(I,NS) = 0$ then

$$CPP(I,NS) = U(CR(I)*(CNFB(I,NS)+NFB(I,NS)))$$

(ii) If $RTS(I)*NFB(I,NS) > 0$ then

$$CPP(I,NS) = \begin{cases} CR(I)/RTS(I), & \text{if } CR(I) < 0 \\ 0, & \text{otherwise} \end{cases}$$

Thus $CPP(I,NS)$ represents either possibly additional piece part inventory requirements (case (i)) or possibly reduced piece part inventory requirements (case (ii)).

6.1.13 ITEM Intermediate Repair Fraction - $RTS(I)$ Factor

For sensitivity analysis on the parameter $RTS(I)$, one is to estimate the change in LCC which results from an absolute (rather than fractional) increase in $RTS(I)$ equal to an amount $FINC$.

In order to properly perform sensitivity analysis on any of the repair level fractions $RTS(I)$, $NRTS(I)$ and $COND(I)$, all ITEM data that is required for any repair level decision must be provided as input to the LCC Model. For example, even if depot level repair is initially intended for an ITEM type I, the user should still input a non-zero, realistic estimate for base repair manhours $BMH(I)$, so that the LCC sensitivity with respect to $RTS(I)$ will represent a meaningful change in cost.

The changes in the values of $RTS(I)$, $NRTS(I)$, and $COND(I)$, (denoted by $CR(I)$, $CN(I)$, and $CC(I)$, respectively) are defined by the following equations and conditions:

Case 1: If $COND(I) = 1$, then set

$$CR(I) = \min[FINC, 1]$$

$$CN(I) = 0 \text{ and } CC(I) = -CR(I).$$

Case 2: If $COND(I) < 1$ then set

$$CR(I) = \min[FINC, NRTS(I)]$$

$$CN(I) = -CR(I) \text{ and } CC(I) = 0.$$

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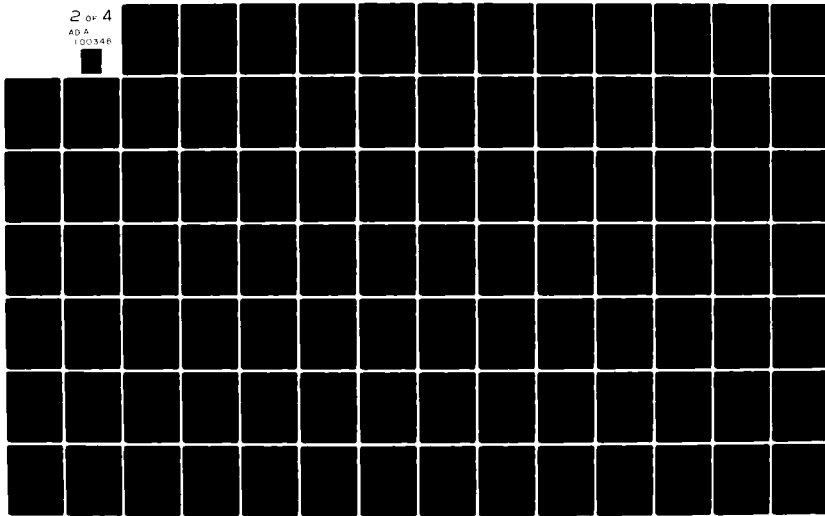
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The resulting change in LCC is then given by

$$TDRTS(I) = \begin{cases} 0, & \text{if } CR(I)=0, \\ CHLCC(CR(I),CN(I),CC(I),I), & \text{if } CR(I)>0; \end{cases}$$

where $CHLCC(CR(I),CN(I),CC(I),I)$ is computed as in Section 6.1.12.

Notes: (1) $CR(I) + CN(I) + CC(I) = 0$ for all cases since the equality $RTS(I) + NRTS(I) + COND(I) = 1$ must be maintained.

(2) It is assumed that $COND(I) = 1$ in Case 1 above indicates a repair level decision, i.e., discard-on-failure, whereas a value of $COND(I) < 1$ indicates a wear-out rate of a normally repairable ITEM. Thus, for LCC sensitivity on $RTS(I)$, we may reduce the value of $COND(I)$ if and only if $COND(I) = 1$. If $COND(I) < 1$ then any increase in the $RTS(I)$ parameter must be absorbed by an equal decrease in the $NRTS(I)$ parameter only.

6.1.14 ITEM Depot Repair Fraction - NRTS(I) Factor

LCC sensitivity analysis on $NRTS(I)$ is performed under the same assumptions as made for LCC sensitivity on $RTS(I)$. Thus, for a given value of $FINC$, the changes in the values of $RTS(I)$, $NRTS(I)$, and $COND(I)$, (denoted by $CR(I)$, $CN(I)$, and $CC(I)$, respectively) are defined by the following criteria:

Case 1: If $COND(I)=1$ then set

$$CN(I) = \min[FINC, 1],$$

$$CR(I) = 0 \text{ and } CC(I) = -CN(I).$$

Case 2: If $COND(I) < 1$ then set

$$CN(I) = \min[FINC, RTS(I)],$$

$$CR(I) = -CN(I) \text{ and } CC(I) = 0.$$

The change in LCC produced by this absolute increase of $CN(I)$ in the value of $NRTS(I)$ is then given by

$$TDNRTS(I) = \begin{cases} C, & \text{if } CN(I)=0, \\ CHLCC(CR(I),CN(I),CC(I),I), & \text{if } CN(I) > 0. \end{cases}$$

where again $CHLCC(CR(I),CN(I),CC(I),I)$ is calculated via the equation presented in Section 6.1.12.

6.1.15 ITEM Condemnation Rate - COND(I) Factor

LCC sensitivity with respect to the COND(I) factor is performed under the same assumptions as were made for LCC sensitivity with respect to the RTS(I) and NRTS(I) factors. Thus, for a given value of FINC, we define the changes CR(I), CN(I), and CC(I) in the values of RTS(I), NRTS(I) and COND(I), respectively, in accordance with the two cases below:

Case 1: If $COND(I)=1$ then $CC(I)=CR(I)=CN(I)=0$.

Case 2: If $COND(I) < 1$ then set

$$CC(I) = \min[FINC, 1-COND(I)],$$

$$CR(I) = \frac{-RTS(I)}{(RTS(I)+NRTS(I))} * CC(I)$$

and

$$CN(I) = \frac{-NRTS(I)}{(RTS(I)+NRTS(I))} * CC(I)$$

Note, in this case, that the decreases are pro-rated in RTS(I) and NRTS(I) that are necessary to compensate for the increase in COND(I).

The estimated change in LCC that is produced by an absolute increase of CC(I) in the value of COND(I) is then given by

$$TDCOND(I) = \begin{cases} 0, & \text{if } CC(I)=0 \\ CHLCC(CR(I),CN(I),CC(I),I), & \text{if } CC(I)>0, \end{cases}$$

where again $CHLCC(CR(I),CN(I),CC(I),I)$ is calculated as indicated in Section 6.1.12.

Notes: (1) The value of TDCOND(I) represents the estimated change in LCC that results from increasing the condemnation rate of ITEM type I by an amount CC(I) (in the extreme case of FINC=1, from making ITEM type I a discard-on-failure component). However, the estimate of the change in LCC that is produced by decreasing the condemnation rate of a discard-on-failure ITEM (i.e., $COND(I)=1$), and hence

making it either base or depot-level repairable, is given by the value of either TDRTS(I) or TDNRTS(I), respectively.

(2) The value of TDCOND(I) includes a prorated projected savings in support equipment (SE) costs; i.e., if an ITEM is discarded-on-failure then its associated SE is utilized less often. However, a rerun of the LCC Model with COND(I)=1 for that ITEM may not produce the indicated savings in SE cost if other ITEM types utilize the same SE as ITEM type I. In fact, in most cases, to realize a savings in the SE cost of a particular SE type L, all ITEM types which utilize this SE type must be designated as discard-on-failure (COND=1). If TDCOND(I) is negative for all (or most) of these ITEM types, then making them all discard-on-failure will be a cost-effective repair-level decision.

6.2 Simplified Repair Level Analysis Capability

The sensitivity analysis calculations with respect to RTS(I), NRTS(I) and COND(I) provide the LCC Model with a simplified repair level analysis capability. For example, if ITEM type I is always repaired at the base level (i.e., RTS(I)=1), then the change in LCC produced by switching it to depot-level repair (NRTS(I)=1), is estimated by the value of TDNRTS(I), computed using a value of FINC=1. Thus, if the value of TDNRTS(I) is negative, that may indicate that depot-level repair of ITEM type I is cheaper than base-level repair. (Although further detailed analysis would be warranted before making that decision.)

Similarly, the change in LCC produced by switching ITEM type I to discard-on-failure (COND(I)=1) is estimated by the value of TDCOND(I), also computed using a value of FINC=1. In general, the following table summarizes the estimated changes in LCC that would be produced by switching the current repair-level strategy for ITEM type I (represented by the input values of RTS(I), NRTS(I) and COND(I)) to each of the following possibilities: (i) all repair at base-level, (ii) all repair at depot-level, and (iii) discard ITEM upon failure. (The reader should reread Caution (4) in Section 6.1 concerning the necessity to input data concerning all ITEM repair level decisions in order for the calculations of TDRTS(I), TDNRTS(I), and TDCOND(I) to represent meaningful changes in LCC.)

Repair Level Decision	*	Resulting Change in LCC	

	*		
Base-level repair	*	TDRTS(I)	
	*		
Depot-level repair	*	TDNRTS(I)	all computed using FINC=1
	*		
Discard-on-failure	*	TDCOND(I)	

Note that the simplified RLA procedure described here is not a replacement for the more elaborate global RLA program described in Section 7. Using the sensitivity analysis permits a repair level question on a single item to be answered on a single run. On the other hand, the product of the RLA program is a system-wide economical maintenance strategy consisting of a repair level decision for every ITEM.

6.3 LCC Sensitivity to Identify Which SRUs Should Be LRUs

This section estimates the change in LCC which would occur if individual SRUs were made LRUs. For this purpose one will only examine ITEMS which are SRUs and whose next higher level indenture ITEM is an LRU, i.e., ITEM types I satisfying $LRU(I)=0$ and $LRU(NHI(I))=1$. Also the following assumptions are made:

If SRU type I is made an LRU, then

- (1) The failure rate of the LRU type $NHI(I)$ will be reduced by the failure rate of ITEM type I.
- (2) The unit cost of LRU type $NHI(I)$ will be reduced by the unit cost of ITEM type I.
- (3) The false pull rate of ITEM type I will become the same as for LRU type $NHI(I)$. (Recall only LRUs have non-zero false pull rates.)
- (4) The repair level fractions RTS, NRTS, and COND will remain the same for both ITEM type I and LRU type $NHI(I)$.
- (5) Removal man-hours and cost of in-place repairs for ITEM type I (if changed to an LRU) will be the same as for LRU type $NHI(I)$.
- (6) The weight (for shipping) of LRU type $NHI(I)$ will be reduced by an amount equal to the weight of ITEM type I.

The above assumptions reflect the fact that if an SRU is to be re-designed as an LRU, then it will be physically removed from its next higher LRU assembly. The next higher LRU assembly will also require

re-designing after which it presumably will weigh less, cost less, and fail less often as a result of having a portion of its original components removed (i.e., the SRU).

The change in LCC that is calculated below as being produced by changing SRU type I to an LRU is denoted by TDSRU(I). The value of TDSRU(I) must be negative of course, (indicating a savings in LCC) in order to indicate that it might be cost-effective to re-design SRU type I as an LRU. However, TDSRU(I) does not include an adjustment for the cost of the necessary re-designing of both the SRU and its next higher LRU assembly into new LRU configurations. Thus, the LCC Model user will have to ascertain for himself whether a savings in LCC indicated by negative value of TDSRU(I) for a particular ITEM type I is large enough to off-set the implicit re-design engineering cost which would be incurred if the actual reconfiguration of the ITEM was undertaken.

Also, since we are primarily interested in potential savings in LCC, the LCC Model will sort out the TDSRU(I) calculations in order of largest negative values. Thus, the model will identify that ITEM type I for which TDSRU(I) is most negative (indicating the largest potential savings in LCC) and will print that value first in the Sensitivity Analysis Output Table. The next most negative value will be printed second, and so on.

Another consideration which may introduce some inaccuracy in the calculation of TDSRU(I) is the fact that SRU type I may be a component in several different LRU types, among which LRU type NHI(I) represents only its most common usage. The calculation of TDSRU(I) will assume that SRU type I has been changed to an LRU in all of its occurrences, but will only include changes in the higher LRU costs for LRU type NHI(I). Also, the data base of the LCC Model does not reveal whether there are multiple copies of a particular SRU within a given LRU. (Only the number of ITEMS of each type on whole platforms are given.)

Thus the TDSRU(I) calculation should be used only as a "first-pass" screening device to indicate those SRUs which potentially might produce some cost savings if they were re-designed as LRUs. After identification of such a prospective SRU in a "first-pass" TDSRU(I) calculation, a more detailed analysis would be warranted. For example as a next step, the data base of the LCC Model could be revised to incorporate all anticipated design, failure rate, unit cost, and maintenance changes to the SRU and all its higher level LRUs that would be expected if the SRU were re-designed as an LRU. A rerun of the LCC Model would then yield a more accurate estimate of the resulting change in LCC.

The equation for TDSRU(I) is:

- (i) If ITEM type I is not an SRU whose next higher indenture level assembly is an LRU, then TDSRU(I)=0.
- (ii) Otherwise, i.e., LRU(I)=0 and LRU(NHI(I))=1, then

$$\begin{aligned}
 \text{TDSRU}(I) = & \sum_{\text{NS}} \text{TNB}(\text{NS}) * \left\{ [\text{F}(\text{DNHNFBI}, \text{NS}) * (\text{UP}(\text{NHI}(I)) - \text{UP}(I)) \right. \\
 & \quad \left. - \text{F}(\text{NFB}(\text{NHI}(I), \text{NS})) * \text{UP}(\text{NHI}(I))] * \text{XUC} \right. \\
 & \quad \left. + [\text{F}(\text{DINFBI}, \text{NS}) - \text{F}(\text{NFB}(I, \text{NS}))] * \text{UP}(I) * \text{XUC} \right\} \\
 & + [\text{F}(\text{DNHNFDI}) * (\text{UP}(\text{NHI}(I)) - \text{UP}(I)) - \text{F}(\text{NFD}(\text{NHI}(I)) * \text{UP}(\text{NHI}(I)))] * \text{XUC} \\
 & + [\text{F}(\text{DINFDI}) - \text{F}(\text{NFD}(I))] * \text{UP}(I) * \text{XUC} \\
 & + 12 * \text{PIUP} * \left\{ \sum_{\text{NS}} (\max[\text{FAIL}(\text{NHI}(I), \text{NS}) - \text{FAIL}(I, \text{NS}), 0] * (\text{UP}(\text{NHI}(I)) - \text{UP}(I)) \right. \\
 & \quad \left. - \text{FAIL}(\text{NHI}(I), \text{NS}) * \text{UP}(\text{NHI}(I))) * \text{TNB}(\text{NS}) \right\} \\
 & \quad * [\text{COND}(\text{NHI}(I)) + (1 - \text{COND}(\text{NHI}(I))) * \text{RM}(\text{NHI}(I))] * \text{XUC} \\
 & + 12 * \text{PIUP} * \sum_{\text{NS}} \min[\text{FAIL}(I, \text{NS}), \text{FAIL}(\text{NHI}(I), \text{NS})] * \text{TNB}(\text{NS}) * \text{COND}(\text{NHI}(I)) \\
 & \quad * [\text{COND}(I) + (1 - \text{COND}(I)) * \text{RM}(I)] * \text{UP}(I) * \text{XUC} \\
 & - 12 * \text{PIUP} * \sum_{\text{NS}} \min[\text{FAIL}(I, \text{NS}), \text{FAIL}(\text{NHI}(I), \text{NS})] * \text{TNB}(\text{NS}) \\
 & \quad * \left\{ [(1 + \text{FPR}(\text{NHI}(I)) * \text{XFPR}) * \text{BCM}(\text{NHI}(I)) + \text{RTS}(\text{NHI}(I)) * \text{BM}(\text{NHI}(I))] * \text{BMF} * \text{BLR} \right. \\
 & \quad + \text{NRTS}(\text{NHI}(I)) * [\text{DM}(\text{NHI}(I)) * \text{DMF} * \text{DLR} + 2 * \text{CPPD}(\text{LO}(\text{NS})) * \text{WT}(\text{NHI}(I))] \\
 & \quad + \text{COND}(\text{NHI}(I)) * \text{CPPD}(\text{LO}(\text{NS})) * \text{WT}(\text{NHI}(I)) \\
 & \quad \left. + \text{SAT}(\text{NS}) * (1 + \text{FPR}(I) * \text{XFPR}) * 2 * \text{CPPC} * \text{WT}(\text{NHI}(I)) \right\}
 \end{aligned}$$

$$\begin{aligned}
& + 12 * PIUP * \sum_{NS} \min[FAIL(I, NS), FAIL(NHI(I), NS)] * TNB(NS) * COND(NHI(I)) \\
& \quad * \left\{ [(1 + FPR(NHI(I)) * XFPR) * BCMH(I) + RTS(I) * BMH(I)] * BMF * BLR \right. \\
& \quad \quad \left. + NRTS(I) * DMH(I) * DMF * DLR \right\} \\
& - 12 * PIUP * \sum_{NS} \min[FAIL(NHI(I), NS), FAIL(I, NS)] * TNB \\
& \quad * [(2 * NRTS(NHI(I)) + COND(NHI(I))) * CPPD(LO(NS)) * WT(NHI(I)) \\
& \quad \quad + SAT(NS) * (1 + FPR(NHI(I)) * XFPR) * 2 * CPPC * WT(NHI(I))] \\
& - \sum_L U(A(NHI(I), L)) * \left\{ \sum_{NS} TNB(NS) * (USE(L, NS) * RNMH(I, NS) * ISET(L, NS) / BAA \right. \\
& \quad + USED(L) * \min[FAIL(I, NS), FAIL(NHI(I), NS)] * NRTS(NHI(I)) \\
& \quad \quad \left. * DMH(NHI(I)) * DMF * ISETD(L) / DAA \right\} * CSE(L) * (1 + PIUP * MSE(L)) \\
& + PIUP * SA * \sum_{NS} U(FAIL(I, NS)) * SAT(NS) * TNB(NS)
\end{aligned}$$

The terms in the above equation (following each summation) account for the changes in LCC produced in, respectively, Initial Spares, Replacement Spares (two summations), Off-Equipment Maintenance (two summations), Packing and Shipping, Support Equipment, and ITEM Inventory Management.

The revised base pipelines for ITEM type I and its higher LRU assembly NHI(I) which are used in the above equation and denoted by DINFB(I, NS) and DNHNFB(I, NS), respectively, are given by:

(i) If NS is a Satellite base, then

$$DINFB(I, NS) = FAIL(I, NS) * (1 + FPR(NHI(I))) * OSTC$$

and

$$DNHNFB(I, NS) = (FAIL(NHI(I), NS) - FAIL(I, NS)) * (1 + FPR(NHI(I))) * OSTC$$

(ii) If NS is an Independent or CIMF base, then

$$\begin{aligned} \text{DINF}(I, NS) = & \text{FAIL}(I, NS) * [(\text{FPR}(\text{NHI}(I)) * \text{XFPR} + \text{RTS}(I)) * \text{BRCT} \\ & + (\text{NRTS}(I) + \text{COND}(I)) * \text{OST}(\text{LO}(NS))] \\ & + \text{CIMF}(NS) * \sum_{\substack{B \\ \text{NHB}(B) = NS}} \text{FAIL}(I, B) * \text{NBC}(B) * [(\text{RTS}(I) + \text{FPR}(\text{NHI}(I)) * \text{XFPR}) * \text{CRCT} \\ & + (\text{NRTS}(I) + \text{COND}(I)) * (\text{OST}(\text{LO}(NS)) + \text{U}(\text{FPR}(\text{NHI}(I)) * \text{XFPR}) * \text{CRCT})] \end{aligned}$$

and

$$\begin{aligned} \text{DNHNF}(I, NS) = & \max[\text{FAIL}(\text{NHI}(I), NS) - \text{FAIL}(I, NS), 0] \\ & * [(\text{FPR}(\text{NHI}(I)) * \text{XFPR} + \text{RTS}(\text{NHI}(I))) * \text{BRCT} \\ & + (\text{NRTS}(\text{NHI}(I)) + \text{COND}(\text{NHI}(I))) * \text{OST}(\text{LO}(NS))] \\ & + \text{CIMF}(NS) * \left\{ \sum_{\substack{B \\ \text{NHB}(B) = NS}} \max[\text{FAIL}(\text{NHI}(I), B) - \text{FAIL}(I, B), 0] * \text{NBC}(B) \right\} \\ & * [(\text{RTS}(\text{NHI}(I)) + \text{FPR}(\text{NHI}(I)) * \text{XFPR}) * \text{CRCT} + (\text{NRTS}(\text{NHI}(I)) \\ & + \text{COND}(\text{NHI}(I))) * (\text{OST}(\text{LO}(NS)) + \text{U}(\text{FPR}(\text{NHI}(I)) * \text{XFPR}) * \text{CRCT})] \end{aligned}$$

The revised depot pipelines for ITEM type I and its higher LRU assembly NHI(I) are denoted by DINFD(I) and DNHNFD(I), respectively, and calculated via the equations:

$$\text{DINF}(I) = \sum_{NS} \text{FAIL}(I, NS) * \text{TNB}(NS) * \text{NRTS}(I) * \text{DRCT}(\text{LO}(NS))$$

and

$$\begin{aligned} \text{DNHNF}(I) = & \sum_{NS} \max[\text{FAIL}(\text{NHI}(I), NS) - \text{FAIL}(I, NS), 0] * \text{TNB}(NS) \\ & * \text{NRTS}(\text{NHI}(I)) * \text{DRCT}(\text{LO}(NS)) \end{aligned}$$

Finally, the variable RNHMH(I, NS), which is used in the equation for TDSRU(I) to represent the reduction in manhours expended in the intermediate level repair of the LRU assembly NHI(I) at base NS, is determined by:

$$RNHMH(I,NS) = \begin{cases} 0, & \text{if FAIL(NHI(I),NS)=0} \\ \min[\text{FAIL(I,NS)/FAIL(NHI(I),NS)}, 1] * \text{ERHBI(NHI(I),NS)}, & \text{otherwise} \end{cases}$$

Note that this reduction in manhours is assumed to be due to the reduced failure rate of the LRU type NHI(I) which results from the removal of its component SRC type I.

6.4 LCC Sensitivity Analysis through Global Multiplier Factors

The four global multiplier factors XUC, XFR, XFPR, and XMIL, which are direct input parameters from Data File 1 are provided in the LCC Model as additional LCC sensitivity analysis tools. These factors may be used either in conjunction with or independently of the LCC sensitivity calculations presented in Sections 6.1.1, 6.1.2, 6.1.3, and 6.1.7.

For example, suppose that the global unit cost sensitivity calculation TDXUC was to indicate that a \$50M increase in LCC would result from a 25 percent increase (i.e., FINC=.25) in all ITEM and Terminal unit costs. To gain more insight as to exactly which cost elements would be affected, the LCC Model user need only input XUC=1.25 (immediately in NAMELIST /GO2/ if operating in Interactive Mode, see Section 8.4) and then rerun the model. The specific cost increases, in this case to the Production, Investment Spares, and Replenishment Spares Cost Elements, would then be visible in the resulting Output Tables of the Model.

As another example, suppose the user wished to perform a system-wide trade-off analysis on increased reliability versus increased unit cost. If it were determined that to produce a 40 percent reduction in system-wide failure rates would require an approximate 25 percent increase in the unit costs of all ITEMS and Terminals, then a rerun of the model using XFR=.60 and XUC=1.25 would exhibit the resulting changes in LCC. Note that this method would incorporate the implicit "interaction" resulting from changing failure rates and unit costs at the same time. The LCC sensitivity calculations for TDXFR and TDXUC, on the other hand, only represent the respective changes which would result from changing these factors one at a time and, hence, measure no interactive effect.

In addition, note that, for any one run of the LCC Model, all LCC sensitivity calculations must be made with the same fractional increase factor FINC. By using the global multiplier factors, however, one can measure the effect of, say, increasing global

failure rates by 20 percent, decreasing all unit costs by 30 percent, increasing all ITEM false pull rates by 25 percent and increasing all Modification/Installation labor manhour estimates by 50 percent, by inputting XFR=1.2, XUC=.70, XFPR=1.25, and XMIL=1.5 and re-running the Model. Thus the global multiplier factors provide a convenient method to incorporate any set of desired adjustments to the four system-wide categories: ITEM and Terminal unit costs, ITEM failure rates, ITEM false pull rates, and Modification/Installation labor hours.

It should also be noted that global LCC sensitivity analysis on corrective maintenance manhours may be accomplished by utilizing the maintenance factors BMF and DMF. The purpose of these two parameters in the LCC Model (as indicated by their definitions in the Glossary) is not specifically to serve as LCC sensitivity multiplier factors, but they may, in fact, easily serve this function. Thus, for example, to measure the LCC impact of a 25 percent increase in all base repair times one need only increase the current value of BMF by 25 percent and rerun the Model.

Note, however, that for ITEM-specific LCC sensitivity analysis one must still rely on the calculations presented in Sections 6.1.8 through 6.1.15. In addition, the global multiplier factors do not average out any jump increases in cost, say for support equipment, and hence do not indicate the continuous "trend" in LCC. For this reason, the increase in LCC predicted by the LCC sensitivity calculation for TDNFR with FINC=.20 may not agree exactly with the increase obtained by rerunning the model using XFR=1.20. (For XUC and TDNUC, however, the values should agree exactly, since there are no jump increases to average out.)

SECTION 7

REPAIR LEVEL ANALYSIS CAPABILITY

7.1 Introduction

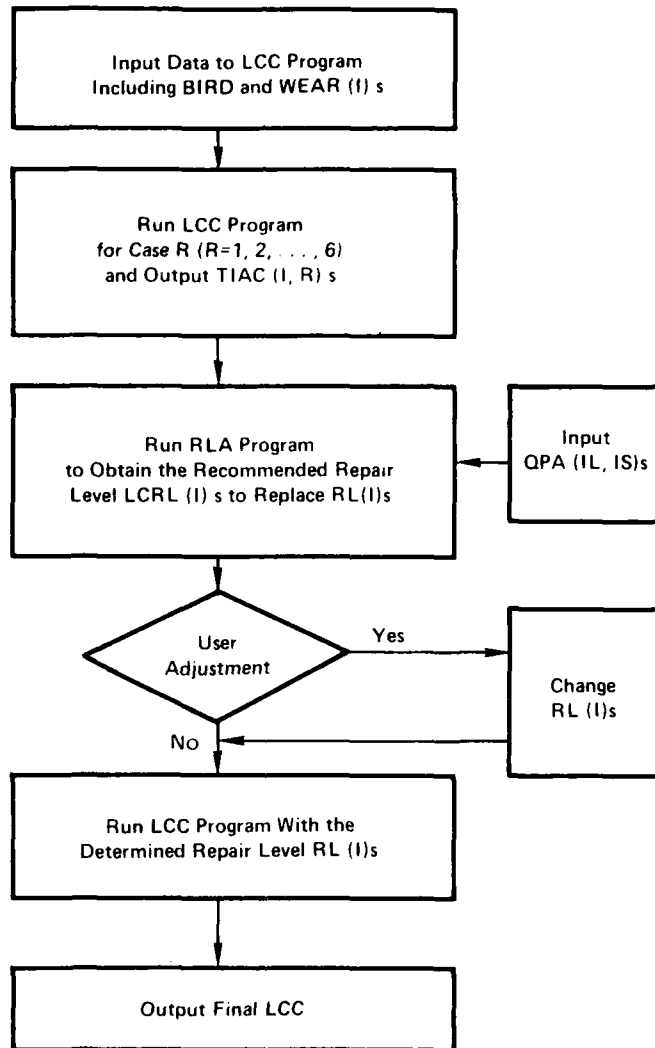
Described in this section is an approach to help determine the repair level for each ITEM in the SEEK TALK system. This approach has been implemented to be used in conjunction with the computerized SEEK TALK LCC Model. In repair level analysis, there are two interrelated stages of decisions: repair levels for LRUs and those for SRUs. For each stage there are three choices for each ITEM: base repair, depot repair, and discard-on-failure. Since the stages are interrelated, i.e., the decisions made at one stage affect the decisions to be made at the other, each ITEM's repair level should not be determined in isolation. The approach described below is one that recognizes this interrelationship. It should be noted, however, that the approach will not necessarily guarantee an optimal solution to the repair level decision situation. It is only an approximation, since the solution is based on prorated support costs among ITEM's.

The approach for the repair level analysis is outlined in the flow chart (Figure 7-1) below. As shown, a scalar and a vector of input data are required initially:

- BIRD: fraction of base-repair-intended failures which are actually repaired at the depot due to insufficient repair capability at the bases.
- WEAR(I): fraction of removed failures of ITEM type I which must be condemned due to normal wear-out.

These input parameters are used in the LCC Program to calculate $RTS(I)$, $NRTS(I)$, and $COND(I)$ for each ITEM type I, which in turn are used in the LCC accounting model equations. There are six different accounting model runs to be made and indexed by the value of R. Each R value defines a different repair strategy represented by the values of $RTS(I,R)$, $NRTS(I,R)$, and $COND(I,R)$, as specified later. In each run R, all the other inputs remain the same and the total cost attributable to each ITEM type I is calculated and denoted as $TIAC(I,R)$. Detailed calculation of the above is presented in Section 7.2.

The Repair Level Analysis (RLA) program then uses the matrix $TIAC(I,R)$ along with another matrix $QPA(IL,JS)$ to analytically determine the repair level for each ITEM, where



IA-60,785

Figure 7-1. Process of the Repair Level Analysis

$QPA(IL,IS) =$ number of units of SRU ITEM type IS contained in one unit of LRU ITEM type IL. Note that the index IS represents those values of the ITEM index I which designate SRUs, while the index IL represents those values which designate LRUs.

As an output of the analysis, the repair level decision reached for each ITEM type I is saved on a data file. A subsequent LCC program run to implement the repair level decisions (with possible user adjustment) is thus ready to be conducted. The specific procedure of finding the recommended repair levels in the RLA Program is presented in Section 7.3.

Note that when requested with proper inputs, the complete process of computing $TIAC(I,R)$ s will be performed automatically by the LCC computer program. With this calculated matrix $TIAC(I,R)$ saved on a data file and the additional input matrix $QPA(IL,IS)$, the RLA program is ready to proceed. In addition, the results from the RLA Program can be easily used through a simple input procedure. See Section 10 for details on how this is accomplished and Appendix II (II.2-II.5) for a complete example.

7.2 Calculation of ITEM Costs

To determine the repair level for each ITEM, one has to first determine the total cost which is affected by an ITEM's repair level. There are three different repair levels for each LRU: base repair, depot repair, and discard-on-failure. For each SRU, there may also be a choice of repair levels, depending on the specific repair level chosen for its LRU. More explicitly, there are 6 different cases of repairing for each SRU and they can be grouped into 3 sets according to its parent LRU's repair level, as follows:

Table 7-I

Different Cases of Repairing

Set J	Case R	LRU	SRU
	1	base repair	base repair
1	2	base repair	depot repair
	3	base repair	discard
2	4	depot repair	depot repair
	5	depot repair	discard
3	6	discard	discard

Note that the set of first 3 cases has the parent LRU base-repaired, while the SRU can be base-repaired, depot-repaired, or discarded on failure. The set of next 2 cases requires depot repair for the LRU and allows either depot repair or discard-on-failure for its SRU. Base repair for the SRU is considered not practical when its LRU is sent for depot repair. The last case (or set) is that the parent LRU and thus the SRU will be discarded when failure occurs. For these different cases, there are different cost implications for each ITEM, SRU or LRU. To determine the total cost effect of each ITEM's repair level, six LCC accounting model runs are to be made, each corresponding to a case in Table 7-I. The model specifications of $RTS(I)$, $NRTS(I)$, and $COND(I)$ for each ITEM type I in making these runs are listed in Table 7-II. Note that the entries of this table are determined by knowing that the value of $COND(I)$ has to be at least $WEAR(I)$ and the value of $NRTS(I)$ at least $RTS(I) \cdot BIRD$, and then by assigning a largest possible fraction to $RTS(I)$, $NRTS(I)$, or $COND(I)$, depending on whether ITEM type I is base-repaired, depot-repaired, or discarded on failure, as specified in Table 7-I. Of course, the condition that $RTS(I) + NRTS(I) + COND(I) = 1$ should always be observed.

Based on the results of each LCC accounting model run R, one can sum up all the cost elements which are affected by the repair level of each ITEM type I as follows:

Table 7-II

Model Specifications of Repairing Cases

Set J	Case R	LRU			SRU		
		RTS(IL)	NRTS(IL)	COND(IL)	RTS(IS)	NRTS(IS)	COND(IS)
1	1	$\frac{1-WEAR(IL)}{1+BIRD}$	$RTS(IL)*BIRD$	WEAR(IL)	$\frac{1-WEAR(IS)}{1+BIRD}$	$RTS(IS)*BIRD$	WEAR(IS)
	2	$\frac{1-WEAR(IL)}{1+BIRD}$	$RTS(IL)*BIRD$	WEAR(IL)	0	1-WEAR(IS)	WEAR(IS)
	3	$\frac{1-WEAR(IL)}{1+BIRD}$	$RTS(IL)*BIRD$	WEAR(IL)	0	0	1
2	4	0	1-WEAR(IL)	WEAR(IL)	0	1-WEAR(IS)	WEAR(IS)
	5	0	1-WEAR(IL)	WEAR(IL)	0	0	1
3	6	0	0	1	0	0	1

$$\begin{aligned} \text{TIAC}(I,R) = & \text{ISCA}(I) + \text{RSCA}(I) + \text{ONMCA}(I) + \text{OFMCA}(I) \\ & + \text{TSECI}(I) + \text{IIMCA}(I) + \text{TDC}(I) + \text{MTRCI}(I) \end{aligned}$$

where $\text{ISCA}(I)$ = investment spares cost of ITEM type I
(See Section 5.2.4)

$\text{RSCA}(I)$ = replacement spares cost of ITEM type I
(See Section 5.2.5)

$\text{ONMCA}(I)$ = on-equipment maintenance cost of ITEM type I
(See Section 5.2.6)

$\text{OFMCA}(I)$ = off-equipment maintenance cost of ITEM type I
(See Section 5.2.7)

$\text{TSECI}(I)$ = total support equipment cost allocated to ITEM type I
(See Section 5.2.8)

$\text{IIMCA}(I)$ = inventory management cost of ITEM type I
(See Section 5.2.9)

$\text{TDC}(I)$ = technical data cost allocated to ITEM type I
(See Section 5.2.10)

$\text{MTRCI}(I)$ = maintenance training cost allocated to ITEM type I
(See Section 5.2.11)

7.3 Analytical Procedure

The procedure to analytically determine the repair level for each ITEM is described here. There are four steps in the procedure and the first three steps are based on dynamic programming concepts. In Step 1 a search of the least cost repair level for each SRU is done for each possible repair level of the LRUs which contain the SRU. In Step 2 a search of the least cost repair levels for the LRUs begins. At this point, the cost of each LRU's repair level will include the cost attributable to that LRU at the repair level as well as the costs of all its SRUs at their corresponding best repair levels. The repair level of an LRU determined this way will cost the least when the complete process of repairing the LRU and all its SRUs is considered. The repair level decision made for the

LRU in Step 2 implies the repair levels for its SRUs. These SRU repair levels are recorded in Step 3. If the repair level of an SRU installed in two or more LRUs is found to be inconsistent, Step 4 makes reasonable adjustments. A more complete but intuitive description of the procedure follows.

STEP 1:

Assuming each possible repair level for an LRU, one can determine the best repair levels for its SRUs. This is accomplished by comparing for each SRU ITEM type IS the cost of different repair levels allowed by the LRU's repair level, i.e., by comparing the calculated $TIAC(IS,R)$ among all cases R in the set J corresponding to the LRU's repair level. The least $TIAC(IS,R)$ will be called $TSAC(IS,J)$ and the corresponding case R, $LCRS(IS,J)$.

STEP 2:

Next, the repair levels of each LRU ITEM type IL are optimized. The cost corresponding to each LRU's repair level (denoted as $TSAC(IL,J)$) includes the input $TIAC(IL,R)$, and the optimal costs of all the SRUs contained in LRU ITEM type IL are determined in Step 1. By comparing $TSAC(IL,J)$ among different J values, one will obtain the best repair level for IL when the complete process of repairing the LRU and its SRUs is considered. The set number J which gives the least $TSAC(IL,J)$ for IL is called $LCRL(IL)$.

STEP 3:

Within this set, i.e., given the LRU repair level, one can easily determine the implied repair level for each of its SRUs by recalling $LCRS(IS,J)$ s with J set to $LCRL(IL)$. Note that $LCRS(IS,J)$ gives the case number and will be translated into a code number $LCRLS(IL,IS)$, which is directly comparable to the $LCRL(IL)$.

STEP 4:

Finally, the value of $LCRLS(IL,IS)$ for an SRU ITEM type IS may be different for different ILs, i.e., inconsistent repair level for IS among different containing LRUs. In this case, one can make an adjustment by minimizing the cost over each SRU's repair level allowed by all containing LRUs and then revising the SRU's repair level to be the one that yields the least cost. This final repair level for IS is coded as $LCRL(IS)$.

The exact analytical procedure is now given below.

Step 1: For each SRU ITEM type IS, let TSAC(IS,J) be the smallest of TIAC(IS,R) among all cases R in set J (of given LRU repair level), i.e.,

$$TSAC(IS,J) = \text{Min} \left\{ \begin{array}{l} TIAC(IS,R) \\ R \text{ in set } J \end{array} \right\}$$

Note that in set 1 the choice of least cost for each SRU ITEM type IS is among TIAC(IS,1), TIAC(IS,2), and TIAC(IS,3). The choice for each IS in set 2 is only between TIAC(IS,4) and TIAC(IS,5). In set 3, the least cost is simply TIAC(IS,6) for each IS.

Finally, let LCRS(IS,J) be the least cost repairing case in set J for SRU ITEM type IS and set

$$LCRS(IS,J) = R_1 \text{ for which } TIAC(IS,R_1) = TSAC(IS,J)$$

Step 2: For each LRU repair level indicated by set J, let TSAC(IL,J) be the total cost attributable to LRU ITEM type IL as a whole:

$$TSAC(IL,J) = \sum_{\substack{IS \text{ in } IL \text{ and} \\ R_1 = LCRS(IS,J)}} TIAC(IL,R_1)/NDS(IL) \\ + \sum_{IS \text{ in } IL} TSAC(IS,J) * QPA(IL,IS)/NTL(IS)$$

or = TIAC(IL,R₁) if no SRUs in IL,
where R₁ is the smallest R value in set J

where NDS(IL) = number of different SRUs in LRU ITEM IL
NTL(IS) = total number of SRU ITEM type IS in all the LRUs

$$= \sum_{IL} QPA(IL,IS)$$

Then for each LRU ITEM type IL, let TLAC(IL) be the least of TSAC(IL,J) among all sets J, i.e.,

$$TLAC(IL) = \min_J \{ TSAC(IL,J) \}$$

Note that this is simply a choice of the least cost alternative for each IL among the LRU repair levels of base repair, depot repair, and discard-on-failure.

Step 3: Let LCRL(IL) be a least cost repair level indicator for LRU ITEM type IL and set

$$LCRL(IL) = J1 \text{ for which } TSAC(IL,J1) = TLAC(IL)$$

Clearly, LCRL(IL) registers the set number which indicates the least cost repair level for LRU type IL. Let the corresponding least cost repair level for each SRU ITEM type IS in IL, LCRLS(IL,IS), be

$$LCRLS(IL,IS) = \begin{cases} 1 & \text{if } LCRS(IS,J1) = 1 & \text{(or SRU base-repaired)} \\ 2 & \text{if } LCRS(IS,J1) = 2 \text{ or } 4 & \text{(or SRU depot-repaired)} \\ 3 & \text{if } LCRS(IS,J1) = 3, 5, \text{ or } 6 & \text{(or SRU discarded on failure)} \end{cases}$$

where $J1 = LCRL(IL)$

Note LCRS(IS,J1) gives the case number which indicates the least cost repair level for the SRU ITEM type IS in IL, and LCRLS(IL,IS) is to register 1 if LCRS(IS,J1) indicates base-repair, 2 if depot-repair, and 3 if discard-on-failure. For example, if $LCRL(IL) = 2$, then the LRU ITEM type IL under consideration should be depot-repaired as indicated by set 2 in Table 7-I. Furthermore, its SRU ITEM type IS should be depot-repaired if $LCRLS(IL,IS) = 2$ or discarded on failure if $LCRLS(IL,IS) = 3$.

Step 4: The least cost repair level for each ITEM can thus be determined by referring to LCRL(IL)s and LCRLS(IL,IS)s. However, there is no guarantee that a given SRU which goes into more than one LRU will be treated at the same repair level. For example, SRU ITEM type IS may have LCRLS(IL1,IS) = 1 or base-repair in an LRU ITEM type IL1, while having LCRLS(IL2,IS) = 2 or depot-repair in another LRU ITEM type IL2. In this case, an inconsistency exists and an adjustment to reach the same repair level for the same SRU may be made with proper judgment. As evidenced in Step 1, the repair level for an SRU will be consistent as long as its LRUs have the same repair level. Thus, the inconsistency in the repair level of an SRU can occur only when its LRUs have different repair levels. Further, since an LRU repair level limits the repair alternatives of its SRU level, the lowest (most decentralized) repair level that an SRU can have is the highest (most centralized) repair level among its LRUs, i.e.,

$$LCRL(IS) \geq \text{Max} \left\{ LCRL(IL) \right\}_{IL \text{ containing } IS}$$

where LCRL(IS) is the (adjusted) repair level for SRU ITEM type IS in any LRU. Now considering all the possible sets of different LRU repair levels, one can only have the following: {1,2}, {1,3}, {2,3}, and {1,2,3}. In all these cases except the first one, level 3 is involved and, for these cases according to the above inequality, LCRL(IS) must be 3 (discard-on-failure). Consider the first case where an SRU ITEM type IS has different LCRLS(IL,IS) for different IL and LCRL(IL) = 1 for some IL's and LCRL(IL) = 2 for the others. By the above inequality, LCRL(IS) can be 2 or 3 (depot repair or discard-on-failure). Judgment based on experience may be exercised here to further determine the LCRL(IS) to be a specific number. Or to more objectively choose an adjusted repair level, one can compute and compare the costs attributable to IS when LCRL(IS) is set to be 2 and when it is set to be 3. That is, one can compute the following with JD = 2 and then with JD = 3:

$$AIAC(IS,JD) = \sum_{IL \text{ containing } IS} TIAC(IS,R2,JD,LCRL(IL)) * QPA(IL,IS) / NTL(IS)$$

where R2 is the case number corresponding to JD in the set given by LCRL(IL), as listed below:

JD	LCRL(IL)	R2
2	1	2
	2	4
3	1	3
	2	5

Comparing $AIAC(IS, JD=2)$ and $AIAC(IS, JD=3)$, one can determine the adjusted repair level for IS by setting $LCRL(IS)$ to be the JD value which gives the smaller $AIAC(IS, JD)$.

Now, we summarize the SRU repair level adjustment in the following: For each SRU ITEM type IS, set

$LCRL(IS) = LCRLS(IL, IS)$ if IS is in IL only or
if $LCRLS(IL, IS)$ is the same
for each IL which contains IS;

= 3 if $LCRLS(IL, IS)$ is different
for different IL which contains IS
and $LCRL(IL)=3$ for some of the IL's;

= 3 if it is none of the above
and $AIAC(IS, 3) \leq AIAC(IS, 2)$;

= 2 if it is none of the above
and $AIAC(IS, 2) \leq AIAC(IS, 3)$.

The vector $LCRL(I)$ is the main result of the repair level analysis, each entry representing the recommended repair level for ITEM type I. It is stored as $RL(I)$ on an input data file to the LCC Program and can be changed as the user wishes. For the reason to be explained at the end of this section, further change of $RL(I)$ based on user's inspection of the cost structure of the shared support equipment may prove to be beneficial. When $RL(I)$ is read in the LCC Program, it is translated into $RTS(I)$, $NRTS(I)$, and $COND(I)$ according to the table below:

Table 7-III

Model Specifications of Repair Levels

<u>RL(I)</u>	<u>RTS(I)</u>	<u>NRTS(I)</u>	<u>COND(I)</u>
0	(Values provided on data file will be used.)		
1(base)	$\frac{1-\text{WEAR}(I)}{1+\text{BIRD}}$	$\text{RTS}(I)*\text{BIRD}$	$\text{WEAR}(I)$
2(depot)	0	$1-\text{WEAR}(I)$	$\text{WEAR}(I)$
3(discard)	0	0	1

Note: The procedure described above explicitly recognizes the cost attributable to each SRU ITEM type IS being dependent on its LRU's repair level as indicated in the notation TIAC(IS,R). However, the procedure will be more accurate if one can assume the cost attributable to each LRU is independent of the repair levels of its SRUs. Specifically, this means that TIAC(IL,R) of an LRU ITEM type IL is the same for each R value in set J and thus in Step 2 the first summation term in the expression for TSAC(IL,J) becomes simply TIAC(IL,R) with any R value in set J. However, due to some inherent difficulty in perfectly allocating the cost of shared resources (e.g., support equipment) between ITEMS, the value of TIAC(IL,R) may vary somewhat for different R in set J. For this reason, when calculating TSAC(IL,J) the value of TIAC(IL,R) is weighted by the proportion of IL's SRU ITEMS which have a least cost repair level corresponding to case R in set J. More fundamentally, the procedure also assumes that for each ITEM type I the cost TIAC(I,R) is only dependent on R. If I is an LRU this implies, along with the earlier assumption, that the cost only depends on the value of J which contains R, i.e., it only depends on the LRU's own repair level. On the other hand, if I is an SRU the cost depends on its repair level, its LRU's repair level, and no others. Because of the same difficulty in allocating the cost of shared resources between ITEMS, TIAC(I,R) may vary somewhat due to different repair levels of the other ITEMS. Thus, as indicated at the beginning of this section, the approach given above can only be viewed as an approximation and further improvement on LCC may still be achieved by user's modification of the RL(I)s. (See Section 10.6 and Appendix 11.5 for more discussions.)

SECTION 8

INPUT PARAMETERS AND VARIABLES

In this Section the description of the LCC model is concluded with a consolidated set of listings of input parameters and variables. In addition, values are provided for input parameters established by the Air Force, and ground rules and instructions are given for the determination of parameters to be furnished by the contractor.

The input data elements identified and defined in conjunction with the description of the Model Equations in Section 5, the Sensitivity Analysis in Section 6, and the Repair Level Analysis in Section 7 are listed below in Section 8.1. This listing provides an overall picture of the data elements and data structures that are employed. Detailed definitions of the terms used in the Model are given in Appendix I, Glossary of Variables. The precise representation of each data element in the input files and output tables is established in Section 10, Operating Procedures. Appendix II shows actual input and output formats and illustrative data contents.

8.1 Input Data Elements and General File Structures

The basic inputs to the model equations are provided by eleven input files, two of which have an A and a B part. The files are:

- (1) System-Wide Scalar Parameters (AF,CN)
- (2) Base Configuration Data (AF)
- (3) Platform Operation Data (AF,CN)
- (4) Platform Terminal and Non-Recurring Modification/Installation Data (AF,CN)
- (5) Platform Recurring Modification/Installation Data (AF,CN)
- (6) Platform Deployment at Bases (AF)
- (7) Support Equipment Data (CN)
- (8A) ITEM Equipment Data (CN)
- (8B) SRC/LRU Cross-Reference Data (CN)
- (9A) ITEM Maintenance Data (CN)
- (9B) ITEM Tech. Order, Training and SE Software Data (CN)
- (10) ITEM/Support Equipment Cross Reference Data (CN)
- (11) ITEM Configurations on Platforms (CN)

After each heading, the source of the input data is indicated: AF = Air Force; CN = Contractor.

In addition to the above inputs, there are special inputs used only in the sensitivity analyses and for Repair Level Analysis. These are covered in Section 10.

The structure and purpose of each input data file is further explained in Table 8-I. A consolidated list of the data elements in each file is provided in Table 8-II.

As shown in Table 8-I, the input files have the following roles:

- . File (1) - provides all inputs that are scalars, that is, those that do not vary by base, platform, Support Equipment type or ITEM. Examples are labor rates and pipeline times.
- . File (2) - defines characteristics of base groupings
- . Files (3), (4), (5) - define characteristics of platform groupings, numbers of terminals per platform, and all parameters associated with platforms and terminals.
- . File (6) - defines deployment of platform groupings at bases
- . File (7) - establishes characteristics of Support Equipment groupings
- . Files (8A), (8B), (9A), (9B) - define equipment ITEMS, their logistic interrelationships, their reliabilities and maintenance characteristics, and their impact on technical orders and training.
- . File (10) - relates Support Equipment to ITEMS.
- . File (11) - defines ITEM configurations by platform types.

As also shown in Table 8-I, the primary indices used in the input data files are the following:

- NP - Host platform type.
- NS - Operational base (or site) type.
- L - Support equipment type
- I - ITEM type, identifying both LRUs and SRUs
- K - Sequence index.

It should be noted that the host platform type index NP designates both the platform itself (e.g. tactical aircraft, mobile ground element) and also the PME terminal configuration. These configurations are: Full-up (maximum or Type I), Partial Array (intermediate or Type II), Modem-only (minimum or Type III).

Section 8.2 defines numerical values for those parameters in the input files that are established by the Air Force. Section 8.3 provides instructions and data for contractors to use in developing their input parameters.

TABLE 8-1
STRUCTURE AND CONTENT OF INPUT DATA FILES

FILE NO.	PRIMARY INDEX	SECONDARY INDEX	DATA CONTENT
(1)*	---	---	* . System - Wide Scalars: * Labor rates & factors, pipeline times, * Various costs and logistic factors, * Planned inventory util. period, etc
(2)*	BASE Type NS	---	* . Base Grouping, classification; * No. of bases per group.
(3)*	Platform Type NP	---	* . Platform grouping, classification; * operating data
(4)*	Platform Type NP	---	* . Deployment of Terminals per Platform, * Terminal costs; Misc. Plat. parameters * Non-recur. Mod/Install. costs by * platform
(5)*	Platform Type NP	---	* . Recurring Modification/Installation cost * factors by platform
(6)*	Platform Type NP	Base Type NS	* . Deployment of platforms * per Base
(7)*	*Sup. Equip.* Type L	---	* . Support Equip. Grouping, * classification, cost factors
(8A)*	ITEM Type I	---	* . Equip. ITEM definition, * classification, properties; ITEM costs
(8B)*	LRU ITEM Type I	* SRU Sequence No. K	* . No. of SRUs in each LRU. * (Used only in RLA calculation)
(9A)*	ITEM Type I	---	* . ITEM reliability and maintenance * characteristics
(9B)*	ITEM Type I	---	* . ITEM technical orders, training, * and SE development
(10)*	ITEM Type I	* Supp. Equip *Sequence No.K*	* . ITEM requirements * for supp. equipment
(11)*	ITEM Type I	* Platform Type NP	* . Deployment of ITEMS per Terminal or * per Platform

TABLE 8-II
CONSOLIDATED LIST OF DATA ELEMENTS
IN INPUT FILES

INDICES NP - Platform type, NS - Base type, I - ITEM type,
L - Support Equipment type, M - Mode of Installation,
IA - Installation Functional Area, LE(NP) - Operational Environment,
LO(NS) - Location of Base by Operational Theatre.
Also, Index K is used as a sequence number, and IL is used as an
index for LRUs only in File (8B).

DATA SOURCES (AF)=Air Force, (CN)=Contractor

File (1) System-Wide Scalar Parameters

(AF) Labor Factor: BAA, DMF, DAA, DMF, HPD2, MRF, MRO, SR,
TORB, TORC, TR
(AF) Labor Rates: BLR, DLR, MILR(M), PAL1, PAL2B, PAL2D, PMLR,
TNLR, TRAV1D, TRAVB
(AF) Log. Pipeline Times: BRCT, CRCT, DAD, DRCT(LO(NS)), OST(LO(NS)),
OSTC
(AF) Unit Cost Factors: ACPP, CFG(LO(NS)), CPD2, CPPC, CPPD(LO(NS)),
IMC, RCPP, RMC, SA, UCPP
(AF) Misc. Factors: BF, BIRD, KFAC(LE(NP)), MUSE, PIUP, QTYP1,
QTYP2B, QTYP2D, SPC2, TYP2TF, XFPR, XFR, XMIL, XUC
(CN) Training & Tech. Orders: BDATA, CPD1, DDATA, HPD1, SPC1, TEFM
(CN) FSED Cost: FSEDC

File (2) Base Configuration Data - for Base Types NS

(AF) Designation: BNOUN(NS)
(AF) Characteristics: BPLAT(NS), BTYPE(NS), LO(NS), NBC(NS), NHB(NS),
TNB(NS)

File (3) Platform Operation Data - for Platform Types NP

(AF) Designation and Environment: PNOUN(NP); LE(NP)
(AF) Op. Hours - No. of Missions: AMPM(NP,LO(NS)), APFH(NP,LO(NS)),
TFAC(NP)
(CN) Op. Labor Times: MMPD(NP,LO(NS)), MMPM(NP)
(AF) Thrust/Fuel Consumption: FGH(NP); THRS(NP)

Table 8-II (continued)

File (4) Platform Terminal Data and Non-Recurring Mod/Installation Data - for Platform Types NP.

(AF,CN*) Terminal Data: NTRMP(NP), NTRMT(NP)*, TUPP(NP)*, TUPM(NP)*
(CN) Non-Recurr. Mod Instal. Costs: NRMI(NP)
(AF,CN*) Other Parameters: DRAG(NP)*, FR(M,NP), K(NP),
PDIV(NP)

File (5) Platform Recurring Mod/Installation Data - for Platform Types NP

(AF,CN*) AKIT(IA,NP)*, MIFIX(M,NP), MIMH(IA,M,NP)*
(CN) NAE(NP)

File (6) Platform Deployment at Bases - for Platform Types NP and Base Types NS.

(AF) NPLT(NP,NS)

File (7) Support Equipment Data - for S.E. Types L.

(CN) Designation: SENGUN(L), SENUM(L)
(CN) Characteristics: CSE(L), MSE(L), SETYPE(L), SED(L)
(CN) Tech. Order Pages: DATAS(L)

File(8A) ITEM Equipment Data - for ITEM Types I

(CN) ITEM Description & Class.: INGUN(I), PTNUM(I); EQ(I), GFE(I),
INTEG(I), LRU(I), NHI(I)
(CN) Other ITEM Properties: PA(I), KM(I), UP(I), WT(I)

File (8B) LRU/SRU Cross-Reference Data - for LRU Types IL and the Kth SRU type contained in IL. (Used only in RLA calculation.)

(CN) NDS(IL); ISRU(IL,K), QPA(IL,K)

Table 8-II (concluded)

File (9A) ITEM Maintenance Data - for ITEM Types I

(CN) Reliability: PMTBF(I,LE(NP))

(CN) Relative Frequencies of Maint. Actions: COND(I), FPR(I), NRTS(I),
RIP(I), RTS(I)

(CN) Man Hrs. or Cost for Maint. Actions: BCMH(I), BMH(I), DMH(I),
IPCF(I), RMH(I)

(CN) Repair Level Decision: RL(I)

File (9B) ITEM Technical Order, Training Data and SE Software Dev. -
for ITEM type I

(CN) Tech. Order Pages: DATAB(I), DATAD(I)

(CN) Hours Type 1 Training: TIME1(I)

(CN) Support Equipment Software Development: SESW(I), PSESW(I)

File (10) ITEM/Support Equipment Cross Reference Data - for ITEM
Types I and the Kth SE type for I.

(CN) NJA(I); A(I,K), QSA(I,K)

File (11) ITEM Configurations for Different Platforms - for
ITEM Types I, and Platform Types NP.

