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MILITARY STANDARD

LEVEL OF REPAIR

AMSC AREA–ILSS

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DEPARTMENT OF THE NAVY
Washington, D.C. 20360

Level of Repair
MIL-STD-1390C(NAVY)

1. This Military Standard is mandatory for use by the Naval Air Systems Command, Space and Naval Warfare Systems Command, Naval Sea Systems Command, and the Marine Corps.

2. Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this standard should be addressed to: Commanding Officer, Naval Air Engineering Center, Code 5322, Lakehurst, NJ 08733-5100, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this standard or by letter.

FOREWORD

1. LOR (Level of Repair) analysis is a justification of the decision to repair or discard a failed item of hardware for each anticipated maintenance action on that item. This economic justification shall be provided to support the decision to repair at any maintenance level.

2. Past experience has shown that repair decisions made during a weapon system's life cycle have led to repair at the lowest level of maintenance. This decision is sometimes necessary due to factors such as readiness, safety, reliability, etc. However, at present, technological advancement and increased system hardware cost have made cost benefit one of the priorities. In addition, LOR decision affects manning levels, support equipment, stock levels and training. The cost benefit of these parameters should be obvious, if not, the process shall be evaluated until there is some kind of cost benefit.

3. LOR analysis is an integral part of the Logistic Support Analysis (LSA) process whether the LOR analysis is performed by the government or the contractor.

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1. SCOPE

1.1 Purpose. This standard provides methods, algorithms, and reporting requirements for examining the various repair alternatives [Level of Repair (LOR)] so as to establish the most economical life cycle support cost for Naval material.

1.2 Application. This standard is applicable when an LOR analysis is required and cited in solicitations or contracts.

2. REFERENCED DOCUMENTS

2.1 Government Documents.

2.1.1 Specifications, Standards, and Handbooks. Unless otherwise specified, the following specifications, standards, and handbooks of the issue listed in that issue of the Department of Defense Index of Specifications and Standards (DoDISS) specified in the solicitation form a part of this standard to the extent specified herein.

Standards

Military

MIL-STD-280	Definitions of Item Levels, Item Exchangeability, Models and Related Terms
MIL-STD-721	Definitions of Effectiveness, Terms for Reliability, Maintainability, Human Factors, and Safety
MIL-STD-1388-1A	Logistic Support Analysis
MIL-STD-1388-2A	DoD Requirements for a Logistic Support Analysis Record

(Copies of specifications, standards, handbooks, drawings, and publications required by contractors in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting officer.)

3. DEFINITIONS

3.1 Definition of Terms. For the purpose of this standard the following terms are as defined. Other terms, abbreviations, and acronyms used are defined in MIL-STD-280, MIL-STD-721, MIL-STD-1388-1A/2A, or as specified herein.

3.1.1 Allowance Quantity. The inventory stocked at operational sites to support remove and replace maintenance actions.

3.1.2 Assembly. A collection of parts and/or LRI's joined together, that is removed and replaced from a Unit in response to a unit fault.

3.1.3 Attrition Quantity (AQ). That part of the allowance quantity stocked at the operational site to account for items which are to be sent to a higher level maintenance facility for repair.

3.1.4 Back-up Quantity. The inventory stocked at a supply depot to account for the depot repair resupply pipeline.

3.1.5 Best Replacement Factor (BRF). An estimate for the actual annual operational assembly usage derived by smoothing actual experienced demand with initial technicians' estimates for predicted replacements.

3.1.6 Beyond Capability of Maintenance Rate (BCM). The percentage of failed items, coded repair, which have been administratively or technically screened by designated and authorized maintenance personnel, found to be not repairable at the maintenance activity indicated by the repair code and sent to a higher level of maintenance for repair.

3.1.7 Common Support Equipment (CSE). A support equipment type that is designed for a wide range of applications and usually exists in the normal support equipment inventory.

3.1.8 Contract Data Requirements List (CDRL). Contract form (DD 1423) listing all DIDs selected from an authorized data list required to be delivered under the contract.