(CN) INTEG(I), NITEMR(I,NP)

8.2 Values for Parameters Furnished by the Air Force

The input parameters furnished by the Air Force appear in the following six input files:

- (1) System-Wide Scalar Parameters
- (2) Base Configuration Data
- (3) Platform Operation Data
- (4) Platform Terminal Data and Non-Recurring Modification/Installation Data
- (5) Platform Recurring Modification/Installation Data
- (6) Platform Deployment at Bases

The principal set of Air Force inputs that are given below defines a baseline deployment matrix (Platforms NP by Base NS) in Input File (6), and a baseline deployment and logistic configuration of Bases NS in Input File (2). These baseline values are utilized in the illustrative computer run in Appendix II. Data are also provided in Files (2) and (6) for two other deployment levels, one lower than the baseline, and one higher. Changing deployment levels also affects the variable PDIV(NP) in File (4). There are also two variants of the logistic configuration of Bases NS provided in File (2).

It must be emphasized that deployment and operations data for each of the three deployment levels are aggregated and simplified, and do not represent any Air Force force structure or operating plans.

A table of Air Force parameter values is provided below for each of these input files. Air Force inputs to Sensitivity Analysis calculations and Repair Level Analysis are discussed in Section 17. As indicated in the Tables for Files (1), (3), (4), and (5) these files have contractor (CN) inputs in addition to Air Force inputs. See Section 8.3 for discussions of CN inputs.

8.2.1 Air Force Values for Input File (1) - System-Wide Scalar Parameters

Data values for Input File (1) are shown in Table 8-III. It should be noted that some of the "scalar" parameters are functions of one of the so-called "miscellaneous" indices, specifically: mod/installation labor rate MILR(M) depends upon mode of installation, M; pipeline times DRCT(LO(NS)) and OST(LO(NS)) and unit cost factors CFG(LO(NS)) and CPPD(LO(NS)) all depend upon base location, LO(NS); and failure rate adjustment factor KFAC(LE(NP)) depends upon platform environment, LE(NP).

Table 8-III

Values for Air Force Inputs to Input File (1),
System-Wide Scalar Parameters

GOVERNMENT-PROVIDED PARAMETERS

LABOR FACTORS	VALUE
BAA - Monthly Available Working Hours per Maintenance Man at Base Level	168
BMF - Base Maintenance Factor	1.5
DAA - Monthly Available Working Hours per Maintenance Man at Depot Level	168
DMF - Depot Maintenance Factor	1.5
HPD2 - Number of in class hours per day for type 2 training	8
MRF - Average manhours per failure to complete off-equipment maintenance records	0.24
MRO - Average manhours per failure to complete on-equipment maintenance records	0.08
SR - Average manhours per failure to complete supply transaction records	0.25
TORB - Turnover rate for base avionics maintenance personnel	0.33
TORD - The same for depot personnel	0.0683
TR - Average manhours per failure to complete transportation transaction forms	0.16
LABOR RATES	
BLR - Base Maintenance Labor Rate in \$ Per Hour	\$35.54
DLR - Depot Maintenance Labor Rate in \$ Per Hour	\$38.27
MILR(1) - Mod/Installation Labor Rate During Production in \$ Per Hour	\$29.85
MILR(2) - Mod/Installation Labor Rate for Field Mods Using Depot Team in \$ Per Hour	\$44.01
MILR(3) - Mod/Installation Labor Rate for Mods Performed at the Depot in \$ Per Hour	\$38.27
PAL1 - Average daily pay and allowance for type 1 trainee	\$80.00
PAL2B - Same for type 2 base trainee	\$50.00
PAL2D - Same for type 2 depot trainee	\$60.00
PMLR - Prime Mission Equip Oper Labor Rate in \$ Per Hour	\$27.75
TNLR - Timing Net Operation Labor Rates in \$ Per Hour	\$27.75
TRAVID - Average round trip travel expense for type 1 and type 2 depot trainees	\$200.00
TRAVB - Same for type 2 base trainees	\$300.00

Table 8-III (continued)

PIPELINE TIMES		VALUE
BRCT	- Base Repair Cycle Time in Months	0.132
CRCT	- Time for Failure at Satellite Base Until Repair at CIMF Base in Months	0.5
DAD	- Time from Failure Removal at Depot Until Repair at Depot in Months	0.132
DRCT(1)	- Time from Failure at CONUS Base Until Repair at Depot in Months	1.9
DRCT(2)	- Time from Failure at Pacific Base Until Repair at Depot in Months	1.9
DRCT(3)	- Time from Failure at Europe Base Until Repair at Depot in Months	1.9
OST(1)	- Order and Shipping Time from CONUS Base to Depot in Months	0.504
OST(2)	- Order and Shipping Time from Pacific Base to Depot in Months	0.525
OST(3)	- Order and Shipping Time from Europe Base to Depot in Months	0.526
OSTC	- Order and Shipping Time from a Satellite Base to its CIMF Base in Months	0.250
UNIT COST FACTORS		
ACPP	- Average acquisition cost per page for tech. order negatives	\$248.00
CFG(1)	- Cost of Fuel in \$ per Gallon at CONUS Bases	\$ 1.11
CFG(2)	- Cost of Fuel in \$ per Gallon at Pacific Bases	\$ 1.11
CFG(3)	- Cost of Fuel in \$ per Gallon at Europe Bases	\$ 1.11
CPD2	- Cost per class per day for type 2 training	\$960.00
CPPC	- Cost of Packing and Shipping from a Satellite Base to its CIMF Base in \$ per Net Weight Pound	\$ 0.779
CPPD(1)	- Cost of Packing and Shipping from CONUS Base to Depot in \$ per Net Weight Pound	\$ 0.779
CPPD(2)	- Cost of Packing and Shipping from Pacific Base to Depot in \$ per Net Weight Pound	\$ 0.972
CPPD(3)	- Cost of Packing and Shipping from Europe Base to Depot in \$ per Net Weight Pound	\$ 0.972
IMC	- Initial Depot Inventory by Management Cost per New Part in \$	\$1200.00
RCPP	- Tech. Order Reproduction Cost per Copy per Page	\$ 0.010
RMC	- Recurring Depot Inventory Management Cost per New Part in \$ per Year	\$ 150.00
SA	- Base-Level Inventory Management Cost per New Part in \$ per Year	0
UCPP	- Annual tech. order upkeep cost per page	\$ 60.00

Table 8-III (concluded)

MISCELLANEOUS FACTORS		VALUE
BF	- Coefficient in Sparing Function	1.65
BIRD	- Fraction of base-repair-intended failures that are actually repaired at the depot	0.05
KFAC(1)	- Failure rate experience factor for airborne fighter environment	1.70
KFAC(2)	- Failure rate experience factor for airborne cargo environment	1.14
KFAC(3)	- Failure rate experience factor for ground fixed/transportable environment	1.10
KFAC(4)	- Failure rate experience factor for ground mobile/manpack environment	1.10
MUSE	- Minimum Fractional Utilization for Sensitivity Calculations on Support Equipment Costs	0.50
PIUP	- Number of System Operating Years	15
QTYP1	- Number of trainees for type 1 training	25
QTYP2B	- Initial number of base trainees for type 2 training	250
QTYP2D	- Initial number of depot trainees for type 2 training	35
SPC2	- Maximum number of students per type 2 training class	12.0
TYP2TF	- Ratio of type 2 training time to type 1 training time for same material	1.5
XFPR	- False Pull Rate Sensitivity Multiplier Factor	1.0
XFR	- Failure Rate Sensitivity Multiplier Factor	1.0
XMIL	- Mod/I Labor Hours Sensitivity Multiplier Factor	1.0
XUC	- Unit Cost Sensitivity Multiplier Factor	1.0

Note: Contractor Inputs to File (1) are: BDATA, CPD1, DDATA,
HPD1, SPC1, TEFM, FSEDC.

8.2.2 Air Force Values for Input File (2) - Base Configuration Data

Table 8-IV gives data summarizing operational sites or bases at which SEEK TALK is deployed. Base configuration data are shown for three levels of deployment, namely: a baseline level, a lower level and a higher level. The baseline level shall be used for trade studies except when specifically investigating the effect of deployment level. Also tables 8-IVA, 8-IVB and 8-IVC provide, at the baseline deployment level, three different logistic configurations for Centralized Intermediate Maintenance Facilities (CIMFs), namely: A. No CIMFs, B. One CIMF in European Theatre, serving airborne installations only, C. Two CIMFs in European Theatre, one serving airborne installations, the other, surface. Table 8-IVA shall be used by the contractor as a baseline, except when the LCC effect of introducing CIMFs is being investigated. It should be noted that, when the contractor is investigating CIMFs, he should utilize the instructions given in Appendix IV.

The bases or sites that are described in File (2) are of two types: airbases, where aircraft are deployed and surface bases, where elements of the Tactical Air Control System (TACS) such as TACCs, CRC/CRPs, TACPs - are deployed. All of these locations have prime mission equipment (PME) terminals on the aircraft or the surface elements. In addition each of the airbase locations, and the locations of elements of the TACS, are candidates for installation of Timing Net Equipment (TNE) Master Clock terminals.

In interpreting the Air Force data in File (2), the contractor should note that the following assumptions were made concerning the geographical distribution of SEEK TALK equipments, and their host platforms, from the standpoint of operation and logistic support:

- o At the organizational and intermediate levels, logistic support systems for airborne equipment and for ground-based equipment are independent. Also such systems for Air National Guard (ANG) and for the Air Force Reserve (AFR) are independent.

Because of the independence of these several logistic systems, a base or site containing both airborne and surface-based terminals is counted as two logistic locations, and a base or site containing active units and ANG or AFR units, or ANG and AFR units, is counted as two logistic locations.

Table 8-IV

Values for Air Force Inputs to Input File (2),
Base Configuration Data

<u>BASELINE VALUES</u>							
BASE INDEX (NS)	BASE NAME (BNOUN)	NO. OF BASES (TNB)	LOC. OF BASE (LO)	BASE TYPE (BTYPE)	NEXT	NO.	BASE PLAT- FORMS (BPLAT)
					HIGHER BASE (NHB)	UNDER CIMF (NBC)	
1	Airborne, CONUS	85	1	1	0	0	1
2	Ground, CONUS	130	1	1	0	0	2
3	Airborne, EUR	1	3	1	0	0	1
4	Ground, EUR	1	3	1	0	0	2
5	Airborne, EUR	14	3	1	0	0	1
6	Ground, EUR	45	3	1	0	0	2
7	Airborne, PAC	6	2	1	0	0	1
8	Ground, PAC	15	2	1	0	0	2

THREE LOGISTIC CONFIGURATIONS

BASE INDEX (NS)	<u>A. BASELINE</u>			<u>B. ONE CIMF</u>			<u>C. TWO CIMFS</u>		
	(BTYPE)	(NHB)	(NBC)	(BTYPE)	(NHB)	(NBC)	(BTYPE)	(NHB)	(NBC)
1	1	0	0	1	0	0	1	0	0
2	1	0	0	1	0	0	1	0	0
3	1	0	0	2	0	0	2	0	0
4	1	0	0	1	0	0	2	0	0
5	1	0	0	3	3	14	3	3	14
6	1	0	0	1	0	0	3	4	45
7	1	0	0	1	0	0	1	0	0
8	1	0	0	1	0	0	1	0	0

THREE DEPLOYMENT LEVELS

BASE INDEX (NS)	LOW	<u>BASELINE</u>	<u>HIGH</u>
	(TNB)	(TNB)	(TNB)
1	60	85	130
2	90	130	155
3	1	1	1
4	1	1	1
5	12	14	22
6	40	45	58
7	5	6	7
8	12	15	16

Note: The sum of airborne and surface bases may add to a quantity of bases greater than the number of sites at which SEEK TALK equipments are deployed. This results from the partitioning of airborne and surface support facilities, and of active, guard and reserve facilities.

8.2.3 Air Force Values for Input File (3) - Platform Operation Data

Input File (3) defines operating characteristics for each host platform grouping, which is identified by the index NP. Of the ten parameters listed, three depend upon base location LO(NS) as well as upon Platform type. The parameters for Input File (3) are given in Table 8-V.

File (3) is constructed using eight platform groupings:

- (1) Tactical Aircraft, Full-up (maximum or Type I) configuration
- (2) Tactical Aircraft, Partial Array (intermediate or Type II) configuration
- (3) Tactical Aircraft, Modem-only (minimum or Type III) configuration
- (4) Cargo/Electronics Aircraft, Modem-only (This category is used primarily for airborne C² platforms)
- (5) Fixed/Transportable Ground Element, Modem-only
- (6) Mobile Ground Element, Partial Array
- (7) Manpack Unit, Modem-only
- (8) Master Clock Site

The first seven of these platform types are primarily hosts for prime mission equipment (PME) terminals. (In some contractor system designs, some of these PME terminals may also have a timing function, or there may be both a PME terminal and a lower echelon TNE terminal collocated - see Section 8.3.3.) Since the LCC equations require that every terminal (whether PME or TNE) is installed on a "platform", platform type (8) is introduced as a type of surface element which is host for a Master Clock TNE terminal installation.

8.2.4 Air Force Values for Input File (4) - Platform Terminal Data and Non-Recurring Mod/Installation Data

Air Force parameters in Input File (4) define for each of the eight platform types NP, first, the average number of Prime Mission Equipment terminals to be installed; second, two parameters

Table 8-V

Values for Air Force Inputs to Input File (3),
Platform Operation Data

PLAT- FORM INDEX (NP)	PLATFORM NOMENCLATURE (PNOUN)	EN- VIRON MENT (LE)	OPERATING HOURS IN			UTILI- ZATION FACTOR (TFAC)	ACTI- VATION TIME (MMPM)
			CONUS	PACIF	EUROPE		
1	Tactical A/C, FU	1	25.3	26.8	29.9	2.10	↑ CONTRACTOR INPUT
2	Tactical A/C, PA	1	21.0	22.6	19.8	2.10	
3	Tactical A/C, MO	1	19.6	19.2	18.7	2.10	
4	Cargo/Elec., MO	2	51.7	57.0	56.6	1.20	
5	Fixed/Trans., MO	3	200.	200.	200.	1.00	
6	Mobile, PA	4	300.	300.	300.	1.00	
7	Manpack, MO	4	300.	300.	300.	1.00	
8	Master Clock	3	730.	730.	730.	1.00	

PLAT- FORM INDEX (NP)	MISSIONS PER MONTH			TNE OPERATING MINS.			THRUST IN POUNDS (THRS)	GALLONS PER OPER HR (FGH)
	CONUS	PACIF	EUROPE	CONUS	PACIF	EUROPE		
1	17.0	17.0	17.0				6000	930
2	17.0	17.0	17.0				6000	930
3	17.0	17.0	17.0				6000	930
4	8.0	8.0	8.0	CONTRACTOR INPUTS			7800	1200
5	25.0	25.0	25.0				0	0
6	25.0	25.0	25.0				0	0
7	25.0	25.0	25.0				0	0
8	0	0	0				0	0

characterizing the Modification/Installation diversity and the fraction of installations to be made in each installation mode M; and third, two parameters relating to drag/fuel consumption calculations (for airborne platforms only). Parameter values are given in Table 8-VI.

It should be noted that the quantity NTRMP(NP), in the second column of File (4), represents the number of PME terminals per platform group, averaged over all platforms in the group. All of the platforms in groups NP = 1, 2, 3, 6, and 7 have only one PME terminal per platform. The platforms in groups NP=4 and NP=5 (Cargo/Electronics Aircraft and Fixed/Transportable Ground Elements) have multiple terminals per platform.

File (4) provides three alternate sets of values for PDIV(NP), corresponding to the three levels of deployment defined in Files (2) and (6). The mod/installation platform diversity factor PDIV(NP) is a measure of the number of different platforms included in a type grouping. For aircraft platforms this is the number of different aircraft types (e.g., F-15, F-16) included in the grouping. Well-defined model differences (e.g., F-4D/E, F-4G) are also differentiated. For surface platforms, the number of different kinds of units (TACC, CRP/CRC) is stated. For Master clock platforms, the diversity factor is arbitrarily set at unity.

The parameter values of FR(M,NP) (fraction of installations in Mode M) shown in Table 8-VI are for the baseline situation. Here, all SEEK TALK installations are considered to be field retrofits carried out by a depot team (M=2). Subsequent Air Force guidance may also request studies for values of FR(NP) that represent some installation during platform production, or as depot retrofits.

8.2.5 Air Force Values for Input File (5) - Platform Recurring Modification/Installation Data

In File (5) Air Force parameters are provided for the fixed element of recurring Modification/Installation costs. These parameters are values of MIFIX (M,NP) for different installation modes M and different platform groupings NP. MIFIX represents the cost of platform preparation for mod/installation, and the subsequent platform restoration necessary to return the platform to the operational inventory. Values of MIFIX are given in Table 8-VII. Note that MIFIX is shown as non-zero only for airborne retrofits.

Table 8-VI

Values for Air Force Inputs to Input File (4),
Platform Terminal Data and Non-Recurring Mod/Installation Data
(See Footnote)

PLATFORM INDEX NP	NO. PME TERMINALS (NTRMP)	PLATFORM DIVERSITY (PDIV)	FRACTION MODS IN PROD FIELD DEPOT (FR)		THRUST -FUEL CONSUMPT. FACTOR (K)
1	1.0	3.00	0.0	1.00 0.0	0.67
2	1.0	6.00	0.0	1.00 0.0	0.67
3	1.0	5.00	0.0	1.00 0.0	0.67
4	6.86	6.00	0.0	1.00 0.0	0.67
5	4.83	10.00	0.0	1.00 0.0	0.0
6	1.0	3.00	0.0	1.00 0.0	0.0
7	1.0	1.00	0.0	1.00 0.0	0.0
8	0	1.00	0.0	1.00 0.0	0.0

PLATFORM INDEX NP	PLATFORM DIVERSITY FACTOR (PDIV) FOR DIFFERENT DEPLOYMENT LEVELS		
	LOW	BASELINE	HIGH
1	3.00	3.00	3.00
2	4.00	6.00	7.00
3	3.00	5.00	6.00
4	4.00	6.00	9.00
5	8.00	10.00	12.00
6	3.00	3.00	4.00
7	1.00	1.00	1.00
8	1.00	1.00	1.00

Note: Contractor Inputs to File (4) are: NTRMT(NP), TUPP(NP), TUPT(NP)
MIENG(NP), DABKIT(NP), TEST(NP), PROOF(NP), DATA(NP), DRAG(NP)

Table 8-VII

Values for Air Force Inputs to Input File (5),
Platform Recurring Mod/Installation Data

PLATFORM INDEX NP	FIXED MOD/I COST (dollars)*			A KIT EQUIP. COST (A KIT)	MOD/ INSTALL. LABOR HOURS (MIMH)
	PROD	FIELD (MIFIX)	DEPOT		
1	0.	4000	6000.		
2	0.	4000	6000.		
3	0.	4000	6000.	CONTRACTOR INPUTS	
4	0.	4000	6000.		
5	0.	0	0.		
6	0.	0	0.		
7	0.	0	0.		
8	0.	0	0.		

* Note: Exact charges would depend upon whether transportation charges are assessed against SEEK TALK, and whether aircraft preparation and restoration charges are allocated entirely to SEEK TALK, or are shared between SEEK TALK and other work. Accordingly, the values shown in the table are nominal only.

8.2.6 Air Force Values for Input File (6) - Platform Deployment at Bases

Input File (6), shown in Table 8-VIII, contains a platform population or deployment matrix $NPLT(NP,NS)$, defining for each platform type NP, the average number of individual platforms per individual base in each base grouping, identified by the index NS. Three versions of File (5) give the deployment for three different levels, namely: baseline, lower and higher. Contractors shall use the baseline deployment except where specifically directed otherwise.

It should be noted that each matrix element $NPLT(NP,NS)$ is the number of platforms of type NP per base, averaged over all bases in base grouping NS. The Model equations determine the total number of terminals of type NP, world-wide, by the following calculation:

$$NTRMP(NP) * \sum_{NS} NPLT(NP,NS) * TNB(NS)$$

The number of Master Clock platforms or sites is computed as the number of tactical airbase sites, plus the number of sites where units of the TACS or other surface elements operate.

8.3 Ground Rules and Instructions for Contractor Established Input Parameters

The input parameters designated as contractor inputs shall be established in accordance with the ground rules and instructions given below.

Contractor inputs are required for eight of the input files defined in Section 8.1. Two of the files each have two parts. The files are:

- (1) System-Wide Scalar Parameters
- (3) Platform Operation Data
- (4) Platform Terminal Data and Non-Recurring Modification/Installation Data
- (5) Platform Recurring Modification/Installation Data
- (7) Support Equipment Data
- (8A) ITEM Equipment Data
- (8B) LRU/SRU Cross-reference Data
- (9A) ITEM Maintenance Data
- (9B) ITEM Technical Order, Training and SE Software Development Data
- (10) ITEM/Support Equipment Cross Reference

Table 8-VIII

Values for Air Force Inputs to Input File (6),
Platform Deployment at Bases
NPLT (NP, NS)

PLATFORM INDEX (NP)	Base Index NS		<u>LOW</u>					
	1	2	3	4	5	6	7	8
1	15.00	0.0	0.0	0.0	50.00	0.0	25.00	0.0
2	12.00	0.0	72.0	0.0	40.00	0.0	32.00	0.0
3	7.00	0.0	0.0	0.0	10.00	0.0	0.0	0.0
4	0.75	0.0	0.0	0.0	1.00	0.0	1.33	0.0
5	0.0	0.70	0.0	1.00	0.0	1.10	0.0	1.30
6	0.0	5.00	0.0	0.0	0.0	5.00	0.0	4.00
7	0.0	5.00	0.0	0.0	0.0	5.00	0.0	4.00
8	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
<u>BASELINE</u>								
1	15.39	0.0	0.0	0.0	52.50	0.0	26.67	0.0
2	12.59	0.0	72.00	0.0	37.57	0.0	34.50	0.0
3	7.20	0.0	0.0	0.0	11.14	0.0	0.0	0.0
4	0.75	0.0	0.0	0.0	1.00	0.0	1.33	0.0
5	0.0	0.65	0.0	1.00	0.0	1.15	0.0	1.27
6	0.0	5.32	0.0	0.0	0.0	4.82	0.0	4.47
7	0.0	5.32	0.0	0.0	0.0	4.82	0.0	4.47
8	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
<u>HIGH</u>								
1	16.00	0.0	0.0	0.0	55.00	0.0	30.00	0.0
2	13.00	0.0	72.00	0.0	40.00	0.0	35.00	0.0
3	8.00	0.0	0.0	0.0	12.00	0.0	0.0	0.0
4	3.00	0.0	0.0	0.0	3.00	0.0	3.00	0.0
5	0.0	0.70	0.0	1.00	0.0	1.20	0.0	1.30
6	0.0	5.50	0.0	0.0	0.0	5.00	0.0	5.00
7	0.0	5.50	0.0	0.0	0.0	5.00	0.0	5.00
8	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

(11) ITEM Configurations on Platforms

Several of the above files contain costs or cost-related parameters. The contractor shall make all cost estimates in constant FY 1981 dollars.

The generation of data for each of the listed files is discussed in turn.

8.3.1 Contractor Inputs to File (1), System-Wide Scalar Parameters

Contractor inputs to File (1) relate to Training and Technical Orders. Instructions for establishing these parameters are as follows:

- BDATA - Number of additional (beyond those intended for depot use only) distinct pages of system level (not ITEM or support equipment specific) technical orders written for base level maintenance.
- CPD1 - Cost per class per day for type 1 training.
- DDATA - Number of distinct pages of system level (not ITEM or support equipment specific) technical orders intended for depot maintenance only.
- HPD1 - Number of inclass hours per day for a type 1 training class.
- SPC1 - Maximum number of students per type 1 training class.
- TEFM - Cost in dollars of equipment, facilities, and manuals required for all training and not accounted for by any other Cost Element of the Model. (Type 2 training facilities should not be included.)
- FSEDC - Cost to the Air Force of contractor's FSED effort.

8.3.2 Contractor Inputs to File (3), Platform Operation Data

The two contractor inputs to File (3) are MMPM(NP) and MMPD(NP,LO(NS)). The ground rules for estimating these parameters are given below:

MPPM(NP) Man minutes of operational labor per mission for initial activation of the SEEK TALK prime mission equipment (PME) terminal(s) on platform type NP. This includes time for inserting code of the day, for establishing initial

synchronization, and for carrying out other pre-mission tasks. It should also include time expended in verifying the correct operability of the adaptive array antenna. It depends upon the contractor's concept of what initial activities would be required, and how and by whom they would be carried out. Tasks not reasonably separable from the normal activities of the operating crew may be disregarded with suitable Air Force review and approval.

The number of missions per platform per month is given by the Air Force parameter AMPM in Input File (3). If the concept of minutes of operating time per mission does not correspond with the contractor's approach for initial activation of his PME terminals, the contractor should identify to the Air Force what concept is more applicable in his case and how he has incorporated his concept into his LCC Model input data.

MMPD(NP,LO(NS)) Man minutes of operational labor per day for carrying out non-automated aspects of timing net equipment (TNE) functions at an individual TNE terminal associated with platform NP. Requirements for operational labor will depend both upon the contractor's TNE system design, and upon the operational concept associated with that design. If that system design and operational concept differ by theatre of operations, MMPD must be considered a function not only of platform NP, but also of base location LO(NS). In calculating MMPD, the contractor must take into account not only the master clock terminals required at each (or selected) major base(s) or operating site(s), but also second and third tier timing facilities, if these are part of the contractor's design concept. For purposes of this calculation, the master clock terminals, and any lower tier terminal, shall be considered to be dedicated to the SEEK TALK System.

8.3.3 Contractor Inputs to File (4), Platform Terminal Data and Non-Recurring Modification/Installation Data

There are two types of Contractor inputs to File (4), namely: Platform Terminal Data And Non-Recurring Modification/Installation Data. There are also some Air Force inputs to File (4).

The contractor inputs are described below:

Contractor data inputs of Platform Terminal Data for each platform type NP shall be generated in accordance with the following ground rules:

NTRMT(NP) - Average number of timing net equipment (TNE) terminals to be installed on a platform type of NP.

TUPP(NP) - Average unit production cost (1981 dollars) of prime mission equipment (PME) terminals to be installed on platforms of type NP. Note that each platform grouping corresponding to a value of the index NP has associated with it only one overall terminal configuration - either full-up (maximum or type I), partial array (intermediate or Type II), or modem-only (minimum or Type III). The configuration type is defined in part of the descriptive name of the grouping, e.g. tactical aircraft, partial array.

TUPT(NP) - Average unit production cost (1981 dollars) of a TNE terminal to be installed on platform type NP.

NAE(NP) - Number of new antenna elements that must be installed on platform NP.

It should be noted that the number of PME terminals per platform is NTRMP(NP), an Air Force input to File (4). By contrast, the number of TNE terminals per platform, NTRMT(NP), depends upon the contractor's timing net design, and is therefore a contractor input to File (4). If the contractor's timing net concept is a single tier arrangement, with timing net functions consolidated at all (or selected) airbases and major surface equipment sites, NTRMT(NP) would be zero except for $NP = 8$, which represents master clock "platforms" or sites. Under these circumstances, NTRMT(NP=8) would be equal to the total number of master clock terminals world-wide divided by the total number of airbases plus ground bases, world-wide. If there are second or third tier subsidiary clock terminals, however, NTRMT(NP) may be non-zero for other platform types. As described above in Section 8.2.6, platform populations by Base, NPLT(NP,NS), are Air Force inputs contained in File (6).

In calculating each of the production costs TUPP(NP) and TUPT(NP), the contractor shall include the cost elements listed in Table 8-IX. Production of the equipment shall be phased to provide deliveries over 6 years for PME and 2 years for TNE. (Note: the two year period for TNE deliveries represents a change from the ADM LCC Model.) The contractor shall state and justify his learning curve assumptions. Timing net equipment terminals are defined as support terminals with no direct tactical communications function. Any terminal which has such a direct function as well as a timing function is considered PME. For simplicity, it is assumed that all items of investment and replacement spares are procured on the same

Table 8-IX

Cost Elements* to be Included in Production Cost Estimate

CONTRACTOR PRODUCTION COST (NON-RECURRING)

Producibility Planning
Initial Production Facilities
 Production Engineering
 Tooling
 Industrial Facilities
 Manufacturing Support Equipment
System Integration
Quality Assurance Program
Qualification Testing Program
Production Sampling
Documentation
Technical Support
Other Non-Recurring Production Costs
Leaseholds
General and Administrative Costs (G&A)
Fee or Profit

CONTRACTOR PRODUCTION COSTS (RECURRING)

Manufacturing/Assembly/Test
Production Materials
 Purchased Equipment and Parts
 Subcontracted Items
 Other Raw and Finished Materials
Sustaining Engineering
Quality Control and Inspection
Packaging and Transportation
Other Recurring Production Costs
General and Administrative Costs (G&A)
Fee or Profit

CONTRACTOR PRODUCTION MANAGEMENT COSTS

Planning
Administrative
Control

*Ref: AFP 800-7, Chapter VII, Figure VII-6A, page VII-33.

schedule and contractual basis as the terminals themselves. Hence, production quantities shall include the item spares computed by the appropriate logistic support equations of the LCC Model.

The terminal unit prices TUPP(NP) and TUPT(NP) must be consistent with the ITEM Configuration on Platforms NITEM(I,NP) data that the contractor puts into File (11), and the ITEM Unit Production cost prices UP(I) that the contractor puts into File (8A).

Special instructions apply to PME and TNE designs that incorporate an AM radio (such as the ARC-164 or the GRC-171). If such an AM radio is incorporated in the design for any platform type NP, the entire configuration of AM radio LRUs and SRUs that are used in SEEK TALK must be included in the ITEM list in File (8A), including, both those ITEMS that have been modified and those that have not been modified. In TUPP(NP), only the cost of the modification is included, the original cost of the unmodified AM radio is considered to be a sunk cost. For TUPT(NP), however, no costs are considered to be sunk, and the full acquisition cost of the AM radio ITEMS and their modification costs are included. The modification cost shall include the cost of bench checkout and test of the modified ITEMS.

The quantity NAE(NP), number of added antenna elements, applies to airborne platforms only and is used in the model equations only to estimate the added drag that SEEK TALK antennas will produce, and the resulting added fuel consumption that will be necessary. Where antenna configurations vary within one platform grouping NP, an average value for NAE(NP) shall be used.

Table 8-X provides the basic information that the contractor shall use in calculating DRAG(NP). (Parameters, other than NAE and DRAG, that appear in the equation for added cost of fuel are all furnished by the Air Force.)

The contractor should note that further studies may indicate that equipment weight is a significant contributor to added fuel consumption. If so, the LCC Model may be modified and additional contractor inputs will be required in File (4).

Contractor data inputs for Non-Recurring Modification/Installation costs shall be generated as described below. A single non-recurring cost parameter shall be estimated by the contractor for each platform grouping NP. This parameter, NRMI(NP), combines the costs of engineering, prototype Group A kits, testing, proofing and data into a single cost element. This parameter defines for a given value of index NP, the average cost per platform type, for platforms within the grouping. In calculating total cost, the LCC model

Table 8-X
Data for Calculations of Antenna Drag

<u>Type of Platform</u>	<u>Average Drag per Element in lbs.</u>
1. Tactical Aircraft, Full-up	3.3
2. Tactical Aircraft, Partial Array	Note (1)
3. Tactical Aircraft, Modem-Only	0.0
4. Cargo/Electronics Aircraft, Modem-Only	0.0

The drag figures given above are applicable to a single "standard" UHF blade antenna (height, 7-3/4 inches, and cross sectional area perpendicular to the airstream, about 3.5 square inches).

Contractor shall estimate and justify drag figures for his antenna configuration if it differs from a standard UHF blade. For a UHF blade of smaller size than the standard blade, assume the drag is proportional to the area perpendicular to the airstream.

It is assumed that, in peacetime, high performance aircraft operate at subsonic speeds most of the time.

Note (1) If partial array requires additional or modified antenna elements, figure added drag as a proportion of a standard UHF blade, at 3.3 lbs. drag.

equations multiply the above parameters by the diversity factor PDIV(NP), before summing over all platform groupings. PDIV(NP) counts the number of different platform types (e.g. F-4, F-15, F-16) in a platform grouping, and makes an allowance also for different models (e.g. F-4E and F-4G). Specific guidance is furnished in Appendix III.

8.3.4 Contractor Inputs to File (5) - Platform Recurring Modification/Installation Data

Contractor inputs to File (5) define the recurring acquisition cost of A-Kits in dollars, and the number of recurring labor hours to modify platforms and install SEEK TALK terminals. The cost of A-Kits AKIT(IA,NP) is classified by installation area IA and by platform type NP. The mod/installation labor hours MIMH(IA,M,NP) depends upon mode of installation M as well as upon installation area and platform type. Both Prime Mission Equipment and Timing Net Equipment, and both airborne and ground-based platforms, are involved. The installation areas IA are 1-antenna, 2-electronics box, 3-control head, and 4-cabling. The modes M are 1-installed during platform production, 2-retrofit performed in the field by a depot team, and 3-retrofit performed at the depot.

For the baseline situation, the contractor shall determine MIMH(IA,M, NP) for M=2 only. For subsequent special studies, the Air Force may require parameter inputs for other values of M. Appendix III has specific guidance for determining parameters.

Note that AKIT(IA,NP) and MIMH(IA,M.NP) both refer to the complete complement of equipment installed on a platform, which may include only one terminal, or may include two or more terminals as defined by the input parameters NTRMP(NP) and NTRMT(NP) of Input File (4).

8.3.5 Contractor Inputs to File (7), Support Equipment Data

File (7) defines types and unit costs for common and peculiar support equipment (SE) that the contractor determines will be needed for SEEK TALK. Quantities of support equipment required for test and repair of each ITEM are defined later in Input File (10). Total numbers of units of support equipment that will be needed for all SEEK TALK equipment worldwide are calculated by the appropriate equations in the LCC Model.

The contractor shall determine what items of common and of peculiar support equipment will be necessary for test and repair of operational SEEK TALK equipment. These include three types of equipment: common equipment usually available at a base or depot,

common equipment that will probably have to be procured, and peculiar equipment. Once the SE items have been defined, they shall be classified into sets of items with similar usage patterns. The item sets are identified by the index L. Any classification that allows convenient definition of the ITEM/Support Equipment Cross Reference Table (see Input File (10), below) is acceptable.

In considering what types of support equipment are needed for the SEEK TALK system, the contractor shall take into account the following special requirement. Means are required to check out the functioning of the adaptive antenna array on either a daily, or a start-of-mission basis. Equipment suitable for performing this checkout function shall be included in the list of peculiar support equipment. (Note: Although the adaptive array checkout unit differs from other SE in its manner of use, the LCC Model equations should nevertheless provide a reasonable approximation to the total number of units required.)

For each SE item set identified by a value of the Index L, the contractor shall define an appropriate name SENOUN(L) and part number SENUM(L) and the following parameters:

- SETYPE(L) - Which is 1 for support equipment which is common and available on site (Refer to Air Force provided list of this support equipment); 2 for support equipment which is common but must be procured for SEEK TALK use; 3 for peculiar support equipment.
- CSE(L) - estimated acquisition cost (1981 dollars) for one set of items L. This does not include any allowance for hardware development or for programming: these costs are entered separately. CSE(L) does include an allowance for initial SE spares.
- MSE(L) - ratio of the annual cost (1981 dollars) of maintaining the support equipment of type L to CSE(L). Both labor and replacement SE spares shall be considered in determining MSE(L).
- SED(L) - Cost of development of support equipment of type L. It is zero for common support equipment.
- DATAS(L) - Number of additional distinct pages of technical orders required for use of support equipment type L and not including any documentation which may be included in the unit cost of L.

8.3.6 Contractor Inputs to File (8A), ITEM Equipment Data

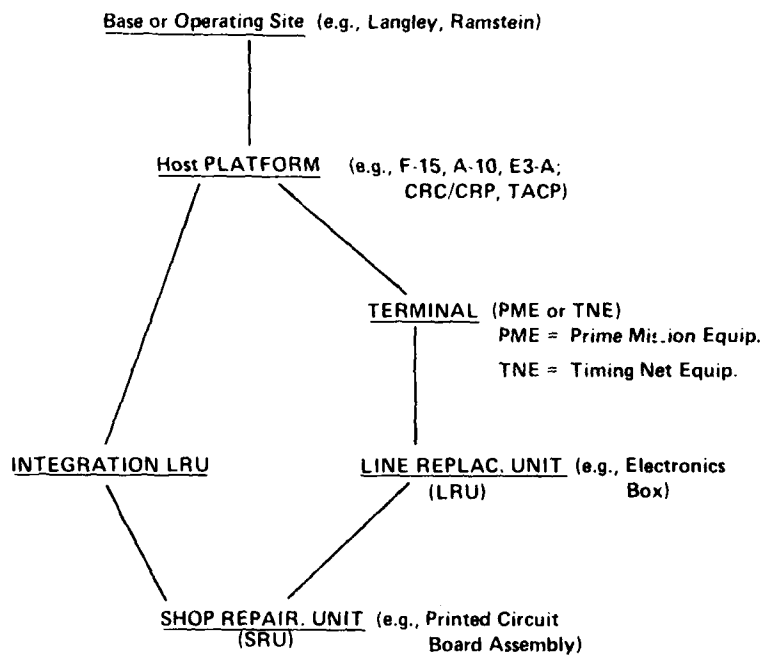
The ITEM Equipment Data File (Input File (8A)), defines the logistic configuration for all ITEMS I in the SEEK TALK system. It also defines ITEM unit cost, unit weight and other parameters.

An ITEM is a Line Replaceable Unit (LRU) or a Shop Repairable Unit (SRU). An ITEM may be used in Prime Mission Equipment (PME), in Timing Net Equipment (TNE), or in both. Terminals may incorporate ITEMS of existing AM radios, such as the ARC-164 or GRC-171, either with or without modification. Such ITEMS are separately identified in the ITEM list, and their parameters are handled differently from those of other ITEMS. Finally an ITEM may be a component unit in a PME or TNE terminal, or may be a "platform integration" unit (i.e., an LRU installed on a platform, which LRU is not part of a terminal). The contractor is responsible for determining what different LRUs are necessary to realize the SEEK TALK system on all platforms at all bases, and how these LRUs should be broken down into SRUs. In all files except File (8B), all LRUs and SRUs are combined into a single ITEM list, identified by an Index I.

Figure 8-1 shows the logistic hierarchy that File (8A) represents. Data elements used in File (8A) to represent this structure are given below:

<u>INOUN(I)</u>	Name assigned to ITEM
<u>PTNUM(I)</u>	Part number assigned to ITEM I
<u>EQ(I)</u>	Index with the values: 1 if ITEM is used in PME only, 2 if ITEM is used in TNE only, 3 if ITEM is used in both
<u>LRU(I)</u>	Index with values: 1 if ITEM is an LRU, 0 otherwise
<u>NHI(I)</u>	ITEM Index for ITEM next higher than ITEM I in the logistic hierarchy (0 unless ITEM I is an SRU). (If an SRU is a component of more than one type of LRU, the index of the most numerous LRU shall be used.)
<u>GFE(I)</u>	Index with values: 1 if ITEM is unmodified GFE, 2 if ITEM is modified GFE, 3 if ITEM is not GFE. This index is used to identify those ITEMS which are parts of existing AM radios, and therefore may already be in the Air Force inventory.
<u>INTEG(I)</u>	Index with values: 1 if ITEM is an integration ITEM, 0 otherwise

In addition to these parameters defining the logistic structure within SEEK TALK, there are four parameters defining ITEM



Notes: File (6) Defines Platforms per Base
 File (4) Defines Terminals per Platform
 File (11) Defines ITEMS per Terminal or per Platform
 LRUs and SRUs are collectively called ITEMS.

IA-60.789

Figure 8-1. Logistic Structure for SEEK TALK Equipment

characteristics. Note that the ITEM list must include the LRUs and SRUs of AM radios such as the ARC-164 and the GRC-171 if these radios are incorporated in the contractor's system design.

These are:

UP(I) Unit Production cost (1981 dollars) of ITEM I. This is established by the contractor using the same ground rules as those defined for the per terminal production cost values contained in Input File (4). It should be noted that the sum of the costs of the separate SRU ITEMS making up an LRU should equal the cost of the LRU, except for additional assembly and testing required at the higher assembly level. Similarly, LRU costs should add up to terminal costs, except for additional terminal level assembly and testing. Special instructions relating to LRUs and SRUs of AM radios are given below.

WT(I) This is the net weight of ITEM I.
PA(I) This is the estimated number of new piece parts introduced into the Air Force inventory by the introduction of ITEM I into the SEEK TALK system (note remarks in Section 5.2.9 on preventing multiple counting.)

RM(I) This is the repair materials factor, which equals the fraction of UP(I) that is consumed (in piece parts below the item indenture level) in the repair of ITEM of type I. (note remark (1) in Section 5.2.5.)

There are special instructions for handling AM radio ITEMS (such as ARC-164 or GRC-171 ITEMS) which are incorporated into SEEK TALK either with or without modification. All AM radio ITEMS (LRUs and SRUs) that are included in a PME or TNE terminal configuration shall be included in the ITEM list in Files (8A), (8B), (9A), (9B), (10) and (11) - whether or not they are modified for inclusion in the SEEK TALK system. The Air Force will supply to contractors specific procedures and AM radio support information that shall be used in generating support parameters for those ITEMS.

Contractors have studied the ARC-164 in detail, and are being provided information on other AM radios. Contractors shall utilize this information in developing applicable cost and maintenance parameters for the AM radio component of SEEK TALK. A list of

applicable AM radios, classified by platform type, is given in Table III-1 of Appendix III.

In accordance with SEEK TALK System Specifications, the Master Clock TNE Terminals must provide three capabilities:

- (1) Means for taking time from a primary time distribution system, which is traceable to the Naval Observatory.
- (2) A clock capable of maintaining time to a suitable accuracy, for a to-be-determined period of time, in the absence of a signal from (1).
- (3) Means for distributing time to local PME terminals.

The contractor's system concept determines how many Master Clock TNE Terminals are required, and the nature and cost of the distribution means identified in (1) and (3) above.

Both the list of ITEMS in Files (8A), (8B), (9A), (9B) and 10 and the terminal cost elements TUPP(NP) and TUPT(NP) in File (4) shall include provision of a complete system-wide timing distribution capability.

8.3.7 Contractor Inputs to File (8B), LRU/SRU Cross Reference Data

The data in File (8B) are not utilized in the main LCC run, they are utilized only in the Repair Level Analysis (RLA). File (8B) defines, in "pointer matrix" form, what SRUs make up each LRU. In order to show this relationship, the File utilizes an LRU index IL. The index IL represents those values of the ITEM index I which designate LRUs. It also utilizes a sequential index K to identify the several SRUs contained in each LRU. The following variables are involved:

NDS(IL) - This is the number of distinct SRUs that are contained in LRU type IL.

ISRU(IL,K) - This is the index i of the Kth type of SRU contained in an LRU of type IL.

QPA(IL,K) - This is the number of SRUs of type ISRU(IL,K) that are contained in one LRU of type IL.

8.3.8 Contractor Inputs to File (9A), ITEM Maintenance Data

The data for file (9A), ITEM Maintenance Data, is completely furnished by the contractor. It involves several sets of data elements for each ITEM, namely: predicted mean time between failures (PMTBF) for each of four operating environments, five different parameters defining relative frequencies of different types of maintenance actions, five parameters defining man-hours (or in one case cost) for different maintenance actions, and a repair level code.

- o PMTBF(I,LE(NP)) - contractor shall predict mean time between failures (PMTBF) in production, for each ITEM I in each applicable operating environment. Values shall be computed in accordance with the procedures of MIL-HANDBOOK-217C, and the environmental conditions specified in the next paragraph. The reliability prediction shall be carried out in conformity with the paragraph entitled Reliability Prediction, of the PSED SOW. The contractor shall utilize, however, a completely serial system reliability block diagram. All items of equipment in a SEEK TALK terminal shall be assumed to operate continuously during the period when the terminal is turned on, except the transmitter, which shall initially be assumed to have a 15% duty cycle, for all platforms except fixed/transportable. For fixed/transportables, the transmitter duty cycle shall initially be assumed to be 50%. When more complete operational data becomes available, the Air Force may need to change these percentages.

Note that the variable LE(NP), operating environment for platform grouping NP, is an Air Force input, shown in the first data column of Input File (3) (See p. 8-16.) It specifies which operating environment is appropriate for each platform type.

The "application environment" that shall be used in the reliability calculations, to be made in accordance with MIL-HANDBOOK-217C, are shown in Table 8-XI.

Table 8-XI
OPERATIONAL ENVIRONMENT

<u>Index</u> LE(NP)	<u>Application Environment</u>
1	Airborne uninhabited, fighter
2	Airborne uninhabited, transport
3	Ground fixed
4	Ground mobile

The relation between these "application environments," as defined in MIL-HANDBOOK-217C, and the platform classification categories NP, is shown in the "Environment" column of Input File (3). See Table 8-V.

It should be noted that the model computes failure rates per ITEM per month (see equation on p. 5-2) using the expression:

$$APFH(NP, LO(NS)) * TFAC(NP) / PMTBF(1, LE(NP)) * KFAC(LE(NP))$$

The first two factors determine total terminal operating hours per month. APFH(NP, LO(NS)) is platform operating hours per month for operating location (i.e. theatre) LO(NS). TFAC(NP) converts platform operating hours to terminal operating hours. APFH and TFAC are Air Force inputs in Input File (3). The expression in brackets gives the "intrinsic" failure rate per month. The factor KFAC(LE(NP)) is then used to convert the intrinsic failure rate to the "operational" failure rate that may be expected in field operation. KFAC is an Air Force input in File (1). Note that KFAC is used to adjust failure rates not only for general field environment, but also to account for mishandling, breakage, and other hazards.

- o Relative Frequencies of Maintenance Actions - The parameters required for each ITEM I are:
 - FPR(I) False pull rate -the ratio of removals that are false pulls to those that are verified failures.
 - KIP(I) Fraction of maintenance actions that are accomplished by repair-in-place with piece parts. (Applies only to LRUs, not to SRUs.)
 - RTS(I) Fraction of removed failures assigned to repair at base shop
 - NRTS(I) Fraction of removed failures assigned to repair at depot.

COND(I) Fraction of (removed) failures which are condemned, due to normal wear-out. (The LCC Model will automatically adjust the fraction to account for ITEM type I being discarded because its next higher assembly has worn-out or is a discard-on-failure assembly.)

The "maintenance actions" associated with the PMTBF are repair-in-place actions plus removals that test out as failures. Such removed failures are then allocated to further maintenance actions in accordance with RTS, NRTS and COND. The contractor shall determine the relative frequency parameters in accordance with a documented logistic approach that is in conformity with Air Force guidance. Note that maintenance actions performed on SRUs must be consistent with those on the LRUs in which they reside.

- o Man-Hours, or Cost, for Different Maintenance Actions
The following Parameters are required for each ITEM:
 - RMH(I) Average manhours to remove and replace (applicable only to an LRU, not an SRU)
 - BCMh(I) Average manhours to perform base shop bench check
 - BMH(I) Average manhours to perform base-level corrective maintenance
 - DMH(I) Average manhours to perform depot level repair, including bench check
 - IPCF(I) Average cost per failure of repair-in-place actions, including cost of replacement parts and labor

Contractor calculations of these parameters shall be in accordance with the applicable provisions of MIL-Handbook-472.

Finally, File (9A) contains a repair level code, defined below:

RL(I) - Repair level code for ITEM type I:

- = 0 if initially input RTS(I), NRTS(I), and COND(I) values are to be used;
- = 1 if RTS(I), NRTS(I), and COND(I) are to be internally calculated to represent base repair of ITEM I;
- = 2 if RTS(I), NRTS(I), and COND(I) are to be internally calculated to represent depot repair of ITEM I;
- = 3 if RTS(I), NRTS(I), and COND(I) are to

be internally calculated to represent
discard-on-failure of ITEM I.

The variable RL(I) provides a short-cut method for the input of maintenance strategy. Its non-zero values cause the overriding of the previously input RTS(I), NRTS(I) and COND(I) values.

8.3.9 Contractor Inputs to File (9B), ITEM Technical Order, Training and SE Software Development Data

This file contains contractor inputs defining Technical Order, Training and SE Software Development characteristics of individual ITEMS I. Five parameters are involved. These are defined below:

- DATAB(I) - Number of additional distinct pages of technical orders required for base repair of ITEM type I.
- DATAD(I) - Number of additional distinct pages of technical orders required for repair of ITEM type I and written for depot use only.
- TIME1(I) - The number of additional hours of type I training added for ITEM type I.
- SESW(I) - Cost of development of support equipment software required for maintenance of ITEM type I.
- PSESW(I) - This provides a partition of SESW(I) by SE Index L. It defines for each SE type L, requiring software development for maintenance of ITEM type I, what fraction of SESW(I) is applicable to L. PSESW(I) serves only to clarify the nature of SESW(I): it is not used in model calculations. (See Section 10.2.9B for specific input format to be used.)

8.3.10 Contractor Inputs to File (10) ITEM/Support Equipment Cross Reference Data

This file, containing only contractor furnished data, defines what types (Index L) and numbers of units of Support Equipment (SE) must be utilized in the test and repair of an ITEM I. File (10) deals with the types or sets of SE defined by File (7), and the types of ITEMS defined by Files (8A) and (9A). See Appendix I for admissible values of SECODE(I,L):

Basically, File (10) is used to input the matrix variables A(I,L) and SECODE(I,L) which are used in the LCC Model equations presented in Sections 5 and 6. A(I,L) represents the number of copies of SE type L required in each repair or bench-check of an ITEM of type I. SECODE(I,L) indicates the type of maintenance (repair, bench-check, or both) of ITEMS of type I for which SE type L is required. However, these two matrices are combined into one which must be input in "pointer form" in File (10).

Three variables are involved as described below:

- NJA(I) - number of different support equipment types (i.e., different values of L) required in the repair of ITEM I.
- A(I,K) - Index number of Kth support equipment type required for maintenance of ITEM type I.
- QSA(I,K) - For support equipment type A(I,K), this is a 3 digit whole number. The hundreds digit of QSA(I,K) is the value of SECODE(I,A(I,K)). The units digit of QSA(I,K) is the number of pieces of support equipment of type A(I,K) required for performance of one maintenance action on one ITEM of type I.

The specific instructions given in Section 10.2.10 should be followed so as to avoid confusion when inputting this file.

8.3.11 Contractor Inputs to File (11). ITEM Configurations for Different Platforms

File(11) contains only contractor inputs. For each ITEM I, File (11) first gives INTEG(I), defining whether the ITEM is an integration ITEM (INTEG(I) = 1), or is not an integration ITEM (INTEG(I) = 0). The value of INTEG(I) is the same here as in the

appropriate column of File(8A). File(11) then gives for each ITEM I, the configuration NITEMR(I,NP) for each platform type NP.

If ITEM I is an integration ITEM, NITEMR(I,NP) states the number of such ITEMS per platform.

If ITEM I is not an integration ITEM, NITEMR(I,NP) states the number of such ITEMS per terminal. The number of ITEMS per terminal for each platform type NP must be consistent with the SEEK TALK overall PME terminal configuration identified in the descriptive name of the platform type, e.g. for NP=2, Tactical Airborne, Partial array.

It should be noted that the Model equations determine the total number of installed ITEMS of type I, world-wide, by the following calculation:

$$\sum_{NP} \sum_{NS} NITEM(I,NP) * NPLT(NP,NS) * TNB(NS), \text{ where}$$

$$NITEM(I,NP) = [INTEG(I) + (1 - INTEG(I)) * (NTRMP(NP) + NTRMT(NP))] * NITEMR(I,NP)$$

The contractor should note that all LRUs and all SRUs are contained in File (11). Values of NITEMR(I,NP) must be consistent with the logistic hierarchy defined by the ITEM Equipment Data in File (8A). Thus if a particular platform type contains only 3 LRUs of a certain type, each composed of one each of the same set of 4 different SRUs, NITEMR will contain both the three LRU populations and all four of the SRU populations. The logistic equations in the LCC Model are so constructed that there is never any "double-counting" in computing failures, spares, and other logistic variables.

SECTION 9

OPERATING CHARACTERISTICS OF THE SEEK TALK LCC MODEL

9.1 General Properties of the LCC Model

This section gives an overall view of the operation of the LCC Model. This discussion will give the reader in general and the LCC Computer Program user in particular brief information on how the LCC Model is used, what the major components and features of the model are, and what type of computer facility is required for running the model. To help delineate the overall structure of the model, a concise description of the data input files and output tables is also presented.

While the material in this section gives, in condensed form, a description of all of the main operating characteristics of the LCC Model, it does not contain the technical details necessary for the user to set up and run the LCC Model on his computer system. This latter information is provided in Section 10.

9.1.1 Organization of the Model

The SEEK TALK FSED Phase LCC Model is a tool to estimate the total Life Cycle Cost to the Air Force of alternative SEEK TALK System designs. The model highlights cost elements which depend wholly or in part on the design of the system and those which depend on contractor provided data which affect system installation, operation and support. Thus, the output of the LCC Model will be useful to both the Air Force and contractors in estimating the Life Cycle Cost of potential system designs.

The SEEK TALK LCC Model computer program package consists of a main program and a supportive program. The main program has two components, the LCC Accounting Model and Sensitivity Analysis, and will be simply called the LCC program. The supportive program will be referred to as the Repair Level Analysis (RLA) program.

The first component of the LCC program implements an accounting model which computes the Life Cycle Cost of the system based on the values of the input parameters corresponding to a particular system design (see Section 5 for a complete description of this accounting model). The output of the first component gives the total LCC and also the LCC divided into four top-level cost elements: Production, Platform Modification and SEEK TALK Installation (Modification/Installation), Initial Support, and Recurrent Operations & Support. The output is divided further into a number

of cost sub-elements, and also according to type of host platform, type of operational base, and type of equipment ITEM. This breakdown of Life Cycle Cost into various categories is intended to help the user identify cost drivers and areas in which design and cost trade-offs should be considered.

The second component of the LCC program provides Sensitivity Analysis computations to be used as an additional aid in trade-off considerations. More specifically, for certain selected contractor parameter inputs (e.g., UP(I) - the unit price of the Ith ITEM or FR(I) - the failure rate of the Ith ITEM) this program component computes the average change (either positive or negative) in total LCC which is produced by a fractional increase in the value of the given parameter. These calculations should further aid the user in identifying elements of his system design to which the LCC is particularly sensitive, again indicating possible trade-offs in design and/or installation, operation or support characteristics. (See Section 6 for a full discussion of the Sensitivity Analysis component.)

The supportive program (RLA) of the LCC Model computer program package helps determine the repair level (base repair, depot repair, or discard-on-failure) for each ITEM. It is a separate program which utilizes output from six runs of the first component (accounting model), each run using a different repair strategy for the LRUs and their SRUs. The cost implications for each ITEM due to different repair strategies are assessed and then evaluated in an analytical procedure to select a repair level for each ITEM. Model specifications corresponding to each ITEM's recommended repair level are provided in the output and can be implemented in a subsequent run of the LCC program.

9.1.2 Operation of the Model

The contractor will generally operate the programmed SEEK TALK FSED Phase LCC Model interactively, both as a design tool and to meet formal requirements for submitting LCC estimates to the Government. For example, use of the LCC Model in a design study is illustrated in Figure 9-1.

The LCC model computer program package requires data inputs from both the Air Force and the contractor (see Section 8, or the Glossary in Appendix I for this breakdown). The contractor data inputs incorporate his system design, including production costs, a maintenance concept, and characteristics affecting the other top-level cost elements. Air Force data inputs include all factors over which the contractor has no control (e.g., SEEK TALK deployment and

terminal operating hours) and also constraints which the contractor's design must meet (e.g., the confidence factor for safety stock of spare ITEMS).