3.1.9 Contractor. Any corporation, company, association, or individual which undertakes performance under the terms of a contract, letter contract, letter of intent or purchase order, project order, or allotment in which this document may be incorporated by reference. For the purpose of the use of this document the term includes government operated activities undertaking performances under a project order or allotment with the exception of depot maintenance facilities.

3.1.10 Degradation Factor. A factor which, when multiplied by the predicted Mean-Time-Between-Failures, yields a reasonable estimate of the operational Mean-Time-Between-Failures.

3.1.11 Deployment Factor. The average fraction of time that specified sites are operational e.g., the deployment factor for a carrier that is at sea four months per year is .33.

3.1.12 Designated Overhaul Point (DOP). A depot level rework facility assigned the technical and rework responsibility for a given aeronautical system, subsystem, or component.

3.1.13 Direct Maintenance Man Hours to Discard. The number of man hours required to fault isolate to the item level and to replace the item.

3.1.14 Direct Maintenance Man Hours to Repair. The number of man hours required to fault isolate the item to the component level and repair the item.

3.1.15 Discard (or washout). A unique maintenance action where no attempt is made to repair a failed item; that item is thrown away (discarded).

3.1.16 End Article. An end weapon, aircraft system, subsystem, component, or equipment e.g., transmission, engine, computer, radio, etc., being procured on the contract, including contractor furnished material.

3.1.17 False Removal. The removal of an item from its normal location which, after testing, is found to be operating properly.

3.1.18 Field Survival Rate (FSR). The percentage of failed assemblies sent from an operational site that actually arrive at the designated maintenance facility.

3.1.19 First Echelon Support Requirement (FESR). The assembly inventory stocked only at operational sites to support remove and replace maintenance actions on failed assemblies. This quantity is also referred to as the on-board allowance quantity.

3.1.20 Fixed Cost. A cost independent of the number of repairs.

3.1.21 Level of Repair (LOR). The maintenance level at which repair or discard of naval material is performed. The repair levels considered in this document are repair organizational, intermediate, prime intermediate, and depot.

3.1.22 Logistic Support Analysis (LSA). The selective application of scientific and engineering efforts undertaken during the acquisition process, as part of the system engineering and design process, to assist in complying with supportability and other ILS objectives.

3.1.23 Lowest Replacement Item (LRI). A collection of parts joined together, that is removed and replaced from an Assembly in response to an Assembly fault.

3.1.24 Maintenance Action. Any one of a number of types of specific maintenance operations necessary to retain an item in or restore it to a specified condition.

3.1.25 Maintenance Task. Those incremental maintenance elements performed by maintenance personnel in completing a maintenance action.

3.1.26 Mean Time Between Replacements. The average operational time between replacements, either preventive, corrective, or both.

3.1.27 Military Essentiality Code (MEC). The military essentiality code expresses the vitalness of the assembly to the next higher equipment level. Specifically, it accounts for the following: first, the effect of inoperability of the assembly on the operation of the next higher equipment level and compensation by use of an identical standby; second, the effect of failure of a single assembly on the immediate operation of the next higher assembly; third, the effect of compensation by use of some alternative or emergency assembly (not an identical assembly).

3.1.28 Minimum Replaceable Unit (MRU). The minimum assembly quantity required to satisfactorily perform repairs on the failed item. For example, in repairing an engine, all six spark plugs or piston rings would be changed instead of just one. The MRU in this case would be six.

3.1.29 Offspring. The next lower item in a system reversing the definition of a parent item, e.g., an assembly within a unit, or an LRI within an assembly.

3.1.30 Overhaul (Engines, Accessories, Equipment). The disassembly of an engine, accessory, or equipage as required to permit inspection of every component part. Component parts that upon inspection will not meet requirements as set forth in applicable specifications are restored or replaced by new parts so that after reassembly and test the engine, accessory, or equipage will meet the requirements, as stated above, set forth in the applicable specifications.

3.1.31 Parent. The next higher item in a system, e.g., the associated Unit for an Assembly, or the associated Assembly for an LRI.

3.1.32 Peculiar Support Equipment (PSE). A support equipment type that is unique and generally designed for use with a specific equipment or equipment family.