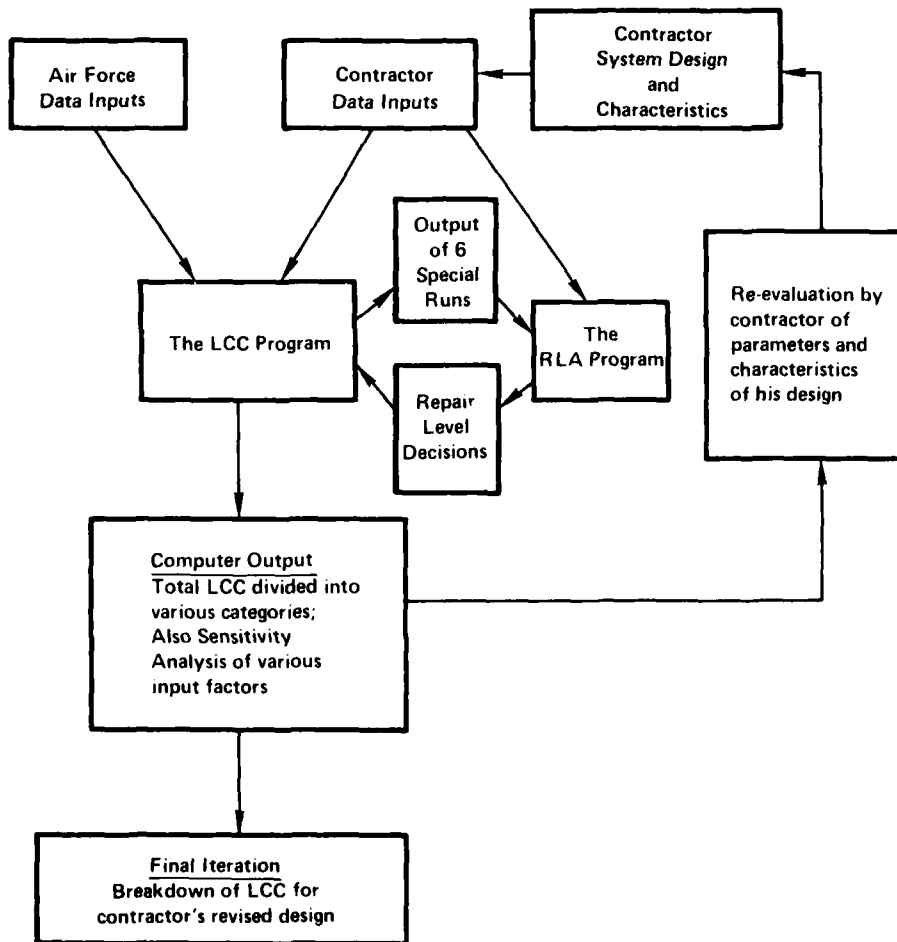
Supplied with Air Force and contractor inputs, the main program of the LCC computer model (the LCC program) calculates and prints out the total LCC and its breakdown into various categories, and also outputs the results of the Sensitivity Analysis. When requested, the LCC program can also provide the inputs to the RLA program for making repair level decisions, which in turn can be used in a subsequent run of the LCC program to produce the previously described outputs. Using these outputs, the contractor can then reevaluate his system design, perform trade-offs in design and other parameters, and develop design and repair level modifications. Any new system design would then give rise to a change in contractor data inputs to be used in a subsequent LCC Model computer run. The contractor may iterate through this cycle as many times as he wishes, evaluating many possible design variations as he carries out the LCC tasks defined in the FSED Statements of Work.

9.1.3 Configuration of the Model

The SEEK TALK FSED Phase LCC Model is designed for interactive use via a time-shared capability. However, the LCC Model may easily be used in batch mode (see Section 10.5 for instructions). For interactive mode, the user will need to have the capability to run a FORTRAN program on-line with 13 input data sets and 3 output data sets. The user must have a computer terminal with a display of at least 80 columns which serves as one of the input data sets and as one of the output data sets. The user must also have an off-line printer with at least 133 column capability (including one column for carriage control) for printing out the second output data set, a FORTRAN compiler with NAMELIST capability, and provision for bytes of core storage (where 1K byte = 1024 bytes). With the exception of NAMELIST statements, the remainder of the SEEK TALK LCC Model, and its interactive interface, are written in ANSI FORTRAN (version X3.9 - 1966). Finally, since the LCC Model is furnished in the form of FORTRAN statements on magnetic tapes, the user will require a magnetic tape reader for use as an input device.

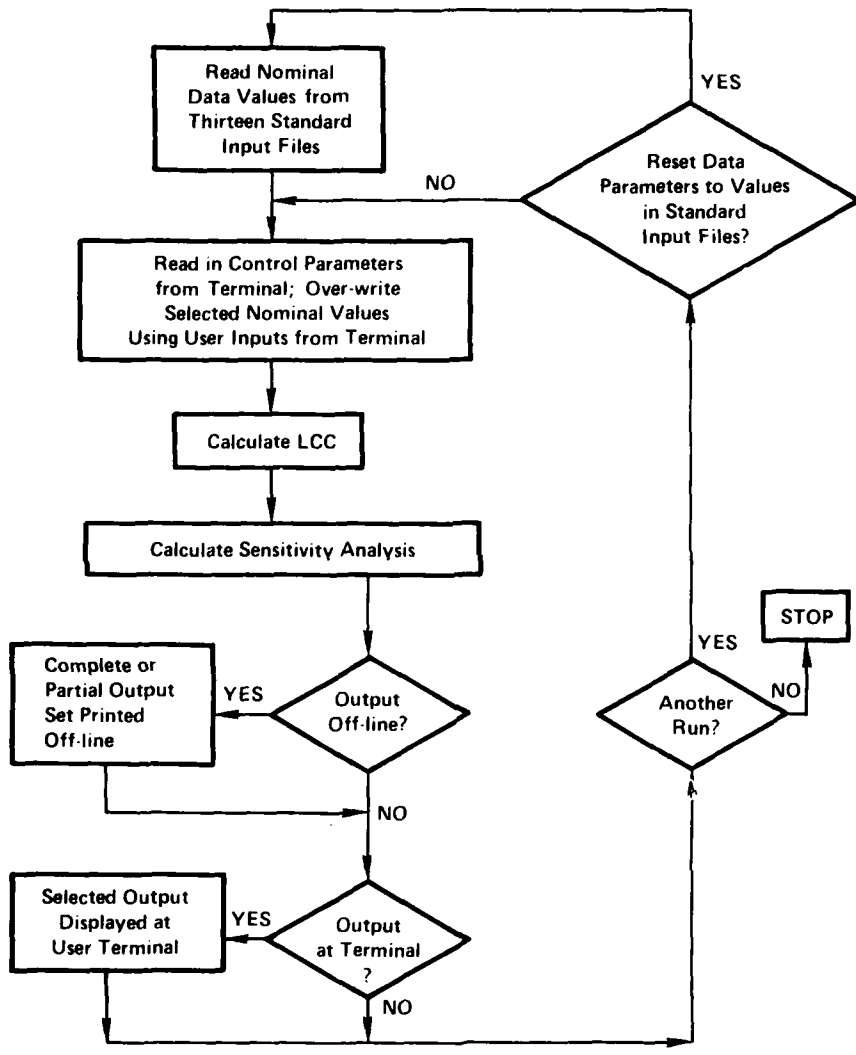
9.1.4 Operation of the LCC Program

Figure 9-2 presents an overview of the operation of the LCC program. First, the nominal values of thirteen standard input data files (which include Air Force and contractor data) are read into the model. Next, certain instructions for output format are input by the user from his terminal in the format of responses to a sequence



IA-60.787

Figure 9.1. Operation of the LCC Model for One Design Study



IA-60,786

Figure 9-2. Operation of the LCC Program

of computer-prompted questions. At this point, the user may also over-write the nominal values of any selection of previous data inputs. Control is then transferred to the computer processor where the program calculates successively the Life Cycle Cost of the modeled system; and the related values of the Sensitivity Analysis. The output of these computations is then directed to two separate devices. If the appropriate control parameter indicates that an off-line copy of output data is required, then the complete (or partial) set of program output is produced on the off-line printer, including the LCC divided into various categories and the Sensitivity Analysis values of all designated input factors. In addition, if specified, the user's terminal may receive a subset consisting of two tables of the LCC output, and the values of the Sensitivity Analysis calculations for a selected number of "most sensitive" input factors.

The user is then asked at the terminal if he wishes another run. A "NO" response terminates the program. A "YES" response allows the user to initiate an interactive rerun of the LCC program. To prepare for this rerun, the user is first asked whether he wishes to reset the values of all data parameters back to those values found in the thirteen standard input files. A "YES" response to this question will cause the values in these Standard Files to be reread into the Model. Subsequent operation of the LCC program on the interactive rerun would then be exactly the same as described for the initial run. A "NO" response to this question directs that the values of data parameters used during the previous run (including any "over-written" values) be assumed as the "nominal" or initial values for use on the interactive rerun and then the user is transferred back to the second step in the system operation. At this point he may input new values for the control parameters and/or over-write the nominal values of a different selection of data inputs and then make a new run of the LCC Model. The user may make as many successive modifications of his data and reruns of the LCC program in this "interactive" mode as he wishes. Alternatively, if the user wishes to perform a detailed analysis of the LCC output, and/or Sensitivity Analysis factors before he reruns the model, he may terminate the program and use the more detailed off-line output as an aid in reevaluating his system design and associated parameters.

9.1.5 Operation of the RLA Program

As noted above, the Repair Level Analysis (RLA) is done by a separate program which utilizes the output of 6 special LCC Accounting Model runs. In order to facilitate the making of these runs, the user is provided with a special command file, which automatically makes the required runs by using the 12 input data files and setting the appropriate LRU and SRU repair levels in the batch mode. The outputs of these 6 runs are saved on a special output file, which together with an LRU/SRU organization file (see File 8B in Section 9.2.1 below) are input to the RLA program. The RLA program is then run to produce a full report of the Repair Level Analysis results. A means is also provided to automatically update the repair levels within the appropriate input data files for the LCC Accounting Model.

9.1.6 Performance Characteristics

The SEEK TALK LCC Model has been designed so as to be readily adaptable to any computer system of moderate capability and at least 450K bytes of core storage. In particular, as previously mentioned in Section 9.1.3, the LCC Model is written completely in ANSI FORTRAN, with the one exception of its NAMELIST statements. In addition, even though the LCC Model is designed to be run in an interactive computer mode, it may easily be utilized in batch mode. Complete instructions for operating the LCC Model in batch mode are given in Section 10.5.

The rate at which the LCC Model will accept inputs, process its calculations, and produce its output tables will depend to a large extent on the capability of the user's computer system. Processing time will also be a function of the amount of data which is input to the Model. However, as one indication of processing time, the LCC Model run which produced the sample output in Appendix II consumed 24.5 CPU seconds of processing time on an IBM 370/3031 computer system with VS2 operating system. The user should note, however, that the amount of input data to this sample run, as listed in the fourteen input Tables in Appendix II, may be smaller than that required for a complete contractor design. Specific limits for the amount of input data accepted by the LCC Model are given in Section 10.2.

Many errors in the formatting and values of data inputs will be detected by the LCC Model which will in turn generate appropriate error messages. For the proper interpretation of error messages, the user should refer to Section 10.3. As an additional aid in debugging input errors, the values of all data inputs, along with their associated variable names, will be printed out in the first component of the output of the LCC Model.

9.2 General Description of Inputs, Processing, and Outputs

To aid in the discussion of this section, it should be noted that the SEEK TALK system is made up of prime mission equipment (PME) terminals and timing net equipment (TNE) terminals installed on host platforms (airborne or surface-based) that are deployed at operational bases or sites. Terminals are broken down into line replaceable units (LRUs) and those in turn into shop repairable units (SRUs). LRUs and SRUs are collectively called ITEMs. On-equipment maintenance is conducted at all bases; off-equipment maintenance, at some or all bases, and at the depot (ALC).

9.2.1 Model Inputs

There are thirteen standard input data files maintained by the user which are read into working storage in the computer. These data files are named:

- (1) System-Wide Scalar Parameters
- (2) Base Configuration Data
- (3) Platform Operation Data
- (4) Platform Terminal Data and Non-Recurring Modification/Installation Data
- (5) Platform Recurring Modification/Installation Data
- (6) Platform Deployment at Bases
- (7) Support Equipment Data
- (8A) ITEM Equipment Data
- (8B) SRU/LRU Cross Reference Data
- (9A) ITEM Maintenance Data
- (9B) ITEM Technical Orders, Training, and SE Software Development Data
- (10) ITEM/Support Equipment Cross Reference Data
- (11) ITEM Configuration for Different Platforms

All of the files, except the first, which is a NAMELIST file, are organized primarily by one of the four major indices: NS, which identifies groupings of operational sites or bases; NP, which identifies groupings of host platforms; L, which identifies types or groupings of support equipment; and I, which identifies types of equipment ITEMs. Three of the files are organized primarily by one of these indices, and secondarily by a different index.

Each of these files will now be described briefly. It should be noted that more complete file descriptions are given in Section 8, and detailed file formats are specified in Section 10.2.

File(1), System-Wide Scalar Parameters This file contains Air Force provided parameters that define installation, operation and maintenance labor rates, labor factors, logistic pipeline times, certain unit cost factors (such as fuel cost per gallon and packing and shipping costs per pound), and miscellaneous factors including the failure rate correction factors for the various operating environments. In addition, there are seven contractor provided parameters included in File 1. Six of them are inputs pertaining to technical orders and maintenance training, and the seventh is the total Full Scale Engineering Development cost.

File(2), Base Configuration Data (Organized by Base Type NS) The data in this file, all provided by the Air Force, defines the characteristics of the operational bases (sites) at which airborne or surface-based host platforms equipped with SEEK TALK terminals will be deployed. Bases at which airborne or ground-based terminals will be operated are aggregated into groups according to operational theatre and role in off-equipment maintenance. File(2) indicates the number of bases in each base group (index NS), and also whether these bases perform their own off-equipment maintenance, and if so, whether they do maintenance for equipment deployed at other bases as well.

File(3), Platform Operation Data (Organized by Platform Type NP) This file contains data, furnished partly by the Air Force and partly by the contractor, describing operational characteristics of host platforms for SEEK TALK terminals. The Air Force furnishes platform-oriented data concerning the operation of Prime Mission Equipment (PME) terminals, while the contractor furnishes similar data for Timing Net Equipment (TNE) Terminals. In addition, Air Force parameters classify the operating environment provided by the host platform, and provide factors used in computing added fuel consumption due to antenna drag (weight effect on fuel not considered). Airborne and Surface platform types are aggregated into a small number of groups (identified by index NP), such as high performance aircraft, or fixed transportable ground units.

File(4), Platform Terminal Data and Non-recurring Modification/Installation Data (Organized by Platform Type NP) This file contains a mixture of Air Force parameters and contractor parameters. The Air Force defines average number of PME terminals per platform in each platform grouping NP, certain parameters classifying mod/installation characteristics of platform groupings

and a thrust/fuel consumption factor. The contractor inputs unit costs for both PME and TNE terminals, defines the average number of TNE terminals per platform in each platform grouping, and average number of added antenna elements per platform. The contractor also estimates the non-recurring modification/installation costs using a detailed estimating procedure provided by the Air Force. (Non-recurring costs are those incurred once for each platform type; recurring, those incurred once for each individual installation.)

File(5), Platform Recurring Mod/Installation Data (Organized by Platform Type NP) Data elements are all established jointly. They define fixed modification cost, cost of group A kits, and variable labor hours, classified (as appropriate) by mode of installation M and/or by installation functional area IA. Modes are: during platform manufacture, depot retrofit, field retrofit by depot team. Installation areas are antennas, electronics boxes, control heads and cabling/interconnections.

File(6), Platform Deployment at Bases (Organized by Platform Type NP and Base Type NS) These Air Force inputs define the average number of SEEK TALK equipped platforms in each group NP that are deployed per base in each base grouping NS.

File(7), Support Equipment Data (Organized by SE Type L) The data in this file, all supplied by the contractor, defines the types of support equipment required to test and maintain SEEK TALK. Required support equipment (SE) is identified by the contractor, and classified into groups of like SE items. Groups (identified by index L) are characterized in File (7) as common support equipment usually available on a support base, common support equipment that must be procured, and peculiar support equipment. Unit purchase prices of SE, annual maintenance cost factors, numbers of technical order pages, and development costs for each SE type are also established in File (7).

File(8A), ITEM Equipment Data (Organized by ITEM I) File (8A) defines the equipment ITEMS identified by index I, which are made up of Line Replaceable Units (LRUs) and their component Shop Repairable Units (SRUs); that the contractor determines are necessary to implement his system design, for all types of PME and of TNE terminals. All data in File (8A) is contractor furnished. Data elements classify each ITEM as an LRU or SRU, defines how it fits into the logistic indenture level hierarchy, defines its unit cost, its fraction of value replaced in repair, its weight, and its count of piece parts.

File(8B), LRU/SRU Cross Reference Data (Organized by LRU index IL and SRU index IS) This file is furnished by the contractor based on his system design. It indicates the different SRUs and their individual quantities contained in each LRU. This file is a required input for Repair Level Analysis, and is not used by the LCC Accounting Model as a reference.

File(9A), ITEM Maintenance Data (Organized by ITEM I) File (9A) contains contractor inputs that define for each ITEM I listed in File (8A) the following: predicted mean time between failures (PMTBFs) for each operating environment, fractions of maintenance actions that fall into each of five classes (false pull, repair in place, base repair, depot repair and condemnation), man-hours for the major types of maintenance actions (in-place repair, remove and replace, base bench check, base repair and depot repair), and repair level code.

File(9B), ITEM Technical Orders, Training, and SE Software Development Data (Organized by ITEM I) File (9B) contains for each ITEM I the number of technical order pages required for depot and base maintenance, the number of hours required for type 1 training, the SE software development cost and its breakdown by SE type. This File is, again, furnished by the contractor.

File(10), ITEM/Support Equipment Cross Reference Data (Organized by ITEM I and SE group L) This file, all established by the contractor on the basis of his concept of how maintenance actions will be conducted, defines for each ITEM I, the types and number of pieces of SE of group L that will be used in maintenance of the ITEM.

File(11), ITEM Configurations for Different Platforms (Organized by ITEM I and Platform Group NP) These data elements, all furnished by the contractor, define how many units of each ITEM I are required to make up the PME and/or TNE configurations for platforms in each grouping NP.

In addition to these thirteen data files, the user's terminal acts as a fourteenth data input file. Prior to each run of the LCC Model, the user must enter several inputs from his terminal to control the LCC Model output, and he may also use his NAMELIST capability to overwrite from his terminal previously input data values from the standard data files (1) through (11) listed above.

9.2.2 Processing: The Accounting Model Equations

Two types of processing are involved in the main program (the LCC Program) of the LCC Model: first, the accounting model equations, and second, the sensitivity analysis equations. Besides, the repair level analysis procedure is involved in the supportive program (the RLA Program) of the LCC Model. Each of these will be described briefly.

The accounting model equations are concerned with calculating the LCC elements and subelements. These are four top-level cost elements, together with a number of subelements, as listed below:

a. PRODUCTION

This is not formally broken down in the Model, but contractor calculations of production cost are required to take into account the list of non-recurring, recurring, and management cost subelements given in Table 8-IX.

b. MOD/INSTALLATION

Non-Recurring: Engineering, Group A Prototype, Testing, Proofing, Data.

Recurring: Fixed (platform preparation), Group A Kits and Variable Labor hours by installation area.

c. INITIAL SUPPORT

This cost includes the following subelements:

Initial Spares,
Support Equipment Acquisition,
SE Hardware and Software Development,
Technical Orders Acquisition,
Type 1 Training, and
Initial Inventory Management.

d. RECURRENT OPERATIONS AND SUPPORT

Operations: PME labor, TNE labor, added fuel cost due to extra antenna drag (weight effect on fuel not considered).

Support: Replacement Spares, On-and-Off-Equipment Maintenance, Support Equipment Maintenance, Recurrent Technical Orders and Training, and Recurrent ITEM Inventory Management.

The total of the cost elements and subelements listed above is then the life cycle cost for purposes of the Model. (As explained in Section 4.1, however, the life cycle cost computed by the model has some cost components missing.) In addition to the cost elements and subelements and total life cycle cost, various partial results, costs by various classifications, costs per terminal, and supplementary variables are computed. These are required for the output tables that are described in Section 9.2.5.

9.2.3 Processing: The Sensitivity Analysis Equations

The most direct method of determining sensitivity of LCC to a specific increment in a generic input parameter is to run the accounting model twice, once with the original parameter value, and once with the modified value. Such an approach may require a large set of changes to input data, if the generic parameter appears in many places - for example, the unit cost $UP(I)$ of each equipment ITEM I. This approach also consumes a lot of computer time. Instead of using this brute force approach, the LCC program automatically computes, in each run, the change in LCC for the input parameter changes of interest. This approach shortens the computation time and it may also expose parameters and/or ITEMS to which LCC is particularly sensitive, which may not have otherwise come to the user's attention. In particular, the LCC program will "sort out" those ITEMS, for each ITEM-specific parameter, to which LCC is "most sensitive". (See Section 6.1.)

Two kinds of sensitivity analysis capabilities are provided. The first is called global analysis, since it deals only in system wide changes. The second kind is called ITEM-specific, since it deals with the LCC impact of changes in ITEM-dependent parameters - i.e., parameter changes made separately to each individual ITEM.

The sensitivity analysis equations define LCC changes produced by fractional increases in each of the parameters listed below. There is a separate sensitivity analysis equation in the LCC program for each of these parameters where each equation represents an analytic formulation of the exact components of LCC which are affected by a change in the given parameter.

Global Factors

Unit Costs
Failure Rates
False Pull Rates
Maintenance Repair Times
Repair Materials Costs
Program Lifetime
Modification/Installation Labor Hours

ITEM Specific Factors

Unit Cost
Failure Rate
False Pull Rate
Repair Materials
Intermediate Repair Fraction
Depot Repair Fraction
Condemnation Rate
SRU/LRU Configuration

The results of applying the sensitivity analysis equations are used to determine:

- . Change in LCC due to prescribed change in each global factor.
- . Change in LCC due to prescribed change in each ITEM-specific factor for each ITEM. For each factor, ITEMS are then ordered by magnitude of LCC change.
- . The effect on LCC of varying for each ITEM the level of repair (i.e., at the base or at the depot).
- . The effect on LCC of changing each SRU into an LRU.

9.2.4 Processing: The Repair Level Analysis Procedure

The Repair Level Analysis is basically AFLC-AFSC 800-4 methodology implemented with a modification to especially account for LRU/SRU item interaction. Specifically, the procedure explicitly recognizes that the repair level of an SRU depends on the repair level of its containing LRU and thus the repair level decision for each ITEM should not be made in isolation. When evaluating an LRU's repair level, the procedure takes the cost implication on its SRUs into consideration. And when a decision is made about an LRU's repair level, the procedure also identifies the best repair levels for its SRUs. If there are some SRUs each contained in more than one LRU, the procedure also makes adjustments to achieve a single repair level for each SRU. See Section 7 for a detailed description of this procedure.

9.2.5 Model Outputs

The user's completion of his interactive responses to the sequence of computer-prompted questions initiates the processing of both the accounting model equations and the sensitivity analysis equations. The outputs of the LCC program are then printed in "hard-copy" on the off-line printer and/or on the user's terminal, in accordance with the user's previous interactive directions. The outputs are divided into three sections, which are: echo of input tables, cost elements and related outputs, and sensitivity analysis outputs. In addition, if the repair level analysis in the RLA Program is conducted, the results are contained in a separate output table. An illustrative, complete set of output tables from the LCC Model appears in Appendix II.

The first section of output on hard-copy contains an echoing of data inputs and their variable names from standard data files (1) through (11). This output allows the user to check that his data was input correctly to the LCC Model.

The second section of output on hard-copy contains the total LCC of the user's SEEK TALK system design, divided into various categories and accompanied by other useful information such as installed ITEM equipment counts, counts of spares, and numbers of failures. Seven separate tables are provided, as follows:

Output Table(1), Summary by Cost Element

This table provides the total LCC and its subtotals in six cost groups. The first four groups are investment costs and they are RDT&E (FSED only), Equipment Acquisition, Modification/Installation, and Initial Support Acquisition. The last two groups are ownership costs and they are Recurring Support and Operations. The group subtotals are further divided into cost elements. A summary of the total numbers of PME and TNE terminals is also attached at the end of this table.

Output Table(2), Platform Modification/Installation Costs

Table(2) contains total non-recurring and total recurring mod/installation costs for each platform grouping NP, and for all groupings combined. The total recurring Mod/I costs are also divided into fixed platform preparation/restoration, Group A Kit equipment, and variable mod/installation labor. In addition the total recurring Mod/I cost for each grouping NP is separated into retrofit and production components, and A Kit

plus Mod/I labor is listed by installation area (antenna, electronics box, control head, cabling).

Output Table(3), Operation and Logistic Support Cost Elements

This table provides total system-wide Operation and Logistics Support (O&LS) cost by cost subelement, namely: operations labor, added fuel consumption, initial spares, replacement spares, on-equipment maintenance, off-equipment maintenance, support equipment, ITEM inventory management, technical orders, and maintenance training. For each of these cost subelements and the top level element, the table also provides a number of breakdowns. These are: first, initial cost and recurring cost; second, costs incurred at the following locations: independent bases, centralized intermediate maintenance facility (CIMF) bases, satellite (to a CIMF) bases, and the depot; and third, cost incurred at locations characterized as: airbases, ground bases and mixed bases. In addition there is a count of the numbers of bases that are independent, CIMF, and satellite, and the numbers that are airbases, ground bases and mixed bases.

Output Table(4). ITEM-Specific Costs and Maintenance Characteristics

Table(4) has three parts (a, b, and c) and provides support costs and other Maintenance data for each ITEM i that the contractor has defined. ITEMS include both line replaceable units (LRUs) and their component sub-units, shop repairable units (SRUs). For each LRU and each SRU, Table(4a) provides an LRU identifier and breaks down total support cost for each ITEM into eight components: initial spares, replacement spares, on-equipment maintenance, off-equipment maintenance, maintenance training, technical data, inventory management, and total support equipment. There is also a column giving average corrective maintenance cost per failure for each of the LRUs and SRUs. Table(4b) breaks down the system total number of each ITEM into three portions: total number installed in the system, total initial spares at bases, and total initial spares at the depot. It also gives the monthly and lifetime failures for each ITEM. Table(4c) provides the average corrective maintenance cost per failure for all the LRUs and for all the SRUs, and the total monthly and lifetime failures for all LRUs.

Output Table(5), Support Equipment Requirements and Costs

In this table output data are provided for each type or grouping (identified by the index L) of support equipment (SE) that the contractor has defined. The table provides, for each SE grouping L, total number of SE units required system-wide, lifetime cost per unit, SE technical order cost, SE development cost, and aggregate system-wide lifetime cost. It also gives total SE unit requirements of the six location categories: independent bases, CIMF bases; air bases, ground bases, mixed bases; and the depot.

Output Table(6), Platform/Terminal Cost and Failure Rate Data

Table(6) shows for each platform grouping NP the total number of the platforms system-wide, number of PME terminals and number of TNE terminals per platform, total production cost and total modification/installation cost per platform type. Table(6) also exhibits the average per platform failure rate for each grouping NP, both in terms of failures per month and failures per million operating hours (i.e., the aggregate (series) failure rate of all SEEK TALK equipment installed on the given platforms). The per terminal failure rate is also shown for each platform grouping NP with the per terminal mean time (in operating hours) between failures given at the end of the table.

Output Table(7), Manpower Requirements

This table provides manpower requirements per year per base for off-equipment maintenance and for keeping management data (including maintenance records, supply transaction records, and transportation transaction forms). These figures are listed for each base type. Also shown in this table are the manpower requirements per year per base type, the total for all bases, and the total for the depot. The total manpower requirements in training are also listed for the first year and for each subsequent year.

The seven output tables described above are available at the hard-copy off-line printer. At the user's terminal, he may, if he chooses, obtain copies of Output Tables (1) and (6). Table (6), as displayed at the terminal, is somewhat abbreviated from the version described above.

The third section of output on hard-copy, the LCC Sensitivity Analysis Table, contains the results of the global and ITEM-specific sensitivity analysis calculations.

For the global calculations, the output consists of the change in total system-wide LCC for the assumed fractional change in each of the global factors listed above. This output consists of a single number for each global factor and these calculations always appear in the LCC Sensitivity Analysis Output Table.

For each ITEM-specific parameter for which LCC sensitivity analysis is provided, however, an LCC sensitivity value is computed for each different ITEM type. The number of values that get printed in the LCC Sensitivity Analysis Table, if any, depends on the directions which the user inputs during his interactive sequence of responses. (See Section 10.4 for details.) As mentioned above, for each ITEM-specific parameter, the most significant calculation will be printed first.

Besides the three sections of the main program output as described above, there is an additional output generated by the Repair Level Analysis (RLA) Program. Obviously, this output is available only if the corresponding processing is to be performed. It contains a printout of two RLA input files: Input Table 1, which is an echoing of File (8B), and Input Table 2, which is from the save file of total ITEM support cost TIAC(I,R)s. The RLA results are then contained in Output Table 1, which indicates the recommended repair level (base-repair, depot-repair, or discard on failure) for each LRU and SRU. It also indicates for each ITEM whether the recommended repair level is different from that input by the contractor.

SECTION 10

OPERATING PROCEDURES

This section provides all the technical details necessary for the user to implement the FSED Phase SEEK TALK LCC Model on his computer system. Specifically, Section 10.1 identifies all input and output device channel numbers which are referred to in the FORTRAN code of the LCC Model (both the LCC Program and the RLA Program). Section 10.2 describes the exact formatting and field column allocation that is required in each of the thirteen data input files. Section 10.3 identifies the error messages which the LCC Program will generate in response to errors detected in either the formatting or the values of data in the input files. Section 10.4 describes the operation of the LCC Program in interactive mode, including instructions on the appropriate user responses at the terminal to the sequence of computer-prompted questions which are generated by the LCC Program. Section 10.5 illustrates the steps required to convert the LCC Program to batch mode operation. Section 10.6 shows the detailed procedures for running the RLA Program in conjunction with the LCC Program. Finally, Section 10.7 gives a detailed description of the information printed by the LCC Model which includes all the Input Tables (basically echoing the data in all the input files), seven Output Tables (presenting the estimated LCC, divided into various cost categories), an LCC Sensitivity Analysis table, and a RLA output table.

10.1 Input/Output Device Channel Numbers

Table 10-I lists the channel numbers which the user should assign to the various input/output files that are required by the LCC Program. These numbers correspond to the device designation numbers used internally by the computer program.

TABLE 10-I
LCC INPUT/OUTPUT DEVICE CHANNEL NUMBERS

INPUT/OUTPUT CHANNEL NUMBER	FILE
5	User Interactive Inputs from Terminal
6	LCC Program Outputs to Terminal
7	LCC Program Outputs to Off-line Printer
11	System-Wide Scalars (Data File 1)
12	Base Configuration Data (Data File 2)
13	Platform Operation Data (Data File 3)
14	Platform Term Data & Non-Recur. MOD/I Data (Data File 4)
15	Platform Recur. MOD/I Data (Data File 5)
16	Platform Deployment at Bases (Data File 6)
17	Support Equipment Data (Data File 7)
18	ITEM Equipment Data (Data File 8A)
19	ITEM Maintenance Data (Data File 9A)
20	ITEM/SE Cross Reference Data (Data File 10)
21	ITEM Configuration for Different Platforms (Data File 11)
22	ITEM Technical Orders and Training Data (Data File 9B)
23	Repair Level Analysis Save File (Data File 13)
24	LRU/SRU Cross Reference Data (Data File 8B)

Note: All input/output files require a minimum record size of 80 bytes (i.e., each line on the file must be at least 80 bytes long), except unit 7, the off-line printer, which requires a record size of at least 133 bytes.

Table 10-II lists the channel numbers which the user should assign to the various input/output files that are required by the RLA Program. These numbers correspond to the device designation numbers used internally by the computer program.

Table 10-II

RLA Input/Output Device Channel Numbers

Input/Output Channel Number	File
7	RLA Program Outputs to Off-line Printer
11	LRU/SRU Cross Reference Data (Data File 8B)
12	Repair Level Analysis Save File(Data File 13)
13	ITEM Maintenance Data (Original Data File 9A)
14	A copy of Data File 9A with updated RL(I)s (New Data File 9A)

10.2 Preparation of Data Input Files

The thirteen data input files (listed in Table 8-II) contain all the information necessary to describe the design, operation, deployment, and maintenance strategies of the LCC Model of the user's SEEK TALK System concept. This information is a combination of Air Force and contractor provided data. Since the purpose here is only to describe how this information is to be prepared on data input files, this section does not discuss the source, interpretation, or LCC Model utilization of any of the data input parameters. The reader should refer to Section 8 for a breakdown of the various data input parameters into categories of Air Force-provided and contractor-provided. Detailed ground rules and guidelines are also presented in Section 8 for the determination of contractor-provided data inputs. In addition, definitions of all data input parameters appear in the Glossary in Appendix I.

The Data Files 1 through 11 may be input from any device (e.g., punched cards, magnetic tape, disk) that the user chooses as long as the correct channel designations are used. For ease of presentation below, it is assumed that this data is being input on punched cards, but the discussion will be sufficient to indicate the correct formatting of data on any input device.

In addition, Data File 1 (on channel 11) must be input via the user's NAMELIST capability (where the data inputs can be listed in any order). Data Files 2 through 11 do not utilize the NAMELIST capability, but are instead read in record by record, where each record adheres to a fixed format and order of data elements, according to the reference type (i.e., ITEM, Support Equipment, Base, Platform or Fiscal Year) of the record.

Most of the information required for the preparation of Data Files 2 through 11 can be determined from the respective figures presented below. These data files are read into the LCC Model record by record. For the discussion below, it is assumed that each record corresponds to a separate punched card and a byte of input data identifies with a column on the punched card. However, important information on the number and sequence of records in each file is presented in the text.

Each of these thirteen data files are specifically discussed in the respective subsections which follow.

10.2.1 System-Wide Scalar Parameters - Data File 1

Data File 1 contains mostly system-wide scalar parameters and is input via a NAMELIST, entitled "MISC". The data parameters which must be input in this file are listed in Table 10-III, and their definitions appear in the Glossary in Appendix I.

Figure 10-1 below, gives a generalized example of a listing of Data File 1. To determine the exact formatting of NAMELIST MISC that is appropriate for the computer system on which the LCC Model is being run, the user should consult his installation's FORTRAN manual.

```
(NAMELIST /MISC/ HEADER) BAA=144.0, BYF=1.5, DAA=144.0,  
...,MILR(1)=30.00, MILR(2)=30.00, MILR(3)=30.00,  
...,TEFM=1000000. (End-of-NAMELIST Designator)
```

Figure 10-1. Generalized Example of Data File 1.

In the above example, the NAMELIST header and end-of-NAMELIST formats must be determined by the user from his installation's FORTRAN manual. There may also be differences in the formatting of the data inputs which are internal to NAMELIST /MISC/. For example, in Figure 10-1, it may be permissible to replace "MILR(1)=30.00, MILR(2)=30.00, MILR(3)=30.00" by the equivalent formulation "MILR(1)=3*30.00", depending on the user's NAMELIST capability. As noted, it is up to the user to determine the details of his required NAMELIST formatting.

Table 10-III

System-wide Scalar Parameters

<u>LABOR FACTORS</u>	<u>LABOR RATES</u>	<u>PIPELINE TIMES</u>
BAA	BLR	BRCT
BMF	DLR	CRCT
DAA	MILR(1)	DAD
DMF	MILR(2)	DRCT(1)
HPD2	MILR(3)	DRCT(2)
TORB	PAL1	DRCT(3)
TORD	PAL2B	OST(1)
	PAL2D	OST(2)
	PMLR	OST(3)
	TNLR	OSTC
	TRAV1D	
	TRAVB	

<u>UNIT COST FACTORS</u>	<u>MISCELLANEOUS</u>	<u>CONTRACTOR-PROVIDED PARAMETERS</u>
ACPP	BF	BDATA
CFG(1)	BIRD	CPD1
CFG(2)	DSC	DDATA
CFG(3)	KFAC(1)	FSEDC
CPD2	KFAC(2)	HPD1
CPPC	KFAC(3)	SPC1
CPPD(1)	KFAC(4)	TEFM
CPPD(2)	MUSE	
CPPD(3)	PIUP	
IMC	QTYP1	
RCPP	QTYP1	
RMC	QTYP2D	
SA	R	
UCPP	SPC2	
	TYP2TF	
	XFPR	
	XFK	
	XMIL	
	XUC	

10.2.2 Base Configuration Data - Data File 2

Data File 2 contains information describing the bases at which SEEK TALK equipment will be deployed. Each record (punched card) in Data File 2 should contain all data pertaining to a particular base type NS. The data input parameters which should be listed on each record of this file, together with their designated formats and column allocations are indicated in Figure 10-2. In particular, the index number of the particular base grouping (i.e., the value of NS) should appear in columns 2-3. The index numbers which appear on successive records in Data File 2 must be consecutive positive integers, starting with 1. The current maximum number of base types allowed is 8.

The input data to this file is entirely Air Force provided, hence there should be no need to make additions or deletions of records from the file. Thus "gaps" in successive base index numbers should never occur and, in fact, are not allowed.

Note that the first column of each record serves as an end-of-file designator. This column must be left blank if the record contains data inputs for a particular base type NS. The record for the last base type should be followed by a record with an asterisk "*" in the first column and with all other columns left blank (so that it should appear as the second row in Figure 10-2). The "*" in the first column of this otherwise blank record then designates the end of the Base Configuration Data File.

COLUMNS	DESCRIPTION	FORM	RESERVED
1	INDEX	ALPHA	F
2-4	INDEX NUMBER	NUMERIC	0
5-10	INDEX NAME	ALPHA	PK
11-12	INDEX VALUE	NUMERIC	00 of 00
13-14	INDEX TYPE	ALPHA	RI
15-16	INDEX CLASS	NUMERIC	00 of 00
17-18	INDEX VALUE	NUMERIC	RI
19-20	INDEX VALUE	NUMERIC	00 of 00
21-22	INDEX VALUE	NUMERIC	RI
23-24	INDEX VALUE	NUMERIC	00 of 00
25-26	INDEX VALUE	NUMERIC	RI
27-28	INDEX VALUE	NUMERIC	00 of 00
29-30	INDEX VALUE	NUMERIC	RI
31-32	INDEX VALUE	NUMERIC	00 of 00
33-34	INDEX VALUE	NUMERIC	RI
35-36	INDEX VALUE	NUMERIC	00 of 00
37-38	INDEX VALUE	NUMERIC	RI
39-40	INDEX VALUE	NUMERIC	00 of 00
41-42	INDEX VALUE	NUMERIC	RI
43-44	INDEX VALUE	NUMERIC	00 of 00
45-46	INDEX VALUE	NUMERIC	RI
47-48	INDEX VALUE	NUMERIC	00 of 00
49-50	INDEX VALUE	NUMERIC	RI
51-52	INDEX VALUE	NUMERIC	00 of 00
53-54	INDEX VALUE	NUMERIC	RI
55-56	INDEX VALUE	NUMERIC	00 of 00
57-58	INDEX VALUE	NUMERIC	RI
59-60	INDEX VALUE	NUMERIC	00 of 00
61-62	INDEX VALUE	NUMERIC	RI
63-64	INDEX VALUE	NUMERIC	00 of 00
65-66	INDEX VALUE	NUMERIC	RI
67-68	INDEX VALUE	NUMERIC	00 of 00
69-70	INDEX VALUE	NUMERIC	RI
71-72	INDEX VALUE	NUMERIC	00 of 00
73-74	INDEX VALUE	NUMERIC	RI
75-76	INDEX VALUE	NUMERIC	00 of 00
77-78	INDEX VALUE	NUMERIC	RI
79-80	INDEX VALUE	NUMERIC	00 of 00
81-82	INDEX VALUE	NUMERIC	RI
83-84	INDEX VALUE	NUMERIC	00 of 00
85-86	INDEX VALUE	NUMERIC	RI
87-88	INDEX VALUE	NUMERIC	00 of 00
89-90	INDEX VALUE	NUMERIC	RI
91-92	INDEX VALUE	NUMERIC	00 of 00
93-94	INDEX VALUE	NUMERIC	RI
95-96	INDEX VALUE	NUMERIC	00 of 00
97-98	INDEX VALUE	NUMERIC	RI
99-100	INDEX VALUE	NUMERIC	00 of 00

LEGEND

- FI - Fixed Form
- FR - Free Form
- RI - Right Justified
- LD - Implicit decimal - comply with format
- ED - Explicit decimal - supply decimal

Figure 1 - Base Configuration - Data File

10.2.3 Platform Operation Data - Data File 3

Data File 3 contains information about the operating characteristics of the various platform types (actually, platform groupings) into which SEEK TALK equipment will be installed. Each record (punched card) in Data File 3 should contain all data pertaining to a particular platform type NP. The data input parameters which should be listed on each record of this file, together with their designated formats and column allocations are indicated in Figure 10-3. In particular, the index number of the particular platform grouping (i.e., the value of NP) should appear in columns 2-4. The index numbers which appear on successive records in Data File 3 must also be consecutive positive integers starting with 1. The current maximum number of platform types allowed is 6.

The index numbers and platform types (as well as most of the other inputs) that are to be listed in Data File 3 are Air Force-provided data inputs. Thus, again, no need will arise for "gaps" in successive index numbers.

One should note the use of implicit decimal formatting in Data File 3 (as well as other data files). The location of "implicit" decimals is indicated in Figure 10-3 (and following figures) by the "triangles" printed between adjacent columns. For example, if the value of the data input TFAC(NS) is indicated by listing "100" in columns 31-33, as shown in Figure 10-3, then the value assigned by the LCC Model when the file is read in will be TFAC(NS)=1.00. Thus there is no need to "use up" a column by including an explicit decimal. However, if the implicit decimal formatting in a particular field is not appropriate for a particular data input, the use of an explicit decimal will over-ride the implicit decimal location indicated in Figure 10-3.

Again the first column serves as an end-of-file designator in Data File 3. Thus an asterisk "*" in the first column denotes the end-of-file in the same manner as described for Data File 2 in Section 10.2.2.

10.2.4 Platform Terminal & Non-Recurring MOD/I Data - Data File 4

Data File 4 contains a combination of platform terminal installation and cost data and non-recurring modification/installation data. Each record (punched card) in Data file 4 should contain data pertaining to a particular platform type NP. The data input parameters which should be listed on each record of this file, together with their designated formats and column allocations are indicated in Figure 10-4.

The platform index number NP must appear in columns 2-4 as indicated and must represent exactly the same platform types that they stood for in Data File 3. In addition, each platform type which is represented by a record in Data File 3 must also be represented by a record in Data File 4, and vice-versa. Thus, the records in Data Files 3 and 4 must match up index number by index number, representing identical platform types (or "groupings") in exactly the same sequence. Clearly, both files must also contain the same number of records (up to a maximum of 8).

Note that implicit decimal formatting is used in Data File 4 also and has the same interpretation as was explained for Data File 3 in Section 10.2.3.

Again the first column in Data File 4 serves as an end-of-file designator. Thus an asterisk "*" in the first column denotes the end-of-file in the same manner as was described for Data File 2 in Section 10.2.2.

10.2.5 Platform Recurring Modification/Installation Data - Data File 5

All of the parameters in Data File 5 relate to recurring mod/installation costs and the parameter NAE(NP) is also used to compute added fuel costs. Each record (punched card) in Data File 5 should contain data pertaining to a particular platform type NP. The data input parameters which should be listed on each record of this file, together with their designated formats and column allocations are indicated in Figure 10-5.

The platform index number NP must appear in columns 2-4 as indicated and must represent exactly the same platform types that they stood for in Data Files 3 and 4. In addition, each platform type which is represented by a record in Data File 3 and 4 must also be represented by a record in Data File 5, and vice-versa. Thus, the records in Data Files 3, 4, and 5 must match up index number by index number, representing identical platform types in exactly the same sequence. Thus all three files must contain the same number of records (up to a maximum of 8).

Note that two implicit decimals are specified in Figure 10-5 for the data parameter NAE(NP). This format is to allow better accuracy if the average number of new antenna elements for the (not necessarily identical) platforms within grouping NP is not an integer.

Again the first column in Data File 5 serves as an end-of-file designator. Thus an asterisk "*" in the first column denotes the end-of-file in the same manner as was described for Data File 2 in Section 10.2.2.

10.2.6 Platform Deployment at Bases - Data File 6

Data File 6 contains all of the values of the matrix variable $NPLT(NP,NS)$, the number of platforms of type NP located at each base of type NS. Each record in Data File 6 gives the base deployment information pertaining to a particular platform type NP. The designated format and column allocations for this data is indicated in Figure 10-6. Note, in particular, that two implicit decimals are allowed in each $NPLT(NP,NS)$ field to allow better accuracy in the case that the average number of platforms of type NP located at a typical base within grouping NS is not an integer. (An explanation of the correct interpretation of implicit decimal formatting is given in Section 10.2.3.)

The platform index number NP which appears in columns 2-4 again must match up record for record with the respective index numbers used in Data Files 3, 4, and 5, in the manner described in the previous section.

Again, the first column in Data File 6 serves as an end-of-file designator. Thus an asterisk "*" in the first column denotes the end-of-file in the same manner as was described for Data File 2 in Section 10.2.2.

PLATFORM INDEX (NP)	NPLT-1	NPLT-2	NPLT-3	NPLT-4	NPLT-5	NPLT-6	NPLT-7	NPLT-8	NPLT-9	NPLT-10	NPLT-11	NPLT-12	JUSTIFICATION
1	0	0	0	0	0	0	0	0	0	0	0	0	F1
2	0	0	0	0	0	0	0	0	0	0	0	0	RJ
3	0	0	0	0	0	0	0	0	0	0	0	0	
4	0	0	0	0	0	0	0	0	0	0	0	0	
5	0	0	0	0	0	0	0	0	0	0	0	0	
6	0	0	0	0	0	0	0	0	0	0	0	0	
7	0	0	0	0	0	0	0	0	0	0	0	0	
8	0	0	0	0	0	0	0	0	0	0	0	0	
9	0	0	0	0	0	0	0	0	0	0	0	0	
10	0	0	0	0	0	0	0	0	0	0	0	0	
11	0	0	0	0	0	0	0	0	0	0	0	0	
12	0	0	0	0	0	0	0	0	0	0	0	0	
13	0	0	0	0	0	0	0	0	0	0	0	0	
14	0	0	0	0	0	0	0	0	0	0	0	0	
15	0	0	0	0	0	0	0	0	0	0	0	0	
16	0	0	0	0	0	0	0	0	0	0	0	0	
17	0	0	0	0	0	0	0	0	0	0	0	0	
18	0	0	0	0	0	0	0	0	0	0	0	0	
19	0	0	0	0	0	0	0	0	0	0	0	0	
20	0	0	0	0	0	0	0	0	0	0	0	0	
21	0	0	0	0	0	0	0	0	0	0	0	0	
22	0	0	0	0	0	0	0	0	0	0	0	0	
23	0	0	0	0	0	0	0	0	0	0	0	0	
24	0	0	0	0	0	0	0	0	0	0	0	0	
25	0	0	0	0	0	0	0	0	0	0	0	0	
26	0	0	0	0	0	0	0	0	0	0	0	0	
27	0	0	0	0	0	0	0	0	0	0	0	0	
28	0	0	0	0	0	0	0	0	0	0	0	0	
29	0	0	0	0	0	0	0	0	0	0	0	0	
30	0	0	0	0	0	0	0	0	0	0	0	0	
31	0	0	0	0	0	0	0	0	0	0	0	0	
32	0	0	0	0	0	0	0	0	0	0	0	0	
33	0	0	0	0	0	0	0	0	0	0	0	0	
34	0	0	0	0	0	0	0	0	0	0	0	0	
35	0	0	0	0	0	0	0	0	0	0	0	0	
36	0	0	0	0	0	0	0	0	0	0	0	0	
37	0	0	0	0	0	0	0	0	0	0	0	0	
38	0	0	0	0	0	0	0	0	0	0	0	0	
39	0	0	0	0	0	0	0	0	0	0	0	0	
40	0	0	0	0	0	0	0	0	0	0	0	0	
41	0	0	0	0	0	0	0	0	0	0	0	0	
42	0	0	0	0	0	0	0	0	0	0	0	0	
43	0	0	0	0	0	0	0	0	0	0	0	0	
44	0	0	0	0	0	0	0	0	0	0	0	0	
45	0	0	0	0	0	0	0	0	0	0	0	0	
46	0	0	0	0	0	0	0	0	0	0	0	0	
47	0	0	0	0	0	0	0	0	0	0	0	0	
48	0	0	0	0	0	0	0	0	0	0	0	0	
49	0	0	0	0	0	0	0	0	0	0	0	0	
50	0	0	0	0	0	0	0	0	0	0	0	0	
51	0	0	0	0	0	0	0	0	0	0	0	0	
52	0	0	0	0	0	0	0	0	0	0	0	0	
53	0	0	0	0	0	0	0	0	0	0	0	0	
54	0	0	0	0	0	0	0	0	0	0	0	0	
55	0	0	0	0	0	0	0	0	0	0	0	0	
56	0	0	0	0	0	0	0	0	0	0	0	0	
57	0	0	0	0	0	0	0	0	0	0	0	0	
58	0	0	0	0	0	0	0	0	0	0	0	0	
59	0	0	0	0	0	0	0	0	0	0	0	0	
60	0	0	0	0	0	0	0	0	0	0	0	0	

DESCRIPTION
 END-OF-FILE-INDICATOR
 PLATFORM INDEX NUMBER - NP
 ALPHA "*" enter only on last card
 NUMERIC - INTEGER (I)

NUMERIC - REAL (F4.2)
 ID or ED

LEGEND

- F1 = Fixed Form
- FR = Free Form
- R1 = Right Justified
- ID = Implicit Decimal - Comply with Format [A]
- ED = Explicit Decimal - Supply Decimal

Figure 1-1. Platform Deployment at Bases - Data File 6

10.2.7 Support Equipment Data - Data File 7

Data File 7 lists all support equipment that is required for intermediate and depot-level corrective maintenance actions on ITEMS within the contractor's SEEK TALK system design. Support equipment which may be required for organizational maintenance actions only (e.g., removing and replacing failed LRUs on-board a platform) need not be included. However, as mentioned in Section 8, any "tester" required for validating the functioning of adaptive array antennas should be included here.

This file contains information concerning support equipment cost, maintenance, development and type (i.e., common/on-site, procurable common, or peculiar). SE designated common/on-site must appear on the Air Force - provided list. The designated format and column allocations for this data is indicated in Figure 10-7. Each record (punched card) in Data File 7 should contain all data pertaining to a particular support equipment (SE) type L.

In particular, the SE index number (i.e., value of L) should appear in columns 2-4. In contrast to the previous data files, the SE index numbers appearing on successive records in Data File 7 need not be consecutive, and the first index number need not be 1. Rather, successive SE index numbers should only be positive integers, listed in increasing order. Thus "gaps" are allowed in successive SE index numbers. This feature allows the LCC Model user flexibility in making changes to and/or deletions from his SE list. Since the inputs to Data File 7 are all contractor-provided, it might be anticipated that changes to this data will be made fairly frequently, as the contractor gains more information regarding his maintenance requirements or possibly wants to trade-off alternate SE configurations.

In addition, the maximum SE index number allowed is 30. Thus a maximum of 30 different SE types may be represented in Data File 7 (in which case the index numbers would have to be consecutive integers starting with 1). (See comment on maximum index values in Section 10.2.8A.)

Again, the first column in Data File 7 serves as an end-of-file designator. Thus an asterisk "*" in the first column denotes the end-of-file in the same manner as was described for Data File 2 in Section 10.2.2.

10.2.8A ITEM Equipment Data - Data File 8A

Data File 8A contains information concerning the ITEM equipment characteristics. Each record (punched card) in the file should contain all data pertaining to a particular ITEM type I. The data input parameters which should be listed on each record of this file, together with their designated formats and column allocations are indicated in Figure 10-8A.

In particular, the ITEM index number (i.e., value of I) should appear in columns 2-4. As is the case for the SE index numbers in the previous data file, the ITEM index numbers appearing on successive records in Data File 8A need not be consecutive and the first index number need not be 1. Successive ITEM index numbers should only be positive integers, listed in increasing order. Thus, "gaps" are allowed in successive ITEM index numbers. Again this feature allows the LCC Model user flexibility in making changes to and/or deletions from his ITEM list. Since the contractor may wish to experiment with different possible design configurations, it may be that Data File 8A will undergo fairly frequent revisions.

The maximum ITEM index number currently allowed is 120. Thus a maximum of 120 different ITEM types may be represented in Data File 8A (in which case the index numbers would have to be consecutive integers starting with 1). The maximum ITEM index number was somewhat arbitrarily determined, as was the maximum SE index number. Of course, these maximum values directly impact the core storage requirements of the LCC Model. If the contractor is presented with any difficulty produced by these maximum index values being either too large or too small, he should contact the Contracting Officer regarding making dimension changes to the LCC Model.

An error check is made on Data File 8A to ensure that the LkU(I) and NHI(I) values given for each ITEM type I are consistent. Recall that if ITEM type I is an LRU, so that LRU(I)=1, then NHI(I) must be zero. Conversely, if ITEM type I is not an LRU, then LRU(I)=0 and NHI(I) must equal a positive integer (i.e., the ITEM index number of its next higher LRU assembly). See Section 10.3 for a discussion of error checks and messages.

"Implicit" decimal formatting is used in Data File 8A and the reader is referred to Section 10.2.3 for an explanation of the feature.

Again, the first column in Data File 8A serves as an end-of-file designator. Thus an asterisk "*" in the first column denotes the end-of-file in the same manner as was described for Data File 2 in Section 10.2.2.

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USER'S MANUAL FOR SEEK TALK FULL SCALE ENGINEERING DEVELOPMENT --ETC(U)

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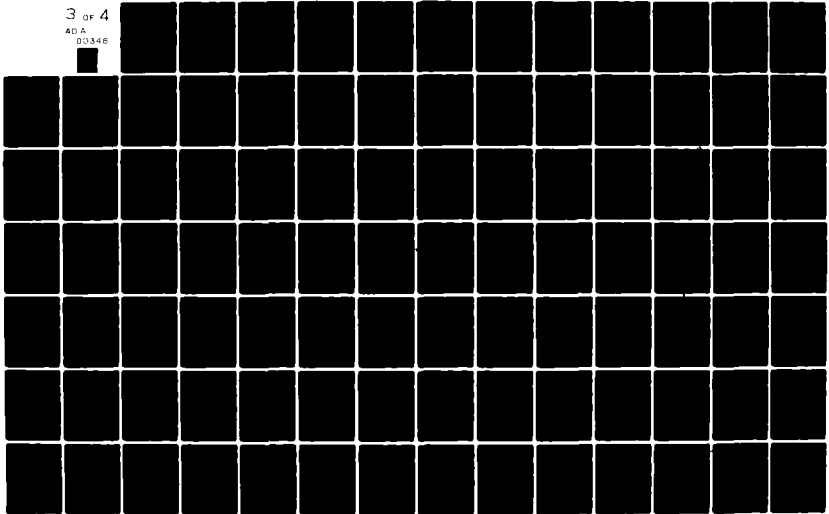
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10.2.8B LRU/SRU Cross Reference Data - Data File 8B

Data File 8B indicates for each LRU ITEM how many units that each SRU ITEM type goes into it according to the contractor's design. This information is required for conducting the repair level analysis (see Section 7), where the matrix variable $QPA(IL,IS)$ is used to mean the quantity of SRU ITEM type IS per assembly of LRU ITEM type IL. The actual input of this information, however, is through a matrix in pointer form as described below.

Each record (punched card) in File 8B contains all the information for a particular LRU ITEM type IL regarding the make-up of its SRUs. The LRU ITEM index IL is given in columns 2-4. The number of distinct SRUs which it contains is denoted by the variable $NDS(IL)$ and is given in columns 5-6. The index numbers of these distinct SRU ITEMS are represented in Data File 8B by the variables $ISRU(IL,K)$ where K runs from 1 to $NDS(IL)$.

The index number $ISRU(IL,K)$ should represent exactly the same SRU ITEM type that it stood for in Data File 8A. The quantity of SRU ITEM type with index $ISRU(IL,K)$ in each LRU ITEM type IL is represented by the variable $QPA(IL,K)$. Note that this is a different interpretation of the matrix QPA than was used in the Repair Level Analysis Capability of the LCC Model. For example, in Figure 10-8B, $QPA(1,2) = 3$ means that 3 units of SRU ITEM type $ISRU(1,2) = 24$ (not type K=2) are contained in an LRU ITEM type 1. Thus, K does not stand for an SRU ITEM index number, but rather only refers to the order of the SRU ITEM type in the record corresponding to LRU ITEM type IL.