3.1.33 Personnel Attrition Rate. That percentage of personnel who are replaced each year.

3.1.34 Piece-Part. One piece, or two or more pieces joined together which are not normally subjected to disassembly without destruction of designed use. (Examples: Outer front wheel bearing of 3/4 ton truck, electron tube, composition resistor, screw, gear, capacitor, audio transformer, milling cutter.)

3.1.35 Pipeline Time (PILT). The resupply time elapsed between the shipment of a failed assembly from the operational site to a depot repair facility and the arrival of an RFI assembly from the shore stock point.

3.1.36 Planned Maintenance Requirement (PMR). The number of assemblies to be replaced per given maintenance cycle to account for the case of scheduled maintenance.

3.1.37 Prime Intermediate Maintenance Activity (PIMA). A higher level of intermediate level repair which is located at selected Naval Air Stations for repair of failed avionic equipments which are located at intermediate Naval Air Stations and carriers.

3.1.38 Procurement Lead Time (PLT). The time elapsed between the identification of a procurement requirement and the arrival of a new assembly at the stock point.

3.1.39 Ready For Issue (RFI). An item that is functionally operational and meets performance specifications. This item may be new, repaired, or overhauled.

3.1.40 Repair Cycle Time (RCT). The elapsed time from failure of an item until the item is repaired and restored to an RFI condition and returned to the operational site.

3.1.41 Repair Material Rate. The ratio of material cost for the average item repair to the item unit cost.

3.1.42 Repair Path. A specified maintenance alternative, i.e., a directed sequence of repair points, e.g., organizational, 3rd echelon, depot, where failed item repair is authorized.

3.1.43 Replacement. The removal of an item from its operational location and replacing it with an identical RFI item. The remove and replace repair action is necessary to account for a failed item and scheduled maintenance.

3.1.44 Required Days of Stock (RDS). The amount of time an intermediate repair facility must be self-sufficient without logistics support from outside sources.

3.1.45 Rotatable Pool Quantity (RP). That part of the allowance quantity of repairable items reserved at the operational site for support of avionic equipment.

3.1.46 Scrap Rate. The percentage of failed assemblies that cannot be repaired at the designated maintenance facility, are condemned and consequently replaced in the supply system.

3.1.47 Second Echelon Support Requirement (SESR). The assembly inventory stocked at points different from the operational site such as at a tender or land based stock point. It is a composite of oversea and tender second echelon support requirements.

3.1.48 Source, Maintenance, and Recoverability Codes (SM&R). A series of alpha or alpha-numeric symbols used at the time of provisioning to indicate the source of supply of an item, its maintenance implications, and recoverability characteristics. The provisioning activity may require the contractor to recommend these codes.

3.1.49 Special Support Equipment (SSE). A support equipment type that is specific to the item it is supporting.

3.1.50 Stock Point Potential (PO). The number of failed assemblies that are BCM at a tender and sent to a land based stock point for repair.

3.1.51 System Stock Requirement (SSR). A first year replenishment assembly inventory based upon the predicted annual demand. It is a back-up quantity utilized to augment the allowance quantity and is stocked at various stock points.

3.1.52 Technical Override Requirement (TOR). An override to the computed allowance quantity of an item. If positive, this is a required minimum allowance quantity. If zero, this is the maximum allowance quantity permitted.

3.1.53 Unit. A combination of parts, LRI's and/or assemblies mounted together, which is removed and replaced from a system in response to a fault.

3.1.54 Variable Cost. A cost directly proportional to the number of repairs.

3.2 Acronyms and Symbols.

AIQ	Attrition Inventory Quantity
AQ	Attrition Quantity
AQIMDR	Attrition Quantity Item Mean Demand Rate
BCM	Beyond Capability of Maintenance
BUIQ	Back-up Inventory Quantity
BRF	Best Replacement Factor
CB	Carrier Based
CDRL	Contract Data Requirement List
CER	Complete Engine Repair
CFE	Contractor Furnished Equipment
CONUS	Continental United States
CRAW	Carrier Replacement Air Wing
CRWLF	Combined Resource Work Load Factor
CSE	Common Support Equipment
CV	Aircraft Carrier
D	LOR Code Assignment for Depot Repair
DDR	Daily Demand Rate