The parameters $ISRU(IL,K)$ and $QPA(IL,K)$ must be input in pairs, according to the format and column allocations indicated in Figure 10-8B. When there are fifteen or more (up to thirty) pairs of them ($15 \leq K \leq 30$) for an IL, the second line of the record can be used with the same format (I3, I2) repeating right from column one. The LRU ITEM index numbers that appear in columns 2-4 in Data File 8B must represent exactly the same LRU ITEM types that they stood for in Data File 8A. Note that there should be exactly one record in Data File 8B for each LRU ITEM type (if an LRU ITEM type has no SRUs, it should have $NDS(IL)=0$) and that the records should be sequenced by LRU ITEM index numbers in increasing order (gaps allowed).

Again, the first column in Data File 8B serves as an end-of-file designator. Thus, an asterisk "*" in the first column denotes the end-of-file in the same manner as was described in Section 10.2.2.

10.2.9A ITEM Maintenance Data - Data File 9A

Data File 9A contains all the information concerning the reliability and corrective maintenance characteristics of each ITEM type. Each record (punched card) in the file should contain all data pertaining to a particular ITEM type I. The data input parameters which should be listed on each record of this file, together with their designated formats and column allocations are indicated in Figure 10-9A.

The same ITEM indexing conventions that were described for Data File 8A also apply to Data File 9A. In addition, the ITEM index numbers appearing in columns 2-4 in Data File 9A must represent exactly the same ITEM types that they stood for in Data File 8A. Moreover, each ITEM type which is represented by a record in Data File 8A must also be represented by a record in Data File 9A, and vice-versa. Thus, the records in Data Files 8A and 9A must match up index number by index number, representing identical ITEM types in exactly the same sequence. In fact, an error message will be printed and processing will be terminated if the index numbers in these two files do not so match (see Section 10.3 for a discussion of error messages). Clearly, both files must also contain the same number of records (with a maximum ITEM index value of 120).

A second error check will be performed to ensure that a non-zero value for $PMTBF(I,LE(NP))$ is input in Data File 9A whenever an ITEM of type I is installed on a platform with operating environment $LE(NP)$ (i.e., $NITEM(I,NP) > 0$), where $LE(NP) = 1, 2, 3,$ or 4 , according to its definition given in the Glossary. If an ITEM is never used in a given environment, however, the corresponding $PMTBF(I,LE(NP))$ value may be entered as zero, since it will never be used in any LCC Model calculations.

Finally, if $RL(I)=0$ a third error check will be performed to ensure that the $RTS(I)$, $NRTS(I)$ and $COND(I)$ parameters which appear on each record in Data File 9A add up to exactly one. As mentioned, a list and discussion of all error messages generated by the LCC Model is given in Section 10.3.

Note if $RL(I)=1, 2,$ or 3 , then the program will calculate $RTS(I)$, $NRTS(I)$, and $COND(I)$ using $BIR(I)$ and $WEAR(I)$ according to the repair level code (as shown in Table 7-III, Section 7.2). Recall that $WEAR(I)$ is the fraction of removed failures of ITEM type I which must be condemned due to normal wear-out and is automatically set equal to the original $COND(I)$ provided by the contractor in Data File 9A. $RL(I)$ can be nominally set to 3 if the contractor believes the ITEM of type I should be discarded even if $WEAR(I) < 1$. But $RL(I)$ must be set to 3 if $WEAR(I) = 1$.

ITEM INDEX (1)	PMIBF -1	PMIBF -2	PMIBF -3	PMIBF -4	FPR	RIP	IPCF	RTS	NRTS	COND	RMH	BCBH	BMH	DMH	PL
1	5000	7500	3030	0050	0050	00	001000	001000	0000	0000	30	40	50	50	1

FORMAT

ALPHA - "*" enter only on last card
 NUMERIC - INTEGER (I)
 NUMERIC - REAL (F4.0)

DESCRIPTION

END-OF-FILE-INDICATOR
 ITEM INDEX NUMBER - 1

COLUMN(S)

1
 2-4
 5-12
 13-20
 21-28
 29-36
 37-40
 41-43
 44-48
 49-52
 53-56
 57-60
 61-64
 65-68
 69-72
 73-76
 77
 78-80

JUSTIFICATION

FI
 RJ

NUMERIC - REAL (F4.0)
 NUMERIC - REAL (F4.3)
 NUMERIC - REAL (F3.2)
 NUMERIC - REAL (F5.2)
 NUMERIC - REAL (F4.3)
 NUMERIC - REAL (F4.2)

PMIBF (1, 1)
 PMIBF (1, 2)
 PMIBF (1, 3)
 PMIBF (1, 4)
 FPR (1)
 RIP (1)
 IPCF (1)
 RTS (1)
 NRTS (1)
 COND (1)
 RMH (1)
 BCBH (1)
 BMH (1)
 DMH (1)

LEGEND

- FI = Fixed Form
- FR = Free Form
- RJ = Right Justified
- LD = Implicit Decimal - Comply with Format (a)
- ED = Explicit Decimal - Supply Decimal

FIGURE 1. Item Maintenance Data File

The first column in Data File 9A again serves as an end-of-file designator. Thus an asterisk "*" in the first column denotes the end-of-file in the same manner as was described in Section 10.2.2.

The user should recall from the discussion in Section 6 that the LCC sensitivity analysis calculations with respect to RTS(I), NRTS(I), and COND(I) assume that the maintenance data given for all repair level decisions in Data File 9A represents realistic estimates. Thus, for example, even if an ITEM type I is intended for discard-on-failure, realistic estimates for BCMH(I), BMH(I), and DMH(I) should be entered in the data file for LCC sensitivity analysis purposes.

10.2.9B ITEM Technical Order, Training, and SE Software Development Data - Data File 9B

Data File 9B contains all the information regarding the technical order page and type 1 training time requirements as well as the SE software development cost and its breakdown for each ITEM type. Each record (punched card) in the file should contain all data pertaining to a particular ITEM type I. The data input parameters which should be listed on each record of this file, together with their designated formats and column allocations are indicated in Figure 10-9B.

Exactly the same ITEM indexing conventions that were described for Data File 9A apply to Data File 9B. One can simply refer to Section 10.2.9A for a detailed description.

The first column in Data File 9B again serves as an end-of-file designator. Thus, an asterisk "*" in the first column denotes the end-of-file in the same manner as was described in Section 10.2.2.

10.2.10 ITEM/SE Cross Reference Data - Data File 10

Data File 10 indicates which pieces of support equipment, and how many, are required for intermediate and depot-level corrective maintenance on each ITEM type I. Careful attention should be paid to the instructions for filling out this data file for the following reason: While the matrix variables $SECODE(I,L)$ and $A(I,L)$ appearing in Sections 5 and 6 are treated as separate variables, they are actually only separate digits of one variable, $QSA(I,L)$. Furthermore, the matrix $QSA(I,L)$ must be input in Data File 10 in pointer form.

The matrix $QSA(I,L)$ is input in "pointer form" in Data File 10 using the following conventions: Each record (punched card) in the file contains all SE requirements for a particular ITEM type I, where the index I is given in columns 2-4. The number of different SE types (i.e., different values of L) utilized in the maintenance of ITEM type I is represented by the variable $NJA(I)$, whose value should be given in columns 5-7 (and may not exceed 8). The index numbers of these different SE types are then represented in Data File 10 by the values of the parameters $A(I,K)$ where the K runs from 1 to $NJA(I)$.

The index number $A(I,K)$ should represent the same SE type that it stood for in Data File 7. (Note that this is a different interpretation of the matrix A than was used in the LCC Model Equations.) Thus, $A(I,1)$ is the index number of the first SE type required in the repair of ITEM type I, $A(I,2)$ is the index number of the second SE type required, and so on.

The type of maintenance action on ITEM type I for which SE type $A(I,K)$ is required (denoted in Section 4 by SECODE) and the quantity (i.e., number of copies) of this SE type required for each such maintenance action (denoted in Section 4 by A) are given by the hundreds and units digits of the parameter $QSA(I,K)$. Thus in the example in Figure 10-10, $QSA(1,3)=101$ means that 1 copy of SE type $A(1,3)=4$ is required for repair but not base bench check of ITEM type I. (Note, in particular, that the data given by $QSA(I,K)$ does not correspond to SE type K, i.e., K does not stand for an SE index number, but rather refers only to the order of the SE type in the record corresponding to ITEM type I.)

The parameters $A(I,K)$ and $QSA(I,K)$ must be input in pairs, according to the format and column allocations indicated in Figure 10-10. The ITEM index numbers that appear in columns 2-4 in Data File 10 must represent exactly the same ITEM types that they stood for in Data Files 8A and 9A & B. Moreover, each ITEM type which is represented by a record in Data Files 8A and 9A & B must also be represented by

ITEM INDEX (L)	A-1	QSA-1	A-2	QSA-2	A-3	QSA-3	A-4	QSA-4	A-5	QSA-5	A-6	QSA-6	A-7	QSA-7	A-8	QSA-8
1	3	1301		3201		4101		0		0		0		0		0
2	4	9		10		10		10		10		10		10		10
3	5	10		11		11		11		11		11		11		11
4	6	11		12		12		12		12		12		12		12
5	7	12		13		13		13		13		13		13		13
6	8	13		14		14		14		14		14		14		14
7	9	14		15		15		15		15		15		15		15
8	10	15		16		16		16		16		16		16		16
9	11	16		17		17		17		17		17		17		17
10	12	17		18		18		18		18		18		18		18
11	13	18		19		19		19		19		19		19		19
12	14	19		20		20		20		20		20		20		20
13	15	20		21		21		21		21		21		21		21
14	16	21		22		22		22		22		22		22		22
15	17	22		23		23		23		23		23		23		23
16	18	23		24		24		24		24		24		24		24
17	19	24		25		25		25		25		25		25		25
18	20	25		26		26		26		26		26		26		26
19	21	26		27		27		27		27		27		27		27
20	22	27		28		28		28		28		28		28		28
21	23	28		29		29		29		29		29		29		29
22	24	29		30		30		30		30		30		30		30
23	25	30		31		31		31		31		31		31		31
24	26	31		32		32		32		32		32		32		32
25	27	32		33		33		33		33		33		33		33
26	28	33		34		34		34		34		34		34		34
27	29	34		35		35		35		35		35		35		35
28	30	35		36		36		36		36		36		36		36
29	31	36		37		37		37		37		37		37		37
30	32	37		38		38		38		38		38		38		38
31	33	38		39		39		39		39		39		39		39
32	34	39		40		40		40		40		40		40		40
33	35	40		41		41		41		41		41		41		41
34	36	41		42		42		42		42		42		42		42
35	37	42		43		43		43		43		43		43		43
36	38	43		44		44		44		44		44		44		44
37	39	44		45		45		45		45		45		45		45
38	40	45		46		46		46		46		46		46		46
39	41	46		47		47		47		47		47		47		47
40	42	47		48		48		48		48		48		48		48
41	43	48		49		49		49		49		49		49		49
42	44	49		50		50		50		50		50		50		50
43	45	50		51		51		51		51		51		51		51
44	46	51		52		52		52		52		52		52		52
45	47	52		53		53		53		53		53		53		53
46	48	53		54		54		54		54		54		54		54
47	49	54		55		55		55		55		55		55		55
48	50	55		56		56		56		56		56		56		56
49	51	56		57		57		57		57		57		57		57
50	52	57		58		58		58		58		58		58		58
51	53	58		59		59		59		59		59		59		59
52	54	59		60		60		60		60		60		60		60
53	55	60		61		61		61		61		61		61		61
54	56	61		62		62		62		62		62		62		62
55	57	62		63		63		63		63		63		63		63
56	58	63		64		64		64		64		64		64		64
57	59	64		65		65		65		65		65		65		65
58	60	65		66		66		66		66		66		66		66
59	61	66		67		67		67		67		67		67		67
60	62	67		68		68		68		68		68		68		68
61	63	68		69		69		69		69		69		69		69
62	64	69		70		70		70		70		70		70		70
63	65	70		71		71		71		71		71		71		71
64	66	71		72		72		72		72		72		72		72
65	67	72		73		73		73		73		73		73		73
66	68	73		74		74		74		74		74		74		74
67	69	74		75		75		75		75		75		75		75
68	70	75		76		76		76		76		76		76		76
69	71	76		77		77		77		77		77		77		77
70	72	77		78		78		78		78		78		78		78
71	73	78		79		79		79		79		79		79		79
72	74	79		80		80		80		80		80		80		80
73	75	80		81		81		81		81		81		81		81
74	76	81		82		82		82		82		82		82		82
75	77	82		83		83		83		83		83		83		83
76	78	83		84		84		84		84		84		84		84
77	79	84		85		85		85		85		85		85		85
78	80	85		86		86		86		86		86		86		86
79	81	86		87		87		87		87		87		87		87
80	82	87		88		88		88		88		88		88		88
81	83	88		89		89		89		89		89		89		89
82	84	89		90		90		90		90		90		90		90
83	85	90		91		91		91		91		91		91		91
84	86	91		92		92		92		92		92		92		92
85	87	92		93		93		93		93		93		93		93
86	88	93		94		94		94		94		94		94		94
87	89	94		95		95		95		95		95		95		95
88	90	95		96		96		96		96		96		96		96
89	91	96		97		97		97		97		97		97		97
90	92	97		98		98		98		98		98		98		98
91	93	98		99		99		99		99		99		99		99
92	94	99		100		100		100		100		100		100		100

DESCRIPTION
 END-OF-FILE-INDICATOR
 ITEM INDEX NUMBER - I
 NJA(I)
 A(I,1)
 QSA(I,1)
 A(I,2)
 QSA(I,2)
 A(I,3)
 QSA(I,3)
 A(I,4)
 QSA(I,4)
 A(I,5)
 QSA(I,5)
 A(I,6)
 QSA(I,6)
 A(I,7)
 QSA(I,7)
 A(I,8)
 QSA(I,8)
 BLANK

FORMAT
 ALPHA - "X" enter only on last card
 NUMERIC - INTEGER (I3)
 NUMERIC - INTEGER (I3)
 NUMERIC - INTEGER (14)
 NUMERIC - REAL (F3.0)

JUSTIFICATION
 FI
 RJ
 RJ
 RJ
 ED or ID

LEGEND
 FI - Fixed Form
 FR - Free Form
 RJ - Right Justified
 ID - Implicit Decimal - Comply with Format (A)
 ED - Explicit Decimal - Supply Decimal

Figure 10-10, Item/SE Cross Reference - Data File 10

a record in Data File 10, and vice-versa. (If an ITEM type I requires no support equipment for its repair then the user should set NJA(I)=0.) Thus, the records in Data Files 8A, 9A & B, and 10 must match up index number by index number, representing identical ITEM types in exactly the same sequence. In fact, an error message will be generated and processing will be terminated if the ITEM index numbers in these files do not so match. (See Section 10.3 for a discussion of error messages.)

In particular then, any addition or deletion of ITEMS made to any one of the Data Files 8A, 9A & B, 10 (or 11) must be made to the other four files also.

Note also that if any adaptive array antenna "tester" is required (so that it should have been listed in Data File 7), then it should be associated in Data File 10 with at least one ITEM from the adaptive array antenna assembly.

The first column in Data File 10 serves as an end-of-file designator. Thus, an asterisk "*" in the first column denotes the end-of-file in the same manner as was described in Section 10.2 2.

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10.2.11 ITEM Configurations for Different Platforms - Data File 11

Data File 11 consists of all of the values of the matrix variable NITEMR(I,NP). It is the average number of ITEMS of type I that are to be installed on each platform within grouping NP if I is an integration ITEM. For other ITEMS, it is the average number of ITEMS of type I installed in each terminal on platforms within grouping NP. Each record (punched card) in Data File 11 contains all values which correspond to a particular ITEM type I, where the index I must appear in columns 2-4. Since there is a maximum of 8 different platform groupings NP currently allowed in the LCC Model, each record in the file then contains the values NITEMR(I,1) through NITEMR(I,8).

Note in Figure 10-11 that the format for entering each NITEMR(I,NP) value specifies two implicit decimal places. This format is utilized because of the fact that, while platforms included within a particular platform grouping NP are of a similar type and function, they are not all exactly the same. Thus NITEMR(I,NP) should be determined as a true average number and its value may very well not be an integer. (See Section 10.2.3 for a discussion of implicit decimal formatting.)

The ITEM index numbers that appear in columns 2-4 in Data File 11 must represent exactly the same ITEM types that they stood for in Data Files 8A, 9A & B, and 10. In fact, all the conventions regarding ITEM index numbers that were described for those files apply equally well here. Thus, the records in Data Files 8A, 9A & B, 10 and 11 must match up index number by index number, representing identical ITEM types in exactly the same sequence. Again, an error message will be generated and processing will be terminated if these ITEM index numbers do not so match.

As mentioned in the previous section, any addition or deletion of ITEMS to any one of the Data Files 8A, 9A & B, 10 or 11 must thus be made to the other four files also. However, for trade-off studies, say performed in an "interactive" computer session, one can effectively delete an ITEM type I from his system design by setting NITEM(I,NP) = 0 for all values of NP (without changing any other ITEM data in the other files).

Again, the first column in Data File 11 serves as an end-of-file designator. Thus an asterisk "*" in the first column denotes the end-of-file in the same manner as was described in Section 10.2.2.

10.3 Data Input Error Messages

There are two different categories of error checks which are made by the LCC Model. The error checks in the first category are related to the index numbers used on the records in the standard Data Files 2 through 11. These error checks and associated error messages will be described first in this section. The error checks in the second category are all related to the values of the data inputs to the LCC Model. These error checks will be described in the second part of this section.

Any error messages resulting from error checks made on the index numbers of input records will be printed at the user's terminal during his interactive input sequence at the point immediately preceding the NAMELIST routines (described in detail in Section 10.4 below). If off-line output has been requested by the user, then these error messages will also appear on the off-line printer.

Any error messages resulting from error checks made on the values of data inputs will be printed at the user's terminal after the interactive NAMELIST routines have been completed. The error checks on data input values are made after these NAMELISTs have been completed by the user to ensure that they incorporate any new values of data inputs which may have resulted from "overwriting" in NAMELISTS /G01/ and /G02/. Again, if off-line output has been requested by the user, then these error messages will also appear on the off-line printer. The LCC Model will not be processed if any index number errors occur on data records. However, the user will still be allowed to complete the interactive NAMELISTs in this case so that he can receive the printout of any error messages concerning the values of data inputs. Thus, the user does not have to wait until he has fixed up his index number errors before he is alerted to additional errors in the values of his data inputs. In addition, the first 12 output tables of the LCC Model, which essentially represent an echo print of the 12 input data files, will always be printed out off-line, as an aid in debugging data input errors.

If any data input error messages occur, then, after the interactive NAMELISTs have been entered and any data input value error messages have been printed, the message "PROGRAM STOPS DUE TO (NERRXX) ERRORS ON INPUT", where NERRXX equals the number of errors which have occurred.

We now discuss the specific error messages resulting from error checks on index numbers of input records. Any error message concerning the index number of records in Data Files 2 through 11 will identify the device channel number or name of the input data

file in which the error occurs. (See Section 10.1 for these channel numbers.) We will list and describe these error messages below.

- (1) UNIT (XX) ERROR: END OF FILE CARD NOT FOUND AFTER MAXIMUM NUMBER OF CARDS WERE READ IN:

This error message refers to the data file with channel number (XX) and indicates either that there are too many records (punched cards) listed in the file or that the end-of-file card (i.e., a record with an asterisk "*" in the first column and all other columns blank) does not appear after the maximum number of records have been read in.

The maximum numbers of records allowed in each of the Data Files 2 through 11 are defined as follows: Data File 2 contains records which are indexed by Base type NS. Base-specific input parameters have an array dimension maximum of 8, hence at most 8 records may appear in this file. Data Files 3, 4, 5 and 6 contain records which are indexed by Platform type NP. Since all Platform-specific input parameters have an array dimension maximum of 6, at most 6 records may appear in these files. Data File 7 contains records which are indexed by Support Equipment type L. Since all SE-specific input parameters have an array dimension maximum of 30, at most 30 records may appear in this file.

The Data Files 8A, 9A & B, 10, and 11 all contain records which are indexed by ITEM type I. Currently, all ITEM-specific input parameters have an array dimension maximum of 120. Data File 8A then may have at most (and up to) 120 records. However, the number of records contained in Data File 8A then sets the maximum number of records that may be entered in Data Files 9A & B, 10, and 11. Thus, for example, if Data File 8A contains only 60 records, then none of the Data Files 9A & B, 10, or 11 may contain more than 60 records.

As mentioned in Sections 10.2.8A through 10.2.11, the ITEM index numbers used on successive records within Data Files 8A, 9A & B, 10, and 11 must, in fact, match up record by record, representing exactly the same ITEM types in exactly the same sequence. Since Data File 8A is read in first, it thus sets the ITEM indexing standard against which Data Files 9A & B, 10, and 11 are tested. The following set of error messages all relate to this ITEM index number testing on Data Files 9A & B, 10, and 11.

- (2) ITEM MAINT. FILE CONTAINS FEWER ITEMS THAN ITEM EQUIP. FILE
- (3) ITEM X-REF. FILE CONTAINS FEWER ITEMS THAN ITEM EQUIP. FILE

(4) ITEM CONFIG. FILE CONTAINS FEWER ITEMS THAN ITEM EQUIP. FILE

Error messages (2), (3) and (4) are self-explanatory and indicate, respectively, that Data File 9A & B, 10, or 11 contains fewer (ITEM-indexed) records than Data File 8A.

(5) INDEXING IN ITEM MAINTENANCE DOESN'T MATCH ITEM EQUIPMENT

(6) INDEXING IN ITEM X-REFERNC. DOESN'T MATCH ITEM EQUIPMENT

(7) INDEXING IN ITEM CONFIGURATN. DOESN'T MATCH ITEM EQUIPMENT

Error messages (5), (6), and (7) indicate that the ITEM index numbers used on successive records in, respectively, Data File 9A & B, 10, or 11 do not match up, record by record, with the ITEM index numbers used on successive records in Data File 8A.

We next discuss the error messages resulting from error checks on the values of data input parameters. We list these below.

(8) INPUT ERROR: RTS + NRTS + COND \neq 1 FOR ITEM TYPE (XX).

The ITEM specific parameters RTS(I), NRTS(I) and COND(I), which represent fractional repair level allocations and are entered in Data File 9A, must sum to unity for each ITEM type I with RL(I)=0. If this condition does not hold for a given ITEM type I = XX, then error message (8) will be printed.

(9) INPUT ERROR: INDENTURE LEVEL INDICATORS (LRU & NHI) NOT CONSISTENT FOR ITEM TYPE (XX)

If an ITEM type I is an LRU, i.e., LRU(I) = 1, then the next higher assembly indicator, NHI(I), must be set to zero. Conversely, if ITEM type I is an SRU, i.e., LRU(I) = 0, then NHI(I) must equal the non-zero ITEM index number of its next higher assembly. If either of these conditions fail to hold for a given ITEM type I = XX, then error message (9) will be printed. (Note: LRU(I) and NHI(I) are both contained in Data File 8A.)

(10) INPUT ERROR: PMTBF CANNOT BE ZERO FOR ITEM TYPE (XX) IN OPERATING ENVIRONMENT (YY).

As discussed in Section 10.2.9A, if an ITEM of type I is installed on a platform of type NP, i.e., NITEM(I, NP) > 0, then the mean time between failures for that ITEM type operating in the environment of platform type NP, denoted PMTBF(I, LE(NP)), cannot be given a zero value in Data File 9A. If this condition is violated for an ITEM

*type I = XX operating in environment LE(NP) = YY, then error message (10) will be printed, i.e., in this case PMTBF(XX,YY) will not be allowed to be zero. Note that there is sufficient space allowed in Data File 9A to indicate very low failure rates (i.e., high PMTBFs), if they can be justified.

10.4 Operation of the LCC Program in Interactive Mode

The SEEK TALK FSED Phase LCC Model has been primarily designed for operation in interactive mode. No special procedures are required of the user to operate the LCC Model in interactive mode. There are, however, a few extra steps which are necessary to convert the model to batch mode and these steps are discussed in Section 10.5.

After the user has prepared Data Files 1 through 11 and has initiated a run of the LCC Model, he must respond through his terminal to several computer-prompted questions and he must also complete three separate NAMELIST data input routines. This section gives the specific details necessary for the user to perform his terminal inputs properly. The discussion below will relate to the sample interactive sequence in Figure 10-12, given at the end of this section (beginning on page 212). For illustrative purposes, the computer-prompted questions and directives appear in capital letters and the user responses and inputs appear in small letters.

After a run of the LCC Model has been initiated by the user, the computer first asks the user whether he wants MAXIMUM or MINIMUM PROMPTING, i.e., a maximum or minimum amount of instruction by the computer to the user. These prompting instructions relate to the current values of input and control variables and the purposes of the three separate NAMELIST routines. The example in Figure 10-12 below shows the maximum prompting instructions. Under minimum prompting, part of these instructions would not appear.

One feature of the prompting questions is that if the user requests maximum prompting on his initial run (or any subsequent rerun) of the LCC Model, then he will be asked on his next interactive rerun whether he wants maximum or minimum prompting again. However, if a user requests minimum prompting on one run, then the model will automatically assume that he wishes minimum prompting on the next (and all subsequent) interactive reruns of the model. To change from minimum prompting to maximum prompting, the user must exit from the LCC Model and then reinstate the model as he did for his initial run.

The next two computer prompted questions in the example allow the user to designate whether he wants the output of the LCC Model to go

to his terminal and/or to the off-line printer. As indicated in Figure 10-12, the user may direct either FULL, PARTIAL, OR NONE of the output to the off-line printer. FULL output consists of thirteen Input Tables which echo the thirteen data files, seven LCC Output Tables, and an LCC Sensitivity Analysis Table. PARTIAL output consists of only the first two LCC Output Tables and Output Table 6. Output directed to the user's terminal, if requested, consists of Output Table 1, a slightly condensed version of Output Table 6, and an LCC Sensitivity Analysis Table. These output tables are discussed fully in Section 10.6 and a full set of illustrative output tables is also presented in Appendix II.

If the user directs that the output of the LCC Model should go to the off-line printer, then the next computer instruction printed is "SUBMIT A TITLE FOR THIS RUN:". The user may then designate his current run with a title consisting of at most 28 characters. This title will appear on the header to the off-line output when the current run is processed. The differing titles of successive interactive reruns of the LCC Model will help the user sort out the output from the off-line printer. If output is not to be printed off-line, then a title will not be requested by the LCC Model.

The user then proceeds to the three NAMELIST routines. Before he enters these routines, the computer prints out the instruction, "SET EXITXX=1 IN ANY NAMELIST IF YOU WANT TO EXIT." This instruction means that the user can exit from his current run of the LCC Model during the execution of any of three NAMELIST routines by typing EXITXX=1 as a data input to that NAMELIST. When the NAMELIST is then entered, the processing of the LCC Model is bypassed and the computer-prompted question, "ANOTHER RUN (Y OR N)?" is immediately returned. This option allows the user the flexibility to terminate his current run and either re-initialize his next run or exit from the LCC Model altogether. This option would be useful, for example, if the user were to decide, during one of the NAMELIST routines, that he wanted to change his output designations in the preceding computer-prompted questions.

Next in Figure 10-12, a computer-prompted explanation of NAMELIST /G01/ is printed. As indicated in this explanation, NAMELIST /G01/ contains all data input variables from Data Files 1 through 11 that begin with the letters A through M. Before the first execution of NAMELIST /G01/, these variables are set equal to the values entered in the data input files. To use these values, the user need only submit an empty NAMELIST /G01/. However, he may override (i.e., overwrite) the values assigned by the input files to any of the NAMELIST /G01/ variables (and only these variables) by making the

proper assignment in this NAMELIST. Note that any NAMELIST command must be preceded by a space as shown in Figure 10-12.

Next the user must enter NAMELIST /GO2/. As indicated in Figure 10-12, NAMELIST /GO2/ performs exactly the same function as NAMELIST /GO1/, except that NAMELIST /GO2/ contains all data input variables from Data Files 1 through 11 that begin with the letters N through Z.

As an example, if the user wishes to make changes to the following data input parameters: $BMH(4) = 1.5$, $RTS(5) = 0.$, $COND(5) = 1.$, $FR = 1.25$, then, as indicated in Figure 10-12, he should enter $BMH(4) = 1.5$, $COND(5) = 1.$ in NAMELIST /GO1/ and $RTS(5) = 0.$, $XFR = 1.25$ in NAMELIST /GO2/. All other data input parameters will retain the values that they were given in the Data Files. More extensive and sophisticated entries can, of course, be made in NAMELISTs /GO1/ and /GO2/, in accordance with the user's NAMELIST capability. Again, we emphasize that the NAMELIST format used in the example in Figure 10-12 may not correspond to the format necessary at the user's computer installation. The user must determine his required NAMELIST format from his installation's FORTRAN manual.

After the user enters NAMELISTs /GO1/ and /GO2/, the computer then prints out the prompting for NAMELIST /SENS/. This NAMELIST controls the output of the LCC Sensitivity Analysis calculations. As indicated in the computer prompting, the model will always output at the user's terminal the LCC sensitivity calculations with respect to the global parameters (listed in Table 6-1 in Section 6.1). For the ITEM-specific parameters for which LCC sensitivity analysis is provided, the user must input values for the control variables of the form LDXXX in NAMELIST /SENS/ to indicate the number of (most significant) sensitivity calculations that should be printed at his terminal for each of the ITEM-specific factors XXX(I). Thus, in the first run of Figure 10-12, the NAMELIST /SENS/ inputs direct that the 6 most significant calculations for each of the factors FR(I), UP(I), and SRU(I) be printed. Because the user did not submit a non-zero value for any other sensitivity control variable LDXXX, LCC sensitivity calculations for the other ITEM-specific factors will not appear at the user's terminal. Note that no index 1 is used with the LDXXX variables. Thus, we set LDFR=6 and not LDFR(1)=6. Note that the factor SRU(I), discussed in Section 6.3, is included with the other ITEM-specific factors which are listed in Table 6-1.

The amount of LCC Sensitivity Analysis printed off-line is determined by the values of the control variables LDXXX and the control variable LDERV. The variable LDERV is also included in NAMELIST /SENS/ where it may be set equal to the minimum number of

LCC sensitivity calculations that the user wishes to be printed in "hard-copy" off-line for each of the eight ITEM-specific factors. The actual number of sensitivity calculations for a particular ITEM-specific factor that will be printed off-line would then be equal to the maximum of LDERV and the value of LDXXX for that factor. For example, if LDERV=12 and LDUP=6, then the 12 most significant UP(I) calculations would be printed out off-line and the 6 most significant UP(I) calculations would be printed out at the user's terminal.

The user should take care that none of the values of the control variables LDERV and LDXXX exceed the number of different ITEM types within his system design. An error will occur in the processing of the LCC Model if this condition is violated.

In addition, since the LCC sensitivity calculations for any one of these eight ITEM-specific factors is printed out in a format of 6 per line at the user terminal, the values of LDXXX specified by the user might as well be multiples of 6 to maximize the output per terminal line; and, since these calculations are printed out in a format of 12 per line on the off-line printer, the specified value of LDERV might as well be a multiple of 12.

If LDERV is not assigned a value in NAMELIST /SENS/, then it "defaults" to a value of 12. Thus, the effect of the input to NAMELIST /SENS/ in the first run in Figure 10-12 below is to direct that the 12 most significant calculations for each ITEM-specific factor be printed out off-line.

For a discussion of how "most significant" LCC sensitivity calculations are defined, the reader should refer to Section 6.1 (immediately before the CAUTIONS) and (for SRU(I)) to Section 6.3.

The user may also input a value for the variable FINC in NAMELIST /SENS/. As described fully in Section 6, the value of FINC represents the fractional increase in each factor undergoing sensitivity analysis that is used to determine the change in LCC. If FINC is not assigned a value in NAMELIST /SENS/, then it "defaults" to a value of .25 (as in the first run below).

As soon as NAMELIST /SENS/ is entered, the model computes the LCC, including Sensitivity Analysis calculations. Then before the output of any data (and assuming no errors have occurred in processing the LCC Model), the computer prints out the message "LCC COMPLETED" and the instruction "IF YOU WISH TO EXIT, HIT -E-, THEN HIT -RETURN-; OTHERWISE ADJUST TERMINAL TO NEW PAGE AND HIT -RETURN-". The first part of this instruction tells the user how to exit from his current

LCC Model run without having to wait for the output of the run to be printed. Typing "E" and then "RETURN" has the same effect at this point as entering "EXITXX=1" in any of the NAMELISTs above. Thus, if the "E-RETURN" option is exercised, then no output will be printed, either at the user's terminal or on hard-copy on the off-line printer. Otherwise, to receive the LCC output display, the user may at this point adjust his terminal to a new page (before performing a carriage return) to enhance the readability of the output tables.

LCC Output Tables 1 and 6 will then be printed at the user's terminal. Since Output Tables 1 and 6 (as well as all other output tables) will be explained in detail in Section 10.6, we have left it out of Figure 10-12. After these LCC output tables are printed and before the LCC Sensitivity Analysis calculations are displayed, the instruction "IF YOU WISH TO EXIT, HIT -E-, THEN HIT -RETURN-; OTHERWISE, ADJUST TERMINAL TO NEW PAGE AND HIT -RETURN-" is again printed out at the terminal. This instruction has the same effect at this point as was described for its first occurrence. A carriage return response to this instruction will cause a table of LCC Sensitivity Analysis calculations to be printed at the terminal. Again, since this output will also be explained in Section 10.6, we have left it out of Figure 10-12.

There are two possible variations that can occur in the two displays of the last instruction mentioned above. First, if output is not requested at the terminal, then this instruction will appear only once (immediately after "LCC COMPLETED"). Secondly, under "MINIMUM" prompting, only the last half of this instruction will be printed.

After the printout of the LCC Sensitivity Analysis Table has been completed, the computer-prompted question, "ANOTHER RUN (Y or N)-?", is printed at the user's terminal. An "N" response allows the user to exit from the LCC Model computer program. A "Y" response allows the user to rerun the LCC Model beginning with his interactive terminal inputs. Figure 10-12 below also illustrates a typical interactive rerun.

On any interactive rerun of the LCC Model, all overwritten values of NAMELIST /G01/ and /G02/ variables are retained from previous runs. In particular, this fact holds true even if a previous run was terminated by executing the "EXITXX=1" option in any NAMELIST. In this case, all inputs to any of the three NAMELISTs, either preceding or following the EXITXX=1 input, are retained for the next run.

After a "Y" response to the "ANOTHER RUN?" question, the computer prompts the question, "AT THIS POINT VARIABLE VALUES ARE AS THEY WERE AFTER THE LAST NAMELIST WERE SUBMITTED. DO YOU WISH TO RESET NAMELISTS /GO1/ AND /GO2/ VARIABLES TO THE VALUES FOUND IN THE INPUT FILES (Y OR N)-?". A "Y" response to this question directs that all NAMELIST /GO1/ and /GO2/ variables be set back equal to their initial values found in Data Files 1 through 11. A "N" response to the question directs that the values assigned to these variables through "overwriting" in all NAMELIST /GO1/ and /GO2/ statements entered in previous runs during the current interactive session (and since the last "reset") be retained as current values. Thus, a "N" response designates that all NAMELIST /GO1/ and /GO2/ variables start off the next run with the values used during the last run.

The remaining interactive computer-prompted questions and user responses have the same structure as in the initial run. The user is asked the three questions, "MINIMUM OR MAXIMUM PROMPTING?", "OUTPUT AT TERMINAL?" and "FULL, PARTIAL, OR NO OUTPUT ON OFF-LINE PRINTER?". His responses have the same implications as described for the initial run. He may next enter a new title for his second run. As indicated by the brackets in Figure 10-12, the "SET EXITXX=1" instruction is then printed on interactive reruns only under "MAX" prompting. However, on the initial run, the "SET EXITXX=1" instruction is printed under either "MAX" or "MIN" prompting.

Next, the user again encounters the three NAMELIST routines. Note in the second run of the LCC Model in Figure 10-12 that the maximum prompting portions of the computer instructions to these NAMELISTs have changed (from those in the first run) to indicate the current status of the respective NAMELIST variables. The user may at this point overwrite any selection of the NAMELIST /GO1/ and /GO2/ variables that he chooses, keeping in mind the current values of these variables in light of his response to the "RESET?" question.

The values of the NAMELIST /SENS/ variables are always retained from the previous run (even if it was terminated by using "EXITXX=1" in NAMELIST/SENS). Since these variables are not affected by the user's response to the "RESET" question, the only way to change their values from the previous run is to reassign them via NAMELIST /SENS/. Thus, in the second run in Figure 10-12, the value of FINC is changed to .20 and the value of LDFR is changed to 0. Thus, no sensitivity analysis calculations with respect to the factor FR(1) will appear on the second run, but because of the input to the previous NAMELIST /SENS/, sensitivity calculations with respect to UP(1) and SRU(1) will still appear.

After NAMELIST /SENS/ is again entered, the processing of the second run of the LCC Model takes place. The subsequent computer prompted directives and possible user responses are exactly the same as described for the initial run. The user may continue in this fashion, altering his data inputs and output formats through the three NAMELISTs, and making as many runs as he wishes, until he responds "N" to the question "ANOTHER RUN".

```
SEEK TALK FSED PHASE MODEL

MINIMUM OR MAXIMUM PROMPTING (MIN OR MAX)-?

max

OUTPUT AT TERMINAL (Y OR N)-?

y

OFF-LINE OUTPUT: FULL, PARTIAL, OR NONE (F, P, OR N)-?

f

SUBMIT A TITLE FOR THIS RUN:

first run

SET EXITXX=1 IN ANY NAMELIST IF YOU WANT TO EXIT.

NAMELIST /GO1/ CONTAINS ALL VARIABLES FOUND IN THE INPUT FILES
THAT BEGIN WITH THE LETTERS A TO M.
AT THIS POINT, NAMELIST /GO1/ VARIABLES CONTAIN VALUES AS IN
THE INPUT FILES.
TO USE THESE VALUES, SUBMIT AN EMPTY NAMELIST /GO1/.
TO OVERRIDE ANY OF THESE VALUES, SUBMIT A NON-EMPTY NAMELIST /GO1/.
SUBMIT NAMELIST /GO1/ IN NAMELIST FORMAT:

  Sgo1 bmh(4)=1.5, cond(5)=1. Send

NAMELIST /GO2/ CONTAINS ALL VARIABLES FOUND IN THE INPUT FILES
THAT BEGIN WITH THE LETTERS N TO Z.
AT THIS POINT, NAMELIST /GO2/ VARIABLES CONTAIN VALUES AS IN
THE INPUT FILES.
TO USE THESE VALUES, SUBMIT AN EMPTY NAMELIST /GO2/.
TO OVERRIDE ANY OF THESE VALUES, SUBMIT A NON-EMPTY NAMELIST /GO2/.
SUBMIT NAMELIST /GO2/ IN NAMELIST FORMAT:

  Sgo2 rts(5)=0., xfr=1.25 Send
```

Figure 10-12. Sample User Terminal Interactive Session (Continued)

NAMelist /SENS/ CONTAINS VARIABLES THAT CONTROL THE
DISPLAY OF THE SENSITIVITY ANALYSIS.
AT THIS POINT, THE TERMINAL DISPLAYS SENSITIVITY WITH
RESPECT TO ONLY GLOBAL SENSITIVITY VARIABLES.
FOR THE SAME TERMINAL DISPLAY, SUBMIT AN EMPTY NAMelist /SENS/.
SUBMIT NAMelist /SENS/ IN NAMelist FORMAT:

```
ssens ldf=6, ldup=6, ldsru=6 Send
```

LCC COMPLETED.

IF YOU WISH TO EXIT, HIT -E-, THEN HIT -RETURN-; OTHERWISE,
ADJUST TERMINAL TO NEW PAGE AND HIT -RETURN-.

(LCC OUTPUT TABLES 1 AND 6)

IF YOU WISH TO EXIT, HIT -E-, THEN HIT -RETURN-; OTHERWISE,
ADJUST TERMINAL TO NEW PAGE AND HIT -RETURN-.

(SENSITIVITY ANALYSIS TABLE)

ANOTHER RUN (Y OR N)-?

y

AT THIS POINT, VARIABLE VALUES ARE AS THEY WERE AFTER LAST
NAMelISTS WERE SUBMITTED. DO YOU WISH TO RESET NAMelist /GO1/ AND
/GO2/ VARIABLES TO THE VALUES FOUND IN THE INPUT FILES (Y OR N)-?

n

MINIMUM OR MAXIMUM PROMPTING (MIN OR MAX)-?

max

Figure 10-12. Sample User Terminal Interactive Session (Continued)

OUTPUT AT TERMINAL (Y OR N)-?

y

OFF-LINE OUTPUT: FULL, PARTIAL, OR NONE (F,P, OR N)-?

P

SUBMIT A TITLE FOR THIS RUN:

second run

SET EXITXX=1 IN ANY NAMELIST IF YOU WANT TO EXIT

NAMELIST /GO1/ CONTAINS ALL VARIABLES FOUND IN THE INPUT FILES THAT BEGIN WITH THE LETTERS A TO M.

AT THIS POINT, NAMELIST /GO1/ VARIABLES ARE AS THEY WERE AFTER THE LAST NAMELIST /GO1/ WAS SUBMITTED.

TO USE THESE VALUES, SUBMIT AN EMPTY NAMELIST /GO1/.

TO OVERRIDE ANY OF THESE VALUES, SUBMIT A NON-EMPTY NAMELIST /GO1/.
SUBMIT NAMELIST /GO1/ IN NAMELIST FORMAT:

sgol send

NAMELIST /GO2/ CONTAINS ALL VARIABLES FOUND IN THE INPUT FILES THAT BEGIN WITH THE LETTER N TO Z.

AT THIS POINT NAMELIST /GO2/ VARIABLES ARE AS THEY WERE AFTER THE LAST NAMELIST /GO2/ WAS SUBMITTED.

TO USE THESE VALUES, SUBMIT AN EMPTY NAMELIST /GO2/.

TO OVERRIDE ANY OF THESE VALUES, SUBMIT A NON-EMPTY NAMELIST /GO2/.
SUBMIT NAMELIST /GO2/ IN NAMELIST FORMAT:

Figure 10-12. Sample User Terminal Interactive Session (Continued)

Sgo2 Send

NAMELIST /SENS/ CONTAINS VARIABLES THAT CONTROL THE
DISPLAY OF THE SENSITIVITY ANALYSIS.
AT THIS POINT, THE TERMINAL SENSITIVITY DISPLAY IS
AS IT WAS ON THE PREVIOUS RUN.
FOR THE SAME TERMINAL DISPLAY, SUBMIT AN EMPTY NAMELIST /SENS/.
FOR A DIFFERENT TERMINAL DISPLAY, SUBMIT A NON-EMPTY NAMELIST /SENS/.
SUBMIT NAMELIST /SENS/ IN NAMELIST FORMAT:

Ssens finc=.20, ldf=0 Send

LCC COMPLETED.

IF YOU WISH TO EXIT, HIT -E-, THEN HIT -RETURN-: OTHERWISE,
ADJUST TERMINAL TO NEW PAGE AND HIT -RETURN-.

(LCC OUTPUT TABLES 1 AND 6)

IF YOU WISH TO EXIT, HIT -E-, THEN HIT -RETURN-: OTHERWISE,
ADJUST TERMINAL TO NEW PAGE AND HIT -RETURN-.

(SENSITIVITY ANALYSIS TABLE)

ANOTHER RUN (Y OR N)-?

n

Figure 10-12. Sample User Terminal Interactive Session (Concluded)

10.5 Operation of the LCC Program in Batch Mode

The SEEK TALK FSED Phase LCC Model may be easily converted from its normal interactive mode of operation to a batch mode by merely storing the appropriate interactive user responses in an internal data file and properly adjusting the assignment of device channel numbers. All other aspects of running the LCC Model would remain the same in batch mode as they are in interactive mode. This procedure is explained in greater detail below. (To avoid redundancy, it is assumed that the reader is familiar with the previous contents of Section 10 of this User's Manual, especially Section 10.4.)

To convert to batch mode, the user should create two internal data files. The first of these files should contain the responses which, in interactive mode, would have been input by the user at the terminal. Channel number 5 should be assigned to this file. The second of these files should just be a dummy file to absorb normal computer-prompted messages which, in interactive mode, are displayed at the user's terminal. The user should assign channel number 6 to this dummy file.

The responses which the user puts in the channel 5 file must be consistent with the description found in Section 10.4 and the illustration found in Figure 10-12. Each user response should be listed on a separate and consecutive line in the data file. For example, the interactive interface between user and computer that is illustrated in Figure 10-12 of Section 10.4 would be equivalently simulated in batch mode by creating the two data files described above. A listing of the first of these data files would then be given by Figure 10-13 below.

Thus the lines in Figure 10-13 contain, in sequence, the user responses to the computer-prompted requests listed in Figure 10-12. The reader should compare the corresponding user inputs between Figure 10-12 and Figure 10-13. In particular, he should note that the first blank line in Figure 10-13 serves as a carriage return response to the computer directive, "IF YOU WISH TO EXIT, HIT -E-, THEN HIT -RETURN-; OTHERWISE, ADJUST TERMINAL TO NEW PAGE AND HIT -RETURN-"., which immediately follows the "LCC COMPLETED" message. The next blank line in Figure 10-13 serves as a carriage return response to the same directive when it is again prompted after the printing of the LCC Output Tables in Figure 10-12.

```

max
y
f
first run
  Sgol bmh(4)=1.5, cond(5)=1. Send
  Sgo2 rts(5)=0., xfr=1.25 Send
  Ssens ldfc=6, ldup=6, ldsru=6 Send
(blank line)
(blank line)
y
n
max
y
p
second run
  Sgol Send
  Sgo2 Send
  Ssens finc=.20, ldfc=0 Send
(blank line)
(blank line)
n

```

Figure 10-13. Data File for Batch Mode Version of Figure 10-12.

Of course, the user responses in Figure 10-12 are not very appropriate for batch mode. In particular, since the output which would go to the user's terminal under interactive mode is just dumped into a "dummy" file in batch mode, this portion of the LCC output should be kept to a minimum. Hence, in batch mode, minimum prompting should be requested and the user response to the question "OUTPUT AT TERMINAL (Y or N)-?" should be "N". In addition, the value of each control variable of the form LDXXX should be left at its default value of 0 by merely leaving these variables out of NAMELIST /SENS/.

Thus a more appropriate set of user responses to be listed in the first additional internal data file under batch mode is illustrated by Figure 10-14 below.

```

min
n
f
first run
  $g01 Send
  $g02 Send
  $sens lderiv=24 Send
(blank line)
(blank line)
y
n
n
p
second run
  $g01 Send
  $g02 xuc=1.25, xfr=.70 Send
  $sens finc=.20 Send
(blank line)
(blank line)
n

```

Figure 10-14. Typical Data File for Batch Mode

Note in Figure 10-14 that minimum prompting is requested on the first run, hence, as described in Section 10.4, this prompting question will not be asked on the second run and therefore no "max" or "min" response is required for the second run. Again, the reader should compare the user responses in Figure 10-14 to the computer prompted sequence of requests which are discussed in Section 10.4.

In batch mode the user may still make as many successive reruns of the LCC Model as he wishes, provided that the responses which he lists in the data file are consistent with the computer prompted requests that are generated. An inconsistent response would terminate the processing of the LCC Model and cause an error message to be displayed on the off-line printer.

10.6 Operation of the RLA Program

The purpose of using the RLA Program is to reach a good decision on the repair level for each ITEM. In terms of the input data to the LCC Program, one is to determine the RL(I) value for each ITEM type I. To do this, the following data files have to be set up as inputs to the RLA Program:

1. Data File 9A - This is to provide the initial RL(I) values set by the user. These values are not used directly in the RLA procedure, but rather they will be checked with the RLA-derived LCRL(I) values to indicate any differences. Also, the COND(I)s on Data File 9A will be checked to see any COND(I)=1., for which LCRL(I) will be automatically set to 3 (discard-on-failure) in the RLA procedure.
2. Data File 8B - This is to provide the LRU/SRU Cross-Reference Data QPA(IL,IS)s.
3. Data File 13 - This is a save file with TIAC(I,R)s provided by 6 special LCC Program runs, which are set up in a consecutive batch mode. The data file for conducting these 6 runs is listed in Figure 10-15. The total ITEM support cost TIAC(I,R)s for global repair strategy R=1,2,--,6 are calculated respectively in these six LCC runs and saved on Data File 13 as an input to the RLA Program.

With these inputs, the RLA Program is executed (in batch mode) to produce the recommended repair level LCRL(I) for each ITEM type I. (See Section 7 for the calculation procedure.) The LCRL(I) value is then used by the Program to replace RL(I) on a copy of Data File 9A (the original Data File 9A will be left intact). The new Data File 9A with the updated RL(I)s can then be used for the final LCC Program run, and any further change on the RL(I)s can still be made through the NAMELIST capability of the LCC Program (the value of the parameter R should be set back to 0 at this time). The user is encouraged to make trial changes to the RLA suggested repair levels. These changes can be based on the user's intuition, sensitivity analysis result, or other information. See Appendix II (II.2-II.5) for a complete RLA example.

min	n
n	n
f	f
first run: R=1	fourth run: R=4
\$g01 Send	\$g01 Send
\$g02 R=1 Send	\$g02 R=4 Send
\$sens Send	\$sens Send
(blank line)	(blank line)
(blank line)	(blank line)
y	y
n	n
n	n
f	f
second run: R=2	fifth run: R=5
\$g01 Send	\$g01 Send
\$g02 R=2 Send	\$g02 R=5 Send
\$sens Send	\$sens Send
(blank line)	(blank line)
(blank line)	(blank line)
y	y
n	n
n	n
f	f
third run: R=3	sixth run: R=6
\$g01 Send	\$g01 Send
\$g02 R=3 Send	\$g02 R=6 Send
\$sens Send	\$sens Send
(blank line)	(blank line)
(blank line)	(blank line)
y	n

Figure 10-15. Data File for Six LCC Runs for RLA

10.7 Description of Model Output Tables

A general description of the LCC Model output was given in Section 9.2.5. Output of the LCC Model can be directed by the user to either "hard-copy" on the off-line printer or to the user's terminal (or both), as described in Section 10.4. An example of the full off-line output of the LCC Model is given in Appendix II. This section gives a table by table explanation of the significance of this output. Since the output displayed at the user's terminal is just a subset of the off-line output (as described in Section 10.4) the description of the output in Appendix II will also cover the output displayed at the terminal.

Note: Since bogus data was used to generate the output in Appendix II, the user should in no way construe that the values displayed are meant to be representative of prospective SEEK TALK system designs.

As illustrated in Appendix II, each listing of output on the off-line printer is preceded by the heading, "SEEK TALK FSED PHASE LCC MODEL", and the title of the current run (i.e., the title submitted at the terminal by the user).

The first component of off-line output of the LCC Model is an echoing of the thirteen standard data input files to LCC Program. As shown in Appendix II, the inputs to these files are listed in thirteen successive tables, where in each table the variable name, a brief definition, and the assigned value of each data parameter is printed out. As mentioned previously, this listing of the values of data parameters allows the user to check that his data was input correctly to the LCC Model. Note that, for all but one input data parameter, the Input Table number in which it is printed in Appendix II is the same as the Data File number in which it is entered into the LCC Model. The only exception to this rule is the parameter NAE(NP) which is printed out in Input Table 4, but whose value must be entered in Data File 5 (see Figure 10-5).

Again with the exception of the parameter NAE(NP), the order in which data input parameters are printed out in input Tables 2 through 11 in Appendix II is the same as the order in which these parameters appear in the corresponding Data Files. (This fact is borne out by comparing Input Tables 2 through 11 in Appendix II with Figures 10-2 through 10-11 in Section 10.2.)

After the thirteen tables of input data to LCC Program, the next section of output to the off-line printer contains the total LCC of the user's SEEK TALK System design, broken down into various categories in seven separate tables. As shown in Appendix II,

Output Table 1 of this section contains a breakdown of the total LCC in six cost groups: RDT&E (FSED only), Equipment Acquisition, Modification/Installation, Initial Support Acquisition, Recurring Support, and Operations. The sum of the first four groups is denoted as Total Investment Cost and the sum of the remaining two groups is called Total Ownership Cost. Within each cost group, the subtotals are further broken down into cost elements. A summary of the numbers of terminals within various equipment categories is exhibited at the end of Output Table 1.

Output Table 2 presents a detailed breakdown of the Modification/Installation Cost Element. It exhibits the non-recurring and recurring mod/installation costs broken down into costs incurred by each individual platform grouping. This table is self-explanatory and is easily interpreted by referring to the equation for platform NP recurring mod/installation cost, RMICA(NP), which is presented in Section 5.2.2. In particular, the "Retrofit Mod/I Total" is the sum over "Field" and "Depot" modifications (i.e., modes M=2 and 3). The "Production Mod/I Total" is the sum for "Production" modifications (i.e., mode M=1).

Output Table 3 presents a breakdown of the top-level Initial Support, Recurring Support, Operations Cost Elements which appeared in Output Table 1. As shown in Appendix II, the Initial Spares cost element is considered as an "Initial" or acquisition cost, while the cost elements, Added Fuel, Operations Labor, Replacement Spares, On-Equipment Maintenance, and Off-Equipment Maintenance are considered as "Recurring" costs. In addition, the cost of purchasing required support equipment is considered an Initial cost, while the cost of maintaining support equipment (at the fraction MSE(L) of unit cost per year) is considered a Recurring cost. The breakdown of the Support Equipment Cost Element into Initial and Recurring costs can be determined by examining its equation in Section 5.2.8. Also, the cost of entering new items in the Air Force depot-level inventory management system (at a cost of IMC dollars per item) is considered an Initial cost, whereas the cost of maintaining items in the inventory at the base and depot levels (at costs of SA and RMC dollars per item per year, respectively) is considered a recurring cost. This separation of cost into Initial and Recurring portions can be determined from the ITEM Inventory Management Cost Element equation which is presented in Section 5.2.9. Similarly, the acquisition of technical orders and type 1 training will incur Initial costs, while the upkeep of technical orders and other training activities will incur recurring costs. Again, these breakdowns of costs can be determined from the equations for Technical Orders and Maintenance Training in Sections 5.2.10 and 5.2.11.

All of the cost elements listed in Output Table 3 have their costs calculated within the computerized LCC Model for each individual base type NS and the depot. Thus, each of these cost elements may be easily divided into costs incurred at the various locations indicated in the table. The base indicators BTYPE(NS) and BPLAT(NS) which appear in Input Table 2 are utilized to perform this allocation of costs. These two indicators are also used to determine the numbers of different bases which appear at the bottom of Output Table 3.

Output Table 4 (in three parts: a, b, & c) in Appendix II illustrated the breakdown of costs and other corrective maintenance characteristics which can be attributed to individual ITEM types. In particular, the first part of the table (4a) presents the value of the ITEM specific costs ISCA(I), RSCA(I), ONMCA(I), OFMCA(I), MTRCI(I), TDC(I), IIMCA(I), and TSECI(I) whose equations appear in Sections 5.2.4, 5.2.5, 5.2.6, 5.2.7, 5.2.9, 5.2.10, 5.2.11, and 5.2.8, respectively. Note that the bottom totals for these columns give the total cost of the Initial Spares, Replacement Spares, On-Equipment Maintenance, Off-Equipment Maintenance, Maintenance Training, Technical Data, ITEM Inventory Management, and Total Support Equipment Cost Elements, respectively. These cost elements also appear in Output Table 3. These columns are then followed by a column of their total (Total ITEM Support Cost) for each I.

The costs in Output Table 4a are presented in thousands of dollars. In addition, the cost elements for Production, Modification/Installation, Operations Labor, and Added Fuel do not appear in Output Table 4a, because these costs are not directly attributable to individual ITEM types.

The column designated "Corrective Maintenance Cost per Failure" holds the average cost of Replacement Spares, On-Equipment and Off-Equipment Maintenance per ITEM failure, i.e., the sum of RSCA(I), ONMCA(I) and OFMCA(I) divided by the number of lifetime failures of ITEM type I which is given in the last column of the second part (4b) of the table. Note that the costs of Initial Spares, Maintenance Training, Technical Data, and ITEM Inventory Management are not included in this figure because the costs in these categories are not incurred in association with individual ITEM failures.

The second part (4b) of the table lists for each ITEM the total number installed in the system, total initial spares at bases, and total initial spares at the depot. Their sum is then listed in the fourth column. The monthly and lifetime failures for each ITEM are presented in the last two columns.