DID	Data Item Description
DOP	Designated Overhaul Point
ECP	Engineering Change Proposal
EM	Engine Module
f	Mean Number of Failures per Operating Hour
FESR	First Echelon Support Requirement
FLISP	Fleet Logistics Support Improvement Program
GFE	Government Furnished Equipment
I	LOR Code Assignment for Intermediate Repair
ICP	Inventory Control Point
ID	Interconnecting Device
ILS	Integrated Logistic Support
IMA	Intermediate Maintenance Activity
IMCQ	Item Mission Critical Quantity
LB	Land Based
LOR	Level of Repair
LSA	Logistic Support Analysis
M	Number of Operating Hours per Life Cycle
MCAS	Marine Corps Air Station
MEC	Military Essentiality Code
MOT	Maximum Operating Time
MRU	Minimum Replaceable Unit
MTBF	Mean-Time-Between-Failures
MTBR	Mean-Time-Between-Replacements
MTTR	Mean-Time-to-Repair
NAS	Naval Air Station
NSN	National Stock Number

O	LOR Code Assignment for Organizational Repair
OBRP	On-Board Repair Part
OSESR	Oversea Stock Point Requirement
P	LOR Code Assignment for PIMA Repair
PAD	Predicted Annual Demand
PAR	Progressive Air Rework
PSE	Peculiar Support Equipment
PILT	Pipeline Time
PIMA	Prime Intermediate Maintenance Activity
PLT	Procurement Lead Time
PMR	Planned Maintenance Requirement
PO	Stock Point Potential
R&R	Remove and Replace
RAQ	Raw Attrition Quantity
RCT	Repair Cycle Time
RDS	Required Days of Stock
RFI	Ready for Issue
RFP	Request for Proposal
RISQ	Repair Inventory Quantity for All Sites
RP	Rotatable Pool Quantity
RPIQ	Rotatable Pool Inventory Quantity
RPIMDR	Rotatable Pool Item Mean Demand Rate
RRPQ	Raw Rotatable Pool Quantity
RWS	Repair Work Space
SE	Support Equipment
SEM	Sub-Engine Module
SESR	Second Echelon Support Requirement

SM&R	Source, Maintenance and Recoverability code
SPCC	Ships Parts Control Center
SRA	Shop Replaceable Assembly
SSE	Special Support Equipment
SSEM	Sub-Sub-Engine Module
SSR	System Stock Requirement
SSRA	Sub-Shop Replaceable Assembly
SSSEM	Sub-Sub-Sub-Engine Module
TBO	Time-Between-Overhaul
TO/R	Technical Override Factor
TOR	Technical Override Requirement
TRSR	Tender Repair Scrap Rate
TSESR	Tender Second Echelon Support Requirement
WRA	Weapon Replaceable Assembly
X	LOR Code Assignment for Discard
μ	Predicted number of assembly replacements per quarter per site

4. GENERAL REQUIREMENTS

4.1 General. LOR is an integral part of Logistic Support Analysis (LSA) as required by MIL-STD-1388-1A, task 303.2.7. LOR decisions influence the logistic support cost and system effectiveness of naval material and hence influence the total life cycle cost of ownership. LOR decisions also influence the maintenance plan and the ILS (Integrated Logistic Support) elements resources necessary to maintain the operational readiness of the hardware system. Furthermore, LOR analyses, recommendations, and decisions for new material should be made as soon as the equipment preliminary design has been determined and should continue until a final hardware design decision is reached; the interrelationship of the LOR decision process to the design process is shown in Figure 1.