The last part (4c) of the table gives the average corrective maintenance costs per LRU failure and per SRC failure as well as the estimated total numbers of LRU failures system-wide.

Output Table 5 presents costs and requirements for each individual support equipment type L. Recall that, within the LCC Model, common SE which is available on-site may be acquired and costed on a fractional, pro-rated basis, depending on its utilization for SEEK TALK. Thus, the model may charge, say, .25 of such a SE unit to a particular base location or the depot. All SE requirements in the table, however, (except for the depot) are rounded to the nearest integer.

Common SE which requires procurement for SEEK TALK use (i.e., common SE which is not on the Air Force provided list) and peculiar SE must be acquired within the LCC Model in unit quantities. Thus the full unit cost of this SE will be incurred even if this SE is required for very low utilization.

Output Table 6 shows for each platform grouping NP the total number of the platforms system-wide, number of PME terminals and number of TNE terminals per platform, total production cost and total modification/installation cost per platform type.

Output Table 6 also exhibits the average total (series) failure rate per platform of each type NP in terms of both failures per month and per million operating hours. Per terminal failure rates by platform type are also shown and are obtained by dividing the per platform failure rates by the number of terminals per platform (i.e., by $NTRMP(NP)+NTRMT(NP)$).

The per platform failure rates represent the sum of the (series) failure rates of all SEEK TALK ITEMS which are installed on that platform type (i.e., $NITEN(I, NP)$). As mentioned, the total number of platforms within each grouping NP for the SEEK TALK System is also displayed in Output Table 6. By multiplying these numbers by the per platform failure rates, one can obtain the system-wide failure rates of complete platform groupings. Finally, the per terminal mean time (in operating hours) between failures for each platform grouping is given at the end of the table.

Output Table 7 lists for each base type the maintenance manpower requirements per year per base. These requirements are broken down into two areas: manpower for off-equipment maintenance and that for keeping maintenance management data (both in manhours). The sum of the two is listed (in manyears) in the fourth column of the table. And the last two columns of the table show the total manpower

requirements per year per base type, first in manhours and then in manyears. At the end of each of these two columns, it shows the total for all the base types, the total for the depot, and then their sum or the grand total.

Also shown in the lower portion of Output Table 7 are the total manpower requirements for maintenance training. They are listed in manyears for the first year and then for each subsequent year.

The last section of the main output contains the results of the LCC Sensitivity Analysis calculations. As fully described in Section 6, the Sensitivity Analysis calculations yield the average change (either positive or negative) in the total LCC which is produced by a fractional change in the value of each of the factors XUC, XFR, XFPR, BMF/DMF, XRM, PIUP, XMIL, UP(I), FR(I), FPR(I), RM(I), RTS(I), NRTS(I), COND(I), and SRU(I). (LCC sensitivity with respect to SRU(I) actually measures the cost impact of changing ITEM type I from an SRU to an LRU and hence is not associated with a fractional change, see Section 6.2). For a full appreciation of the significance and the limitations of the LCC Sensitivity Analysis calculations, the user should read Section 6 thoroughly. In particular, the user should read through the "Cautions" listed in Section 6.1.

The LCC Sensitivity Analysis Table first gives the changes in LCC produced by a percentage change (equal to FINC) in each of the global scalar factors XUC through XMIL above (listed in the previous paragraph). For the remaining eight factors, which are all subscripted by ITEM type, a specific number of the "most significant" calculations are displayed for each factor. The specific number of calculations displayed for each factor is determined by the values of the control variables LDERV and LDXXX, as described in Section 10.4. Here the "most significant" calculations follow the definitions given in Sections 6.1 and 6.2.

Thus, under the heading for each of the eight subscripted factors in the LCC Sensitivity Analysis Table, the calculations pertaining to individual ITEM types are presented in a column by column fashion in order of decreasing significance (i.e., most significant appear first). In a given column, representing a particular ITEM type, the three values displayed represent, respectively, the index number of the ITEM type, the actual (i.e., not fractional) change in the value of the factor that is used to determine the change in LCC, and the resulting change in LCC produced by the given change in the factor.

Note, in particular, that the change in the value of FR(I), the failure rate of ITEM type I, is expressed in terms of failures per

million operating hours (PPM). Also, the change in the $SRU(I)$ factor is given as 1 if the calculation represents the estimated cost difference produced by changing ITEM type I from an SRU to an LRU. The change in $SRU(I)$ is given as 0 if ITEM type I cannot be changed from an SRU to an LRU (e.g., if it is already an LRU). In addition the change in the value of $RM(I)$, the repair materials factor, is expressed in terms of the change in the cost of repair materials per repair of ITEM type I (i.e., the change in $RM(I)*UP(I)$), rather than just the change in the factor $RM(I)$ itself.

Also note that, for $RTS(I)$, $NRTS(I)$, $COND(I)$, and $SRU(I)$, only negative changes in LCC will appear in the table, indicating a savings in LCC. This is because, for these four factors, "most significant" is defined as largest negative LCC sensitivity analysis calculations. Thus, to facilitate the sorting of most significant sensitivity calculations, positive changes in LCC for these four factors will be zeroed out. For the other four ITEM-specific factors $UP(I)$, $FR(I)$, $FPR(I)$, and $RM(I)$, "most significant" LCC sensitivity analysis calculations are interpreted as meaning those which are largest in absolute value, because these calculations are basically two-sided (again, see "Cautions" in Section 6.1).

Finally, the output printed at the user's terminal by the LCC Model consists only of Output Table 1 (in the exact same format as it appears in Appendix II), Output Table 6 (where the failure rate columns have been deleted) and the Sensitivity Analysis Table. In addition, at the terminal there may be fewer calculations displayed for each of the eight ITEM-specific factors mentioned above, depending again on the values of the control variables $LDERV$ and $LDXXX$, as described in Section 10.4. None of the echoed Input tables or other Output tables will be displayed at the user's terminal.

When the RLA Program is executed, a separate output will be produced. It contains 2 input tables: Input Table 1, a printout of Data File 8B, and Input Table 2, a list of $TIAC(I,R)$ s from Data File 13. The RLA results are contained in Output Table 1, where the recommended repair level for each ITEM is indicated. Also indicated in this output table is whether the recommended repair level for each ITEM is different from that input by the contractor.

APPENDIX I

GLOSSARY OF VARIABLES

One asterisk, *, indicates a new variable not previously defined in the ADM Phase LCC Model. Two asterisks, **, indicate a variable whose definition has been modified for FSED Phase.

- A(I,L)** = Number of pieces of support equipment of type L required in the maintenance of ITEM type I.
(Note: The matrix A should be input in "pointer" form in Data File 10. See instructions in Section 10.2.10) (Contractor input in Data File 10)
- ACF(I,NS) = Average off-equipment maintenance cost in dollars per failure of ITEM type I at base NS
(Internally calculated in Section 5.2.7)
- ACPP* = Average acquisition cost per page for original negatives of technical orders. (Air Force input in Data File 1)
- AFC = Total cost in dollars for the added Fuel Cost component of the Operations Cost Element
(Internally calculated in Section 5.2.3)
- AKIT(IA,NP) = Unit cost for each "A-Kit" required for a modification/installation to area IA on platform type NP, to include all installation material costs not included in "Terminal" costs
(Contractor input in Data File 5)
- AMPM(NP,LO(NS)) = Average prime mission equipment missions per month for platform type NP at a base at location LO(NS). (Air Force input in Data File 3)
- APFH(NP,LO(NS)) = Average operating hours per month for platform type NP deployed at base location LO(NS) (Air Force input in Data File 3)

- B = (secondary) index used to indicate base groupings, primary index for bases is NS
- BAA = Total available active work time per maintenance man in hours/month at a base repair shop (Air Force input in Data File 1)
- BCIS(I) = The number of bases which perform intermediate level repair of ITEM type I (and hence require an inventory of ITEM piece parts) (Internally calculated in Section 5.2.9)
- BCM(H)(I) = Average manhours to perform a base shop bench check, screening and fault verification of the removed ITEM prior to initiating repair action or condemning the ITEM. (Contractor input in Data File 9A)
- BDATA* = Number of additional (beyond those intended for depot use only) distinct pages of system level (not ITEM or support equipment specific) technical orders written for base level maintenance (Contractor input in Data File 1)
- BF = Coefficient in the function F which is used to compute ITEM initial spares requirements (Air Force input in Data File 1)
- BIRD* = Fraction of base-repair-intended failures which are actually repaired at the depot due to insufficient base repair capability. (Air Force input in data File 1)
- BIS(I) = The number of bases which stock spares of ITEM type I (and hence are charged inventory management costs) (Internally calculated in Section 5.2.9)

BLR = Base Maintenance labor rate in dollars per hour.
(Air Force input in Data File 1)

BMF = Base repair maintenance factor, to be applied to
repair times to allow for time to get test
equipment, parts, etc. (Air Force input in File
1)

BMH(I) = Average manhours to perform base-level
corrective maintenance of a failed ITEM of type
I, including fault isolation, repair and
verification. (Contractor input in Data File 9A)

BPLAT(NS) = Indicator of PME platform types supported by base
NS, equals
1, if base NS supports mainly airborne platforms,
2, if base NS supports mainly ground platforms,
3, if base NS supports a mixture of airborne and
ground platforms. (Air Force input in Data File
2)

BRCT = Base repair cycle time, time from removal of a
failed ITEM at a base until ITEM is repaired (at
the same base) and returned to base inventory.
(Air Force input in Data File 1)

BS(I,NS) = Average number of Initial spares of ITEM type I
that are required at each base within base
grouping NS. (Internally calculated in Section
5.2.4)

BTYPE(NS) = Base types indicator; equals:
1. if base NS is an Independent base
2. if base NS is a CIMF
3. if base NS is a Satellite base
(Air Force input in Data File 2)

CFG(LO(NS)) = Cost in dollars per gallon of fuel at operating
location LO(NS) (Air Force input in Data File 1)

CIMF(NS) = CIMF base indicator equals 1 if base NS is a CIMF (Centralized Intermediate-level Maintenance Facility) and equals 0 otherwise. (Internally calculated in Section 5.1.2)

COND(I)** = Fraction of (removed) failures of ITEM type I which are condemned, due to normal wear-out. (The LCC Model will automatically adjust the COND(I) fraction if ITEM type I is occasionally discarded because its next higher assembly has worn-out or is a discard-on-failure assembly) (Contractor input in Data File 9A)

CPA(I) = Corrected piece part count for ITEM type I; equals PA(I) unless ITEM type I is designated as a discard-on-failure ITEM (i.e., COND(I)=1) in which case CPA(I) is set equal to zero (Internally calculated in Section 5.2.9)

CPD1* = Cost per class per day for type 1 training. (Contractor input in Data File 1)

CPD2* = Cost per class per day for type 2 training. (Air force input in Data File 1)

CPPC = Average one way packing & shipping cost in dollars per (net weight) pound from a satellite base to its associated CIMF (including an adjustment to allow for ratio of packaged weight to unpackaged weight) (Air Force input in Data File 1)

CPPD(LO(NS)) = One-way packing & shipping cost in dollars per (net weight) pound from a base at location LO(NS) to the depot (including an adjustment to allow for the ratio of packaged weight to unpackaged weight) (Air Force input in Data File 1)

CRCT = CIMF repair cycle time, time from removal of a failed ITEM at a satellite base until it is shipped to and repaired at the associated CIMF and placed in CIMF inventory. (Air Force input in Data File 1)

CSE(L)** = Unit cost of SE type L (including an allowance for initial spares) in dollars. It does not include a pro rata portion of hardware development cost or software development cost. (Contractor input in Data File 7)

DAA = Total available active work time per maintenance man in hours/month at a depot repair shop (Air Force input in Data File 1)

DAD = Average depot handling and repair time in months from removal of a failed ITEM at the depot until it is repaired and placed in depot inventory. (Air Force input in Data File 1)

DATAB(I)* = Number of additional distinct pages of technical orders required for base repair of ITEM type I. (Contractor input in Data File 9B)

DATAD(I)* = Number of additional distinct pages of technical orders required for repair of ITEM type I and written for depot use only. (Contractor input in Data File 9B)

DATAS(L)* = Number of additional distinct pages of technical orders required for use of support equipment type L and not including any documentation which may be included in the unit cost of L. (Contractor input in Data File 7)

DDATA* = Number of distinct pages of system level (not ITEM or support equipment specific) technical orders intended for depot maintenance only. (Contractor input in Data File 1)

DLR = Depot maintenance labor rate in dollars per hour. (Air Force input in Data File 1)

DMF = Depot repair maintenance factor, to be applied to repair times to allow for time to get test equipment, spare parts, etc. (Air Force input in Data File 1)

DMH(I) = Average manhours to perform depot-level corrective maintenance on a failed ITEM of type I, including bench check-out, screening, fault verification and isolation, repair action and repair verification. (Contractor input in Data File 9A)

DRAG(NP) = Average drag per added antenna element (in lbs.) for platform type NP (Contractor input in Data File 4)

DRCT(LO(NS)) = Depot repair cycle time in months from shipment of a failed ITEM from base NS to the depot until it is received & repaired at the depot and placed in depot inventory (as a function of the location LO(NS) of base NS). (Air Force input in Data File 1)

DS(I) = Number of Initial spares of ITEM type I that are required at the depot. (Internally calculated in Section 5.2.4)

EBCBI(I,NS)* = Expected intermediate-level maintenance manhours per month expended at a base of type NS in bench-checking of ITEM type I. (Internally calculated in Section 5.1.3)

- EQ(I) = ITEM equipment identifier equals:
 1, if ITEM type I is a PME component only,
 2, if it is a TNE component only,
 3, if it is a component of both PME and TNE
 (Contractor input in Data File 8A)
- ERHAB(L,NS) = Expected utilization of support equipment type L
 at a base of type NS in hours per month.
 (Internally calculated in Section 5.1.3)
- ERHAD(L) = Expected utilization of support equipment type L
 at the depot in hours per month. (Internally
 calculated in Section 5.1.3)
- ERHBI(I,NS)** = Expected intermediate-level maintenance manhours
 per month expended at a base of type NS in
 maintenance of ITEM type I. (Internally
 calculated in Section 5.1.3)
- ERHD(I) = Expected manhours per month expended at the
 depot in the repair of ITEM type I. (Internally
 calculated in Section 5.1.3)
- ERTBI(I,NS)* = Expected intermediate-level maintenance manhours
 per month expended at a base of type NS in repair
 of ITEM type I. (Internally calculated in
 Section 5.1.3)
- F = Function used to compute the number of Initial
 Spares (including safety stock) required to
 support each ITEM, specifically, for any number
 X, F(X) is defined as

$$F(X) = X + BF \cdot \sqrt{X}$$

where the coefficient BF determines the confidence
 level for safety spares (e.g., BF=1.65 yields a
 95 percent confidence level) (See Section 5.2.4)

FAIL(I,NS) = Average number of failures (not including repairs in place or false pulls) of ITEM type I per month at each base of type NS. (Internally calculated in Section 5.1.1)

FGH(NP) = Average fuel consumption in gallons per operating hour (without extra drag) for platforms in group NP. (Air Force input in Data File 3)

FINC = Fractional increase applied to those data input parameters for which LCC Sensitivity Analysis is provided. (Interactive data input in NAMELIST /SENS/) (default value =.25)

FPR(I) = False pull rate for ITEM for type I; i.e., that multiple of actual failures which are removed but haven't failed. FPR(I) should be calculated so as to satisfy the equation:

(# of removals) = (1 + FPR(I)) (# of failures).

e.g., if, out of every 125 removals of ITEM type I, there are, on the average, only 100 actual failures, then FPR(I)=.25. (We assume that only LRUs have non-zero false pull rates.) (Contractor input in Data File 9A)

FR(M,NP) = The fraction of all platforms of type NP which undergo modification/installation in mode M (Air Force input in Data File 4)

FSEDC* = Cost of full scale engineering development. (Contractor input in Data File 1)

GFE(I)** = Air Force furnished equipment indicator, equals:
 1, if ITEM type I is already in the Air Force inventory, and does not require modification for incorporation in SEEK TALK.
 2, if ITEM type I is already in the inventory, but does require modification.
 3, if ITEM type I is new equipment (Contractor input in Data File 8A)

HPD1* = Number of inclass hours per day for a type 1 training class. (Contractor input in Data File 1)

HPD2* = Number of inclass hours per day for a type 2 training class. (Air Force input in Data File 1)

I = Index used to indicate ITEM type

IA = Index used for various modification/installation areas on platforms. Values are:
 1, to indicate Antenna area
 2, to indicate Electronics Box area
 3, to indicate Control H area
 4, to indicate Cabling area

IIMC = Total cost in dollars for the ITEM Inventory Management Cost Element (Internally calculated in Section 5.2.9)

IIMCA(I) = Total lifetime ITEM Inventory Management Costs in dollars for ITEMS of type I (and their piece parts) (Internally calculated in Section 5.2.9)

IL* = Index used in place of I to distinguish LRU's for purposes of repair level analysis.

IMC = Initial inventory management cost in dollars to introduce a new procurable part into the Air Force inventory system. (Air Force input in Data File 1)

IMICA(NP) = Total non-recurring modification/installation development cost in dollars for platforms within grouping NP (Internally calculated in Section 5.2.2)

INTEG(I) = Integration ITEM indicator, equal 1 if ITEM type I is an "Integration Item", i.e., not an integral component of a "Terminal", and equals 0 otherwise. (Contractor input in Data File 8A)

IPCF(I) = Average cost per failure of ITEM type I which is met by repair-in-place, including the costs of both manhours and replacement parts. (Contractor input in Data File 9A)

IS* = Index used in place of I to distinguish SRU's for purposes of repair level analysis.

ISC = Total cost in dollars for the Initial Spares Cost Element. (Internally calculated in Section 5.2.4)

ISCA(I) = Total cost in dollars for the Initial spares of ITEM type I that are required at all locations, i.e., at all bases plus the depot (Internally calculated in Section 5.2.4)

ISET(L,NS)** = Maximum number of copies of support equipment type L required for any maintenance action which will be performed at a base of type NS. (Internally calculated in Section 5.1.3)

ISETD(L)** = Maximum number of copies of support equipment type L required for any maintenance action which will be performed at the depot. (Internally calculated in Section 5.1.3)

ITEM = Any component within the SEEK TALK system which is either an LRU or SRU, Piece Parts excluded.

IUT(I) = ITEM utilization indicator; equals 1 if a spare of ITEM type I is ever required anywhere in the SEEK TALK system (so that depot level inventory management costs are incurred) and equals 0 otherwise (Internally calculated in Section 5.2.9)

K(NP) = Coefficient in thrust-fuel consumption equation for platform type NP (Air Force input in Data File 4)

KFAC(LE(NP))** = The reliability factor used to convert predicted failure rates to operational failure rates as a function of the environment LE(NP) of the host platform NP. (See Section 8.2) (Air Force input in Data File 1)

L = Index used to indicate support equipment type (or grouping)

LDERV = Sensitivity Analysis control parameter. Equals the minimum number of LCC Sensitivity Analysis calculations that are to be printed out off-line for each of the eight ITEM-specific parameters for which LCC Sensitivity Analysis is provided. (interactive data input in NAMELIST /SENS/) (default value=12) (See Section 10.4)

LDXXX = Stands for any of the control variables LDUP, LDFR, LDFPR, LDRM, LDRTS, LDNRTS, LDCOND, LDSRU. If XXX(I) is any one of the eight ITEM-specific factors UP(I), FR(I), FPR(I), ..., SRU(I), then the value of LDXXX specifies the number of LCC Sensitivity Analysis calculations for that factor which are to be displayed at the user's terminal. (Interactive input in NAMELIST /SENS/) Default value=0) (See Section 10.4)

LE(NP) = Operating environment of platform type NP, identified by
 1, Airborne-Fighter
 2, Airborne-Cargo
 3, Ground-Fixed/Transportable
 4, Ground-mobile/manpacks
 (Air Force input in Data File 3)

LO(NS) = Location of base NS, designated by:
 1, for CONUS bases
 2, for PACIFIC bases
 3, for European bases
 (Air Force input in Data File 2)

LRU = Acronym for "line replaceable unit", i.e., an assembly which can be removed and replaced to accomplish organizational level repair.

LRU(I) = LRU indicator, equal 1 if ITEM type I is an LRU and equals 0 otherwise (Contractor input in Data File 8A)

M = Index for mode in which platform Modification and SEEK TALK Installation is performed, identified by:
 1, if MOD/I performed during platform production
 2, if MOD/I performed in the field (by a depot team)
 3, if MOD/I performed at the depot

MIC = Total cost in dollars for the Modification/Installation Cost Element (Internally calculated in Section 5.2.2)

MIFIX(M, NP) = The fixed modification/installation cost in dollars for platform type NP in mod/installation mode M, meant to cover the cost of platform preparation for the mod/installation and the subsequent restoration (Contractor input in Data File 5)

MILR(M) = Modification/installation labor rate in dollars per manhour for mode M mod/installations (Air Force input in Data File 1)

MIMH(IA,M,NP) = Average manhours to perform a mod/installation to area IA on platform type NP in mode M (Contractor input in Data File 5)

MMPD(NP,LO(NS)) = Timing net minutes of operator labor per day for platform type NP deployed at a base at location LO(NS) (Contractor input in Data File 3)

MMPM(NP) = Prime mission equipment minutes of operator labor per mission for platform type NP to cover initial activation of PME terminals (Contractor input in Data File 3)

MRF* = Average manhours per failure to complete off-equipment maintenance records. (Air Force input in Data File 1)

MRO* = Average manhours per failure to complete on-equipment maintenance records. (Air Force input in Data File 1)

MSE(L)** = The yearly cost of maintaining a piece of Support Equipment (SE) of type L (considering both labor and replacement spares) expressed as a fraction of its unit cost CSE(L). (Contractor input in Data File 7)

MTRC* = Total cost in dollars for the Maintenance Training Cost Element. (Internally calculated in Section 5.2.11)

MTRCI(I)* = Pro rata part of Maintenance Training Cost attributed to ITEM type I. (Internally calculated in Section 5.2.11)

MUSE = Minimum fractional utilization threshold for considering additional support equipment (SE) costs in Sensitivity Analysis Calculations, i.e., if a peculiar or common/requiring procurement SE unit is utilized less than the fraction MUSE of its available hours, then additional use of this SE unit will produce no predicted added cost in Sensitivity Analysis Calculations (Air Force input in Data File 1)

NAE(NP) = Number of added antenna elements required for SEEK TALK installation on platform type NP (Contractor input in Data File 5)

NBC(NS) = For satellite bases, equals the number of bases of type NS which occur within the CIMF system which contains base NS (and equals zero if NS is an independent base or a CIMF) (Air Force input in Data File 2)

NDS(IL)* = Number of distinct SRU's contained in one LRU of type IL. (Used to input the matrix QPA(IL,IS) in "pointer form" in Data File 8B) (see instructions in Section 10.)

NFB(I,NS) = Average number of ITEMS of type I in the base type NS pipeline, i.e., the average number of ITEMS of type I which are awaiting maintenance action or replacement in supply at base NS. (Internally Calculated in Section 5.1.2)

NFD(I) = Average number of ITEMS of type I in the depot pipeline, i.e., the average number of ITEMS of type I which are awaiting maintenance action or replacement in supply at the depot. (Internally Calculated in Section 5.1.2)

NHB(NS) = For satellite bases of type NS, equals the index of the CIMF base on which it is dependent. Equals 0 if base NS is not a satellite base. (Air Force input in Data File 2)

NHI(I) = Equals 0 if ITEM of which ITEM type I is an LRU and, for SRUs, equals the index number of the next higher level indented ITEM type I is a component (if an SRU is contained in several larger assemblies, choose the index number of the most common occurrence). (Contractor input in Data File 8A)

NITEM(I,NP) = Average number of ITEMS of type I installed on each platform within grouping NP. (Internally calculated in Section 5.1.1)

NITEMR(I,NP) = ITEM configuration for platforms within grouping NP. If ITEM I is an integration ITEM (INTEG(I) = 1), NITEMR(I,NP) defines number of ITEMS I per platform; otherwise (INTEG(I) = 0), NITEMR(I,NP) defines number of ITEMS I per terminal. (Contractor input in Data File 11)

NJA(I) = The number of different support equipment types (i.e., different values of L) required in the repair of ITEM type I (used to input the matrix A(l,L) in "pointer form" in Data File 10) (See instructions in Section 10.2.10)

NP = Index used to indicate platform groupings

NPLT(NP,NS) = Average number of platforms of type NP deployed at each base of type NS (Air Force input in Data File 6)

NRMI(NP)* = Total cost of non-recurring mod/installation for the installation of SEEK TALK equipment into platforms of type NP. This should account for costs of non-recurring engineering to design, develop, integrate, test, and qualify the required installation; prototype group A kits required to develop the mod/installation; non-recurring testing (including ground testing and flight testing) necessitated by the mod/installation; proofing activities necessitated by the mod/installation including one production group A kit and the engineering manpower required to install, approve, and/or revise the design of the mod/installation; non-recurring data required for the mod/installation. (Contractor input in Data File 4)

NRTS(I) = Fraction of (removed) failures of ITEM type I which must be repaired at the depot level. (The LCC model will automatically adjust the NRTS(I) fraction to include those intermediate-level repairs of ITEM type I which must be performed at the depot due to circumstance, e.g., if ITEM type I is an SRC and its higher LRU is depot repaired for some proportion of its failures (Contractor input in Data File 9A)

NS = Index used to indicate base groupings

NSEB(L,NS) = Number of copies of support equipment type L required at each base of type NS (fractional utilization of common SE is allowed) (Internally Calculated in Section 5.1.3)

NSED(L) = Number of copies of support equipment type L required at the depot (Internally Calculated in Section 5.1.3)

NTRMP(NP) = Average number of PME terminals installed on platforms within type NP (Air Force input in Data File 4)

NTRMT(NP) = Average number of timing net equipment (TNE) terminals installed on platforms within type NP (Contractor input in Data File 4)

OC = Total cost in dollars for the Operations Cost Element (Internally calculated in Section 5.2.3)

OFMC = Total cost in dollars for the Off-Equipment Maintenance Cost Element (Internally calculated in Section 5.2.7)

OFMCA(I) = Total Off-Equipment Maintenance Cost in dollars due to repairs of ITEMS of type I (Internally calculated in Section 5.2.7)

OLC = Total cost in dollars for the Operational Labor Cost component of the Operations Cost Element (Internally calculated in Section 5.2.3)

OLCP = Total Operational Labor Cost in dollars due to requirements for initial activation of PME terminals (Internally calculated in Section 5.2.3)

OLCT = Total Operational Labor Cost in dollars due to timing net equipment operation (Internally calculated in Section 5.2.3)

ONMC = Total cost in dollars for the On-Equipment Maintenance Cost Element (Internally calculated in Section 5.2.6)

ONMCA(I) = Total Lifetime cost in dollars for all On-Equipment Maintenance actions on ITEMS of type I (Internally calculated in Section 5.2.6)

OST(LO(NS)) = Average order & shipping time from a base NS to the depot (as a function of the location of the base LO(NS)), i.e., the time (in months) from when a replacement ITEM is ordered from the depot until it is received and placed in base serviceable stock (Air Force input in Data File 1)

OSTC = Average order & shipping time in months from a satellite to its associated CIMF (Air Force input in Data File 1)

PA(I) = Number of subassemblies or piece parts within ITEM type I which would be added to the Government inventory system if ITEM type I were repaired in the system (Contractor input in Data File 8A)

PAL1* = Average daily pay and allowance during training for a type 1 trainee. (Air Force input in Data File 1)

PAL2B* = Average daily pay and allowance during training for a type 2 base trainee. (Air Force input in Data File 1)

PAL2D* = Average daily pay and allowance during training for a type 2 depot trainee. (Air Force input in Data File 1)

PDIV(NP) = Factor defining total effective number of types of platforms in platform grouping NP. (Air Force input in Data File 4)

PIUP = Operational lifetime in years of the SEEK TALK system (Air Force input in Data File 1)

PME = Acronym for "prime mission equipment", not including timing net equipment

PMLR = Prime mission equipment operator labor rate in dollars per hour (Air Force input in Data File 1)

PMTBF(I,LE(NP))* = Predicted mean operating time in hours between failures over the life cycle, for an ITEM of type I operating in environment LE(NP), including maintenance actions involving repair-in-place. The calculation of PMTBF(I,LE(NP)) should be made on the basis of the series (i.e., not system) failure rate of ITEM type I and should include an adjustment for "duty-cycle", as indicated in MIL HDBK 217C (See Section 8.3.8) (Contractor input in Data File 9A)

PRODC = Total cost in dollars for the Production Cost element (Internally calculated in Section 5.2.1)

PSESW(I)* = Partition of SE software development cost for ITEM type I (SESW(I)). It is specified by a series of pairs of numbers, where each pair represents index L of SE and the fraction of SESW(I) applicable to L (Contractor input in Data File 9B)

QPA(IL,IS)* = Number of units of SRC type IS contained in one unit of LRU type IL. (Note: The matrix QPA(IL,IS) should be input in "pointer form" in Data File 8B. See instructions in Section 10.2.) (Contractor input in Data File 8B)

QSA(I,K)** = A three digit code whose units digit equals the number of copies of the Kth support equipment type that is required for a maintenance action on ITEM type I, and whose hundreds digit indicates the nature of the maintenance action for which this SE is required. The K stands for the order that the SE type is listed in Data File 10 and not the SE index number. (Used to input matrices A(I,L) and SECODE(I,L) in "pointer form" in Data File 10) (See instructions in Section 10.2.10)

QTYP1* = Number of trainees for type 1 training. (Air Force input in Data File 1)

QTYP2B* = Initial number of base trainees for type 2 training. (Air Force input in Data File 1)

QTYP2D* = Initial numbers of depot trainees for type 2 training. (Air Force input in Data File 1)

R* = Global repair strategy indicator primarily used to generate the input file necessary for the Repair Level Analysis program. The value of R automatically sets ITEM repair levels according to the following scheme:

<u>R</u>	<u>All LRUs</u>	<u>All SRUs</u>
0	as input by user	as input by user
1	base repair	base repair
2	base repair	depot repair
3	base repair	discard on failure
4	depot repair	depot repair
5	depot repair	discard on failure
6	discard on failure	discard on failure

(Contractor input in Data File 1)

RCP** = Technical order reproduction cost per copy per page. (Air Force input in Data File 1)

RIP(I) = Fraction of maintenance actions on ITEM type I which are met by repair-in-place with piece parts. (Contractor input in Data File 9A)

RL(I)* = Repair level code for ITEM type I;
 = 0 if initially input RTS (I), NRTS(I), and COND(I) values are to be used;
 = 1 If RTS(I), NRTS(I), and COND(I) are to be internally calculated to represent base repair of ITEM I;
 = 2 if RTS(I), NRTS(I), and COND(I) are to be internally calculated to represent depot repair of ITEM I;
 = 3 if RTS(I), NRTS(I), and COND(I) are to be internally calculated to represent discard-on-failure of ITEM I.
 (Contractor input in Data File 9A)

RM(I) = Repair materials factor for ITEM type I, equals the fraction of UP(I) that is consumed (in piece parts below the ITEM indenture level) in the repair of ITEM type I (Contractor input in Data File 8A)

RMC = Recurring annual inventory management cost in dollars to maintain an ITEM or piece part in the depot-level Air Force inventory system (Air Force input in Data File 1)

RMH(I) = Average number of manhours required to remove and replace a failed ITEM of type I from its host platform. (Applies only to LRUs). Should include time spent in isolating a failure to the ITEM, removing the ITEM, installing a replacement ITEM, and in verifying restoration of the system to operational status. (Contractor input in Data File 9A)

RMICA(NP) = Average recurring modification/installation cost in dollars per platform within grouping NP (Internally calculated in Section 5.2.2)

RSC = Total cost in dollars of the Replacement Spares Cost Element (Internally calculated in Section 5.2.5)

RSCA(I) = Total lifetime cost due to ITEMS of type I for Replacement Spares (including repair materials costs) (Internally calculated in Section 5.2.5)

RTS(I) = Fraction of removed failures (i.e., failures not repaired-in-place) of ITEM type I which can be repaired at the intermediate level, assuming that the ITEM has been removed from its next higher assembly at the intermediate level. (The LCC model will automatically correct the RTS(I) fraction to account for that proportion of failures under which the ITEM is not available for repair at the intermediate level, e.g., if the ITEM is an SRU and its higher LRU is depot-repaired or condemned-on-failure.) (Contractor input in Data File 9A)

SA = Recurring annual cost in dollars to maintain a line item or piece part in a base-level inventory system (Air Force input in Data File 1)

SAT(NS) = Satellite base indicator, equals 1 if base NS is a satellite base and equals 0 otherwise. (Internally Calculated in Section 5.2.7)

SEC = Total cost in dollars for the Support Equipment Cost Element (Internally calculated in Section 5.2.8)

SECI(I)* = Pro rata part of Support Equipment Cost attributed to ITEM type I. (Internally calculated in Section 5.2.8)

SECODE(I,L)* = Requirement indicator for support equipment type L with respect to ITEM type I;

- = 0 if SE type L not required for any maintenance of ITEM type I;
- = 1 If SE type L required for repair but not base shop bench check of ITEM type I;
- = 2 if SE type L required for both repair and base shop bench check of ITEM type I;
- = 3 if SE type L required for base shop bench check but not repair of ITEM type I.

(Note: The matrix SECODE(I,L) should be input in "pointer form" in Data File 10. See instructions in Section 10.2.) (Contractor input in Data File 10)

SED(L)* = Development cost associated with SE type L. The cost should be zero if the SE is common. (Contractor input in Data File 7)

SEDC* = Total SE development cost. (Internally calculated in Section 5.2.8.2)

SESW(I)* = Software development cost for SE used in the maintenance of ITEM type I. (Contractor input in Data File 9B)

SESWC* = Total software development cost for SE. (Internally calculated in Section 5.2.8.3)

SETYPE(L) = Equals 1 if support equipment type L is common and available on-site (refer to Air Force-provided list of this SE), equals 2 if support equipment type L is common but requires procurement for SEEK TALK use, and equals 3 if SE type L is peculiar (Contractor input in Data File 7)

SPC1* = Maximum number of students per type 1 training class. (Contractor input in Data File 1)

SPC2* = Maximum number of students per type 2 training class. (Air Force input in Data File 1)

SR* = Average manhours per failure to complete supply transaction records. (Air Force input in Data File 1)

SRU = Acronym for "shop replaceable (or repairable) unit, i.e., a component which is usually only removable (from an LRU or another SRU) and repairable in a shop (at either base or depot level), e.g., LRU repair may consist of removing and replacing an internal SRU. The SRU itself may then also be repairable.

STDC* = Total cost in dollars of the Technical Orders Cost Element. (Internally calculated in Section 5.2.10)

TDC(I)* = The pro rata part of Technical Orders Cost attributed to ITEM type I (Internally calculated in Section 5.2.10)

TDXXX = Stands for any of the LCC Sensitivity Analysis variables TDUC, DXFR, DXFPR, DDMF, DXRM, DPIUP, DXMIL, DUP(I), DFR(I), DFPR(I), DRM(I), DRTS(I), DNRTS(I), DCOND(I), DSRU(I). In general terms, TDXXX represents the estimated change in LCC that would occur if the parameter XXX were to increase by a fractional amount FINC, where XXX can be any of the factors XUC, XFR, ..., NRTS(I), COND(I). In addition, DSRU(I) represents the change in LCC that would result from changing ITEM type I from an SRU to an LRU. (Internally calculated in Section 6)

TEFM* = Cost in dollars of equipment, facilities, and manuals required for all training and not accounted for by any other Cost Element of the Model. (Type 2 training facilities should not be included.) (Contractor input in Data File 1)

TFAC(NP) = Average fraction of operating time that SEEK TALK equipment on platform type NP is activated (Air Force input in Data File 3)

THRS(NP) = Average thrust in lbs. generated by platform type NP (airborne platforms only). (Air Force input in Data File 3)

TIAC(I,R)* = Total repair-level-dependent cost attributed to ITEM type I by global maintenance strategy R (for non-zero values of R only). This represents a sum of ITEM-specific cost elements and pro rata portions of shared resources. (Internally calculated in Section 5.1.4)

TIME1(I)* = The number of additional hours of type 1 training added for ITEM type I (Contractor input in Data File 9B)

TNB(NS) = Total number of bases within the SEEK TALK system which are (treated as being) identical to base NS (Air Force input in Data File 2)

TNE = Acronym for "timing net equipment" (as distinguished from PME or "prime mission equipment")

TNLR = Timing net operator labor rate in dollars per hour (Air Force input in Data File 1)

TORB* = Turnover rate for base avionics maintenance personnel; the fraction of this work force leaving the Air Force (and replaced) per year. (Air Force input in Data File 1)

TORD* = Turnover rate for depot avionics maintenance personnel; the fraction of this work force leaving the Air Force (and replaced) per year. (Air Force input in Data File 1)

TR* = Average manhours per failure to complete transportation transaction forms. (Air Force input in Data File 1)

TRAV1D* = Average individual roundtrip travel expense for travel of type 1 and type 2 depot trainees to and from the relevant training facilities. (Air Force input in Data File 1)

TRAVB* = Average individual roundtrip travel expense for travel of type 2 base trainees to and from the type 2 training facility. (Air Force input in Data File 1)

TSECI(1)* = Total pro rata part of the SE cost attributed to ITEM type I. (Internally calculated in Section 5.2.8)

TUPP(NP) = Average unit cost in dollars of PME terminals (including all Full-up, Partial, and Modem-only configurations) installed on platforms within grouping NP (Contractor input in Data File 4)

TUPT(NP) = Average unit cost in dollars of timing net terminals installed on platforms of type NP (Contractor input in Data File 4)

TYP2TF* = Ratio of type 2 training time to type 1 training time when the same course material is covered in both. (Air Force input in Data File 1)

U = Unit step function used to indicate positive quantities, i.e., for any number X, $U(X) = 1$ for $X > 0$, and $U(X) = 0$ otherwise

UCPP* = Annual technical order upkeep cost per distinct page of original technical orders. (Air Force input in Data File 1)

UP(I) = Unit cost in dollars for ITEM type I (Contractor input in Data File 8A)

USE(L,NS) = Support equipment indicator used for LCC sensitivity analysis calculations. Equals 0 if SE type L is purchased for base NS (as a whole unit) and is underutilized (so that additional use generates no extra cost) and equals 1 otherwise. (Internally calculated in Section 6.1.4)

USED(L) = Support equipment indicator used for LCC sensitivity in the same manner as USE(L,NS), except refers to SE type L purchased for the depot (Internally calculated in Section 6.1.4)

WT(I) = Net weight of ITEM type I in pounds (Contractor input in Data File 8A)

XFPR = False pull rate multiplier factor. May be used to globally adjust all ITEM false pull rates in LCC sensitivity analyses or sytem trade-off studies (Must be set equal to 1, in Data File 1, in all Air Force submissions)

XFR = Failure rate multiplier factor. May be used to globally adjust all ITEM failure rates in LCC sensitivity analyses or system trade-off studies (Must be set equal to 1, in Data File 1, in all Air Force submissions)

XMIL = Mod/installation labor manhours multiplier factor. May be used to uniformly adjust all mod/installation labor manhour estimates for LCC sensitivity analysis or system trade-off studies (Must be set equal to 1, in Data File 1, in all Air Force submissions)

XUC = Unit cost multiplier cost multiplier factor. May be used to globally adjust all ITEM and Terminal unit costs in LCC sensitivity analyses or system trade-off studies (must be set equal to 1, in Data File 1, in all Air Force submissions)

APPENDIX II

ILLUSTRATIVE COMPUTER RUNS

	<u>Page</u>
II.1 Initial LCC Run	256
II.2 Six Special LCC Runs for RLA Input	284
II.3 RLA Run	309
II.4 Final LCC Run (incorporating RLA results)	313
II.5 LCC Summary and Adjusted Final LCC Run	318

Note: Since bogus data was used to generate the output in this appendix, the user should in no way construe that the values displayed are meant to be representative of prospective SEEK TALK system designs.

II.1 Initial LCC Run

LCC Input Tables 1, 2, 3, 4, 5, 6, 7, 8A, 9A, 9B, 10, 11

LCC Output Tables 1, 2, 3, 4A, 4B, 4C, 5, 6, 7

LCC Sensitivity Analysis Table

```
*****  
* SEEK TALK FSED PHASE LCC MODEL *  
* * * * *  
* RUN: INITIAL RUN *  
* * * * *  
*****
```

INPUT TABLE 1: SYSTEM-WIDE SCALAR PARAMETERS

GOVERNMENT-PROVIDED PARAMETERS

LABOR FACTORS

BAA - MONTHLY AVAILABLE WORKING HOURS PER MAINTENANCE MAN AT BASE LEVEL	168.00
BMF - BASE MAINTENANCE FACTOR	1.50
DAA - MONTHLY AVAILABLE WORKING HOURS PER MAINTENANCE MAN AT DEPOT LEVEL	168.00
DMF - DEPOT MAINTENANCE FACTOR	1.50
HPD2 - NUMBER OF HOURS SPENT BY A TYPE 2 TRAINEE IN CLASS PER DAY	8
MRO - AVERAGE MANHOURS PER FAILURE TO COMPLETE ON-EQUIPMENT MAINTENANCE RECORDS	0.08
MRF - AVERAGE MANHOURS PER FAILURE TO COMPLETE OFF-EQUIPMENT MAINTENANCE RECORDS	0.24
SR - AVERAGE MANHOURS PER FAILURE TO COMPLETE SUPPLY TRANSACTION RECORDS	0.25
TORB - TURNOVER RATE FOR BASE MAINT. PERSONNEL	0.33
TORD - TURNOVER RATE FOR DEPOT MAINT. PERSONNEL	0.07
TR - AVERAGE MANHOURS PER FAILURE TO COMPLETE TRANSPORTATION TRANSACTION FORMS	0.16

LABOR RATES

BLR - BASE MAINTENANCE LABOR RATE IN \$ PER HOUR	35.54
DLR - DEPOT MAINTENANCE LABOR RATE IN \$ PER HOUR	38.27
MILR(1) - MOD/INSTALLATION LABOR RATE DURING PRODUCTION IN \$ PER HOUR	29.85
MILR(2) - MOD/INSTALLATION LABOR RATE FOR FIELD MODS USING DEPOT TEAM IN \$ PER HOUR	44.01
MILR(3) - MOD/INSTALLATION LABOR RATE FOR MODS PERFORMED AT THE DEPOT IN \$ PER HOUR	38.27
PAL1 - AVERAGE DAILY PAY & ALLOWANCE FOR A TYPE 1 TRAINEE	80.00
PAL2B - AVERAGE DAILY PAY & ALLOWANCE FOR A TYPE 2 TRAINEE	50.00
PAL2D - AVERAGE DAILY PAY & ALLOWANCE FOR A TYPE 2 DEPOT TRAINEE	60.00
PMLR - PRIME MISSION EQUIP OPER LABOR RATE IN \$ PER HOUR	27.75
TRAV1D - AVERAGE TRAVEL EXPENSE FOR TYPE 1 AND TYPE 2 DEPOT TRAINEES	200.00
TRAVB - AVERAGE TRAVEL EXPENSE FOR TYPE 2 BASE TRAINEES	300.00
TNLR - TIMING NET OPERATOR LABOR RATE IN \$ PER HOUR	27.75

INPUT TABLE 1: SYSTEM-WIDE SCALAR PARAMETERS
(CONTINUED)

PIPELINE TIMES

BRCT - BASE REPAIR CYCLE TIME IN MONTHS	0.132
CRCT - TIME FOR FAILURE AT SATELLITE BASE UNTIL REPAIR AT CIMF BASE IN MONTHS	0.500
DAD - TIME FROM FAILURE REMOVAL AT DEPOT UNTIL REPAIR AT DEPOT IN MONTHS	0.132
DRCT(1) - TIME FROM FAILURE AT CONUS BASE UNTIL REPAIR AT DEPOT IN MONTHS	1.900
DRCT(2) - TIME FROM FAILURE AT PACIFIC BASE UNTIL REPAIR AT DEPOT IN MONTHS	1.900
DRCT(3) - TIME FROM FAILURE AT EUROPE BASE UNTIL REPAIR AT DEPOT IN MONTHS	1.900
OST(1) - ORDER AND SHIPPING TIME FROM CONUS BASE TO DEPOT IN MONTHS	0.394
OST(2) - ORDER AND SHIPPING TIME FROM PACIFIC BASE TO DEPOT IN MONTHS	0.525
OST(3) - ORDER AND SHIPPING TIME FROM EUROPE BASE TO DEPOT IN MONTHS	0.526
OSTC - ORDER AND SHIPPING TIME FROM A SATELLITE BASE TO ITS CIMF BASE IN MONTHS	0.250

UNIT COST FACTORS

ACPP - ACQUISITION COST PER PAGE FOR ORIGINAL NEGATIVES OF TECH. DATA	348.000
CFG(1) - COST OF FUEL IN \$ PER GALLON AT CONUS BASES	1.180
CFG(2) - COST OF FUEL IN \$ PER GALLON AT PACIFIC BASES	1.180
CFG(3) - COST OF FUEL IN \$ PER GALLON AT EUROPE BASES	1.180
CPD2 - COST PER CLASS PER DAY FOR TYPE 2 TRAINING	960.000
CPPC - COST OF PACKING AND SHIPPING FROM A SATELLITE BASE TO ITS CIMF BASE IN \$ PER NET WEIGHT POUND	0.779
CPPD(1) - COST OF PACKING AND SHIPPING FROM CONUS BASE TO DEPOT IN \$ PER NET WEIGHT POUND	0.779
CPPD(2) - COST OF PACKING AND SHIPPING FROM PACIFIC BASE TO DEPOT IN \$ PER NET WEIGHT POUND	0.972
CPPD(3) - COST OF PACKING AND SHIPPING FROM EUROPE BASE TO DEPOT IN \$ PER NET WEIGHT POUND	0.972
RCPP - REPRODUCTION COST PER COPY PER PAGE OF TECH. DATA	0.010
IMC - INITIAL DEPOT INVENTORY MANAGEMENT COST PER NEW PART IN \$	1200.000
RMC - RECURRING DEPOT INVENTORY MANAGEMENT COST PER NEW PART IN \$ PER YEAR	150.000
SA - BASE-LEVEL INVENTORY MANAGEMENT COST PER NEW PART IN \$ PER YEAR	0.0
UCPP - UPKEEP COST PER YEAR PER DISTINCT PAGE OF TECH. DATA	60.000

INPUT TABLE 1: SYSTEM-WIDE SCALAR PARAMETERS
(CONTINUED)

MISCELLANEOUS FACTORS

BF	- COEFFICIENT IN SPARING FUNCTION	1.65
BIRD	- FRACTION OF BASE-REPAIR-INTENDED FAILURES REQUIRING DEPOT REPAIR	0.05
KFAC(1)	- FAILURE RATE EXPERIENCE FACTOR FOR AIRBORNE- FIGHTER ENVIRONMENT	1.70
KFAC(2)	- FAILURE RATE EXPERIENCE FACTOR FOR AIRBORNE- CARGO ENVIRONMENT	1.14
KFAC(3)	- FAILURE RATE EXPERIENCE FACTOR FOR GROUND- FIXED/TRANSPORTABLE ENVIRONMENT	1.10
KFAC(4)	- FAILURE RATE EXPERIENCE FACTOR FOR GROUND- MOBILE ENVIRONMENT	1.10
MUSE	- MINIMUM FRACTIONAL UTILIZATION FOR SENSITIVITY CALCULATIONS ON SUPPORT EQUIPMENT COSTS	0.50
PIUP	- NUMBER OF SYSTEM OPERATING YEARS	15.000
QTYP1	- NUMBER OF TYPE 1 TRAINEES	25
QTYP2B	- NUMBER OF TYPE 2 BASE TRAINEES	250
QTYP2D	- NUMBER OF TYPE 2 DEPOT TRAINEES	35
R	- REPAIR LEVEL CASE RUN NUMBER	0
SPC2	- MAXIMUM NUMBER OF TYPE 2 TRAINEES PER CLASS	12
TYP2TF	- RATIO OF TYPE 2 TRAINING TIME TO TYPE 1 TRAINING TIME	1.50
XFPR	- FALSE PULL RATE SENSITIVITY MULTIPLIER FACTOR	1.00
XFR	- FAILURE RATE SENSITIVITY MULTIPLIER FACTOR	1.00
XMIL	- MOD/I LABOR HOURS SENSITIVITY MULTIPLIER FACTOR	1.00
XUC	- UNIT COST SENSITIVITY MULTIPLIER FACTOR	1.00

INPUT TABLE 1: SYSTEM-WIDE SCALAR PARAMETERS
(CONTINUED)

CONTRACTOR - DETERMINED PARAMETERS

BDATA - NUMBER OF TECH. DATA PAGES FOR BASE MAINT. AND NOT ITEM OR SE SPECIFIC	25
CPD1 - COST PER CLASS PER DAY FOR TYPE 1 TRAINING	800.00
DDATA - NUMBER OF TECH. DATA PAGES FOR DEPOT MAINT. AND NOT ITEM OR SE SPECIFIC	30
FSEDC - COST OF FULL SCALE ENGINEERING DEVELOPMENT	2000000.0
HPD1 - NUMBER OF CLASS HOURS PER DAY FOR A TYPE 1 TRAINING CLASS	8
SPC1 - MAXIMUM NUMBER OF TYPE 1 TRAINEES PER CLASS	10
TEFM - COST OF TRAINING EQUIPMENT, FACILITIES AND MANUALS	150000.00

INPUT TABLE 2: BASE CONFIGURATION DATA

BASE INDEX (NS)	BASE NAME (BNDUN)	NO. OF BASES (TNB)	LOC. OF BASE (LO)	BASE TYPE (BTYPE)	NEXT HIGHER BASE (NHB)	NO. UNDER CIMF (NBC)	BASE PLAT-FORMS (BPLAT)
1	AIRBORNE, CONUS	85.	1	1	0	0.	1
2	GROUND, CONUS	130.	1	1	0	0.	2
3	AIRBORNE, EUROP*	1.	3	1	0	0.	1
4	GROUND, EUROP*	1.	3	1	0	0.	2
5	AIRBORNE, EUROP	14.	3	1	0	0.	1
6	GROUND, EUROP	45.	3	1	0	0.	2
7	AIRBORNE, PACIF	6.	2	1	0	0.	1
8	GROUND, PACIF	15.	2	1	0	0.	2

* BASE CLASSIFICATIONS NS=3 AND NS=4 ARE SINGLE SITES IN EUROPE THAT ARE USED AS LOCATIONS FOR CIMFS WHEN THIS SUPPORT OPTION IS BEING INVESTIGATED.

INPUT TABLE 3: PLATFORM OPERATION DATA

PLAT- FORM INDEX (NP)	PLATFORM NOMENCLATURE (PNOUN)	EN- VIRON- MENT (LE)	*OPERATING HOURS *CONUS PACIF EUROPE (APFH)	IN*UTILI- ZATION*FACTOR TIME (TFAC) (MMPM)	ACTI- VATION*	*MISSIONS PER MONTH* *CONUS PACIF EUROPE* (AMPM)	*THE OPERATING MINS.* *CONUS PACIF EUROPE* (MMPD)	*THRUST *IN (THRS)	GALLONS PER OPER HR (FGH)
1	TACT A/C, FU	1	25.3 26.8 29.9	2.10	2.0	17.0 17.0 17.0	0.0	0.0	6000.
2	TACT A/C, PA	1	21.0 22.6 19.8	2.10	2.0	17.0 17.0 17.0	0.0	0.0	6000.
3	TACT A/C, MO	1	19.6 19.2 18.7	2.10	2.0	17.0 17.0 17.0	0.0	0.0	6000.
4	CARGO/EL, MO	2	51.7 57.0 56.6	1.20	4.0	8.0 8.0 8.0	0.0	0.0	7800.
5	FIX/TRAN, MO	3	200.0 200.0 200.0	1.00	4.0	25.0 25.0 25.0	0.0	0.0	0.
6	MOBILE, PA	4	300.0 300.0 300.0	1.00	2.0	25.0 25.0 25.0	0.0	0.0	0.
7	MANPACK, MO	4	300.0 300.0 300.0	1.00	2.0	25.0 25.0 25.0	0.0	0.0	0.
8	MASTER CLOCK	3	730.0 730.0 730.0	1.00	0.0	0.0 0.0 0.0	10.0	10.0	0.

INPUT TABLE 4: PLATFORM TERMINAL DATA & NON-RECURRING MOD/INSTALLATION DATA

PLAT- FORM INDEX (NP)	PME TER- MINALS (NTRMP)	PME UNIT COST (TUPP)	NO. TNE TER- MINALS (NTRMT)	TNE UNIT COST (TUPT)	NON- RECURRING MOD/INSTL (NRMI)	PLAT- FORM DIVER- SITY (PDIV)	*FRACTION MODS FIELD (FR)	IN*ADDED DEPOT*NAS (NAE)	LBS. DRAG PER ANTEN. (DRAG)	THRUST -FUEL CNSMPT FACTOR (K)
1	1.00	23000.	0.0	0.	1000000.	3.00	0.0	0.0	3.5	0.67
2	1.00	19000.	0.0	0.	800000.	6.00	0.0	1.00	3.5	0.67
3	1.00	14000.	0.0	0.	600000.	5.00	0.0	1.00	3.5	0.67
4	6.86	14500.	0.0	0.	1000000.	6.00	0.0	1.00	2.5	0.67
5	4.83	14000.	0.0	0.	200000.	10.00	0.0	1.00	0.0	0.0
6	1.00	18000.	0.0	0.	100000.	3.00	0.0	1.00	0.0	0.0
7	1.00	14000.	0.0	0.	0.	1.00	0.0	1.00	0.0	0.0
8	0.0	0.	1.00	53000.	0.	1.00	0.0	1.00	0.0	0.0

INPUT TABLE 5: PLATFORM RECURRING MOD/INSTALLATION DATA

PLAT- FORM INDEX (NP)	*FIXED MOD/I COST *		AKIT EQUIP COST		MOD/INSTALLATION LABOR HOURS BY MODE AND AREA														
	*PROD FIE D DEPOT (MIFIX)	*ANTNA ELGBOX CNTLHD CABLE (AKIT)	*ANTNA ELGBOX CNTLHD CABLE (AKIT)	*AKIT EQUIP COST	*ANTN	*ELBX	*CTLH	*CBL	*ANTN	*ELBX	*CTLH	*CBL	*ANTN	*ELBX	*CTLH	*CBL			
1	0	4000	6000	2000	1000	1000	2000	70	50	30	40	100	100	60	120	100	60	120	
2	0	4000	6000	200	1000	1000	1500	0	0	0	0	20	100	60	90	20	100	60	90
3	0	4000	6000	0	500	1000	1000	0	0	0	0	0	60	60	60	0	60	60	60
4	0	4000	6000	0	2100	2100	4200	0	0	0	0	0	120	90	60	0	120	90	60
5	0	0	0	0	4000	500	3200	0	0	0	0	0	80	20	50	0	80	20	50
6	0	0	0	0	0	500	1000	0	0	0	0	5	30	5	10	5	30	5	10
7	0	0	0	0	1000	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

INPUT TABLE 6: PLATFORM DEPLOYMENT AT BASES - NPLT(NP,NS)
 AVERAGE NUMBER OF PLATFORMS OF GIVEN TYPE AT EACH BASE WITHIN GROUPS BELOW

PLAT- FORM INDEX (NP)	CONUS		EUROPE		EUROPE		EUROPE		PACIFIC	
	A/B 1	SURF 2	A/B* 3	SURF* 4	A/B 5	SURF 6	A/B 7	SURF 8	A/B 7	SURF 8
1	15.39	0.0	0.0	0.0	52.50	0.0	26.67	0.0	26.67	0.0
2	12.59	0.0	72.00	0.0	37.57	0.0	34.50	0.0	34.50	0.0
3	7.20	0.0	0.0	0.0	11.14	0.0	0.0	0.0	0.0	0.0
4	0.75	0.0	0.0	0.0	1.00	0.0	1.33	0.0	1.33	0.0
5	0.0	0.65	0.0	1.00	0.0	1.15	0.0	1.27	0.0	1.27
6	0.0	5.32	0.0	0.0	0.0	4.82	0.0	4.47	0.0	4.47
7	0.0	5.32	0.0	0.0	0.0	4.82	0.0	4.47	0.0	4.47
8	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

* BASE CLASSIFICATIONS NS=3 AND NS=4 ARE SINGLE SITES IN EUROPE THAT ARE USED AS LOCATIONS FOR CIMFS WHEN THIS SUPPORT OPTION IS BEING INVESTIGATED.