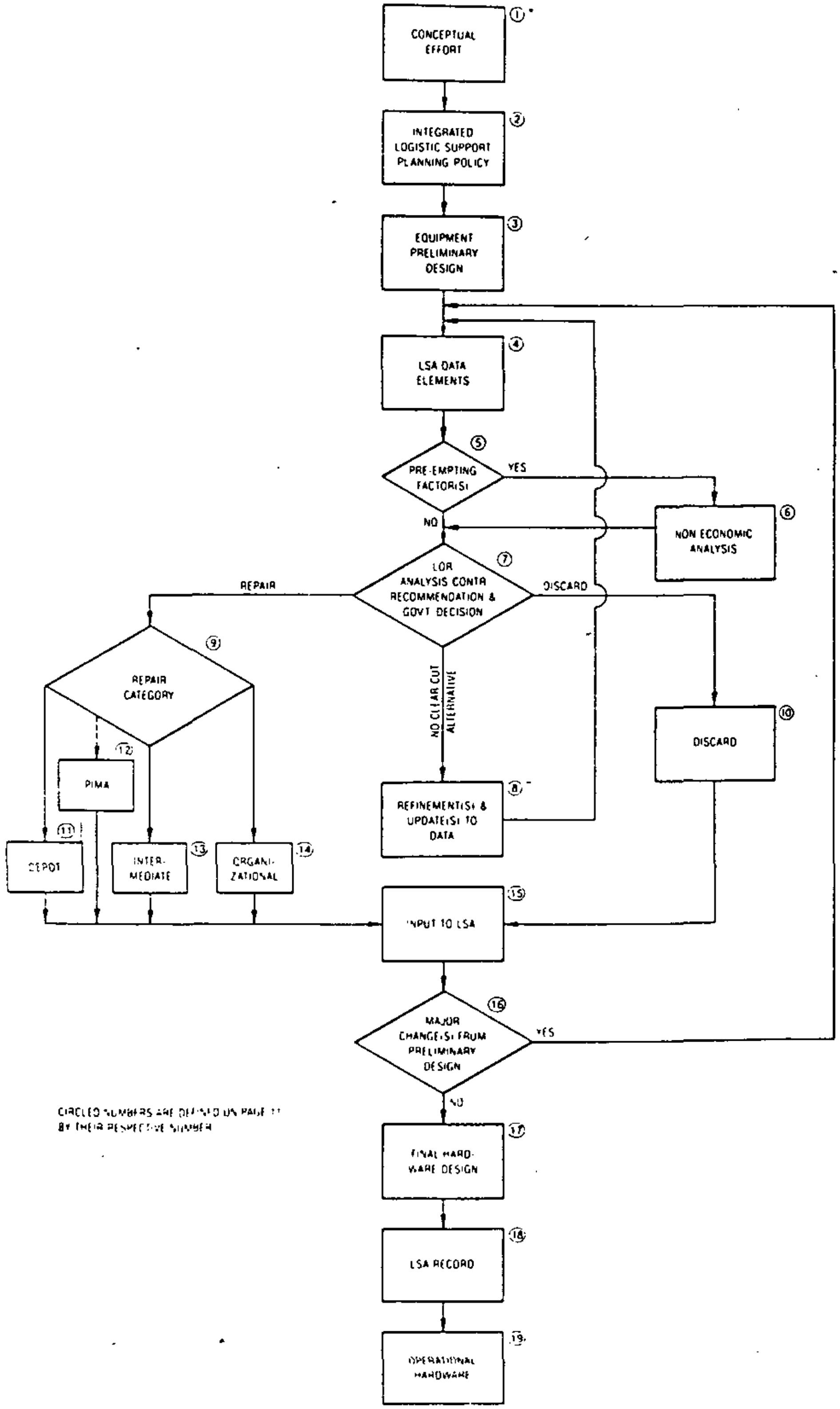
4.1.1 Purpose. The purpose of LOR analyses is to establish the least cost feasible repair level or discard alternative for performing maintenance actions and to influence the equipment design in that direction. The maintenance policy which results from performing an LOR analysis will, therefore, reflect the least-cost feasible method of logistically supporting the naval material. The analysis is based on applicable operational factors such as operating hours and baseloading values; support factors such as maintenance action rates, maintenance times and maintenance costs; and non-economic factors.

4.2 LOR Program. The requirements of a LOR program are to provide a LOR program plan, develop data element values, provide recommendations to the equipment designer and develop a least-cost equipment maintenance alternative and associated logistic support program for contractor or government furnished equipment as described in section 5.