INPUT TABLE 7: SUPPORT EQUIPMENT DATA

SE INDEX (L)	SE NOMENCLATURE (SENDUN)	SE PART NO. (SENDUM)	SE UNIT COST (\$ (CSE))	FRACTION UNIT COST TO MAINTAIN (MSE)	COM. ON-SITE (1) COM. PROCUR. (2) PECULIAR (3) (SETYPE)	NUMBER OF TECH ORDER PAGES (DATAS)	HW DVLPT COST (\$ (SED))
1	COMMON 1	SE001	10000.	0.100	2	10	0.
2	COMMON 2	SE002	10000.	0.100	1	20	0.
3	PECULIAR 1	SE003	30000.	0.100	3	30	50000.
4	PECULIAR 2	SE004	30000.	0.100	3	40	50000.
5	PECULIAR 3	SE005	30000.	0.100	3	50	50000.
6	PECULIAR 4	SE006	30000.	0.100	3	60	50000.

INPUT TABLE BA: ITEM EQUIPMENT DATA

ITEM INDEX (1)	NOMENCLATURE (INDUN)	PART NUMBER (PINUM)	PME(1) (EQ)	PME(2) (EQ)	PME(3) (EQ)	LRU(1) OR SRU(0) (LRU)	NEXT HIGHER ITEM (NHI)	GFE INDI-CATOR (GFE)	INTE-GRATION ITEMS (INTEG)	ITEM UNIT COST (UP)	REPAIR MATERIALS FACTOR (RM)	ITEM WEIGHT (WT)	PIECE PART COUNT (PA)
1	LRU 1	AL001	1			1	0	3	0	12000.	.0	12.00	0.0
2	LRU 2	SL002	3			1	0	3	0	12000.	.0	12.00	0.0
3	LRU 3	AL003	1			1	0	3	0	9000.	.0	9.00	0.0
4	LRU 4	AL004	1			1	0	3	0	7000.	.0	7.00	0.0
5	LRU 5	SL005	1			1	0	3	0	7000.	.0	7.00	0.0
6	LRU 6	AL006	1			1	0	3	0	500.	.100	5.00	10.00
7	LRU 7	SL007	1			1	0	3	0	200.	.100	2.00	10.00
8	LRU 8	AL008	1			1	0	3	0	1000.	.050	2.00	10.00
9	LRU 9	SL009	3			1	0	3	0	1000.	.050	2.00	10.00
10	LRU 10	AL010	1			1	0	2	1	2000.	.050	2.00	10.00
11	LRU 11	AL011	1			1	0	2	0	1000.	.050	5.00	10.00
12	LRU 12	SL012	3			1	0	3	0	1000.	.050	10.00	10.00
13	LRU 13	SL013	2			1	0	3	0	42000.	.0	45.00	10.00
20	SRU 20	AS5020	3			0	1	3	0	1000.	.050	1.00	10.00
21	SRU 21	AS5021	3			0	1	3	0	1000.	.050	1.00	10.00
22	SRU 22	AS5022	3			0	1	3	0	1000.	.050	1.00	10.00
23	SRU 23	AS5023	3			0	1	3	0	1000.	.050	1.00	10.00
24	SRU 24	AS5024	3			0	1	3	0	1000.	.050	1.00	10.00
25	SRU 25	AS5025	3			0	1	3	0	1000.	.050	1.00	10.00
26	SRU 26	AS5026	3			0	1	3	0	1000.	.050	1.00	10.00
27	SRU 27	AS5027	3			0	1	3	0	1000.	.050	1.00	10.00
28	SRU 28	AS5028	3			0	1	3	0	1000.	.050	1.00	10.00
29	SRU 29	AS5029	3			0	1	3	0	1000.	.050	1.00	10.00
30	SRU 30	AS5030	3			0	1	3	0	1000.	.050	1.00	10.00
31	SRU 31	AS5031	1			0	3	3	0	1000.	.050	1.00	10.00
32	SRU 32	AS5032	1			0	3	3	0	1000.	.050	1.00	10.00
33	SRU 33	AS5033	1			0	3	3	0	1000.	.050	1.00	10.00
34	SRU 34	AS5034	1			0	3	3	0	1000.	.050	1.00	10.00
35	SRU 35	AS5035	1			0	3	3	0	1000.	.050	1.00	10.00
36	SRU 36	AS5036	1			0	3	3	0	1000.	.050	1.00	10.00
37	SRU 37	AS5037	1			0	3	3	0	1000.	.050	1.00	10.00
38	SRU 38	AS5038	1			0	3	3	0	1000.	.050	1.00	10.00
39	SRU 39	SS039	2			0	13	3	0	1000.	.050	10.00	10.00
40	SRU 40	SS040	2			0	13	3	0	1000.	.050	10.00	10.00
41	SRU 41	SS041	2			0	13	3	0	1000.	.050	10.00	10.00
42	SRU 42	SS042	2			0	13	3	0	1000.	.050	10.00	10.00

TABLE 88: LRU/SRU CROSS REFERENCE DATA *

LRU INDEX (IL)	#SRU TYPES IN LRU (MDS)	SRU INDEX NO. (ISR)	SRU QUANTITY (OPA)	SRU INDEX NO. (ISR)	SRU QUANTITY (OPA)	SRU INDEX NO. (ISR)	SRU QUANTITY (OPA)	SRU INDEX NO. (ISR)	SRU QUANTITY (OPA)	SRU INDEX NO. (ISR)	SRU QUANTITY (OPA)	SRU INDEX NO. (ISR)	SRU QUANTITY (OPA)
1	11	20	1	21	1	22	1	23	1	24	1	25	1
2	11	27	1	28	1	29	1	30	1	31	1	32	1
3	8	20	1	21	1	22	1	23	1	24	1	25	1
4	6	27	1	28	1	29	1	30	1	31	1	32	1
5	6	31	1	32	1	33	1	34	1	35	1	36	1
6	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0
13	4	39	1	40	1	41	1	42	1	43	1	44	1

* THIS TABLE IS PRINTED HERE TO FURTHER CLARIFY THE CONFIGURATION OF THE SEEK TALK EQUIPMENT. THE DATA IN THIS TABLE ARE USED ONLY IN THE RLA RUN, HOWEVER, NOT IN THE BASIC LCC ACCOUNTING MODEL RUN.

INPUT TABLE 9A: ITEM MAINTENANCE DATA

ITEM (I)	PREDICTED MEAN TIME BETWEEN FAILURES (PMTBF1)	AIR-CARGO-FIXED-GRND-MOBILE (PMTBF2)	FIXED-GRND-MOBILE (PMTBF3)	FAILURE (PMTBF4)	FRACTION REPAIRED IN PLACE (RIP)	FRACTION REPAIRED A BASE DEPT (RTS)	FRACTION REPAIRED A COND (CONDT)	FAILURE REMOVE		FAILURE REPLACE		FAILURE BENCH		FAILURE REPAIR		FAILURE REPAIR	
								MAN HRS	(RMH)	MAN HRS	(RMC)	MAN HRS	(RMC)	MAN HRS	(RMC)	MAN HRS	(RMC)
1	667	0	0	0	0.0	1.000	0.0	0.30	0.30	0.40	0.50	0.50	0	0.50	0	0.50	0
2	0	0	3333	2000	0.0	1.000	0.0	0.0	0.30	0.40	0.50	0	0.50	0	0.50	0	
3	556	0	0	0	0.0	1.000	0.0	0.0	0.30	0.40	0.50	0	0.50	0	0.50	0	
4	764	0	0	0	0.0	1.000	0.0	0.0	0.30	0.40	0.50	0	0.50	0	0.50	0	
5	0	0	0	2500	0.0	1.000	0.0	0.0	0.30	0.40	0.50	0	0.50	0	0.50	0	
6	4000	0	0	0	0.0	1.000	0.0	0.0	0.30	0.40	2.00	3	2.00	3	2.00	3	
7	0	0	0	45045	0.0	1.000	0.0	1.000	0.30	0.40	2.00	3	2.00	3	2.00	3	
8	4000	8000	0	0	0.0	1.000	0.0	1.000	0.30	0.40	2.00	3	2.00	3	2.00	3	
9	0	0	20000	12500	0.0	1.000	0.0	0.0	0.30	0.40	2.00	3	2.00	3	2.00	3	
10	0	5831	0	0	0.0	1.000	0.0	0.0	0.30	0.40	2.00	3	2.00	3	2.00	3	
11	4000	10000	0	0	0.0	1.000	0.0	0.0	0.30	0.40	2.00	3	2.00	3	2.00	3	
12	0	0	0	0	0.0	1.000	0.0	0.0	0.30	0.40	2.00	3	2.00	3	2.00	3	
13	0	0	0	11534	0.0	1.000	0.0	0.0	0.30	0.40	2.00	3	2.00	3	2.00	3	
20	7353	14706	0	0	0.0	1.000	0.0	0.0	0.30	0.40	2.00	3	2.00	3	2.00	3	
21	7353	14706	0	0	0.0	1.000	0.0	0.0	0.30	0.40	2.00	3	2.00	3	2.00	3	
22	7353	14706	0	0	0.0	1.000	0.0	0.0	0.30	0.40	2.00	3	2.00	3	2.00	3	
23	7353	14706	0	0	0.0	1.000	0.0	0.0	0.30	0.40	2.00	3	2.00	3	2.00	3	
24	7353	14706	0	0	0.0	1.000	0.0	0.0	0.30	0.40	2.00	3	2.00	3	2.00	3	
25	7353	14706	0	0	0.0	1.000	0.0	0.0	0.30	0.40	2.00	3	2.00	3	2.00	3	
26	7353	14706	0	0	0.0	1.000	0.0	0.0	0.30	0.40	2.00	3	2.00	3	2.00	3	
27	7353	14706	0	0	0.0	1.000	0.0	0.0	0.30	0.40	2.00	3	2.00	3	2.00	3	
28	7353	14706	0	0	0.0	1.000	0.0	0.0	0.30	0.40	2.00	3	2.00	3	2.00	3	
29	7353	14706	0	0	0.0	1.000	0.0	0.0	0.30	0.40	2.00	3	2.00	3	2.00	3	
30	7353	14706	0	0	0.0	1.000	0.0	0.0	0.30	0.40	2.00	3	2.00	3	2.00	3	
31	4604	0	0	15152	0.0	1.000	0.0	0.0	0.30	0.40	2.00	3	2.00	3	2.00	3	
32	4604	0	0	15152	0.0	1.000	0.0	0.0	0.30	0.40	2.00	3	2.00	3	2.00	3	
33	4608	0	0	15152	0.0	1.000	0.0	0.0	0.30	0.40	2.00	3	2.00	3	2.00	3	
34	4608	0	0	15152	0.0	1.000	0.0	0.0	0.30	0.40	2.00	3	2.00	3	2.00	3	
35	4608	0	0	15152	0.0	1.000	0.0	0.0	0.30	0.40	2.00	3	2.00	3	2.00	3	
36	4608	0	0	15152	0.0	1.000	0.0	0.0	0.30	0.40	2.00	3	2.00	3	2.00	3	
37	4082	0	0	0	0.0	1.000	0.0	0.0	0.30	0.40	2.00	3	2.00	3	2.00	3	
38	4082	0	0	0	0.0	1.000	0.0	0.0	0.30	0.40	2.00	3	2.00	3	2.00	3	
39	0	0	7246	0	0.0	1.000	0.0	0.0	0.30	0.40	2.00	3	2.00	3	2.00	3	
40	0	0	7246	0	0.0	1.000	0.0	0.0	0.30	0.40	2.00	3	2.00	3	2.00	3	
41	0	0	7246	0	0.0	1.000	0.0	0.0	0.30	0.40	2.00	3	2.00	3	2.00	3	
42	0	0	7246	0	0.0	1.000	0.0	0.0	0.30	0.40	2.00	3	2.00	3	2.00	3	

INPUT TABLE 98: TECHNICAL ORDER, TRAINING, AND SE SOFTWARE DEVELOPMENT DATA

ITEM INDEX (I)	NUMBER OF TECH. DATA PAGES FOR DEPOT (DATAD)	NUMBER OF TECH. DATA PAGES FOR BASE (DATAB)	NO. OF HOURS FOR TYPE 1 TRAINING (TIME1)	SE SOFTWARE DEVELOPMENT COST (SESW)	PARTITION OF SESW BY SE INDEX L (PSESW)*
1	20	10	6	25000.	1,1.00
2	20	10	6	25000.	1,1.00
3	20	10	6	25000.	1,1.00
4	20	10	6	25000.	1,1.00
5	20	10	6	25000.	1,1.00
6	20	10	6	10000.	1,1.00
7	20	10	6	10000.	1,1.00
8	20	10	6	10000.	1,1.00
9	20	10	6	10000.	1,1.00
10	20	10	6	10000.	1,1.00
11	20	10	6	10000.	1,1.00
12	20	10	6	10000.	1,1.00
13	20	10	6	25000.	1,0.40;6,0.60
20	40	15	12	25000.	1,1.00
21	40	15	12	25000.	1,1.00
22	40	15	12	25000.	1,1.00
23	40	15	12	25000.	1,1.00
24	40	15	12	25000.	1,1.00
25	40	15	12	25000.	1,1.00
26	40	15	12	25000.	1,1.00
27	40	15	12	25000.	1,1.00
28	40	15	12	25000.	1,1.00
29	40	15	12	25000.	1,1.00
30	40	15	12	25000.	1,1.00
31	40	15	12	25000.	1,1.00
32	40	15	12	25000.	1,1.00
33	40	15	12	25000.	1,1.00
34	40	15	12	25000.	1,1.00
35	40	15	12	25000.	1,1.00
36	40	15	12	25000.	1,1.00
37	40	15	12	25000.	1,1.00
38	40	15	12	25000.	1,1.00
39	40	15	12	25000.	1,0.30;6,0.70
40	40	15	12	25000.	1,0.25;6,0.75
41	40	15	12	25000.	1,0.25;6,0.75
42	40	15	12	25000.	1,0.30;6,0.70

* EACH PAIR OF NUMBERS (SEPARATED BY A SEMICOLON IF MORE THAN ONE PAIR) REPRESENTS INDEX L OF SE AND THE FRACTION OF SESW APPLICABLE TO L.

INPUT TABLE 11: ITEM CONFIGURATIONS FOR DIFFERENT PLATFORMS - NITEMR(I, NP)

INDEX (I)	NOMENCLATURE (INDOUMJ)	INTE- GRATION ITEMS (INTEG)	TACTICAL A/C-			CARGO ELECT. MO	FIXED TRANS. MO	MOBILE		MAN- PACK. MO	TIMING NET
			FU	PA	MO			PA	MO		
1	LRU 1	0	1.00	1.00	1.00	1.00	0.0	0.0	0.0	0.0	0.0
2	LRU 2	0	0.0	0.0	0.0	0.0	1.00	1.00	1.00	1.00	1.00
3	LRU 3	0	1.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	LRU 4	0	0.0	1.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	LRU 5	0	0.0	0.0	0.0	0.0	0.0	1.00	0.0	0.0	0.0
6	LRU 6	0	0.0	1.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	LRU 7	0	0.0	0.0	0.0	0.0	0.0	2.00	0.0	0.0	0.0
8	LRU 8	0	1.00	1.00	1.00	1.00	0.0	0.0	0.0	0.0	0.0
9	LRU 9	0	0.0	0.0	0.0	0.0	1.00	1.00	1.00	1.00	1.00
10	LRU 10	1	0.0	0.0	0.0	1.00	0.0	0.0	0.0	0.0	0.0
11	LRU 11	0	1.00	1.00	1.00	1.00	0.0	0.0	0.0	0.0	0.0
12	LRU 12	0	0.0	0.0	0.0	0.0	1.00	1.00	1.00	1.00	1.00
13	LRU 13	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20	SRU 20	0	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
21	SRU 21	0	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
22	SRU 22	0	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
23	SRU 23	0	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
24	SRU 24	0	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
25	SRU 25	0	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
26	SRU 26	0	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
27	SRU 27	0	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
28	SRU 28	0	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
29	SRU 29	0	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
30	SRU 30	0	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
31	SRU 31	0	1.00	1.00	0.0	0.0	0.0	1.00	0.0	0.0	0.0
32	SRU 32	0	1.00	1.00	0.0	0.0	0.0	1.00	0.0	0.0	0.0
33	SRU 33	0	1.00	1.00	0.0	0.0	0.0	1.00	0.0	0.0	0.0
34	SRU 34	0	1.00	1.00	0.0	0.0	0.0	1.00	0.0	0.0	0.0
35	SRU 35	0	1.00	1.00	0.0	0.0	0.0	1.00	0.0	0.0	0.0
36	SRU 36	0	1.00	1.00	0.0	0.0	0.0	1.00	0.0	0.0	0.0
37	SRU 37	0	1.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
38	SRU 38	0	1.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
39	SRU 39	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.00
40	SRU 40	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.00
41	SRU 41	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.00
42	SRU 42	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.00

OUTPUT TABLE 1: SUMMARY BY COST ELEMENT (IN MILLIONS OF CONSTANT \$)

RD&E (FSED ONLY)	20.00	273.72
EQUIPMENT ACQ.	163.11	
PME, AIR	105.58	
PME, SURF.	41.79	
TNE, AIR	0.0	
TNE, SURF.	15.74	
MOD/INSTALL.	134.75	
NON-RECURR.	19.10	
RECURR. LABOR	69.41	
RECURR. A-KIT	26.52	
RECURR. FIXED	19.73	
INITIAL SUPP. ACQ.	82.69	
INIT. SPARES	30.55	
SUPP. EQUIP.	49.76	
INVENT. ENTRY	0.39	
INIT. TRAINING	1.42	
INIT. TECH. DATA	0.56	
TOTAL INVESTMENT COST	400.55	
RECURR. SUPP.		88.14
REPL. SPARES		8.00
ON-EQUIP. MAINT.		98.03
OFF-EQUIP. MAINT.		73.18
SUPP. EQ. MAINT.		0.73
INVENT. MGMT.		4.18
RECURR. TRAINING		1.45
TECH. DATA MAINT.		
OPERATIONS		119.27
OPS. LABOR		30.89
ADD. FUEL CNSMPTN		88.38
TOTAL OWNERSHIP COST		392.98
TOTAL LCC		793.54
NO. PME TERM.S		0.0
NO. TNE TERM.S		297.00
AIR	5434.36	
SURF.	2706.03	
TOTAL	8140.39	297.00

OUTPUT TABLE 2: PLATFORM MODIFICATION/INSTALLATION COSTS
(IN MILLIONS OF CONSTANT DOLLARS)

PLAT- FORM INDEX (NP)	PLATFORM NAME	***RECURRING MOD/I COST TOTALS BY PLATFORM***										
		TOTAL NON- RECUR. MOD/I	FIXED PLAT. PREP/ RSTR.	A KIT EQUIP- MENT	MOD/I LABOR	RETRO- FIT MOD/I TOTAL	PRDC- TION MOD/I TOTAL	TOTAL * RECUR. MOD/I	AKIT PLUS LABOR COSTS ELEC-BOX	BY AREA CNTL.HD	16.042 10.240 2.796 0.586 0.844 1.405 0.0	
1	TACT A/C, FU	3.000	8.873	13.219	36.845	58.877	0.0	58.877	14.102	11.899	8.021	16.042
2	TACT A/C, PA	4.900	7.501	6.938	22.282	36.720	0.0	36.720	2.026	10.128	6.827	10.240
3	TACT A/C, RD	3.000	3.072	1.997	6.084	11.152	0.0	11.152	0.0	2.489	2.796	2.796
4	CARGO/EL, MO	6.000	0.343	0.720	1.019	2.082	0.0	2.082	0.0	0.633	0.520	0.586
5	FIX/TRAN, MO	2.000	0.0	1.204	1.032	2.235	0.0	2.235	0.0	1.175	0.216	0.844
6	MOBILE, PA	0.300	0.0	1.463	2.147	3.610	0.0	3.610	0.215	1.288	0.702	1.405
7	MANPACK, MO	0.0	0.0	0.976	0.0	0.976	0.0	0.976	0.0	0.976	0.0	0.0
8	MASTER CLOCK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

COST TOTALS		19.100	19.728	26.516	69.408	115.652	0.0	115.652	16.343	28.587	19.081	31.913

OUTPUT TABLE 3: OPERATION AND LOGISTICS SUPPORT COST ELEMENTS
(IN MILLIONS OF CONSTANT DOLLARS)

COST ELEMENT	INITIAL	RECURRING	TOTAL	INDEP BASES	CIMF BASES	SATEL BASES	BASE TOTAL	AIR BASES	GROUND BASES	MIXED BASES	DEPOT TOTAL
OPERATIONS LABOR		30.89	30.89	30.89	0.0	0.0	30.89	16.63	14.26	0.0	
ADDED FUEL		88.38	88.38	88.38	0.0	0.0	88.38	88.38	0.0	0.0	
INITIAL SPARES	30.55	30.55	30.55	24.96	0.0	0.0	24.96	12.39	12.57	0.0	5.60
REPLACE. SPARES		88.14	88.14	88.14	0.0	0.0	88.14	50.22	37.93	0.0	
DN-EQUIP. MAINT.		8.00	8.00	8.00	0.0	0.0	8.00	5.30	2.70	0.0	
OFF-EQUIP. MAINT.		98.03	98.03	62.46	0.0	0.0	62.46	41.19	21.28	0.0	35.57
SUPPORT EQUIPMENT											
COMMON	3.37	5.05	8.42	7.63	0.0	0.0	7.63	2.78	4.86	0.0	0.79
PECULIAR	45.42	68.13	113.55	111.30	0.0	0.0	111.30	39.75	71.55	0.0	2.25
HW + SW DVLP.*	0.97	-	0.97	-	-	-	-	-	-	-	-
INVENTORY MANAG.	0.39	0.73	1.12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.12
MAINT. TRAINING *	1.42	4.18	5.60	-	-	-	4.13	-	-	-	1.47
TECH. DATA	0.56	1.45	2.02	0.00	0.0	0.0	0.00	0.00	0.00	0.0	2.02
TOTALS	82.69	392.98	475.68	421.76	0.0	0.0	425.89	256.62	165.14	0.0	48.81

NUMBER OF BASES:

INDEP. = 297. AIR BASES = 106.
 CIMF = 0. GROUND BASES = 191.
 SATEL. = 0. MIXED BASES = 0.
 TOTAL = 297.

* 'HW + SW DVLP.' IS NOT ALLOCATED TO BASES OR THE DEPOT. 'MAINT. TRAINING' IS ALLOCATED TO BASE
 TOTAL AND DEPOT TOTAL BUT IS NOT FURTHER ALLOCATED AMONG BASE TYPES.

OUTPUT TABLE 4A: ITEM-SPECIFIC COSTS AND MAINTENANCE CHARACTERISTICS
(COSTS IN THOUSANDS OF CONSTANT DOLLARS)

ITEM INDEX (1)	ITEM NAME	LRU INDICATOR (LRU)	INITIAL SPARES (15CA)	REPL. SPARES (RSCA)	ON-EQUIP. MAINT. (ONMCA)	OFF-EQUIP. MAINT. (OFMCA)	TRAINING (MTRCI)	TECH. ORDERS (TDC)	ITEM INVENT. (IIMCA)	TOTAL SUPPORT EQUIP. (TSECI)	TOTAL SUPPORT COST (TIAC)	CORR. MAINT. COST/FAIL (RSCA+ONMCA +OFMCA)
1	LRU 1	1	3209.5	0.0	2204.7	8655.4	246.3	56.0	3.4	11207.6	25583.0	0.095
2	LRU 2	1	3477.2	0.0	1531.4	6012.3	246.3	50.4	3.4	7792.7	19113.7	0.095
3	LRU 3	1	1676.3	0.0	1316.7	5169.2	246.3	49.9	3.4	8874.8	17336.6	0.095
4	LRU 4	1	820.8	0.0	629.4	2471.0	246.3	43.4	3.4	4255.4	8489.7	0.095
5	LRU 5	1	861.5	0.0	444.8	1746.4	246.3	41.7	3.4	3014.9	6359.7	0.095
6	LRU 6	1	48.3	4127.7	158.4	437.6	3.2	25.9	3.4	39.2	4843.7	0.572
7	LRU 7	1	13.0	514.6	49.4	129.6	3.2	25.2	3.4	12.2	750.5	0.270
8	LRU 8	1	79.6	862.0	345.2	2682.9	246.3	45.1	37.9	432.6	4731.6	0.226
9	LRU 9	1	94.1	581.1	232.7	1808.6	246.3	42.6	37.9	294.9	3338.2	0.226
10	LRU 10	1	14.2	19.2	3.7	29.8	246.3	37.5	37.9	14.7	403.3	0.275
11	LRU 11	1	84.3	948.2	363.9	2945.2	246.3	45.9	37.9	474.8	5146.4	0.225
12	LRU 12	1	102.8	684.5	262.7	2126.1	246.3	43.5	37.9	345.5	3849.4	0.225
13	LRU 13	1	6170.1	0.0	452.7	1710.4	246.3	64.1	37.9	26458.0	35139.6	0.095
20	SRU 20	0	408.0	2552.3	0.0	3192.1	48.0	57.3	37.9	1938.9	8234.5	0.326
21	SRU 21	0	408.0	2552.3	0.0	3192.1	48.0	57.3	37.9	1938.9	8234.5	0.326
22	SRU 22	0	408.0	2552.3	0.0	3192.1	48.0	57.3	37.9	1938.9	8234.5	0.326
23	SRU 23	0	408.0	2552.3	0.0	3192.1	48.0	57.3	37.9	1938.9	8234.5	0.326
24	SRU 24	0	408.0	2552.3	0.0	3192.1	48.0	57.3	37.9	1938.9	8234.5	0.326
25	SRU 25	0	408.0	2552.3	0.0	3192.1	48.0	57.3	37.9	1938.9	8234.5	0.326
26	SRU 26	0	408.0	2552.3	0.0	3192.1	48.0	57.3	37.9	1938.9	8234.5	0.326
27	SRU 27	0	408.0	2552.3	0.0	3192.1	48.0	57.3	37.9	1938.9	8234.5	0.326
28	SRU 28	0	408.0	2552.3	0.0	3192.1	48.0	57.3	37.9	1938.9	8234.5	0.326
29	SRU 29	0	408.0	2552.3	0.0	3192.1	48.0	57.3	37.9	1938.9	8234.5	0.326
30	SRU 30	0	408.0	2552.3	0.0	3192.1	48.0	57.3	37.9	1938.9	8234.5	0.326
31	SRU 31	0	344.4	2543.3	0.0	3181.2	48.0	61.2	37.9	2506.0	8772.1	0.326
32	SRU 32	0	344.4	2543.3	0.0	3181.2	48.0	61.2	37.9	2506.0	8772.1	0.326
33	SRU 33	0	344.4	2543.3	0.0	3181.2	48.0	61.2	37.9	2506.0	8772.1	0.326
34	SRU 34	0	344.4	2543.3	0.0	3181.2	48.0	61.2	37.9	2506.0	8772.1	0.326
35	SRU 35	0	344.4	2543.3	0.0	3181.2	48.0	61.2	37.9	2506.0	8772.1	0.326
36	SRU 36	0	344.4	2543.3	0.0	3181.2	48.0	61.2	37.9	2506.0	8772.1	0.326
37	SRU 37	0	204.5	1355.0	0.0	1695.0	48.0	55.9	37.9	1346.8	4743.2	0.326
38	SRU 38	0	204.5	1355.0	0.0	1695.0	48.0	55.9	37.9	1346.8	4743.2	0.326
39	SRU 39	0	1660.3	8590.4	0.0	1129.1	492.5	84.0	37.9	5168.7	17162.9	1.641
40	SRU 40	0	1660.3	8590.4	0.0	1129.1	492.5	84.0	37.9	5168.7	17162.9	1.641
41	SRU 41	0	1660.3	8590.4	0.0	1129.1	492.5	84.0	37.9	5168.7	17162.9	1.641
42	SRU 42	0	1660.3	8590.4	0.0	1129.1	492.5	84.0	37.9	5168.7	17162.9	1.641

COST TOTALS OVER ITEMS												
30556.6 88143.4 7995.8 98030.8 5597.8 2016.6 1124.7 122948.4 356414.8												

OUTPUT TABLE 4B: SYSTEM-WIDE MAINTENANCE CHARACTERISTICS

ITEM INDEX	SYSTEM NO. OF INSTALLED ITEMS	TOTAL NO. OF INITIAL BASE SPARES	TOTAL NO. OF INITIAL DEPOT SPARES	SYSTEM NO. OF ITEMS	NO. OF ITEM FAILS PER MONTH	NO. OF LIFE CYCLE FAILS (NO RIP OR FALSE PULLS)
1	5434.	267.	0.	5702.	638.21	114878.
2	3003.	290.	0.	3293.	443.31	79797.
3	2203.	186.	0.	2389.	381.15	68607.
4	1875.	117.	0.	1992.	182.20	32796.
5	976.	123.	0.	1099.	128.77	23179.
6	19500.	97.	0.	19597.	45.86	8255.
7	1951.	65.	0.	2016.	14.29	2573.
8	5434.	80.	0.	5514.	95.78	17240.
9	3003.	94.	0.	3097.	64.56	11622.
10	86.	7.	0.	93.	1.07	192.
11	5434.	84.	0.	5519.	105.35	18963.
12	3003.	103.	0.	3106.	76.05	13689.
13	297.	147.	0.	444.	125.87	22657.
20	8437.	219.	189.	8845.	97.79	17602.
21	8437.	219.	189.	8845.	97.79	17602.
22	8437.	219.	189.	8845.	97.79	17602.
23	8437.	219.	189.	8845.	97.79	17602.
24	8437.	219.	189.	8845.	97.79	17602.
25	8437.	219.	189.	8845.	97.79	17602.
26	8437.	219.	189.	8845.	97.79	17602.
27	8437.	219.	189.	8845.	97.79	17602.
28	8437.	219.	189.	8845.	97.79	17602.
29	8437.	219.	189.	8845.	97.79	17602.
30	8437.	219.	189.	8845.	97.79	17602.
31	5054.	207.	188.	5448.	97.44	17540.
32	5054.	207.	188.	5448.	97.44	17540.
33	5054.	207.	188.	5448.	97.44	17540.
34	5054.	207.	188.	5448.	97.44	17540.
35	5054.	207.	188.	5448.	97.44	17540.
36	5054.	207.	188.	5448.	97.44	17540.
37	2203.	100.	104.	2408.	51.92	9345.
38	2203.	100.	104.	2408.	51.92	9345.
39	297.	111.	55.	463.	32.91	5924.
40	297.	111.	55.	463.	32.91	5924.
41	297.	111.	55.	463.	32.91	5924.
42	297.	111.	55.	463.	32.91	5924.

OUTPUT TABLE 4C: SYSTEM-WIDE MAINTENANCE CHARACTERISTICS

AVERAGE CORRECTIVE MAINTENANCE COST PER FAILURE (\$K) FOR

LRUS 0.125
SRUS 0.418

TOTAL NUMBERS OF LRU FAILURES:

MONTHLY 2302.
LIFETIME 414446.

OUTPUT TABLE 5: SUPPORT EQUIPMENT REQUIREMENTS AND COSTS
(COSTS IN DOLLARS)

SE INDEX (L)	SUPPORT EQUIP. NAME	NUMBERS OF SUPPORT EQUIPMENT UNITS REQUIRED AT:										SYSTEM TOTAL REQUIRED UNITS (1)	UNIT LIFE- TIME COST* (2)	TECH. ORDER COST (3)	HW DVLPT COST (4)	SYSTEM LIFE- TIME COST (1)+(2)+ (3)+(4)
		INDEP BASES	CIMF BASES	AIR BASES	GROUND BASES	MIXED BASES	THE DEPT									
1	COMMON 1	297.	0.	106.	191.	0.	30.0	327.	25000.	12510.	0.	8187509.				
2	COMMON 2	8.	0.	5.	3.	0.	1.6	10.	25000.	25020.	0.	274130.				
3	PECULIAR 1	297.	0.	106.	191.	0.	0.0	297.	75000.	37529.	50000.	22362512.				
4	PECULIAR 2	297.	0.	106.	191.	0.	0.0	315.	75000.	50039.	50000.	23725024.				
5	PECULIAR 3	296.	0.	106.	190.	0.	12.0	308.	75000.	62548.	50000.	23212544.				
6	PECULIAR 4	594.	0.	212.	382.	0.	0.0	594.	75000.	75059.	50000.	44675056.				

NOTE: UNITS OF SE WITH SETYPE=1 IN INPUT TABLE 7 ARE
ALREADY ON SITE AND DO NOT HAVE TO BE ACQUIRED.

* UNIT LIFETIME COST = ACC. COST + MAINT. COST. (TECH.
ORDER AND HARDWARE DEVELOPMENT ARE EXCLUDED)

OUTPUT TABLE 6: PLATFORM/TERMINAL COST AND FAILURE RATE DATA

PLAT- FORM INDEX (NP)	PLATFORM NAME	SYSTEM NO. OF PLAT- FORMS	PME TERM. PER PLAT	TNE PER PLAT	TOTAL PROD. COST PER PLAT TYPE (\$M)	TOTAL MOD/I COST PER PLAT TYPE (\$M)	FAILS*/ MONTH		FAILS*/ MIL. HRS		FAILS*/ MIL. HRS PER TERM.		MEAN HRS. BETWEEN FAILURES* PER TERM.
							PER PLAT	PER TERM.	PER PLAT	PER TERM.	PER PLAT	PER TERM.	
1	TACT A/C. FU	2203.	1.00	0.0	50.673	61.877	0.385	0.385	14272.	14272.	14272.	70.07	
2	TACT A/C. PA	1875.	1.00	0.0	35.627	41.520	0.247	0.247	11899.	11899.	11899.	84.04	
3	TACT A/C. MO	768.	1.00	0.0	10.751	14.152	0.139	0.139	7137.	7137.	7137.	140.11	
4	CARGO/EL. MO	86.	6.86	0.0	8.529	8.082	0.497	0.073	9386.	1368.	1368.	730.86	
5	FIX/TRAN. MO	156.	4.83	0.0	10.569	4.235	0.425	0.088	2125.	440.	440.	2272.56	
6	MOBILE. PA	976.	1.00	0.0	17.560	3.910	0.367	0.367	1222.	1222.	1222.	818.19	
7	MANPACK. MO	976.	1.00	0.0	13.658	0.976	0.220	0.220	733.	733.	733.	1363.57	
8	MASTER CLOCK	297.	0.0	1.00	15.741	0.0	0.767	0.767	1051.	1051.	1051.	951.34	

* THESE FAILURES INCLUDE EVERY EVENT REQUIRING MAINTENANCE ACTION (INCLUDING REPAIR-IN-PLACE). THEY DO NOT INCLUDE FALSE PULLS.

OUTPUT TABLE 7: MANPOWER REQUIREMENTS

BASE TYPE (NS)	MANHOURS PER YEAR PER BASE	MGMT. DATA**	TOTAL MANYEARS PER YEAR PER BASE	TOTAL MANHOURS PER YEAR/BASE TYPE	TOTAL MANYEARS PER YEAR/BASE TYPE
1	391.	153.	0.32	46299.	26.8
2	154.	58.	0.12	27503.	15.9
3	648.	254.	0.52	902.	0.5
4	46.	17.	0.04	63.	0.0
5	1214.	483.	0.98	23755.	13.7
6	151.	57.	0.12	9346.	5.4
7	753.	298.	0.61	6305.	3.6
8	145.	55.	0.12	3000.	1.7
BASE TOTAL	- -	- -	- -	117173.	67.8
DEPOT TOTAL	- -	- -	- -	60477.	35.0
TOTAL				177649.	102.8

TOTAL MANYEARS PER YEAR IN TRAINING

FIRST YEAR	39.8
EACH SUBSEQUENT YEAR	8.7

* 'MAINT.' INCLUDES MANPOWER FOR OFF-EQUIPMENT MAINT. (EXCLUDING 'MGMT. DATA').
 ** 'MGMT. DATA' INCLUDES MANPOWER FOR ALL MAINTENANCE RECORDS, SUPPLY TRANSACTION RECORDS, AND TRANSPORTATION TRANSACTION FORMS.

LCC SENSITIVITY ANALYSIS TABLE

CHANGE IN LCC (\$M) DUE TO AN INCREASE OF 25.0 % IN:
 GLOBAL UNIT COST (XUC FACTOR) - 70.451
 GLOBAL FAILURE RATE (XFR FACTOR) - 54.889
 GLOBAL FALSE PULL RATE (XFPR FACTOR) - 1.197
 MAINTENANCE REPAIR TIMES (BMF/DMF FACTOR) - 22.761
 REPAIR MATERIALS COST (XRM FACTOR) - 7.012
 MOD/1 LABOR HOURS (XML FACTOR) - 17.352

CHANGE IN LCC (\$M) DUE TO AN INCREASE OF 4.0 YEARS IN:
 SYSTEM LIFETIME (PIUP FACTOR) - 108.202

ITEM FAILURE RATE (ORDERED BY SIGNIFICANCE)

ITEM INDEX	1	41	40	39	42	2	6	40	39	42	26	25	24	23
CHANGE IN FR (PPM)	580.	38.	38.	38.	38.	116.	764.	20.	20.	20.	20.	20.	20.	20.
CHANGE IN LCC (\$M)	3.265	2.723	2.723	2.723	2.723	2.408	1.899	1.582	1.582	1.582	1.582	1.582	1.582	1.582

ITEM UNIT COST (ORDERED BY SIGNIFICANCE)

ITEM INDEX	1	2	3	13	4	5	11	8	12	9	41	24	24	23
CHANGE IN UP	3000.	3000.	22500.	10500.	1750.	125.	2500.	2500.	2500.	2500.	2500.	250.	250.	250.
CHANGE IN LCC (\$M)	17.105	9.878	5.376	4.661	3.487	3.482	3.305	3.305	3.305	3.305	3.305	2.849	2.849	2.849

ITEM FALSE PULL RATE (ORDERED BY SIGNIFICANCE)

ITEM INDEX	1	2	13	3	4	5	11	8	12	9	6	7
CHANGE IN FPR	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
CHANGE IN LCC (\$M)	0.306	0.238	0.187	0.174	0.082	0.064	0.038	0.034	0.028	0.024	0.016	0.005

ITEM REPAIR MATERIALS COST (ORDERED BY SIGNIFICANCE)

ITEM INDEX	42	41	40	39	11	8	28	27	26	25	24	23
CHANGE IN RM (CCST)	125.	125.	125.	125.	12.	12.	12.	12.	12.	12.	12.	12.
CHANGE IN LCC (\$M)	0.666	0.666	0.666	0.666	0.237	0.215	0.198	0.198	0.198	0.198	0.198	0.198

ITEM INTERMEDIATE REPAIR FRACTION (ORDERED BY SIGNIFICANCE)

ITEM INDEX	6	41	40	39	38	37	36	35	34	33	32	31
CHANGE IN RTS	0.0	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
CHANGE IN LCC (\$M)	-0.303	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

ITEM DEPT REPAIR FRACTION (ORDERED BY SIGNIFICANCE)

ITEM INDEX	5	2	6	39	38	37	36	35	34	33	32	31
CHANGE IN NRTS	0.25	0.25	0.0	0.20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHANGE IN LCC (\$M)	-0.646	-0.341	-0.245	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

ITEM CONDEMNATION RATE (ORDERED BY SIGNIFICANCE)

ITEM INDEX	42	41	40	39	38	37	36	35	34	33	32	31
CHANGE IN CONDO	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
CHANGE IN LCC (\$M)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

LCC SENSITIVITY ON WHICH SRUS SHOULD BE LRU

ITEM INDEX	42	41	40	39	36	35	34	33	32	31	30	29
CHANGE IN SRU	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
CHANGE IN LCC (\$M)	-2.474	-2.474	-2.474	-2.474	-1.092	-1.092	-1.092	-1.092	-1.092	-1.092	-1.092	-1.023

II.2 Six Special LCC Runs for RLA Input

LCC Input Table 9A and Output Tables 1 and 4A for Each Run:

- R=1 LRU, base repair; SRU, base repair
- R=2 LRU, base repair; SRU, depot repair
- F LRU, base repair; SRU, discard
- R=4 LRU, depot repair; SRU, depot repair
- R=5 LRU, depot repair; SRU, discard
- R=6 LRU, discard; SRU, discard.

```
*****  
* SEEK TALK FSED PHASE LCC MODEL *  
* * * * *  
* RUN: RUN 1, R=1 *  
* * * * *  
*****
```

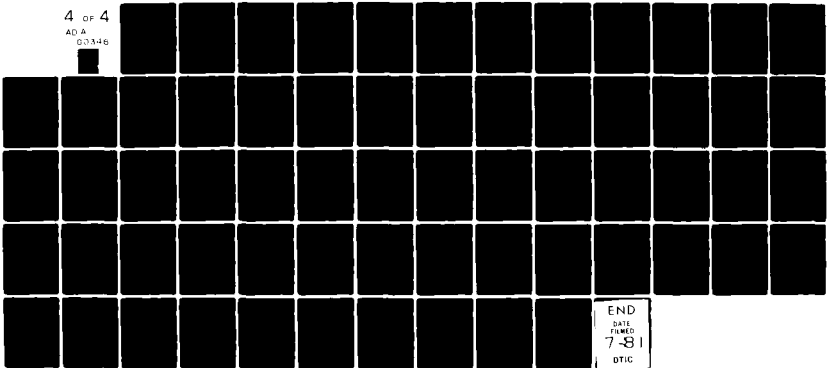
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MITRE CORP BEDFORD MA
USER'S MANUAL FOR SEEK TALK FULL SCALE ENGINEERING DEVELOPMENT --ETC(U)
APR 81 C C CHO, J P SEEGER F19628-81-C-0001
MTR-8210-VOL-2 ESD-TR-81-122-VOL-2 NL

UNCLASSIFIED

4 of 4

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INPUT TABLE 9A: ITEM MAINTENANCE DATA

ITEM (I)	PREDICTED MEAN TIME BETWEEN FAILURES		FAILURE COST PER REPAIR		FRACTION FAILURES REPAIRED AT		FAILURE REMOVE		BASE LV		DEPOT	
	(PMTBF1) AIR-FIGHTER	(PMTBF2) AIR-CARGO	(PMTBF3) GRND-FIXED	(PMTBF4) GRND-MOBILE	(LPCF) REPAIR	(RTS) BASE	(NRTS) COND	(RMH) MAN HRS	(RCH) BENCH	(BMH) MAN HRS	(DMH) MAN HRS	(RL) R.L. CODE
1	667.	1333.	0.	0.	0.0	0.952	0.048	0.0	0.30	0.40	0.50	1
2	0.	0.	3333.	2000.	0.0	0.952	0.048	0.0	0.30	0.40	0.50	1
3	556.	0.	0.	0.	0.0	0.952	0.048	0.0	0.30	0.40	0.50	1
4	764.	0.	0.	0.	0.0	0.952	0.048	0.0	0.30	0.40	0.50	1
5	0.	0.	0.	2500.	0.0	0.952	0.048	0.0	0.30	0.40	0.50	1
6	40000.	0.	0.	0.	0.0	0.0	0.0	1.000	0.30	0.40	2.00	1
7	0.	0.	0.	45045.	0.0	0.0	0.0	1.000	0.30	0.40	2.00	1
8	4000.	8000.	0.	0.	5.00	0.952	0.048	0.0	0.30	0.40	2.00	1
9	0.	0.	20000.	12500.	5.00	0.952	0.043	0.0	0.30	0.40	2.00	1
10	0.	5831.	0.	0.	0.0	0.952	0.048	0.0	0.30	0.40	2.00	1
11	4000.	10000.	0.	0.	0.0	0.952	0.048	0.0	0.30	0.40	2.00	1
12	0.	0.	20000.	11534.	0.0	0.952	0.048	0.0	0.30	0.40	2.00	1
13	0.	0.	1800.	0.	10.00	0.952	0.048	0.0	0.30	0.40	2.00	1
20	7353.	14706.	37037.	22222.	0.0	0.857	0.043	0.100	0.0	1.00	2.00	1
21	7353.	14706.	37037.	22222.	0.0	0.857	0.043	0.100	0.0	1.00	2.00	1
22	7353.	14706.	37037.	22222.	0.0	0.857	0.043	0.100	0.0	1.00	2.00	1
23	7353.	14706.	37037.	22222.	0.0	0.857	0.043	0.100	0.0	1.00	2.00	1
24	7353.	14706.	37037.	22222.	0.0	0.857	0.043	0.100	0.0	1.00	2.00	1
25	7353.	14706.	37037.	22222.	0.0	0.857	0.043	0.100	0.0	1.00	2.00	1
26	7353.	14706.	37037.	22222.	0.0	0.857	0.043	0.100	0.0	1.00	2.00	1
27	7353.	14706.	37037.	22222.	0.0	0.857	0.043	0.100	0.0	1.00	2.00	1
28	7353.	14706.	37037.	22222.	0.0	0.857	0.043	0.100	0.0	1.00	2.00	1
29	7353.	14706.	37037.	22222.	0.0	0.857	0.043	0.100	0.0	1.00	2.00	1
30	7353.	14706.	37037.	22222.	0.0	0.857	0.043	0.100	0.0	1.00	2.00	1
31	4608.	0.	0.	15152.	0.0	0.857	0.043	0.100	0.0	1.00	2.00	1
32	4608.	0.	0.	15152.	0.0	0.857	0.043	0.100	0.0	1.00	2.00	1
33	4608.	0.	0.	15152.	0.0	0.857	0.043	0.100	0.0	1.00	2.00	1
34	4608.	0.	0.	15152.	0.0	0.857	0.043	0.100	0.0	1.00	2.00	1
35	4608.	0.	0.	15152.	0.0	0.857	0.043	0.100	0.0	1.00	2.00	1
36	4608.	0.	0.	15152.	0.0	0.857	0.043	0.100	0.0	1.00	2.00	1
37	4082.	0.	0.	0.	0.0	0.857	0.043	0.100	0.0	1.00	2.00	1
38	4082.	0.	0.	0.	0.0	0.857	0.043	0.100	0.0	1.00	2.00	1
39	0.	0.	7246.	0.	0.0	0.857	0.043	0.100	0.0	1.00	2.00	1
40	0.	0.	7246.	0.	0.0	0.857	0.043	0.100	0.0	1.00	2.00	1
41	0.	0.	7246.	0.	0.0	0.857	0.043	0.100	0.0	1.00	2.00	1
42	0.	0.	7246.	0.	0.0	0.857	0.043	0.100	0.0	1.00	2.00	1

OUTPUT TABLE 1: SUMMARY BY COST ELEMENT (IN MILLIONS OF CONSTANT \$)

RDT&E (FSED ONLY)	20.00	RECURR. SUPP.	276.00
EQUIPMENT ACQ.	163.11	REPL. SPARES	88.14
PME, AIR	105.58	ON-EQUIP. MAINT.	8.00
PME, SURF.	41.79	OFF-EQUIP. MAINT.	94.63
TNE, AIR	0.0	SUPP. EQ. MAINT.	71.71
TNE, SURF.	15.74	INVENT. MGMT.	0.73
MOD/INSTALL.	134.75	RECURR. TRAINING	11.07
NON-RECURR.	19.10	TECH. DATA MAINT.	1.71
RECURR. LABOR	69.41	OPERATIONS	119.27
RECURR. A-KIT	26.52	OPS. LABOR	30.89
RECURR. FIXED	19.73	ADD. FUEL CNSMPTN	88.38
INITIAL SUPP. ACQ.	78.65	TOTAL OWNERSHIP COST	395.26
INIT. SPARES	26.00	*****	*****
SUPP. EQUIP.	48.78	TOTAL LCC	791.77
INVENT. ENTRY	0.39	*****	*****
INIT. TRAINING	2.31	NO. PME TERM.S	NO. TNE TERM.S
INIT. TECH. DATA	0.66	AIR	5434.36
TOTAL INVESTMENT COST	396.51	SURF.	2706.03
		TOTAL	8140.39
			297.00

OUTPUT TABLE 4A: ITEM-SPECIFIC COSTS AND MAINTENANCE CHARACTERISTICS
(COSTS IN THOUSANDS OF CONSTANT DOLLARS)

ITEM INDEX (I)	ITEM NAME	LRU INDICATOR (LRU)	INITIAL SPARES (ISCA)	REPL. SPARES (RSCA)	ON-EQUIP. MAINT. (ONMCA)	OFF-EQUIP. MAINT. (OFMCA)	MAINT. TRAINING (MTRCI)	TECH. ORDERS (TDC)	ITEM INVENT. MGMT. (IIMCA)	TOTAL SUPPORT EQUIP. (ISECI)	TOTAL SUPPORT COST (TIAC)	CORR. MAINT. COST/FAIL (RSCA+DNMCA+OFMCA)
1	LRU 1	1	4255.4	0.0	2204.7	8779.0	243.5	56.5	3.4	6238.1	21780.6	0.096
2	LRU 2	1	4277.2	0.0	1531.4	6096.5	243.5	50.7	3.4	4340.8	16543.5	0.096
3	LRU 3	1	2176.4	0.0	1316.7	5226.7	243.5	50.3	3.4	4925.4	13942.3	0.095
4	LRU 4	1	1029.8	0.0	629.4	2493.0	243.5	43.6	3.4	2367.5	6810.1	0.095
5	LRU 5	1	1027.3	0.0	444.8	1761.6	243.5	41.8	3.4	1680.6	5203.0	0.095
6	LRU 6	1	48.3	4127.7	156.4	437.6	3.0	25.9	3.4	26.0	4830.4	0.572
7	LRU 7	1	13.0	514.6	49.4	129.6	3.0	25.2	3.4	8.1	746.2	0.270
8	LRU 8	1	97.4	862.0	345.2	2652.5	243.5	45.2	37.9	284.2	4607.8	0.226
9	LRU 9	1	108.6	581.1	232.7	1815.0	243.5	42.7	37.9	194.8	3256.3	0.226
10	LRU 10	1	16.0	19.2	3.7	29.9	243.5	37.5	37.9	13.1	400.8	0.275
11	LRU 11	1	103.4	948.2	363.9	2960.3	243.5	45.9	37.9	311.6	5014.8	0.225
12	LRU 12	1	119.2	684.5	262.7	2142.3	243.5	43.6	37.9	227.7	3761.4	0.226
13	LRU 13	1	7191.3	0.0	452.7	1793.5	243.5	65.1	37.9	19048.9	28832.8	0.099
20	SRU 20	0	138.8	2552.3	0.0	3004.0	486.9	76.0	37.9	2608.8	8904.8	0.316
21	SRU 21	0	138.8	2552.3	0.0	3004.0	486.9	76.0	37.9	2608.8	8904.8	0.316
22	SRU 22	0	138.8	2552.3	0.0	3004.0	486.9	76.0	37.9	2608.8	8904.8	0.316
23	SRU 23	0	138.8	2552.3	0.0	3004.0	486.9	76.0	37.9	2608.8	8904.8	0.316
24	SRU 24	0	138.8	2552.3	0.0	3004.0	486.9	76.0	37.9	2608.8	8904.8	0.316
25	SRU 25	0	138.8	2552.3	0.0	3004.0	486.9	76.0	37.9	2608.8	8904.8	0.316
26	SRU 26	0	138.8	2552.3	0.0	3004.0	486.9	76.0	37.9	2608.8	8904.8	0.316
27	SRU 27	0	138.8	2552.3	0.0	3004.0	486.9	76.0	37.9	2608.8	8904.8	0.316
28	SRU 28	0	138.8	2552.3	0.0	3004.0	486.9	76.0	37.9	2608.8	8904.8	0.316
29	SRU 29	0	138.8	2552.3	0.0	3004.0	486.9	76.0	37.9	2608.8	8904.8	0.316
30	SRU 30	0	138.8	2552.3	0.0	3004.0	486.9	76.0	37.9	2608.8	8904.8	0.316
31	SRU 31	0	130.5	2543.3	0.0	2993.5	486.9	79.9	37.9	3428.4	9700.4	0.316
32	SRU 32	0	130.5	2543.3	0.0	2993.5	486.9	79.9	37.9	3428.4	9700.4	0.316
33	SRU 33	0	130.5	2543.3	0.0	2993.5	486.9	79.9	37.9	3428.4	9700.4	0.316
34	SRU 34	0	130.5	2543.3	0.0	2993.5	486.9	79.9	37.9	3428.4	9700.4	0.316
35	SRU 35	0	130.5	2543.3	0.0	2993.5	486.9	79.9	37.9	3428.4	9700.4	0.316
36	SRU 36	0	130.5	2543.3	0.0	2993.5	486.9	79.9	37.9	3428.4	9700.4	0.316
37	SRU 37	0	64.2	1355.0	0.0	1594.9	486.9	74.6	37.9	1838.2	5451.7	0.316
38	SRU 38	0	774.5	8590.4	0.0	1018.9	486.9	83.8	37.9	6972.2	17964.6	1.622
39	SRU 39	0	774.5	8590.4	0.0	1018.9	486.9	83.8	37.9	6972.2	17964.6	1.622
40	SRU 40	0	774.5	8590.4	0.0	1018.9	486.9	83.8	37.9	6972.2	17964.6	1.622
41	SRU 41	0	774.5	8590.4	0.0	1018.9	486.9	83.8	37.9	6972.2	17964.6	1.622
42	SRU 42	0	774.5	8590.4	0.0	1018.9	486.9	83.8	37.9	6972.2	17964.6	1.622

COST TOTALS OVER ITEMS			25999.2	88143.4	7995.8	94627.4	13893.0	2373.1	1124.7	120498.5	354646.0	

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*  
* SEEK TALK FSED PHASE LCC MODEL *  
* * * * *  
* RUN: RUN 2, R=2 *  
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INPUT TABLE 9A: ITEM MAINTENANCE DATA

ITEM (I)	PREDICTED MEAN TIME BETWEEN FAILURES (PMTBF1) (PMTBF2)	INDEX-AIR-FIGHTER-AIR-CARGO-FIXED-GRND-MOBILE-RATE (PMTBF3)	FRACTION *FALSE FAILURES COST PER REPAIRED IN PLACE (RIP)	FRACTION *PULL REPAIRED IN PLACE BASE DEPT (RTS) (NRTS) (COND)	FRACTION REPAIRED AT COND	FAILURE REMOVE REPLACE (RMH)	BASE LV BENCH CHECK MAN HRS (BCNH)	BASE LV REPAIR MAN HRS (BMH)	DEPT REPAIR MAN HR CODE (DMH) (RL)
1	667.	1333.	0.	0.0	0.0	0.30	0.40	0.50	0.50 1
2	0.	3333.	2000.	0.0	0.952	0.30	0.40	0.50	0.50 1
3	556.	0.	0.	0.0	0.952	0.30	0.40	0.50	0.50 1
4	764.	0.	0.	0.0	0.952	0.30	0.40	0.50	0.50 1
5	0.	2500.	0.	0.0	0.952	0.30	0.40	0.50	0.50 1
6	40000.	0.	0.	0.0	0.0	0.30	0.40	2.00	2.00 1
7	0.	45045.	2000.	0.0	0.0	0.30	0.40	2.00	2.00 1
8	4000.	8000.	0.	0.0	0.952	0.30	0.40	2.00	2.00 1
9	0.	0.	0.	5.00	0.952	0.30	0.40	2.00	2.00 1
10	0.	5831.	0.	5.00	0.952	0.30	0.40	2.00	2.00 1
11	4000.	10000.	0.	0.0	0.952	0.30	0.40	2.00	2.00 1
12	0.	0.	0.	0.0	0.952	0.30	0.40	2.00	2.00 1
13	0.	1800.	0.	10.00	0.952	0.30	0.40	0.50	0.50 1
20	7353.	14706.	22222.	0.0	0.0	0.0	1.00	2.00	2.00 2
21	7353.	14706.	22222.	0.0	0.0	0.0	1.00	2.00	2.00 2
22	7353.	14706.	22222.	0.0	0.0	0.0	1.00	2.00	2.00 2
23	7353.	14706.	22222.	0.0	0.0	0.0	1.00	2.00	2.00 2
24	7353.	14706.	22222.	0.0	0.0	0.0	1.00	2.00	2.00 2
25	7353.	14706.	22222.	0.0	0.0	0.0	1.00	2.00	2.00 2
26	7353.	14706.	22222.	0.0	0.0	0.0	1.00	2.00	2.00 2
27	7353.	14706.	22222.	0.0	0.0	0.0	1.00	2.00	2.00 2
28	7353.	14706.	22222.	0.0	0.0	0.0	1.00	2.00	2.00 2
29	7353.	14706.	22222.	0.0	0.0	0.0	1.00	2.00	2.00 2
30	7353.	14706.	22222.	0.0	0.0	0.0	1.00	2.00	2.00 2
31	4608.	0.	15152.	0.0	0.0	0.0	1.00	2.00	2.00 2
32	4608.	0.	15152.	0.0	0.0	0.0	1.00	2.00	2.00 2
33	4608.	0.	15152.	0.0	0.0	0.0	1.00	2.00	2.00 2
34	4608.	0.	15152.	0.0	0.0	0.0	1.00	2.00	2.00 2
35	4608.	0.	15152.	0.0	0.0	0.0	1.00	2.00	2.00 2
36	4608.	0.	15152.	0.0	0.0	0.0	1.00	2.00	2.00 2
37	4608.	0.	0.	0.0	0.0	0.0	1.00	2.00	2.00 2
38	4608.	0.	0.	0.0	0.0	0.0	1.00	2.00	2.00 2
39	0.	7246.	0.	0.0	0.0	0.0	1.00	2.00	2.00 2
40	0.	7246.	0.	0.0	0.0	0.0	1.00	2.00	2.00 2
41	0.	7246.	0.	0.0	0.0	0.0	1.00	2.00	2.00 2
42	0.	7246.	0.	0.0	0.0	0.0	1.00	2.00	2.00 2

OUTPUT TABLE 4A: ITEM-SPECIFIC COSTS AND MAINTENANCE CHARACTERISTICS
(COSTS IN THOUSANDS OF CONSTANT DOLLARS)

ITEM INDEX (I)	ITEM NAME	LRU INDICATOR (LRU)	INITIAL SPARES (ISCA)	REPL. SPARES (RSCA)	ON-EQUIP. MAINT. (ONMCA)	OFF-EQUIP. MAINT. (OFMCA)	MAINT. TRAINING (MTRCI)	TECH. ORDERS (TDC)	ITEM INVENT. MGMT. (IIMCA)	TOTAL SUPPORT EQUIP. (TSECI)	TOTAL SUPPORT COST (TIAC)	CORR. MAINT. COST/FAIL (RSCA+ONMCA+OFMCA)
1	LRU 1	1	4255.4	0.0	2204.7	8779.0	254.6	56.3	3.4	11421.5	26974.8	0.096
2	LRU 2	1	4277.2	0.0	1531.4	6096.5	254.6	50.5	3.4	7941.3	20155.0	0.096
3	LRU 3	1	2176.4	0.0	1316.7	5226.7	254.6	50.1	3.4	9029.3	18057.3	0.095
4	LRU 4	1	1029.8	0.0	629.4	2493.0	254.6	43.5	3.4	4329.2	8783.0	0.095
5	LRU 5	1	1027.3	0.0	484.8	1761.6	254.6	41.7	3.4	3067.1	6600.0	0.095
6	LRU 6	1	48.3	4127.7	158.4	437.6	3.3	25.9	3.4	40.9	4845.6	0.572
7	LRU 7	1	13.0	514.6	49.4	129.6	3.3	25.2	3.4	12.7	751.2	0.270
8	LRU 8	1	97.4	862.0	345.2	2692.5	254.6	45.1	37.9	438.1	4772.8	0.226
9	LRU 9	1	108.6	581.1	232.7	1815.0	254.6	42.6	37.9	298.6	3371.2	0.226
10	LRU 10	1	16.0	19.2	3.7	29.9	254.6	37.5	37.9	14.8	413.6	0.275
11	LRU 11	1	103.4	948.2	363.9	2960.3	254.6	45.9	37.9	480.9	5195.1	0.225
12	LRU 12	1	119.2	684.5	262.7	2142.3	254.6	43.6	37.9	349.9	3894.7	0.226
13	LRU 13	1	7191.3	0.0	452.7	1793.5	254.6	65.0	37.9	30279.5	40074.5	0.099
20	SRU 20	0	393.8	2552.3	0.0	3146.1	45.7	57.2	37.9	1927.0	8160.0	0.324
21	SRU 21	0	393.8	2552.3	0.0	3146.1	45.7	57.2	37.9	1927.0	8160.0	0.324
22	SRU 22	0	393.8	2552.3	0.0	3146.1	45.7	57.2	37.9	1927.0	8160.0	0.324
23	SRU 23	0	393.8	2552.3	0.0	3146.1	45.7	57.2	37.9	1927.0	8160.0	0.324
24	SRU 24	0	393.8	2552.3	0.0	3146.1	45.7	57.2	37.9	1927.0	8160.0	0.324
25	SRU 25	0	393.8	2552.3	0.0	3146.1	45.7	57.2	37.9	1927.0	8160.0	0.324
26	SRU 26	0	393.8	2552.3	0.0	3146.1	45.7	57.2	37.9	1927.0	8160.0	0.324
27	SRU 27	0	393.8	2552.3	0.0	3146.1	45.7	57.2	37.9	1927.0	8160.0	0.324
28	SRU 28	0	393.8	2552.3	0.0	3146.1	45.7	57.2	37.9	1927.0	8160.0	0.324
29	SRU 29	0	393.8	2552.3	0.0	3146.1	45.7	57.2	37.9	1927.0	8160.0	0.324
30	SRU 30	0	393.8	2552.3	0.0	3146.1	45.7	57.2	37.9	1927.0	8160.0	0.324
31	SRU 31	0	380.6	2543.3	0.0	3135.3	45.7	61.1	37.9	2487.3	8691.2	0.324
32	SRU 32	0	380.6	2543.3	0.0	3135.3	45.7	61.1	37.9	2487.3	8691.2	0.324
33	SRU 33	0	380.6	2543.3	0.0	3135.3	45.7	61.1	37.9	2487.3	8691.2	0.324
34	SRU 34	0	380.6	2543.3	0.0	3135.3	45.7	61.1	37.9	2487.3	8691.2	0.324
35	SRU 35	0	380.6	2543.3	0.0	3135.3	45.7	61.1	37.9	2487.3	8691.2	0.324
36	SRU 36	0	380.6	2543.3	0.0	3135.3	45.7	61.1	37.9	2487.3	8691.2	0.324
37	SRU 37	0	197.2	1355.0	0.0	1670.5	45.7	55.9	37.9	1336.9	4699.1	0.324
38	SRU 38	0	197.2	1355.0	0.0	1670.5	45.7	55.9	37.9	1336.9	4699.1	0.324
39	SRU 39	0	1835.9	8590.4	0.0	1139.0	45.7	65.1	37.9	4162.7	15876.7	1.642
40	SRU 40	0	1835.9	8590.4	0.0	1139.0	45.7	65.1	37.9	4162.7	15876.7	1.642
41	SRU 41	0	1835.9	8590.4	0.0	1139.0	45.7	65.1	37.9	4162.7	15876.7	1.642
42	SRU 42	0	1835.9	8590.4	0.0	1139.0	45.7	65.1	37.9	4162.7	15876.7	1.642

COST TOTALS OVER ITEMS												
											358701.1	
											1124.7 123148.9	
											1941.6	
											3857.1	
											7995.8 97672.9	
											68143.4	
											34816.8	

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*****  
* SEEK TALK FSED PHASE LCC MODEL *  
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* RUN: RUN 3, R=3 *  
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OUTPUT TABLE 1: SUMMARY BY COST ELEMENT (IN MILLIONS OF CONSTANT \$)

RT&E (FSED ONLY)	20.00	RECURR. SUPP.	707.90
EQUIPMENT ACQ.	163.11	REPL. SPARES	562.26
PME, AIR	105.58	ON-EQUIP. MAINT.	8.00
PME, SURF.	41.79	OFF-EQUIP. MAINT.	62.01
TNE, AIR	0.0	SUPP. EQ. MAINT.	71.55
TNE, SURF.	15.74	INVENT. MGMT.	0.22
		RECURR. TRAINING	2.47
		TECH. DATA MAINT.	1.40
MOD/INSTALL.	134.75		
NON-RECURR.	19.10	OPERATIONS	119.27
RECURR. LABOR	69.41	OPS. LABOR	30.89
RECURR. A-KIT	26.52	ADD. FUEL CNSMPTN	88.38
RECURR. FIXED	19.73		
INITIAL SUPP. ACQ.	78.54	TOTAL OWNERSHIP COST	827.17
INIT. SPARES	28.91	*****	*****
SUPP. EQUIP.	48.10	TOTAL LCC	1223.57
INVENT. ENTRY	0.12	*****	*****
INIT. TRAINING	0.87	NO. PME TERM.S	NO. TNE TERM.S
INIT. TECH. DATA	0.54	AIR	5434.36
		SURF.	2706.03
			297.00
TOTAL INVESTMENT COST	396.40	TOTAL	8140.39
			297.00

OUTPUT TABLE 4A: ITEM-SPECIFIC COSTS AND MAINTENANCE CHARACTERISTICS
(COSTS IN THOUSANDS OF CONSTANT DOLLARS)

ITEM INDEX (I)	ITEM NAME	LRU INDICATOR (LRU)	INITIAL SPARES (ISCA)	REPL. SPARES (RSCA)	GN- EQUIP. MAINT. (GNMCA)	OFF- EQUIP. MAINT. (OFMCA)	MAINT. TRAINING (MTRCI)	TECH. ORDERS (TDC)	ITEM INVENT. (IIMCA)	TOTAL EQUIP. SUPPORT (TSECI)	TOTAL SUPPORT COST (TTC)	CORR. MAINT. COST/FAIL (RSCA+NMCA +OFMCA)
1	LRU 1	1	4255.4	0.0	2204.7	8779.0	288.8	83.7	3.4	11479.7	27094.8	0.096
2	LRU 2	1	4277.2	0.0	1531.4	6096.5	288.8	69.6	3.4	7981.7	20248.7	0.096
3	LRU 3	1	2176.4	0.0	1316.7	5226.7	288.8	59.3	3.4	9070.2	18141.6	0.095
4	LRU 4	1	1039.8	0.0	629.4	2493.0	288.8	47.9	3.4	4348.6	8841.1	0.095
5	LRU 5	1	1027.3	0.0	444.8	1761.6	288.8	44.8	3.4	3080.9	6651.8	0.095
6	LRU 6	1	48.3	4127.7	158.4	437.6	3.4	26.2	3.4	40.9	4846.1	0.572
7	LRU 7	1	13.0	514.6	49.4	129.6	3.4	12.7	3.4	12.7	751.4	0.270
8	LRU 8	1	97.4	862.0	345.2	2632.5	288.8	47.8	37.9	438.9	4810.6	0.226
9	LRU 9	1	108.6	581.1	232.7	1815.0	288.8	44.5	37.9	299.1	3407.8	0.226
10	LRU 10	1	16.0	19.2	3.7	29.9	288.8	37.6	37.9	14.8	447.9	0.275
11	LRU 11	1	103.4	948.2	363.9	2960.3	288.8	48.9	37.9	481.8	5233.3	0.225
12	LRU 12	1	119.2	684.5	262.7	2142.3	288.8	45.7	37.9	250.6	3931.8	0.226
13	LRU 13	1	7191.3	0.0	452.7	1793.5	288.8	65.9	37.9	30426.0	40256.2	0.099
20	SRU 20	0	213.2	17601.9	0.0	1314.5	6.9	52.8	3.4	1737.0	20929.6	1.075
21	SRU 21	0	213.2	17601.9	0.0	1314.5	6.9	52.8	3.4	1737.0	20929.6	1.075
22	SRU 22	0	213.2	17601.9	0.0	1314.5	6.9	52.8	3.4	1737.0	20929.6	1.075
23	SRU 23	0	213.2	17601.9	0.0	1314.5	6.9	52.8	3.4	1737.0	20929.6	1.075
24	SRU 24	0	213.2	17601.9	0.0	1314.5	6.9	52.8	3.4	1737.0	20929.6	1.075
25	SRU 25	0	213.2	17601.9	0.0	1314.5	6.9	52.8	3.4	1737.0	20929.6	1.075
26	SRU 26	0	213.2	17601.9	0.0	1314.5	6.9	52.8	3.4	1737.0	20929.6	1.075
27	SRU 27	0	213.2	17601.9	0.0	1314.5	6.9	52.8	3.4	1737.0	20929.6	1.075
28	SRU 28	0	213.2	17601.9	0.0	1314.5	6.9	52.8	3.4	1737.0	20929.6	1.075
29	SRU 29	0	213.2	17601.9	0.0	1314.5	6.9	52.8	3.4	1737.0	20929.6	1.075
30	SRU 30	0	213.2	17601.9	0.0	1314.5	6.9	52.8	3.4	1737.0	20929.6	1.075
31	SRU 31	0	200.5	17540.0	0.0	1310.0	6.9	58.5	3.4	2295.1	21414.4	1.075
32	SRU 32	0	200.5	17540.0	0.0	1310.0	6.9	58.5	3.4	2295.1	21414.4	1.075
33	SRU 33	0	200.5	17540.0	0.0	1310.0	6.9	58.5	3.4	2295.1	21414.4	1.075
34	SRU 34	0	200.5	17540.0	0.0	1310.0	6.9	58.5	3.4	2295.1	21414.4	1.075
35	SRU 35	0	200.5	17540.0	0.0	1310.0	6.9	58.5	3.4	2295.1	21414.4	1.075
36	SRU 36	0	200.5	17540.0	0.0	1310.0	6.9	58.5	3.4	2295.1	21414.4	1.075
37	SRU 37	0	97.2	3344.8	0.0	698.0	6.9	54.5	3.4	1222.7	11427.6	1.075
38	SRU 38	0	97.2	3344.8	0.0	698.0	6.9	54.5	3.4	1222.7	11427.6	1.075
39	SRU 39	0	1177.0	59244.2	0.0	484.6	6.9	63.4	3.4	4074.4	85053.9	10.082
40	SRU 40	0	1177.0	59244.2	0.0	484.6	6.9	63.4	3.4	4074.4	85053.9	10.082
41	SRU 41	0	1177.0	59244.2	0.0	484.6	6.9	63.4	3.4	4074.4	85053.9	10.082
42	SRU 42	0	1177.0	59244.2	0.0	484.6	6.9	63.4	3.4	4074.4	85053.9	10.082

COST TOTALS OVER ITEMS												
28913.4 562262.9 7995.8 62011.7 3342.3 1941.6 331.2 119645.5 786445.0												

```
*****  
* SEEK TALK FSED PHASE LCC MODEL *  
* * * * *  
* RUN: RUN 4, R=4 *  
* * * * *  
*****
```


OUTPUT TABLE 1: SUMMARY BY COST ELEMENT (IN MILLIONS OF CONSTANT \$)

ROD&E (FSED ONLY)	20.00	RECURR. SUPP.	207.12
EQUIPMENT ACQ.	163.11	REPL. SPARES	88.14
PME, AIR	105.58	ON-EQUIP. MAINT.	8.00
PME, SURF.	41.79	OFF-EQUIP. MAINT.	88.16
TNE, AIR	0.0	SUPP. EQ. MAINT.	20.46
TNE, SURF.	15.74	INVENT. MGMT.	0.73
		RECURR. TRAINING	0.33
		TECH. DATA MAINT.	1.30
MOD/INSTALL.	134.75		
NON-RECURR.	19.10	OPERATIONS	119.27
RECURR. LABOR	69.41	OPS. LABOR	30.89
RECURR. A-KIT	26.52	ADD. FUEL CNSMPTN	88.38
RECURR. FIXED	19.73		
INITIAL SUPP. ACQ.	99.00	TOTAL OWNERSHIP COST	326.39
INIT. SPARES	82.85		
SUPP. EQUIP.	14.61	TOTAL LCC	743.25
INVENT. ENTRY	0.39		
INIT. TRAINING	0.64	NO. PME TERM.S	NO. TNE TERM.S
INIT. TECH. DATA	0.50	AIR	5434.36
		SURF.	2706.03
			297.00
TOTAL INVESTMENT COST	416.86	TOTAL	8140.39
			297.00

OUTPUT TABLE 4A: ITEM-SPECIFIC COSTS AND MAINTENANCE CHARACTERISTICS

(COSTS IN THOUSANDS OF CONSTANT DOLLARS)

ITEM INDEX (I)	ITEM NAME	LRU INDI-CATOR (LRU)	INITIAL SPARES (ISCA)	REPL. SPARES (RSCA)	OFF-EQUIP. MAINT. (ONMCA)	MAINT. TRAINING (MTRCA)	TECH. ORDERS (TOC)	ITEM INVENT. MGMT. (IIMCA)	TOTAL SUPPORT EQUIP. (TSECI)	TOTAL SUPPORT COST. (TIAC)	CORR.-MAINT. COST/FAIL (RSCA+ONMCA +OFMCA)
1	LRU 1	1	22249.3	0.0	2204.7	11249.7	16.9	54.9	3.4	9885.3	0.117
2	LRU 2	1	17613.1	0.0	1531.4	7781.2	16.9	45.7	3.4	6874.2	0.117
3	LRU 3	1	10485.9	0.0	1316.7	6377.1	16.9	46.2	3.4	5918.4	0.112
4	LRU 4	1	4297.4	0.0	629.4	2933.3	16.9	35.1	3.4	2842.2	0.109
5	LRU 5	1	3529.6	0.0	444.8	2664.9	16.9	32.1	3.4	2016.1	0.108
6	LRU 6	1	48.3	4127.7	158.4	437.6	3.7	25.9	3.4	152.8	0.572
7	LRU 7	1	13.0	514.6	49.4	129.6	3.7	25.3	3.4	47.6	0.270
8	LRU 8	1	358.9	862.0	345.2	2883.1	16.9	33.1	37.9	415.5	0.237
9	LRU 9	1	313.4	581.1	232.7	1942.8	16.9	30.4	37.9	283.4	0.237
10	LRU 10	1	33.0	19.2	3.7	32.0	16.9	25.1	37.9	14.5	0.286
11	LRU 11	1	388.0	948.2	363.9	3262.8	16.9	33.9	37.9	456.1	0.241
12	LRU 12	1	353.7	684.5	262.7	2467.7	16.9	31.5	37.9	332.0	0.249
13	LRU 13	1	22568.8	0.0	452.7	3453.9	16.9	105.4	37.9	2026.6	0.172
20	SRU 20	0	17.2	2552.3	0.0	2225.4	33.8	55.4	37.9	191.2	0.271
21	SRU 21	0	17.2	2552.3	0.0	2225.4	33.8	55.4	37.9	191.2	0.271
22	SRU 22	0	17.2	2552.3	0.0	2225.4	33.8	55.4	37.9	191.2	0.271
23	SRU 23	0	17.2	2552.3	0.0	2225.4	33.8	55.4	37.9	191.2	0.271
24	SRU 24	0	17.2	2552.3	0.0	2225.4	33.8	55.4	37.9	191.2	0.271
25	SRU 25	0	17.2	2552.3	0.0	2225.4	33.8	55.4	37.9	191.2	0.271
26	SRU 26	0	17.2	2552.3	0.0	2225.4	33.8	55.4	37.9	191.2	0.271
27	SRU 27	0	17.2	2552.3	0.0	2225.4	33.8	55.4	37.9	191.2	0.271
28	SRU 28	0	17.2	2552.3	0.0	2225.4	33.8	55.4	37.9	191.2	0.271
29	SRU 29	0	17.2	2552.3	0.0	2225.4	33.8	55.4	37.9	191.2	0.271
30	SRU 30	0	17.2	2552.3	0.0	2225.4	33.8	55.4	37.9	191.2	0.271
31	SRU 31	0	17.2	2543.3	0.0	2217.6	33.8	58.8	37.9	195.0	0.271
32	SRU 32	0	17.2	2543.3	0.0	2217.6	33.8	58.8	37.9	195.0	0.271
33	SRU 33	0	17.2	2543.3	0.0	2217.6	33.8	58.8	37.9	195.0	0.271
34	SRU 34	0	17.2	2543.3	0.0	2217.6	33.8	58.8	37.9	195.0	0.271
35	SRU 35	0	17.2	2543.3	0.0	2217.6	33.8	58.8	37.9	195.0	0.271
36	SRU 36	0	17.2	2543.3	0.0	2217.6	33.8	58.8	37.9	195.0	0.271
37	SRU 37	0	10.3	1355.0	0.0	1181.5	33.8	54.6	37.9	115.5	0.271
38	SRU 38	0	10.3	1355.0	0.0	1181.5	33.8	54.6	37.9	115.5	0.271
39	SRU 39	0	71.7	8590.4	0.0	749.0	33.8	51.9	37.9	76.2	1.576
40	SRU 40	0	71.7	8590.4	0.0	749.0	33.8	51.9	37.9	76.2	1.576
41	SRU 41	0	71.7	8590.4	0.0	749.0	33.8	51.9	37.9	76.2	1.576
42	SRU 42	0	71.7	8590.4	0.0	749.0	33.8	51.9	37.9	76.2	1.576

COST TOTALS OVER ITEMS			82851.7	88143.4	7995.8	88159.3	971.4	1803.6	1124.7	35074.0	306123.9

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*****  
* SEEK TALK FSED PHASE LCC MODEL *  
* * * * *  
* RUN: RUN 5, R=5 *  
* * * * *  
*****
```


INPUT TABLE 9A: ITEM MAINTENANCE DATA

ITEM (1)	PREDICTED MEAN TIME BETWEEN FAILURES		FAILURE RATE		FRACTION FAILURES REPAIRED AT		FAILURE REMOVE		BASE LV		DEPOT	
	(PMTBF1) AIR-CARD	(PMTBF2) GRND-FIXED	(PMTBF3) GRND-MOBILE	(PMTBF4) RATE	(RIP) IN PLACE	(RTS) REPAIR	(COND) BASE	(RMH) REPLACE	(BCH) CHECK	(BCH) MAN HRS	(BCH) MAN HRS	(R) REPAIR
1	667.	1333.	0.	0.	0.0	0.0	1.000	0.0	0.30	0.40	0.50	0.50
2	0.	0.	3333.	2000.	0.0	0.0	1.000	0.0	0.30	0.40	0.50	0.50
3	556.	0.	0.	0.	0.0	0.0	1.000	0.0	0.30	0.40	0.50	0.50
4	764.	0.	0.	0.	0.0	0.0	1.000	0.0	0.30	0.40	0.50	0.50
5	0.	0.	2500.	0.	0.0	0.0	1.000	0.0	0.30	0.40	0.50	0.50
6	40000.	0.	0.	0.	0.0	0.0	1.000	0.0	0.30	0.40	2.00	2.00
7	0.	0.	0.	45045.	0.0	0.0	1.000	0.0	0.30	0.40	2.00	2.00
8	4000.	8000.	0.	0.	5.00	0.0	1.000	0.0	0.30	0.40	2.00	2.00
9	0.	0.	20000.	12500.	5.00	0.0	1.000	0.0	0.30	0.40	2.00	2.00
10	0.	5831.	0.	0.	0.0	0.0	1.000	0.0	0.30	0.40	2.00	2.00
11	4000.	16000.	0.	0.	0.0	0.0	1.000	0.0	0.30	0.40	2.00	2.00
12	0.	0.	20000.	11534.	0.0	0.0	1.000	0.0	0.30	0.40	2.00	2.00
13	0.	0.	1800.	0.	10.00	0.0	1.000	0.0	0.30	0.40	0.50	0.50
20	7353.	14706.	0.	0.	0.0	0.0	1.000	0.0	0.0	1.00	2.00	2.00
21	7353.	14706.	37037.	22222.	0.0	0.0	1.000	0.0	0.0	1.00	2.00	2.00
22	7353.	14706.	37037.	22222.	0.0	0.0	1.000	0.0	0.0	1.00	2.00	2.00
23	7353.	14706.	37037.	22222.	0.0	0.0	1.000	0.0	0.0	1.00	2.00	2.00
24	7353.	14706.	37037.	22222.	0.0	0.0	1.000	0.0	0.0	1.00	2.00	2.00
25	7353.	14706.	37037.	22222.	0.0	0.0	1.000	0.0	0.0	1.00	2.00	2.00
26	7353.	14706.	37037.	22222.	0.0	0.0	1.000	0.0	0.0	1.00	2.00	2.00
27	7353.	14706.	37037.	22222.	0.0	0.0	1.000	0.0	0.0	1.00	2.00	2.00
28	7353.	14706.	37037.	22222.	0.0	0.0	1.000	0.0	0.0	1.00	2.00	2.00
29	7353.	14706.	37037.	22222.	0.0	0.0	1.000	0.0	0.0	1.00	2.00	2.00
30	7353.	14706.	37037.	22222.	0.0	0.0	1.000	0.0	0.0	1.00	2.00	2.00
31	4608.	0.	0.	15152.	0.0	0.0	1.000	0.0	0.0	1.00	2.00	2.00
32	4608.	0.	0.	15152.	0.0	0.0	1.000	0.0	0.0	1.00	2.00	2.00
33	4608.	0.	0.	15152.	0.0	0.0	1.000	0.0	0.0	1.00	2.00	2.00
34	4608.	0.	0.	15152.	0.0	0.0	1.000	0.0	0.0	1.00	2.00	2.00
35	4608.	0.	0.	15152.	0.0	0.0	1.000	0.0	0.0	1.00	2.00	2.00
36	4608.	0.	0.	15152.	0.0	0.0	1.000	0.0	0.0	1.00	2.00	2.00
37	4082.	0.	0.	0.	0.0	0.0	1.000	0.0	0.0	1.00	2.00	2.00
38	4082.	0.	0.	0.	0.0	0.0	1.000	0.0	0.0	1.00	2.00	2.00
39	0.	0.	7246.	0.	0.0	0.0	1.000	0.0	0.0	1.00	2.00	2.00
40	0.	0.	7246.	0.	0.0	0.0	1.000	0.0	0.0	1.00	2.00	2.00
41	0.	0.	7246.	0.	0.0	0.0	1.000	0.0	0.0	1.00	2.00	2.00
42	0.	0.	7246.	0.	0.0	0.0	1.000	0.0	0.0	1.00	2.00	2.00

OUTPUT TABLE 4A: ITEM-SPECIFIC COSTS AND MAINTENANCE CHARACTERISTICS
(COSTS IN THOUSANDS OF CONSTANT DOLLARS)

ITEM INDEX (1)	ITEM NAME	LRU	INDI-CATOR (LRU)	INITIAL SPARES (15CA)	REPL. SPARES (RSCA)	ON-EQUIP. MAINT. (CNCA)	OFF-EQUIP. MAINT. (DFNCA)	MAINT. TRAINING (MTRCI)	TECH. ORDERS (TDC)	ITEM INVENT. MGMT. (IIMCA)	TOTAL SUPPORT EQUIP. (TSECI)	TOTAL SUPPORT COST (TIAC)	CORR-MAINT. COST/FAIL (RSCA+NMCA ->DFMCA)
1	LRU 1	1	22339.3	0.0	2204.7	11249.7	21.2	85.1	3.4	3.4	9907.9	45721.2	0.117
2	LRU 2	1	17613.1	0.0	1531.4	7781.2	21.2	66.7	3.4	3.4	6889.9	33906.9	0.117
3	LRU 3	1	10485.9	0.0	1316.7	6377.1	21.2	77.2	3.4	3.4	5970.2	24231.7	0.112
4	LRU 4	1	4297.4	0.0	629.4	2933.3	21.2	49.8	3.4	3.4	2866.9	10801.5	0.109
5	LRU 5	1	3529.6	0.0	444.8	2064.9	21.2	42.5	3.4	3.4	2033.6	8140.1	0.108
6	LRU 6	1	48.3	4127.7	158.4	437.6	4.7	26.4	3.4	3.4	152.8	4959.4	0.572
7	LRU 7	1	13.0	514.6	49.4	129.6	4.7	25.4	3.4	3.4	47.6	787.6	0.270
8	LRU 8	1	358.9	862.0	345.2	2883.1	21.2	36.4	37.9	415.8	4960.6	0.237	
9	LRU 9	1	313.4	581.1	232.7	1942.8	21.2	32.7	37.9	283.6	3445.3	0.237	
10	LRU 10	1	33.0	19.2	3.7	32.0	21.2	25.1	37.9	14.5	186.6	0.286	
11	LRU 11	1	388.0	948.2	363.9	3262.8	21.2	37.7	37.9	456.4	5516.1	0.241	
12	LRU 12	1	353.7	684.5	262.7	2467.7	21.2	34.3	37.9	332.2	4194.2	0.249	
13	LRU 13	1	23568.8	684.5	262.7	2467.7	21.2	107.3	37.9	2124.7	28766.6	0.172	
20	SRU 20	0	0.0	17601.9	0.0	406.6	9.3	50.4	3.4	3.4	0.0	18071.6	1.023
21	SRU 21	0	0.0	17601.9	0.0	406.6	9.3	50.4	3.4	3.4	0.0	18071.6	1.023
22	SRU 22	0	0.0	17601.9	0.0	406.6	9.3	50.4	3.4	3.4	0.0	18071.6	1.023
23	SRU 23	0	0.0	17601.9	0.0	406.6	9.3	50.4	3.4	3.4	0.0	18071.6	1.023
24	SRU 24	0	0.0	17601.9	0.0	406.6	9.3	50.4	3.4	3.4	0.0	18071.6	1.023
25	SRU 25	0	0.0	17601.9	0.0	406.6	9.3	50.4	3.4	3.4	0.0	18071.6	1.023
26	SRU 26	0	0.0	17601.9	0.0	406.6	9.3	50.4	3.4	3.4	0.0	18071.6	1.023
27	SRU 27	0	0.0	17601.9	0.0	406.6	9.3	50.4	3.4	3.4	0.0	18071.6	1.023
28	SRU 28	0	0.0	17601.9	0.0	406.6	9.3	50.4	3.4	3.4	0.0	18071.6	1.023
29	SRU 29	0	0.0	17601.9	0.0	406.6	9.3	50.4	3.4	3.4	0.0	18071.6	1.023
30	SRU 30	0	0.0	17601.9	0.0	406.6	9.3	50.4	3.4	3.4	0.0	18071.6	1.023
31	SRU 31	0	0.0	17540.0	0.0	405.2	9.3	50.4	3.4	3.4	0.0	18008.3	1.023
32	SRU 32	0	0.0	17540.0	0.0	405.2	9.3	50.4	3.4	3.4	0.0	18008.3	1.023
33	SRU 33	0	0.0	17540.0	0.0	405.2	9.3	50.4	3.4	3.4	0.0	18008.3	1.023
34	SRU 34	0	0.0	17540.0	0.0	405.2	9.3	50.4	3.4	3.4	0.0	18008.3	1.023
35	SRU 35	0	0.0	17540.0	0.0	405.2	9.3	50.4	3.4	3.4	0.0	18008.3	1.023
36	SRU 36	0	0.0	17540.0	0.0	405.2	9.3	50.4	3.4	3.4	0.0	18008.3	1.023
37	SRU 37	0	0.0	9344.8	0.0	215.9	9.3	50.2	3.4	3.4	0.0	9623.6	1.023
38	SRU 38	0	0.0	9344.8	0.0	215.9	9.3	50.2	3.4	3.4	0.0	9623.6	1.023
39	SRU 39	0	0.0	59244.2	0.0	136.9	9.3	50.1	3.4	3.4	0.0	59443.9	10.023
40	SRU 40	0	0.0	59244.2	0.0	136.9	9.3	50.1	3.4	3.4	0.0	59443.9	10.023
41	SRU 41	0	0.0	59244.2	0.0	136.9	9.3	50.1	3.4	3.4	0.0	59443.9	10.023
42	SRU 42	0	0.0	59244.2	0.0	136.9	9.3	50.1	3.4	3.4	0.0	59443.9	10.023

COST TOTALS OVER ITEMS													
82252.3 56262.9 7995.8 52898.8 456.5 1803.6 331.2 31496.2 739497.2													

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*****  
*   SEEK TALK FSED PHASE LCC MODEL   *  
*                                     *  
*   RUN:  RUN 6, R=6                 *  
*                                     *  
*****
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INPUT TABLE 9A: ITEM MAINTENANCE DATA

ITEM (1)	PREDICTED MEAN TIME BETWEEN FAILURES		FRACTION FAILURES COST PER		FRACTION FAILURES		FAILURE BASE LV		BASE LV DEPOT			
	INDEX-AIR-FIGHTER* (PMTBF1)	AIR-CARGO*GRND-FIXED*GRND-MOBILE* (PMTBF2)	FALSE FAILURES (PMTBF3)	GRND-FIXED*GRND-MOBILE* (PMTBF4)	REPAIR IN PLACE (RIP)	REPAIR IN PLACE (IPCF)	REPAIRED AT (RTS) (NRTS)	REPAIRED AT (CO*D)	REMOVE (RMH)	BENCH (BCH)	REPAIR (BMH)	REPAIR R.L. (DMH) (RL)
1	667.	1333.	0.	0.	0.0	0.0	0.0	1.000	0.30	0.40	0.50	0.50
2	0.	0.	3333.	2000.	0.0	0.0	0.0	1.000	0.30	0.40	0.50	0.50
3	556.	0.	0.	0.	0.0	0.0	0.0	1.000	0.30	0.40	0.50	0.50
4	764.	0.	0.	0.	0.0	0.0	0.0	1.000	0.30	0.40	0.50	0.50
5	0.	0.	0.	2500.	0.0	0.0	0.0	1.000	0.30	0.40	0.50	0.50
6	40000.	0.	0.	0.	0.0	0.0	0.0	1.000	0.30	0.40	2.00	2.00
7	0.	0.	0.	45045.	0.0	0.0	0.0	1.000	0.30	0.40	2.00	2.00
8	4000.	8000.	0.	0.	0.0	0.0	0.0	1.000	0.30	0.40	2.00	2.00
9	0.	0.	20000.	12500.	0.0	0.0	0.0	1.000	0.30	0.40	2.00	2.00
10	0.	5831.	0.	0.	0.0	0.0	0.0	1.000	0.30	0.40	2.00	2.00
11	4000.	10000.	0.	0.	0.0	0.0	0.0	1.000	0.30	0.40	2.00	2.00
12	0.	0.	0.	11534.	0.0	0.0	0.0	1.000	0.30	0.40	2.00	2.00
13	0.	0.	1800.	0.	0.0	0.0	0.0	1.000	0.30	0.40	0.50	0.50
20	7353.	14705.	37037.	22222.	0.0	0.0	0.0	1.000	0.0	1.00	2.00	2.00
21	7353.	14705.	37037.	22222.	0.0	0.0	0.0	1.000	0.0	1.00	2.00	2.00
22	7353.	14705.	37037.	22222.	0.0	0.0	0.0	1.000	0.0	1.00	2.00	2.00
23	7353.	14705.	37037.	22222.	0.0	0.0	0.0	1.000	0.0	1.00	2.00	2.00
24	7353.	14705.	37037.	22222.	0.0	0.0	0.0	1.000	0.0	1.00	2.00	2.00
25	7353.	14705.	37037.	22222.	0.0	0.0	0.0	1.000	0.0	1.00	2.00	2.00
26	7353.	14705.	37037.	22222.	0.0	0.0	0.0	1.000	0.0	1.00	2.00	2.00
27	7353.	14705.	37037.	22222.	0.0	0.0	0.0	1.000	0.0	1.00	2.00	2.00
28	7353.	14705.	37037.	22222.	0.0	0.0	0.0	1.000	0.0	1.00	2.00	2.00
29	7353.	14705.	37037.	22222.	0.0	0.0	0.0	1.000	0.0	1.00	2.00	2.00
30	7353.	14705.	37037.	22222.	0.0	0.0	0.0	1.000	0.0	1.00	2.00	2.00
31	4608.	0.	0.	15152.	0.0	0.0	0.0	1.000	0.0	1.00	2.00	2.00
32	4608.	0.	0.	15152.	0.0	0.0	0.0	1.000	0.0	1.00	2.00	2.00
33	4608.	0.	0.	15152.	0.0	0.0	0.0	1.000	0.0	1.00	2.00	2.00
34	4608.	0.	0.	15152.	0.0	0.0	0.0	1.000	0.0	1.00	2.00	2.00
35	4608.	0.	0.	15152.	0.0	0.0	0.0	1.000	0.0	1.00	2.00	2.00
36	4608.	0.	0.	15152.	0.0	0.0	0.0	1.000	0.0	1.00	2.00	2.00
37	4082.	0.	0.	0.	0.0	0.0	0.0	1.000	0.0	1.00	2.00	2.00
38	4082.	0.	0.	0.	0.0	0.0	0.0	1.000	0.0	1.00	2.00	2.00
39	0.	0.	0.	0.	0.0	0.0	0.0	1.000	0.0	1.00	2.00	2.00
40	0.	0.	7246.	0.	0.0	0.0	0.0	1.000	0.0	1.00	2.00	2.00
41	0.	0.	7246.	0.	0.0	0.0	0.0	1.000	0.0	1.00	2.00	2.00
42	0.	0.	7246.	0.	0.0	0.0	0.0	1.000	0.0	1.00	2.00	2.00

OUTPUT TABLE 1: SUMMARY BY COST ELEMENT (IN MILLIONS OF CONSTANT \$)

RDT&E (FSED ONLY)	20.00	RECURR. SUPP.	4422.57
EQUIPMENT ACQ.	163.11	REPL. SPARES *****	
PME, AIR	105.58	DN-EQUIP. MAINT.	8.00
PME, SURF.	41.79	OFF-EQUIP. MAINT.	32.06
TNE, AIR	0.0	SUPP. EQ. MAINT.	17.85
TNE, SURF.	15.74	INVENT. MGMT.	0.03
		RECURR. TRAINING	0.0
		TECH. DATA MAINT.	1.17
MOD/INSTALL.	134.75		
NON-RECURR.	19.10	OPERATIONS	119.27
RECURR. LABOR	69.41	OPS. LABOR	30.89
RECURR. A-KIT	26.52	ADD. FUEL CNSMPTN	88.38
RECURR. FIXED	19.73		
INITIAL SUPP. ACQ.	45.75	TOTAL OWNERSHIP COST	4541.84
INIT. SPARES	33.02	*****	
SUPP. EQUIP.	11.95	TOTAL LCC	4905.45
INVENT. ENTRY	0.02	*****	
INIT. TRAINING	0.32	NO. PME TERM.S	NO. TNE TERM.S
INIT. TECH. DATA	0.45	AIR	5434.36
		SURF.	2706.03
			0.0
			297.00
TOTAL INVESTMENT COST	363.61	TOTAL	8140.39
			297.00

OUTPUT TABLE 4A: ITEM-SPECIFIC COSTS AND MAINTENANCE CHARACTERISTICS
(COSTS IN THOUSANDS OF CONSTANT DOLLARS)

ITEM INDEX (1)	ITEM NAME	LRU INDICATOR (LRU)	INITIAL SPARES (ISCA)	REPL. SPARES (RSCA)	CN- EQUIP. MAINT. (CNMCA)	OFF- EQUIP. MAINT. (OFMCA)	MAINT. TRAINING (MTRCI)	TECH. ORDERS (TDCI)	ITEM INVENT. MGAT. (IIMCA)	TOTAL SUPPORT EQUIP. (TSECI)	TOTAL COST (TIACI)	CORR. MAINT. COST/FAIL (RSCA+CNMCA+OFMCA)
1	LRU 1	1	7008.6	*****	2204.7	6772.9	5.4	56.4	3.4	9559.0	999999.9	12.078
2	LRU 2	1	6930.8	957561.3	1531.4	4688.1	5.4	46.8	3.4	6639.9	977406.9	12.078
3	LRU 3	1	3568.6	617462.5	1316.7	3874.2	5.4	43.5	3.4	5708.8	631982.8	9.076
4	LRU 4	1	1659.3	229569.0	629.4	1794.4	5.4	33.7	3.4	2728.9	236423.3	7.074
5	LRU 5	1	1636.3	162253.4	444.8	1264.1	5.4	31.1	3.4	1926.7	167567.1	7.074
6	LRU 6	1	48.3	4127.7	158.4	437.6	5.4	29.1	3.4	152.8	4962.8	0.572
7	LRU 7	1	13.0	514.6	49.4	129.6	5.4	26.2	3.4	47.6	789.2	0.270
8	LRU 8	1	154.7	17239.6	345.2	874.3	5.4	33.5	3.4	319.1	18975.3	1.071
9	LRU 9	1	172.4	11621.5	232.7	589.0	5.4	30.7	3.4	215.1	12870.3	1.071
10	LRU 10	1	24.2	383.7	3.7	9.7	5.4	25.1	3.4	3.6	458.7	2.070
11	LRU 11	1	164.5	18963.3	363.9	1004.5	5.4	34.4	3.4	351.0	20890.4	1.072
12	LRU 12	1	189.4	13689.3	262.7	781.3	5.4	31.9	3.4	253.4	15216.8	1.076
13	LRU 13	1	11452.7	951578.1	452.7	1955.1	5.4	32.3	3.4	1885.3	967364.7	42.106
20	SRU 20	0	0.0	0.0	0.0	406.6	10.7	50.6	0.0	0.0	468.0	0.023
21	SRU 21	0	0.0	0.0	0.0	406.6	10.7	50.6	0.0	0.0	468.0	0.023
22	SRU 22	0	0.0	0.0	0.0	406.6	10.7	50.6	0.0	0.0	468.0	0.023
23	SRU 23	0	0.0	0.0	0.0	406.6	10.7	50.6	0.0	0.0	468.0	0.023
24	SRU 24	0	0.0	0.0	0.0	406.6	10.7	50.6	0.0	0.0	468.0	0.023
25	SRU 25	0	0.0	0.0	0.0	406.6	10.7	50.6	0.0	0.0	468.0	0.023
26	SRU 26	0	0.0	0.0	0.0	406.6	10.7	50.6	0.0	0.0	468.0	0.023
27	SRU 27	0	0.0	0.0	0.0	406.6	10.7	50.6	0.0	0.0	468.0	0.023
28	SRU 28	0	0.0	0.0	0.0	406.6	10.7	50.6	0.0	0.0	468.0	0.023
29	SRU 29	0	0.0	0.0	0.0	406.6	10.7	50.6	0.0	0.0	468.0	0.023
30	SRU 30	0	0.0	0.0	0.0	406.6	10.7	50.6	0.0	0.0	468.0	0.023
31	SRU 31	0	0.0	0.0	0.0	405.2	10.7	50.6	0.0	0.0	466.6	0.023
32	SRU 32	0	0.0	0.0	0.0	405.2	10.7	50.6	0.0	0.0	466.6	0.023
33	SRU 33	0	0.0	0.0	0.0	405.2	10.7	50.6	0.0	0.0	466.6	0.023
34	SRU 34	0	0.0	0.0	0.0	405.2	10.7	50.6	0.0	0.0	466.6	0.023
35	SRU 35	0	0.0	0.0	0.0	405.2	10.7	50.6	0.0	0.0	466.6	0.023
36	SRU 36	0	0.0	0.0	0.0	405.2	10.7	50.6	0.0	0.0	466.6	0.023
37	SRU 37	0	0.0	0.0	0.0	215.9	10.7	50.3	0.0	0.0	276.9	0.023
38	SRU 38	0	0.0	0.0	0.0	215.9	10.7	50.3	0.0	0.0	276.9	0.023
39	SRU 39	0	0.0	0.0	0.0	136.9	10.7	50.2	0.0	0.0	197.8	0.023
40	SRU 40	0	0.0	0.0	0.0	136.9	10.7	50.2	0.0	0.0	197.8	0.023
41	SRU 41	0	0.0	0.0	0.0	136.9	10.7	50.2	0.0	0.0	197.8	0.023
42	SRU 42	0	0.0	0.0	0.0	136.9	10.7	50.2	0.0	0.0	197.8	0.023

COST TOTALS OVER ITEMS												
33022.8 ***** 7995.8 32057.8 317.0 1616.4 44.8 29793.1 4064175.0												

II.3 RLA Run

RLA Input Table 1 (from file 8B)

RLA Input Table 2 (TIAC values from six special runs)

RLA Output Table 1 (repair level decisions)

INPUT TABLE 1: LRU/SRU CROSS REFERENCE DATA (FROM FILE 8B)

LRU INDEX (IL)	#SRU TYPES IN LRU (NOS)	SRU INDEX (ISRU) (OPA)	SRU QUAN- TITY (OPA)	SRU INDEX NO. (ISRU) (OPA)	SRU QUAN- TITY (OPA)	SRU INDEX NO. (ISRU) (OPA)	SRU QUAN- TITY (OPA)	SRU INDEX NO. (ISRU) (OPA)	SRU QUAN- TITY (OPA)	SRU INDEX NO. (ISRU) (OPA)	SRU QUAN- TITY (OPA)	SRU INDEX NO. (ISRU) (OPA)	SRU QUAN- TITY (OPA)	SRU INDEX NO. (ISRU) (OPA)	SRU QUAN- TITY (OPA)
1	11	20	1	21	1	22	1	23	1	24	1	25	1	26	1
		27	1	28	1	29	1	30	1	31	1	32	1	33	1
2	11	20	1	21	1	22	1	23	1	24	1	25	1	26	1
		27	1	28	1	29	1	30	1	31	1	32	1	33	1
3	8	31	1	32	1	33	1	34	1	35	1	36	1	37	1
		38	1	39	1	40	1	41	1	42	1	43	1	44	1
4	6	31	1	32	1	33	1	34	1	35	1	36	1	37	1
		38	1	39	1	40	1	41	1	42	1	43	1	44	1
5	6	31	1	32	1	33	1	34	1	35	1	36	1	37	1
		38	1	39	1	40	1	41	1	42	1	43	1	44	1
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	4	39	1	40	1	41	1	42	1	43	1	44	1	45	1

INPUT TABLE 2: TOTAL ITEM SUPPORT COST - TIAC(I,R)
(COSTS IN THOUSANDS OF DOLLARS)

ITEM INDEX	GLOBAL MAINTENANCE STRATEGY - R												
	1	2	3	4	5	6	DISCARD	DISCARD	DISCARD	DISCARD	DISCARD	DISCARD	
LRU: BASE	BASE	DEPOT	BASE	DEPOT	DEPOT	DEPOT	DISCARD	DISCARD	DISCARD	DISCARD	DISCARD	DISCARD	DISCARD
SRU: BASE	BASE	DEPOT	BASE	DEPOT	DEPOT	DEPOT	DISCARD	DISCARD	DISCARD	DISCARD	DISCARD	DISCARD	DISCARD
1	21780.6	26974.8	27094.8	45664.2	45721.2	999999.9							
2	16543.5	20155.0	20248.7	33466.0	33906.9	477406.9							
3	13542.3	16057.3	18141.6	24164.7	24251.7	631982.8							
4	6810.1	8737.0	8841.1	10757.8	10801.5	236423.3							
5	5203.0	6602.6	6651.8	8107.9	8140.1	167567.1							
6	4830.4	4845.6	4846.1	4958.0	4959.4	4962.8							
7	746.2	751.2	751.4	786.5	787.6	789.2							
8	4607.8	4772.8	4810.6	4952.7	4960.6	18975.3							
9	3256.3	3371.2	3407.8	3438.6	3445.3	12870.3							
10	400.8	413.6	447.9	182.3	186.6	458.7							
11	5014.8	5193.1	5233.3	5507.8	5516.1	20890.4							
12	3761.4	3894.7	3931.8	4187.0	4194.2	15216.8							
13	2832.8	4007.5	40256.2	28662.3	28766.6	967364.7							
20	8904.8	8100.0	20429.6	5113.3	18071.6	468.0							
21	8904.8	8100.0	20429.6	5113.3	18071.6	468.0							
22	8904.8	8100.0	20429.6	5113.3	18071.6	468.0							
23	8904.8	8100.0	20429.6	5113.3	18071.6	468.0							
24	8904.8	8100.0	20429.6	5113.3	18071.6	468.0							
25	8904.8	8100.0	20429.6	5113.3	18071.6	468.0							
26	8904.8	8100.0	20429.6	5113.3	18071.6	468.0							
27	8904.8	8100.0	20429.6	5113.3	18071.6	468.0							
28	8904.8	8100.0	20429.6	5113.3	18071.6	468.0							
29	8904.8	8100.0	20429.6	5113.3	18071.6	468.0							
30	8904.8	8100.0	20429.6	5113.3	18071.6	468.0							
31	9700.4	8591.2	21414.4	5103.5	18008.3	466.6							
32	9700.4	8591.2	21414.4	5103.5	18008.3	466.6							
33	9700.4	8591.2	21414.4	5103.5	18008.3	466.6							
34	9700.4	8591.2	21414.4	5103.5	18008.3	466.6							
35	9700.4	8591.2	21414.4	5103.5	18008.3	466.6							
36	9700.4	8591.2	21414.4	5103.5	18008.3	466.6							
37	5451.7	4599.1	11427.6	2788.7	9623.6	276.9							
38	5451.7	4599.1	11427.6	2788.7	9623.6	276.9							
39	17984.6	15876.7	65053.9	9611.0	59443.9	197.8							
40	17984.6	15876.7	65053.9	9611.0	59443.9	197.8							
41	17564.6	15576.7	65053.9	9611.0	59443.9	197.8							
42	17984.6	15876.7	65053.9	9611.0	59443.9	197.8							

OUTPUT TABLE 1: REPAIR LEVEL ANALYSIS

ITEM INDEX (1)	LRU (1) OR SRU (0)	REPAIR LEVEL - RL			RESULTS DIFF. FROM CONTRACTOR INPUT
		BASE (1)	DEPOT (2)	DISCARD (3)	
1	1	*			*
2	1		*		*
3	1		*		*
4	1		*		*
5	1		*		*
6	1			*	*
7	1			*	*
8	1	*			*
9	1	*			*
10	1		*		*
11	1	*			*
12	1	*			*
13	1		*		*
20	0		*		*
21	0		*		*
22	0		*		*
23	0		*		*
24	0		*		*
25	0		*		*
26	0		*		*
27	0		*		*
28	0		*		*
29	0		*		*
30	0		*		*
31	0		*		*
32	0		*		*
33	0		*		*
34	0		*		*
35	0		*		*
36	0		*		*
37	0		*		*
38	0		*		*
39	0		*		*
40	0		*		*
41	0		*		*
42	0		*		*

II.4 Final LCC Run (incorporating RLA results)

LCC Input Table 9A

LCC Output Tables 1, 4A

```
*****  
*   SEEK TALK FSED PHASE LCC MODEL   *  
*   *   *   *   *   *   *   *   *   *  
*   RUN: FINAL RUN   *   *   *   *   *  
*   *   *   *   *   *   *   *   *  
*****
```


OUTPUT TABLE 1: SUMMARY BY COST ELEMENT (IN MILLIONS OF CONSTANT \$)

RDT&E (FSED ONLY)	20.00	RECURR. SUPP.	219.67
EQUIPMENT ACQ.	163.11	REPL. SPARES	88.14
PME, AIR	105.58	UN-EQUIP. MAINT.	8.00
PME, SURF.	41.79	OFF-EQUIP. MAINT.	94.87
TNE, AIR	0.0	SUPP. EQ. MAINT.	24.96
TNE, SURF.	15.74	INVENT. MGMT.	0.73
MOD/INSTALL.	134.75	RECURR. TRAINING	1.63
NON-RECURR.	19.10	TECH. DATA MAINT.	1.35
RECURR. LABOR	69.31	OPERATIONS	119.27
RECURR. A-KIT	26.52	OPS. LABOR	30.89
RECURR. FIXED	19.73	ADD. FUEL CNSMPTN	88.58
INITIAL SUPP. ACQ.	87.44	TOTAL OWNERSHIP COST	338.94
INIT. SPARES	68.01	TOTAL LCC	744.24
SUPP. EQUIP.	17.61	NO. PME TERM.S	9.0
INVENT. ENTRY	0.34	AIR	5434.36
INIT. TRAINING	0.90	SURF.	2706.03
INIT. TECH. DATA	0.52	TOTAL	8140.39
TOTAL INVESTMENT COST	405.30		297.00

OUTPUT TABLE 4A: ITEM-SPECIFIC COSTS AND MAINTENANCE CHARACTERISTICS
(COSTS IN THOUSANDS OF CONSTANT DOLLARS)

ITEM INDEX (1)	ITEM NAME	LRU	INDI-CATOR (LRU)	INITIAL SPARES (ISCA)	REPL SPARES (RSCA)	ON-EQUIP. MAINT. (ONMCA)	OFF-EQUIP. MAINT. (OFMCA)	MAINT. TRAINING (MTRCI)	TECH. ORDERS (TDC)	ITEM INVENT. #CWT. (IINCA)	TOTAL SUPPORT EQUIP. (TSECI)	TOTAL SUPPORT COST (TTAC)	CORR./MAINT. COST/FAIL (RSCA+ONMCA +OFMCA)
1	LRU 1	1	4255.4	0.0	2204.7	8779.0	287.9	58.3	3.4	10216.4	25805.0	0.096	
2	LRU 2	1	17613.1	0.0	1531.4	7781.2	20.9	40.5	3.4	3781.9	30772.5	0.117	
3	LRU 3	1	10485.9	0.0	1316.7	6377.1	20.9	41.8	3.4	2473.6	20719.4	0.112	
4	LRU 4	1	4297.4	0.0	629.4	2933.3	20.9	32.9	3.4	1195.5	9112.9	0.109	
5	LRU 5	1	3529.6	0.0	444.8	2064.9	20.9	30.6	3.4	852.3	6946.6	0.108	
6	LRU 6	1	48.3	4127.7	158.4	437.6	3.4	25.9	3.4	57.9	4862.8	0.572	
7	LRU 7	1	13.0	514.6	49.4	129.6	3.4	25.2	3.4	18.0	756.6	0.270	
8	LRU 8	1	97.4	862.0	345.2	2692.5	287.9	45.2	37.9	614.8	4883.0	0.226	
9	LRU 9	1	108.6	581.1	232.7	1815.0	287.9	42.7	37.9	417.8	3523.7	0.226	
10	LRU 10	1	33.6	19.2	3.7	32.0	20.9	25.0	37.9	12.3	164.1	0.286	
11	LRU 11	1	103.4	948.2	363.9	2960.3	287.9	46.0	37.9	675.4	5423.0	0.225	
12	LRU 12	1	119.2	684.5	262.7	2142.3	287.9	43.6	37.9	490.3	4068.5	0.226	
13	LRU 13	1	22568.8	0.0	452.7	3453.9	20.9	103.8	37.9	889.0	27527.2	0.172	
20	SRU 20	0	393.8	2552.3	0.0	3146.1	41.8	57.8	37.9	1743.3	7973.0	0.324	
21	SRU 21	0	393.8	2552.3	0.0	3146.1	41.8	57.8	37.9	1743.3	7973.0	0.324	
22	SRU 22	0	393.8	2552.3	0.0	3146.1	41.8	57.8	37.9	1743.3	7973.0	0.324	
23	SRU 23	0	393.8	2552.3	0.0	3146.1	41.8	57.8	37.9	1743.3	7973.0	0.324	
24	SRU 24	0	393.8	2552.3	0.0	3146.1	41.8	57.8	37.9	1743.3	7973.0	0.324	
25	SRU 25	0	393.8	2552.3	0.0	3146.1	41.8	57.8	37.9	1743.3	7973.0	0.324	
26	SRU 26	0	393.8	2552.3	0.0	3146.1	41.8	57.8	37.9	1743.3	7973.0	0.324	
27	SRU 27	0	393.8	2552.3	0.0	3146.1	41.8	57.8	37.9	1743.3	7973.0	0.324	
28	SRU 28	0	393.8	2552.3	0.0	3146.1	41.8	57.8	37.9	1743.3	7973.0	0.324	
29	SRU 29	0	393.8	2552.3	0.0	3146.1	41.8	57.8	37.9	1743.3	7973.0	0.324	
30	SRU 30	0	393.8	2552.3	0.0	3146.1	41.8	57.8	37.9	1743.3	7973.0	0.324	
31	SRU 31	0	17.2	2543.3	0.0	2217.6	41.8	58.6	37.9	194.6	5111.1	0.271	
32	SRU 32	0	17.2	2543.3	0.0	2217.6	41.8	58.6	37.9	194.6	5111.1	0.271	
33	SRU 33	0	17.2	2543.3	0.0	2217.6	41.8	58.6	37.9	194.6	5111.1	0.271	
34	SRU 34	0	17.2	2543.3	0.0	2217.6	41.8	58.6	37.9	194.6	5111.1	0.271	
35	SRU 35	0	17.2	2543.3	0.0	2217.6	41.8	58.6	37.9	194.6	5111.1	0.271	
36	SRU 36	0	17.2	2543.3	0.0	2217.6	41.8	58.6	37.9	194.6	5111.1	0.271	
37	SRU 37	0	10.3	1355.0	0.0	1181.5	41.8	54.6	37.9	115.4	2796.4	0.271	
38	SRU 38	0	10.3	1355.0	0.0	1181.5	41.8	54.6	37.9	115.4	2796.4	0.271	
39	SRU 39	0	71.7	8590.4	0.0	749.0	41.8	51.9	37.9	76.1	9618.9	1.576	
40	SRU 40	0	71.7	8590.4	0.0	749.0	41.8	51.9	37.9	76.1	9618.9	1.576	
41	SRU 41	0	71.7	8590.4	0.0	749.0	41.8	51.9	37.9	76.1	9618.9	1.576	
42	SRU 42	0	71.7	8590.4	0.0	749.0	41.8	51.9	37.9	76.1	9618.9	1.576	

COST TOTALS OVER ITEMS			68015.4	88143.4	7995.8	94870.0	2533.0	1866.2	1124.7	42574.0	307121.7		

II.5 LCC Summary and Adjusted Final LCC Run

A summary of the LCCs and the total support costs is given below for the six special LCC runs (Section II.2) and the final LCC run (Section II.4). (Ignore the last line of the table for now.)

<u>Run</u>	<u>LCC (\$M)</u>	<u>Total Support (\$1,000)</u>
R = 1	791.77	354646.0
R = 2	795.82	358701.1
R = 3	1223.57	786445.0
R = 4	743.25	306123.9
R = 5	1176.62	739497.2
R = 6	4905.45	4064175.0
Final	744.24	307121.7
Adj. Final	742.57	305446.2

Recall that the six special LCC runs (R = 1 to 6) were made to provide the total support costs for each ITEM (TIAC(I,R)s) as an input to the RLA program, which in turn provided the ITEM repair level decisions (RL(I)s) as an input to the final LCC run. Ideally, this final run should provide the lowest LCC (or total support cost). In this case, however, the fourth run (R = 4) gives the lowest figures. This is due to the fact that the RLA results are based on the individual ITEM support costs, which are prorated in the six special LCC runs each with a different global repair strategy. The proration does not necessarily reflect the individual ITEM support costs accurately in the final run where the ITEM repair levels are mixed. This would cause the situation as indicated in the summary table above, particularly when there are many near optimal repair level solutions. As shown in the table, the fourth run and the final run both produce very close LCCs. Minor alternations between the two repair level solutions used in these two LCC runs would also generate near optimal LCCs. For example, knowing that ITEM 1 and ITEM 2 both share the same set of SRUs, one may change the RLA results so that these two LRUs are either both base-repaired or both depot-repaired. In fact, changing the repair level of ITEM 1 from base-repair to depot-repair (RL(1) changed from 1 to 2) in the RLA results produces a lowest, but only slightly better LCC (or total support cost), as shown in the last line (adjusted final) of the table above. The detailed output of this run is attached as in the following sequence:

LCC Input Table 9A
LCC Output Tables 1, 4A

```
*****  
*   SEEK TALK FSED PHASE LCC MODEL   *  
*                                     *  
*   RUN: FINAL RUN, RL(1)=2         *  
*                                     *  
*****
```

INPUT TABLE 9A: ITEM MAINTENANCE DATA

ITEM (1)	PREDICTED MEAN TIME BETWEEN FAILURES		FAILURE RATE		FRACTION FAILURES REPAIRED AT		FAILURE REMOVE		BASE LV		REPAIR R.L.	
	(PMTBF1) (AIR-CARGO)	(PMTBF2) (GRND-FIXED)	(PMTBF3) (GRND-MOBILE)	(PMTBF4) (RATE)	(RIP) (IN PLACE)	(RTS) (NRTS)	(CONV) (CONV)	(RMH) (MAN HRS)	(BCH) (MAN HRS)	(DMH) (MAN HRS)	(RL) (CODE)	(RL) (CODE)
1	667	1333	0	0	0	0	0	0	0	0	0	2
2	0	0	3333	2000	0	0	1	0	0	0	0	2
3	556	0	0	0	0	0	1	0	0	0	0	2
4	764	0	0	0	0	0	1	0	0	0	0	2
5	0	0	0	2500	0	0	1	0	0	0	0	2
6	4000	0	0	0	0	0	0	1	0	0	0	3
7	0	0	0	45045	0	0	0	0	1	0	0	3
8	4000	8000	0	0	0	0	0	0	0	0	0	1
9	0	0	20000	12500	0	0	0	0	0	0	0	2
10	0	5831	0	0	0	0	0	0	0	0	0	1
11	0	10000	0	0	0	0	0	0	0	0	0	1
12	0	0	0	11534	0	0	0	0	0	0	0	1
13	0	0	0	0	0	0	0	0	0	0	0	1
20	7353	14705	0	22222	0	0	0	0	0	0	0	2
21	7353	14705	37037	22222	0	0	0	0	0	0	0	2
22	7353	14705	37037	22222	0	0	0	0	0	0	0	2
23	7353	14705	37037	22222	0	0	0	0	0	0	0	2
24	7353	14705	37037	22222	0	0	0	0	0	0	0	2
25	7353	14705	37037	22222	0	0	0	0	0	0	0	2
26	7353	14705	37037	22222	0	0	0	0	0	0	0	2
27	7353	14705	37037	22222	0	0	0	0	0	0	0	2
28	7353	14705	37037	22222	0	0	0	0	0	0	0	2
29	7353	14705	37037	22222	0	0	0	0	0	0	0	2
30	7353	14705	37037	22222	0	0	0	0	0	0	0	2
31	4608	0	0	15152	0	0	0	0	0	0	0	2
32	4608	0	0	15152	0	0	0	0	0	0	0	2
33	4608	0	0	15152	0	0	0	0	0	0	0	2
34	4608	0	0	15152	0	0	0	0	0	0	0	2
35	4608	0	0	15152	0	0	0	0	0	0	0	2
36	4608	0	0	15152	0	0	0	0	0	0	0	2
37	4082	0	0	0	0	0	0	0	0	0	0	2
38	4082	0	0	0	0	0	0	0	0	0	0	2
39	0	0	7246	0	0	0	0	0	0	0	0	2
40	0	0	7246	0	0	0	0	0	0	0	0	2
41	0	0	7246	0	0	0	0	0	0	0	0	2
42	0	0	7246	0	0	0	0	0	0	0	0	2

OUTPUT TABLE 1: SUMMARY BY COST ELEMENT (IN MILLIONS OF CONSTANT \$)

RT&E (FSED ONLY)	20.00	RECURR. SUPP.	207.25
EQUIPMENT ACQ.	163.11	REPL. SPARES	88.14
PME, AIR	105.58	ON-EQUIP. MAINT.	8.00
PME, SURF.	41.79	OFF-EQUIP. MAINT.	87.21
TNE, AIR	0.0	SUPP. EQ. MAINT.	20.37
TNE, SURF.	15.74	INVENT. MGMT.	0.73
MOD/INSTALL.	134.75	RECURR. TRAINING	1.46
NON-RECURR.	19.10	TECH. DATA MAINT.	1.34
RECURR. LABOR	69.41	OPERATIONS	119.27
RECURR. A-KIT	26.52	OPS. LABOR	30.89
RECURR. FIXED	19.73	ADD. FUEL CNSMPTN	88.38
INITIAL SUPP. ACC.	98.20	TOTAL OWNERSHIP COST	326.51
INIT. SPARES	81.87	TOTAL LCC	742.57
SUPP. EQUIP.	14.55	*****	*****
INVENT. ENTRY	0.39	NO. PME TERM.S	NO. TNE TERM.S
INIT. TRAINING	0.87	AIR	5434.36
INIT. TECH. DATA	0.52	SURF.	2706.03
TOTAL INVESTMENT COST	416.06	TOTAL	8140.39
			297.00

OUTPUT TABLE 4A: ITEM-SPECIFIC COSTS AND MAINTENANCE CHARACTERISTICS
(COSTS IN THOUSANDS OF CONSTANT DOLLARS)

ITEM INDEX (1)	ITEM NAME	LRU INDI-CATOR (LRU)	INITIAL SPARES (ISCA)	REPL. SPARES (RSCA)	ON-MAINT. (ONMCA)	EQUIP. MAINT. (EMCA)	OFF-MAINT. (OFMCA)	MAINT. TRAINING (INTRCI)	TECH. ORDERS (TOCI)	ITEM INVENT. MGMT. (IIMCA)	TOTAL EQUIP. (TSEC1)	TOTAL SUPPORT COST (TSC)	CORR. MAINT. COST/FAIL (RSCA/ONMCA + OFMCA)
1	LRU 1	1	22249.3	0.0	2204.7	11249.7	20.4	55.0	3.4	3.4	9122.3	44904.8	0.117
2	LRU 2	1	17613.1	0.0	1531.4	7781.2	20.4	45.8	3.4	3.4	6344.2	33339.5	0.117
3	LRU 3	1	10485.9	0.0	1316.7	6377.1	20.4	46.3	3.4	3.4	5462.8	23712.5	0.112
4	LRU 4	1	4297.4	0.0	629.4	2933.3	20.4	35.1	3.4	3.4	2624.4	10543.4	0.109
5	LRU 5	1	3529.6	0.0	444.8	2054.9	20.4	32.1	3.4	3.4	1862.2	7957.5	0.108
6	LRU 6	1	48.3	4127.7	158.4	437.6	3.5	25.9	3.4	3.4	98.0	4902.9	0.572
7	LRU 7	1	13.0	514.6	49.4	129.6	3.5	25.3	3.4	3.4	30.5	769.2	0.270
8	LRU 8	1	97.4	862.0	345.2	2692.5	309.4	45.5	37.9	37.9	1030.8	5420.7	0.226
9	LRU 9	1	108.6	581.1	232.7	1815.0	309.4	42.9	37.9	37.9	698.1	3825.8	0.226
10	LRU 10	1	33.0	19.2	3.7	32.0	20.4	25.1	37.9	37.9	113.2	184.5	0.286
11	LRU 11	1	103.4	946.2	363.9	2960.3	309.4	46.2	37.9	37.9	1132.8	5902.3	0.225
12	LRU 12	1	119.2	684.5	262.7	2142.3	309.4	43.8	37.9	37.9	820.6	4420.5	0.172
13	LRU 13	1	23568.8	0.0	452.7	3453.9	20.4	105.4	37.9	37.9	1876.1	28515.3	0.172
20	SRU 20	0	17.2	2552.3	0.0	2225.4	40.8	55.4	37.9	37.9	191.2	5120.2	0.271
21	SRU 21	0	17.2	2552.3	0.0	2225.4	40.8	55.4	37.9	37.9	191.2	5120.2	0.271
22	SRU 22	0	17.2	2552.3	0.0	2225.4	40.8	55.4	37.9	37.9	191.2	5120.2	0.271
23	SRU 23	0	17.2	2552.3	0.0	2225.4	40.8	55.4	37.9	37.9	191.2	5120.2	0.271
24	SRU 24	0	17.2	2552.3	0.0	2225.4	40.8	55.4	37.9	37.9	191.2	5120.2	0.271
25	SRU 25	0	17.2	2552.3	0.0	2225.4	40.8	55.4	37.9	37.9	191.2	5120.2	0.271
26	SRU 26	0	17.2	2552.3	0.0	2225.4	40.8	55.4	37.9	37.9	191.2	5120.2	0.271
27	SRU 27	0	17.2	2552.3	0.0	2225.4	40.8	55.4	37.9	37.9	191.2	5120.2	0.271
28	SRU 28	0	17.2	2552.3	0.0	2225.4	40.8	55.4	37.9	37.9	191.2	5120.2	0.271
29	SRU 29	0	17.2	2552.3	0.0	2225.4	40.8	55.4	37.9	37.9	191.2	5120.2	0.271
30	SRU 30	0	17.2	2552.3	0.0	2225.4	40.8	55.4	37.9	37.9	191.2	5120.2	0.271
31	SRU 31	0	17.2	2543.3	0.0	2217.6	40.8	58.8	37.9	37.9	194.9	5110.4	0.271
32	SRU 32	0	17.2	2543.3	0.0	2217.6	40.8	58.8	37.9	37.9	194.9	5110.4	0.271
33	SRU 33	0	17.2	2543.3	0.0	2217.6	40.8	58.8	37.9	37.9	194.9	5110.4	0.271
34	SRU 34	0	17.2	2543.3	0.0	2217.6	40.8	58.8	37.9	37.9	194.9	5110.4	0.271
35	SRU 35	0	17.2	2543.3	0.0	2217.6	40.8	58.8	37.9	37.9	194.9	5110.4	0.271
36	SRU 36	0	17.2	2543.3	0.0	2217.6	40.8	58.8	37.9	37.9	194.9	5110.4	0.271
37	SRU 37	0	10.3	1355.0	0.0	1181.5	40.8	54.6	37.9	37.9	115.5	2795.5	0.271
38	SRU 38	0	10.3	1355.0	0.0	1181.5	40.8	54.6	37.9	37.9	115.5	2795.5	0.271
39	SRU 39	0	71.7	8590.4	0.0	749.0	40.8	51.9	37.9	37.9	76.2	9618.0	1.576
40	SRU 40	0	71.7	8590.4	0.0	749.0	40.8	51.9	37.9	37.9	76.2	9618.0	1.576
41	SRU 41	0	71.7	8590.4	0.0	749.0	40.8	51.9	37.9	37.9	76.2	9618.0	1.576
42	SRU 42	0	71.7	8590.4	0.0	749.0	40.8	51.9	37.9	37.9	76.2	9618.0	1.576

COST TOTALS CVE ITEMS			81866.3	88143.4	7995.8	87213.0	2325.2	1853.6	1124.7	34924.0	305446.2		

APPENDIX III

INSTRUCTIONS FOR CALCULATING MODIFICATION/INSTALLATION COST ELEMENT

The purpose of this appendix is to serve as a guide and assist in the preparation of parameter estimates for the SEEK TALK Modification/Installation costs. Appendix III serves therefore as a supplement to Section 8, paragraphs 8.3.4 and 8.3.5. The appendix consists of three parts. Part III.1 identifies the particular host platforms that will be used as the basis for the cost estimates. Part III.2 gives ground rules for preparation of the non-recurring cost element NRMI(NP), while Part III.3 describes the preparation of two recurring cost parameters: A Kit Cost, AKIT(IA,NP), and variable labor hours, MIMH(IA,M,NP). (Here NP defines host platform category, IA defines installation area, and M defines mode of installation.)

It should be noted that all costs are figured on a per platform basis, not a per terminal basis. Thus for example if a set of four terminals is to be installed on a particular type of platform, NRMI, AKIT and MIMH represent the costs or labor hours associated with the complete set, not the costs or labor hours for a single terminal.

III.1 Use of Particular Host Platforms as Basis Platforms

The FSED Phase LCC Model groups host platforms for Prime Mission Equipment terminals into seven categories, identified by index NP:

- (1) Tactical aircraft, full-up or Type I terminal configuration
- (2) Tactical aircraft, partial array or Type II
- (3) Tactical aircraft, modem-only or Type III
- (4) Cargo/electronic aircraft, modem-only (This category includes primarily airborne C² platforms)
- (5) Ground fixed/transportable element, modem-only
- (6) Ground mobile element, partial array
- (7) Ground manpack unit, modem-only

In addition to these seven platform groupings there is an eighth type for Timing Net Equipment master clock terminals. Within the seven PME host platform categories, there are some 34 different platforms (types and models) as indicated by the sum of the platform diversity parameters PDIV(NP) shown in Input File(4) (See Table 8-VI).

During the FSED Phase of SFEK TALK, development contractors will have information on only a few platform types, which will be called basis platforms. Contractors shall therefore estimate first the Modification/Installation parameters NRMI, AKIT and MIMH for the basis platforms. Once this has been done, contractors shall convert the basis estimates to the platform category estimates necessary for inputs to the LCC Model. The conversion process for each platform category NP involves a weighted summation of parameters for selected basis platforms. Two different weighting schemes are required; one applies to the non-recurring parameter NRMI, the other to the recurring parameters AKIT and MIMH.

The basis platforms that shall be used, and the corresponding interfacing AM radios, are listed below.

<u>Aircraft</u>	<u>Ground</u>
A-10 (ARC-164)	FACP (ARC-164)
E-3A (ARC-171)	
F-4E (ARC-164)	CRC (GRC-171 and other radios)
F-15 (ARC-164)	TACP (MRC-107/108;GRC-206)
F-16 (ARC-164)	Manpack (PRC-113)
OV-10 (ARC-164)	

In order to project or extend the information on the basis platforms to provide inputs approximately representative of the platform categories NP, more than one terminal configuration must be artificially introduced for three of the basis platforms. The basis platforms and terminal configurations, which are identified by the index NPB, are as follows:

- | | |
|--------------------------|--------------------------|
| (1) A-10, full-up | (11) FACP, modem only |
| (2) A-10, partial array | (12) CRC, modem only |
| (3) E-3A, modem only | (13) TACP, partial array |
| (4) F-4, partial array | (14) Manpack, modem only |
| (5) F-4, modem only | |
| (6) F-15, partial array | |
| (7) F-16, full-up | |
| (8) OV-10, full-up | |
| (9) OV-10, partial array | |
| (10) OV-10, modem only | |

In order to distinguish between parameters relating to basis platform NPB and those relating to platform grouping NP, the following nomenclature is introduced:

<u>Name</u>	<u>Parameter for Basis Platforms</u>	<u>Parameter for Platform Groupings</u>
Non-recurring cost	NRMIB(NPB)	NRMI(NP)
A-Kit recurring cost	AKITB(IA,NPB)	AKIT(IA,NP)
Recurring labor hours	MIMHB(IA,M,NPB)	MIMH(IA,M,NP)

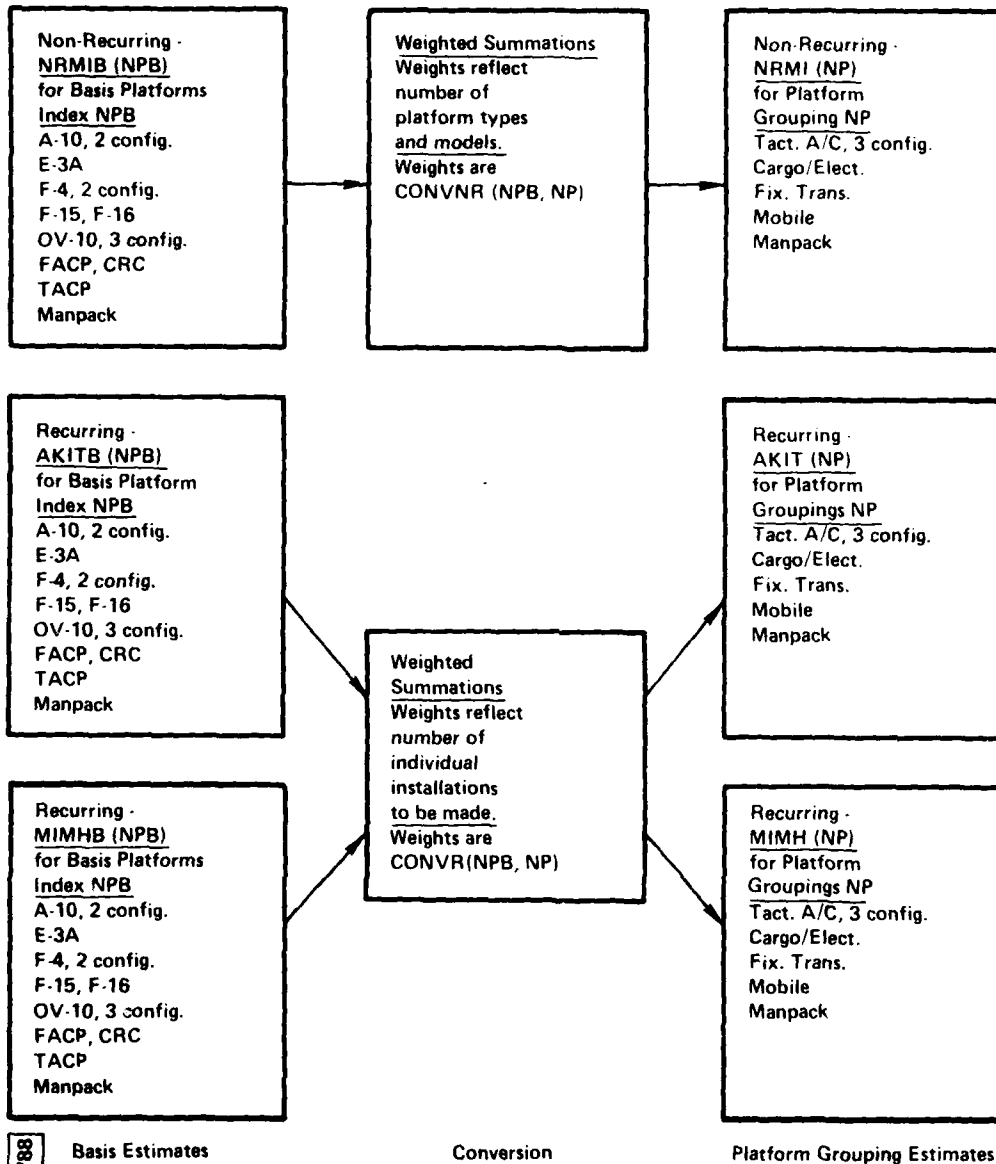
The process for converting estimates for the above basis platforms to the platform groupings NP is illustrated in Figure III-1. As indicated in the figure, the weighting or conversion factors CONVNR(NPB,NP) for the non-recurring cost NRMI takes into account only how many platform types are involved. By contrast, the weighting or conversion factors CONVR(NPB,NP) for the recurring parameters AKIT and MIMH takes into account also the number of installations that will be made.

III.2 Non-Recurring Cost Element Guideline

a. Introduction

This part of Appendix III serves as a guide for the preparation of estimates for the parameter NRMI(NP). It supplements paragraph 8.3.4. Non-Recurring costs of a modification program are generally described in AFR 57-4 "Modification Program Approval". For purposes of this cost analysis only an aggregate cost is estimated, NRMI(NP), which is the sum of five components. These components are defined in the following section, and the procedures for deriving the values to be entered into the LCC program are discussed in Section c.

The LCC Model allows for three different modes of installation M, namely: M=1, installed during host platform production; M=2, installed as a field retrofit by a depot team; and M=3, installed as a depot retrofit. If more than one mode of installation is involved for a given platform type, this fact must be taken into account in estimating values of NRMI. In their initial LCC studies during FSED, contractors shall assume that all installations are made in mode M=2. After a definitive installation plan and schedule is available, this assumption may be changed.



IA-60,788

Figure III-1. Conversion from Basis Estimates to Platform Grouping Estimates

b. Definition

The total non-recurring Modification/Installation cost NRMI(NP) is the sum of five components, namely:

- 1) Engineering: Engineering effort required to design, develop, integrate, test and qualify the installation of a terminal or set of terminals as specified for the platform.
- 2) Kits for Prototyping: Cost of one prototype group A Kit plus cost of man-hours to install kit. Cost of prototype installation is usually higher than normal installation. (Note that two different A Kit designs may be required for a given platform type if some installations are to be made in Mode 2 or 3, and others, in Mode 1.)
- 3) Testing: Cost of testing divided into two subfunctions: ground testing and flight testing. Ground test includes cost of equipment and cost of personnel, figured as man-hours for ground support personnel and for engineering times cost per man-hour. Flight test includes cost of aircraft operation engineers man-hours plus the cost of flight and support personnel man-hours.
- 4) Proofing: Cost of one production group A kit plus cost of engineering man-hours to install and approve or revise the installation design and procedures.
- 5) Data: This is the cost for updating manuals, printing of manuals, preparing and printing of TCTO. This may be calculated as number of pages times cost per page.

c. Procedures

The contractor shall perform the calculations that are defined in the work sheet shown in Figure III-2. As shown on the worksheet, three steps are involved:

- 1) Estimate the total non-recurring mod/installation cost NRMIB(NPB) for each of the basis platforms, for the terminal configuration or configurations indicated. This is the sum of the five elements listed in b. above. Note that for some basis platforms only one configuration is required, while for others, two or three are.
- 2) Convert these basis platform estimates to platform grouping estimates using for each platform grouping NP the

Platform Groupings

Index NPB	Basis Platforms & Terminal Config.	Contractor Inputs Non-Recurr. Costs NRMIB(NPB) for Basis Platforms	Airborne				Ground			
			NP = 1 Tactical A/C, FU	NP = 2 Tactical A/C, PA	NP = 3 Tactical A/C, MO	NP = 4 Cargo/Elect., MO	NP = 5 Fix/Trans., MO	NP = 6 Mobile, PA	NP = 7 Manpack, MO	
1	A-10, Full-up	12	1/3	weights for conversion (govt.)						
2	A-10, Modem-Only	6		1/5	CONVNR(NPB,NP)					
3	E-3A, Modem-Only	14			0.31					
4	F-4, Partial Array	10		3.5/6						
5	F-4, Modem-Only	7		3/5						
6	F-15, Partial Array	9		1.5/6						
7	F-16, Full-up	13	1/3							
8	OV-10, Full-up	11	1/3							
9	OV-10, Partial Array	8		1/6						
10	OV-10, Modem-Only	5		1/5	1.18					
11	FACP, Modem-Only	4				1/2				
12	CRC, Modem-Only	3				1/2				
13	TACP, Partial Array	2					1			
14	Manpack, Modem-Only	1						1		
<u>Outputs</u>			12.00	9.42	6.4	10.24	3.5	2	1	
Weighted Sums - NRMIB(NP)										

$$NRMIB(NP) = \sum_{NPB} NRMIB(NPB) * CONVNR(NPB,NP)$$

Figure 111-2

Worksheet for Calculating NRMIB(NP)

(Note: A set of illustrative (but completely unrealistic) inputs and corresponding outputs, are shown.)

indicated set of basis platforms and the indicated weights. The calculation is as follows:

$$\text{NRMI}(\text{NP}) = \sum_{\text{NPB}} \text{NRMIB}(\text{NPB}) * \text{CONVNR}(\text{NPB}, \text{NP})$$

- 3) Enter the results of step 2) into Input File (4) as the element NRMI(NP).

To show how the conversion process works, Figure III-2 provides an example of the calculations. It should be noted that the "contractor inputs" given in the example are chosen arbitrarily, and do not represent realistic costs. However, government provided weighting factors are to be used as shown.

III.3 Recurring Cost Element Guidelines

a. Introduction

This part of Appendix III serves as a guide for the preparation of estimates for two parameters - A Kit Cost, AKIT(IA,NP) and variable labor hours MIMH(IA,M,NP). This discussion supplements paragraph 8.3.5. Recurring cost elements of a modification are discussed in AFR57-4 "Modification Program Approval". For purposes of this analysis, three (3) specific elements have been identified. Two of these, AKIT(IA,NP) and MIMH(IA,M,NP) are estimated by the contractor. The third element, MIFIX(M,NP) is an Air Force input. The contractor elements will be estimated based upon a detailed analysis of the tasks involved for installations on specific platform types. These specific (basis) platform types were identified in Section III.1 above. The estimate for these specific platform types will then be converted to estimates by platform grouping NP.

The following section provides definitions for the two recurring cost elements to be estimated. Section c. addresses an analysis structure that is to be utilized for estimating the variable man-hours MIMH. Section d. outlines the procedures that are to be used for preparing the parameter estimates for the basis platforms, and converting these to LCC Model inputs.

b. Definitions

The following definitions apply to the parameters to be estimated as recurring cost elements.

A-Kit, AKIT(IA,NP): The items, parts or components to be permanently or semi-permanently installed in a configuration item to support, secure, interconnect or accommodate the prime mission equipment included in a modification. Note that for purposes of this analysis this cost is broken up into separate costs for each major subsystem or installation area IA included in the installation.

Variable Man-hours, MIMH(IA,M,NP): The man-hours, by installation area and mode of installation, associated with the actual work content of the modification/installation itself. These man-hours are directly affected by the installation design and comprise the performance of the tasks that would be identified in TCTO procedures. These are shown as seven (7) tasks in the analysis structure identified in Section c.

The following definitions are used in the analysis structure identified in Section c.

Installation Modes, identified by the index M. Installation modes were defined in Section III.2, above. Initially, FSED contractors shall assume that all installations are field retrofits by a depot team - mode M=2.

SEEK TALK Installation Areas (or Subsystems) identified by index IA, are defined below:

- 1) Antenna Subsystem - Consists of both new and/or modified antenna elements and any electronic boxes directly associated with them. Installation consists of mounting the new elements and any electronic boxes, connecting all power and RF connections and performing any required inspection tasks.
- 2) Electronics Subsystem - Consists of the major electronic boxes comprising the installed system. Installation consists of mounting all new boxes, removal and replacement of any modified boxes and completing power and RF connections. A complete system check out upon completion of the installation is also included as a task.
- 3) Control Subsystem - Consists of the separate radio/system control boxes. Installation consists of removal and replacement of existing control panels or integration of a new panel.

- 4) Cable/Wiring Subsystem - Consists of all inter-connecting cabling between and among the other main subsystems. Installation of the other subsystems implies merely making connections to cabling installed separately as a part of this subsystem.

Modification/Installation work category descriptions:

- 1) Equipment Removal (Temporary) - In order to gain access to the affected areas and systems of the platform, it may be necessary to temporarily remove items such as panels, doors, floor boards, seats, tubing, wire barriers, clamps, brackets and electronic equipment that are obstructing the modification work area of the platform. Also included is the removal of these items for relocation on the platform.
- 2) Equipment Removal (Permanent) - This task includes permanent removal of electronics, mechanical equipment, brackets, cabling, clamps, fittings, controls and other items that are part of a system that is being replaced or modified for retrofit of a new one. These items will be discarded or recycled.
- 3) Structure Modification - Any alterations to the basic mechanical framework and housing of the platform such as the airframe, bulkheads, stringers and skins in the case of an aircraft. Work in this category includes layout and cutting/drilling of holes and openings; reinforcement with doublers; enlargement of holes; cut-outs; creation of new recesses; removal of identification, instructions, nameplates; filling of openings, holes, cavities; bending, cutting, welding, riveting new structural members to frameworks; smoothing, refinishing, resealing, repainting, etc.
- 4) Facilities/System Modifications - This group is concerned with changes to heating, lighting, cooling, power, oxygen, pneumatic, hydraulic and other facilities made necessary to accommodate the SEEK TALK system. It includes cutting, drilling, bending, clamping and rerouting cables, tubing, ducts and pipes. Also, the relocation and mounting of motors, fans, compressors, pumps and other facilities equipment.
- 5) Equipment Installation - The assembly and mounting of the SEEK TALK system and supporting equipment in the platform. Installation includes "A" Kit brackets, clips, cables, etc.

and then fixing the "B" Kit prime mission equipment in position for mission operation.

- 6) Original Equipment Reinstallations - The replacement of items such as panels, doors, floorboards, seats, tubing, electronic equipment, and wire harnesses that were temporarily removed to gain access to the modification work area or for relocation on the platform.
- 7) System Operational Check-out - This task includes a functional check on both the new system and any system that was disturbed during the installation.

c. Analysis Structure for Calculating MIMH for Basis Platforms

The variable manhours costs for installing the SEEK TALK system can be calculated by using the structure shown in Figure III-3.

As shown, the previously defined four subsystems are used to describe the SEEK TALK equipment parameters. For each subsystem the work that is associated with its installation is analyzed by using the common set of seven Modification/Installation work categories. The sum of the manhours in this 4x7 table comprises the basic estimate for the recurring installation effort.

<u>Modification Work Categories</u>	<u>SEEK TALK EQUIPMENT SUBSYSTEM IA</u>				
	<u>Antennas</u>	<u>Electronics</u>	<u>Controls</u>	<u>Cabling/Wiring</u>	
Temp. Removals	*	*	*	*	*
Perm. Removals	*	*	*	*	*
Structure Mods	*	*	*	*	*
Facility Mods	*	*	*	*	*
Equip. Install.	*	*	*	*	*
Reinstallations	*	*	*	*	*
System Checkout	*	*	*	*	*

Figure III-3
Structure for Calculating Recurring
Variable Labor Hours MIMH(IA,M,NP)

d. Procedures

The cost of A Kits is to be estimated separately for each of the four installation subsystems. The first three subsystems primarily involve mounting brackets; however, the wiring subsystem includes the cost of the cabling to be installed. B Kit costs are estimated elsewhere as Prime Mission Equipment (PME); however, cabling is not included in the PME.

The variable man-hours involved in an installation are estimated in detail using the analysis structure defined in Section c.

Three steps are involved in the calculation for AKIT(IA,NP) or for MIMH(IA,M,NP), where M is taken as 2. See the worksheets given in Figures III-4 and III-5, respectively.

These steps are as follows:

- 1) Estimate AKITB(IA,NPB), or MIMHB(IA,M,NPB), for each basis platform and each value of Installation Area IA, for the terminal configuration or configurations indicated. Note that for some basis platforms only one configuration is required, while for others two or three are.
- 2) Convert these basis platform estimates to platform grouping estimates, using for each platform grouping NP, the indicated set of basis platforms and the indicated weights. The calculations are as follows:

$$AKIT(IA,NP) = \sum_{NPB} AKITB(IA,NPB) * CONVR(NPB,NP)$$

$$MIMH(IA,M,NP) = \sum_{NPB} MIMHB(IA,M,NPB) * CONVR(NPB,NP)$$

- 3) Enter the results of steps 2) into Input File (5) as the element AKIT(IA,NP), or MIMH(IA,M,NP).

Note that the conversion process for AKIT or MIMH is the same as that for the non-recurring cost NRMI, but that the weights or conversion factors are different, and that AKIT and MIMH require conversion calculations for each of the four installation areas. Only one set of weights CONVR(NPB,NP) is used: this set applies to both parameters and all four installation areas.

		Contractor Inputs					Platform Groupings							
		Recurring Costs for Basis Platforms AKITB(IA,NPB)												
Index NPB	Basis Plat- forms & Term. Config.	IA = 1 Antennas	IA = 2 Electronic	IA = 3 Control Head	IA = 4 Cabling	Airborne			Ground					
						NP = 1	NP = 2	NP = 3	NP = 4	NP = 5	NP = 6	NP = 7		
1	A-10, FU				12	0.33	weights for conversion (govt.) CONVR(NPB,NP)							
2	A-10, MO				6			0.41						
3	E-3A, MO				14				0.46					
4	F-4, PA				10		0.57							
5	F-4, MO				7			0.45						
6	F-15, PA				9		0.37							
7	F-16, FU				13	0.63								
8	OV-10, FU				11	0.04								
9	OV-10, PA				8		0.06							
10	OV-10, MO				5			0.14	0.91					
11	FACP, MO				4					0.66				
12	CRC, MO				3					0.12				
13	TACP, PA				2							1		
14	Manpack, MO													1

Outputs

Weighted Sums
AKIT (IA,NP)
for IA = 1

= 2
= 3
= 4

12.59 9.51 6.31 10.99 3.00 2 1

NP 1 2 3 4 5 6 7

$$AKIT(IA,NP) = \sum_{NPB} AKITB(IA,NPB) * CONVR(NPB,NP)$$

Figure III-4

Worksheet for Calculating AKIT(IA,NP)

(Note: A set of illustrative (but completely unrealistic) inputs and corresponding outputs are shown.)

Contractor
Inputs

Recurring Hours
for Basis Platforms
MIMHB(IA,M,NPB)

Platforms Groupings

Index NPB	Basis Plat- forms & Term. Config.	IA = 1 Antennas	IA = 2 Electronic	IA = 3 Control Head	IA = 4 Cabling	Airborne				Ground		
						NP = 1	NP = 2	NP = 3	NP = 4	NP = 5	NP = 6	NP = 7
1	A-10, FU				12	0.33	weights for conversion (govt.)					
2	A-10, MO				6			0.41	CONVR(NPB,NP)			
3	E-3A, MO				14				0.46			
4	F-4, PA				10		0.57					
5	F-4, MO				7			0.45				
6	F-15, PA				9		0.37					
7	F-16, FU				13	0.63						
8	OV-10, FU				11	0.04						
9	OV-10, PA				8		0.06					
10	OV-10, MO				5			0.14	0.91			
11	FACP, MO				4					0.66		
12	CRC, MO				3					0.12		
13	TACP, PA				2						1	
14	Manpack, MO				1							1
<hr/>												
<u>Outputs</u>												
Weighted Sums												
MIMH(IA,M,NPB)												
for IA = 1												
= 2												
= 3												
= 4												
						12.59	9.51	6.31	10.99	3.00	2	1
						<hr/>						
						1	2	3	4	5	6	7

$$MIMH(IA,M,NP) = \sum_{NPB} MIMHB(IA,M,NPB) * CONVR(NPB,NP)$$

Figure III-5

Worksheet for Calculating MIMH(IA,M,NP) for M=2

(Note: A set of illustrative (but completely unrealistic) inputs and corresponding outputs are shown.)

To show how the conversion process works, Figures III-4 and III-5 provide an example of the calculations for AKIT and for MIMH for one value of installation Area IA. It should be noted that the "contractor inputs" used in the example are chosen arbitrarily, and do not represent realistic costs. However, government weighting factors given are to be used as shown.

APPENDIX IV

LCC CALCULATIONS WITH INTERIM CONTRACTOR SUPPORT AND WITH CENTRALIZED INTERMEDIATE MAINTENANCE FACILITIES

The first of the LCC tasks defined in the FSED SOW and in Section 3 of this User's Manual is entitled "Support Concept Analysis: (see page 14 of Volume I). This task requires the contractor to investigate the cost implications of Interim Contractor Support (ICS), and the cost implications of Centralized Intermediate Maintenance Facilities (CIMFs). The LCC accounting model described in Section 5 of this manual does not, however, explicitly allow for an initial maintenance approach that differs from the mature approach. The accounting model also does not permit CIMFs, if they are utilized, to have a repair capability (i.e., a set of values for RTS(I), NRTS(I), and COND(I)) that differs from the set for an independent base. The purpose of this appendix is to show how, by indirect methods, the contractor may circumvent these restrictions in the use of the model, in order to make the required analyses. This appendix presents a procedure to modify the LCC Model results to obtain the LCC estimate when ICS with or without warranty is considered. Then a method will be given to assess the LCC impact of having CIMFs with a repair capability different from that of the independent bases.

IV.1 LCC Impact of Interim Contractor Support

Interim Contractor Support (ICS) may be used by the Air Force in the initial period of the total life cycle. It provides a period during which the Air Force will gain more time as well as some field experience with the equipment to better plan the logistic support. It allows deferral of major decisions and acquisition processes in the support function to a later time when the equipment becomes more mature and its support requirements are more finalized. During the ICS period, all the support functions would be provided by the Contractor, except on-equipment maintenance, which is expected to be always conducted by the Air Force. The total cost (to the Air Force) incurred in an ICS period can be broken down into components as shown in Table IV-1.

The Contractor is required to estimate the LCC with 2, 3, 4, and 5 years of ICS. The Contractor shall also cost out, as an alternative to ICS, lifetime contractor maintenance at the depot level. This can be done without using the multiple computer runs necessary for costing out ICS, but with suitable substitution of contractor inputs for depot-related Air Force inputs.

Table IV-I

Cost Breakdown Structure for ICS

- a. Initial Support Cost - consisting of the following cost elements:
 - Initial Spares
 - Support Equipment (including HW/SW development)
 - Inventory Entry
 - Initial Training
 - Initial Technical Data

- b. Recurring Support Cost - consisting of the following cost elements:
 - Replacement Spares
 - Off-Equipment Maintenance
 - Support Equipment Maintenance
 - Inventory Management
 - Recurring Training
 - Technical Data Maintenance

- c. G&A plus Profit - expressed as a fixed percentage of the total of initial and recurring support costs (parts a & b above).

- d. Warranty Risk - a cost component to be added by the Contractor only if the ICS contract is of a fixed-price warranty type, under which the Contractor is to maintain the equipment and to improve its reliability at a fixed total cost to the Air Force. This cost component is included in the total fixed amount in recognizing the uncertainty involved in the Contractor's cost prediction and the expense incurred in any reliability improvement effort.

The LCC with ICS can be estimated by means of a set of four different LCC Program runs. In the following, the additional data needed for making these runs will be detailed first, followed by the description of the four specific LCC runs and the way to carry out the estimation.

IV.1.1 Input Data

There are four sets of data that are needed for the ICS calculation:

(1) NTFD, the number of years to full deployment (an AF input assumed to be 6 here); also NICS, the number of years of ICS (a Contractor input), which will take the values of 2, 3, 4, and 5, respectively.

(2) A set of data supplied by the AF to reflect the partial deployment during the first NTFD years: TNDB(NS,T), which is the total number of bases in base group NS that are deployed with the SEEK TALK equipment by the end of year T and is given below in Table IV-II.

(3) ANDB(NS,T), the average number of bases in base group NS that are deployed with the SEEK TALK equipment during the first T years. This number can be derived from TNDB(NS,T) as follows:

$$ANDB(NS,T) = \left(\sum_{S=1}^T TNDB(NS,S) - TNDB(NS,T) \right) / 2T$$

and the result (rounded to its nearest integer) is given below in Table IV-III.

(4) Additional input data to be supplied by the Contractor. There are input parameters in the LCC Model which are originally furnished by the Air Force alone but now must be supplied separately by the Contractor for the ICS period. These parameters, all contained in Input File (1), are listed in Table IV-IV below, and their definitions would then be interpreted from the Contractor's point of view according to his own operating characteristics and procedures.

Table IV-II
 Total Number of Deployed Bases TNDB(NS,T)
 (Illustrative)

NS	T:	1	2	3	4	5	6	7	8
1 Airborne, CONUS		14	28	43	57	71	85	85	85
2 Ground, CONUS		22	44	65	87	109	130	130	130
3 Airborne, Europe*		1	1	1	1	1	1	1	1
4 Ground, Europe*		1	1	1	1	1	1	1	1
5 Airborne, Europe		2	5	7	9	12	14	14	14
6 Ground, Europe		8	15	23	30	38	45	45	45
7 Airborne, Pacific		0	1	2	4	5	6	6	6
8 Ground, Pacific		1	4	7	10	13	15	15	15

* The base assigned in this grouping is the designated site for a possible CIMF.

Note that in the table above $TNDB(NS,T) = TNB(NS)$ or full deployment figure for all $T \geq NTFD$.

This set of data will be used in estimating Contractor's initial support cost during ICS period.

Table IV-III
Average Number of Deployed Bases ANDB(NS,T)
(Illustrative)

T:	1	2	3	4	5	6	7	8
<u>NS</u>								
1 Airborne, CONUS	7	14	21	28	36	43	49	53
2 Ground, CONUS	11	22	33	44	55	65	75	82
3 Airborne, Europe*	1	1	1	1	1	1	1	1
4 Ground, Europe*	1	1	1	1	1	1	1	1
5 Airborne, Europe	1	2	4	5	6	7	8	9
6 Ground, Europe	4	8	12	15	19	23	26	28
7 Airborne, Pacific	0	0	1	1	2	3	3	3
8 Ground, Pacific	1	2	3	4	6	7	8	9

* The base assigned in this grouping is the designated site for a possible CIMF.

This set of data will be used in estimating Contractor's recurring support cost during ICS period.

Table IV-IV

Additional Contractor Supplied Parameters for ICS
(See Appendix I for definitions of these parameters.)

<u>Labor Factors</u>	<u>Labor Rates</u>	<u>Pipelines Times</u>
BAA	BLR	BRCT
BMF	DLR*	CRCT
DAA*	PAL1**	DAD*
DMF*	PAL2B	DRCT(1)*
MPD2	PAL2D**	DRCT(2)*
MRO	TRAV1D**	DRCT(3)*
MRF	TRAVB	OST(1)
SR		OST(2)
TORB		OST(3)
TORD*		OSTC
TR		

Unit Cost Factors

ACPP**
CPD2**
CPPC
CPPD(1)
CPPD(2)
CPPD(3)
RCPP
IMC*
RMC*
SA
UCPP

Miscellaneous Factors

QTYP1**
QTYP2B**
QTYP2D**
SPC2**
TYP2TF**

For determination of lifetime contractor maintenance at the depot level, not all the above parameters must be changed to contractor inputs. The parameters marked by a single asterisk do require change; those marked with a double asterisk may require change depending upon the Contractor's approach to training and technical orders.

IV.1.2 Procedure

The steps to obtain the LCC estimate with ICS, as detailed below, are basically to replace part of the AF's costs during the ICS period by the Contractor's amount.

(1) Obtain the LCC with no ICS. This is a basic run with all the inputs as originally specified in the model. However, if there is a reliability improvement, the inputs to the reliability parameters (PMTBF(I,LE(NP))s) of the improved ITEMS should be revised to their individual final values. If the improvement is global (applicable to all ITEMS), one only needs to adjust the failure rate multiplier XFR to a corresponding value. (Of course, XFR decreases as the reliability increases.) Also, the repair levels in this run should be optimized. Note that all the support costs, initial as well as recurring, are listed in Output Table 1.

(2) Make an LCC run with changes in the input data for the following parameters:

PIUP = NICS as specified by the Contractor,

TNB(NS) = ANDB(NS,T=NICS) for all NS as listed in Table IV-III.

All the other parameters remain the same as in step (1). Note that all the recurring support costs listed in Output Table 1 are costs that would occur under Air Force support during the first NICS years of the total life cycle and thus are to be replaced (except on-equipment maintenance) if Interim Contractor Support is to be used. Note also that the initial support costs listed in this table are based on an adjusted (lower) deployment and thus are not complete. Since the amount of these costs under the full deployment will be incurred eventually, the corresponding figures listed in Output Table 1 of the first run described above will still be used.

(3) There are two separate LCC runs to be made in this step. The first run is to calculate the total recurring support cost of ICS using the average deployment during ICS period, while the second run is to estimate the total initial support cost for ICS based on the deployment at the end of ICS period. In both runs, the reliability parameters of the improved ITEMS (if any) should be set at

their average levels determined by their individual improvement and deployment schedules. Again, if the improvement is global, only XFR needs to be adjusted.

(a) Make an LCC run with $PIUP = NICS$ and $TNB(NS) = ANDB(NS, T=NICS)$ for all NS as in step (2) and with the Contractor input data for those parameters listed in Table IV-IV. Also, the repair levels in this run may be differently specified according to the Contractor's discretion. Then Output Table 1 of this run provides the total recurring support cost (TRS) for ICS. It is the total of all the recurring support costs listed in Output Table 1 except on-equipment maintenance.

(b) Make another LCC run with the same inputs as in part (a) above except that

$TNB(NS) = TNDB(NS, T=NICS)$ for all NS as listed in Table IV-II.

Again, if the input data provided by the Contractor for the parameters listed in Table IV-IV reflect the characteristics of the Contractor's support functions, the initial support cost elements listed in Output Table 1 should provide an estimate for the total initial support cost (TIS) of the ICS period.

(4) Given the total initial support cost (TIS) and the total recurring support cost (TRS) described in step (3), the total incurred cost for ICS can be calculated as

$$\text{Total Cost of ICS} = (TIS + TRS) * (1 + P/100) + WR$$

where P, a Contractor input, is G&A plus Profit expressed as a percentage of the total of TIS and TRS costs, and WR, when applicable, is the Contractor estimated cost component for his warranty risk.

(5) Finally, to find the total LCC with ICS one would have

$$\text{LCC with ICS} = \text{LCC with no ICS in step (1)}$$

- total recurring support cost in step (2)

+ total cost of ICS in step (4)

- adjustment

Where the adjustment is due to the fact that the initial support equipment and initial spares invested by the Contractor during ICS period may also be used (with possible rework) by the Air Force for the rest of the life cycle. Since these costs are included both in the original LCC with no ICS and in the total ICS cost above, an amount equal to the transferable portion of the Contractor's initial spares and initial support equipment minus rework cost should be deducted to obtain the correct LCC with ICS. To find these transferable portions, both LCC runs in step (1) and step (3b) should be carefully compared between their individual Output Tables 4B (for initial spares) and between their individual Output Tables 5 (for initial support equipment, including SE development and SE software development). The Contractor shall also estimate the cost of possible rework necessary for these transferable portions.

Note that the steps described above are mainly designed to reflect growing deployment during the production period, as shown in a steady increase in the number of operational bases where SEEK TALK equipment is deployed. A different approach would be used when a more detailed deployment schedule in terms of specific platforms is known. This approach will be provided to the Contractor when such a schedule becomes available.

IV.1.3 Illustrative Example

A step-by-step example of the ICS calculation is presented below, using the same basic set of data as in Appendix II. No reliability improvement is assumed.

(1) The optimal LCC with no ICS can be obtained in this case by referring to Section II.5, where (adjusted final) LCC = \$742.57M.

(2) Make an LCC run with the following input changes:

PIUP = NICS = 4 in this example and

TNB(NS) = ANDB(NS,T=4) for all NS, i.e.,

TNB(1) = 28, TNB(2) = 44, TNB(3) = 1, TNB(4) = 1,

TNB(5) = 5, TNB(6) = 15, TNB(7) = 1, TNB(8) = 4.

From Output Table 1 of this run, the AF's cost which is to be replaced is the total recurring support cost of \$19.04M minus the on-equipment maintenance cost of \$0.71M, or \$18.33M.

(3a) Use the same input changes as in step (2) above and Contractor's inputs for the parameters listed in Table IV-IV. For simplicity, only the following parameters among those listed in Table IV-IV are assigned with values different from AF's:

$$\text{BMF} = 1.20, \text{DMF} = 1.20,$$

$$\text{BLR} = 30.00, \text{DLR} = 30.00,$$

$$\text{and DAD} = 0.100.$$

For this example, the repair levels are kept the same as in the previous runs. Then Output Table 1 of this run provides the total recurring support cost (TRS) for ICS, which is the total recurring support cost as listed, \$16.53M, minus the on-equipment maintenance cost of \$0.48M, or \$16.05M.

(3b) Use the same inputs as in (3a) above except that TNB(NS) is now changed to TNDB(NS,T=4) for all NS, i.e.,

$$\text{TNB}(1) = 57, \text{TNB}(2) = 87, \text{TNB}(3) = 1, \text{TNB}(4) = 1,$$

$$\text{TNB}(5) = 9, \text{TNB}(6) = 30, \text{TNB}(7) = 4, \text{TNB}(8) = 10.$$

Output Table 1 of this run shows that the total initial support cost (TIS) for ICS is \$66.71M.

(4) Assuming $P = 10\%$ and $WR = 0$ (no warranty risk), the total cost of ICS = $(66.71 + 16.05) * (1 + 10/100)$

$$= 91.036 \text{ or } \$91.04\text{M}.$$

(5) The adjustment is the total of the initial spares and initial support equipment common to both run (1) and run (3b), minus rework cost. From Output Tables 4B and 5 of both runs, it is determined that the Contractor's investment in both initial spares (\$55.08M) and initial support equipment (\$9.86M) can be assumed by the Air Force with a rework cost of \$6.49M. Thus, the adjustment is \$58.45M and following the equation for this step gives the LCC with ICS to be $\$742.57 - \$18.33 + \$91.04 - \$58.45 = \$756.83\text{M}$.

IV.2 LCC Impact of CIMFs with Repair Capability Different from that of Independent Bases

Recall in the LCC model the variable BTYPE(NS) is used to indicate whether the base NS is an independent base (=1), a CIMF (=2), or a satellite base (=3). This indicates the model is capable of predicting the LCC when there is a mix of different types of bases. However, since only one unique set of fractions of repair actions is allowed for each ITEM of type I (i.e., RTS(I), NRTS(I), and COND(I) in Input File (9A)), all the CIMFs and independent bases are considered to have the same repair capability in the model. To estimate the LCC when the CIMFs are considered to have a different (presumably higher) repair capability as compared to independent bases, it becomes necessary to use the model several times and to obtain the desired results in a few steps.

IV.2.1 Procedure

Since the European Theatre is of primary interest for utilization of CIMFs, the method outlined below is based on the assumption that only Europe has CIMF bases and all the U.S. and Pacific bases are still independent. Also, due to the current setup of Input Files (2) and (6), two CIMFs will be assumed in Europe and the data under the Logistic Configuration C in Table 8-IV will be used for Input File (2). This indicates that one airborne base (NS=3) is designated as a CIMF for all the other European airborne bases and, similarly, a ground base (NS=4) serves as a CIMF for all the rest of the European ground bases.

The basic concept of the method is to have (a), the European portion of the world-wide LCC, where the two European CIMFs have the same repair capability as that of any independent base in the rest of the world replaced by (b) a European Theatre LCC, where the two CIMFs have a different or independently determined repair capability. Thus, the steps are:

- (1) Obtain the world-wide LCC, where all the independent bases and the two European CIMFs have a repair capability (as indicated by the RTS(I)s, NRTS(I)s, and COND(I)s) optimally determined by the RLA Program (Section 7). Recall in Section 7, six special LCC runs have to be made before conducting the Repair Level Analysis to determine the optimal RTS(I)s, NRTS(I)s, and COND(I)s. A separate LCC run is then made using these values (with possible final adjustment). Denote the result as LCC(1).

(2) Isolate the European Theatre portion of the LCC(1) obtained in step (1). This can be done by another run of the LCC Program with all the non-European bases deleted (i.e., with $TNB(NS) = 0$ for each NS not in Europe). The RTS(I)s, NRTS(I)s, and COND(I)s remain the same as in step (1). Call the result of this step LCC(2).

(3) Obtain the LCC for the European Theatre only, where again two bases are assumed to be CIMFs and the rest European bases satellites. The CIMFs have a repair capability optimally determined by the RLA Program and for European Theatre only. The operation involved in this step is the same as that in step (1), i.e., there will be six special LCC runs for determining optimal RTS(I)s, NRTS(I)s, and COND(I)s, and a separate LCC run using these values (with possible final adjustment). The only difference here is that all the non-European bases are deleted by zeroing out the appropriate $TNB(NS)$ s as in step (2). Let the result of this step be LCC(3).

(4) Recall that LCC(1) is the world-wide LCC with all the independent bases and the two European CIMFs having the same repair capability, LCC(2) the European Theatre portion of the LCC(1), and LCC(3) also a European Theatre LCC but with CIMFs of an independently determined (presumably different) repair capability. Now, if we define LCC(4) to be the world-wide LCC with the two European CIMFs different from the independent bases in terms of their repair capability, then

$$LCC(4) = LCC(1) - LCC(2) + LCC(3).$$

Note that the method outlined in the steps above, where the European Theatre is used as an example, can also be applied to the other theatres. That is, the 'Europe' and 'European' in the description of the steps can be replaced by the 'U.S.' or 'Pacific,' depending on the theatre studied. In fact, it also applies when any 2 of the 3 theatres are considered together to have CIMFs. However, in either of these cases, the base groupings (indexed by NS) in the U.S. and/or Pacific Theatres have to be changed to reflect the existence of CIMFs in these areas. As a result, Input Files (2) and (6) have to be revised before conducting the LCC estimation. When all the three theatres are considered to have CIMFs, the task of LCC estimation becomes much easier. Since only one set of RTS(I)s, NRTS(I)s, and COND(I)s is involved, the LCC Model is capable of

directly predicting the LCC as long as Input Files (2) and (6) are properly set up.

IV.2.2 Illustrative Example

The following shows an example using the same set of input data as in Appendix II except Input File (2), which was changed to reflect the logistic configuration of two CIMFs in the European Theatre (Logistic Configuration C in Table 8-IV).

(1) The optimal repair level of each ITEM for this configuration is first determined. The repair levels provided by the RLA Program result in a final LCC of \$745.43M. With RL(1) value changed from 1 to 2, the adjusted final result is $LCC(1) = \$744.91M$.

(2) The European Theatre portion of the LCC(1) above is obtained by another run of the LCC Program with $TNB(NS) = 0$ for $NS = 1, 2, 7,$ and 8 . The result is $LCC(2) = \$251.29M$.

(3) With $TNB(NS) = 0$ for $NS = 1, 2, 7,$ and 8 , the optimal repair level of each ITEM is re-determined (with no final adjustment needed). The resulting LCC(3) is \$241.88M.

(4) Thus, $LCC(4) = 744.91 - 251.29 + 241.88$
 $= \$735.50M$.

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-8