4.3 LOR Analyses and Recommendations. LOR analyses shall be performed iteratively. The final analysis shall verify the results of the earlier analyses or recommend a change based upon finalized input data. The LOR analyses and associated results shall have impact upon the repair or discard decisions made on naval material and will therefore provide repair or discard recommendations to the equipment designer. Also, it shall provide inputs to the procuring activity so that proper ILS decisions may be reached.

4.4 LOR Reports. As soon as LOR analyses are complete, written LOR reports shall be submitted to the procuring activity for use in the development of a maintenance plan. Since LOR decisions effect support equipment requirements, provisioning, etc., these reports should contain all data elements used in making the recommendations. LOR reports and other reporting requirements are contained in 5.4.

4.5 Limited Application of LOR Analyses. For contractor and government furnished equipments currently designed, LOR analyses may be performed to determine the repair or discard decision. However, in such cases, the analyses would be tailored to the existing hardware. Redesign at this stage may not necessarily be practical or cost effective.



--- Note: If PIMA is utilized in LOR model.

FIGURE 1. Level of repair decision process for new equipment design.

FIGURE 1 (Continued)

Description of Level of Repair
Decision Process for New Equipment Design

Prior to performing an LOR analysis, several preliminary steps are required. The operational requirements in terms of broad criteria (technical, logistic, military, economic, etc.) are established during the initial phase of the hardware system's life cycle which is called Conceptual Effort (1) *. The interrelationship and delineation of ILS, LSA (Logistic Support Analysis) and LOR as well as the ILS System Concept are derived from the ILS Planning Policy (2), which was originally established to fulfill the operational requirements. The next step in the process is the Equipment Preliminary Design (3) in which engineering drawings are developed along with preliminary technical, logistic, military, and economic data. The preliminary data, i.e., MTBF (Mean-Time-Between-Failures), unit cost, support equipment and personnel requirements, etc., are then the substance of the LSA Data Elements (4), which will provide some of the data necessary to perform an LOR analysis. Only one step remains before the performance of an LOR analysis; that is, the recognition of Pre-empting Factors (5), i.e., safety, repair feasibility, mission success, readiness, etc., which would necessitate the performance of a Non-Economic Analysis (6).

Whether or not pre-empting factors exist, an LOR economic analysis must be performed in order to generate an LOR Analysis Recommendation and a Government Decision (7) as to the least cost decision alternative. Both analyses, if required, are performed for either CFE (Contractor Furnished Equipment) or GFE (Government Furnished Equipment) as directed by the procuring activity. If the situation is such that there is no clear cut repair or discard recommendation and a government decision cannot be reached, refinements and updates to the original LSA data elements will be made and the analysis repeated until a decision can be ascertained (8). If the LOR analysis recommends a repair decision, the LOR process continues to the Repair Category decision block (9). Furthermore, the LOR analysis not only recommends a repair decision but also the optimum repair level, i.e., Depot (11), Prime Intermediate Maintenance Activity (12), Intermediate (13), or Organizational (14). On the other hand, the LOR analysis may recommend Discard (10) as the least cost alternative. The LOR repair or discard decision is then provided as a primary input to the LSA (15) and will significantly influence the maintenance concept.

If one or more Changes from the Item Preliminary Design (16) are incurred, the LSA data elements will reflect those changes and the entire LOR analytical process is repeated from that point. The LOR process is then iteratively repeated until no design changes are incurred, at which time the item configuration becomes the Final Hardware Design (17). This design is input to the LSA Record (18) as a preliminary step towards inclusion of the item in the fleet as Operational Hardware (19).

* Numbers refer to the blocks in Figure 1.

5. DETAILED REQUIREMENTS

5.1 Preparation of LOR Program Plan.

5.1.1 General. An LOR Program Plan shall be established. This LOR Program Plan shall be either:

a. an integral but separately identifiable part of the ILS Program Plan as specified in the applicable documents cited by the contract, or

b. an integral but separately identifiable part of the Logistic Support Analysis Program Plan as specified in the applicable documents cited by the contract, or

c. an independent element of a system/element Design and Development Program Plan.

The LOR Program Plan shall be incorporated into the overall naval material procurement program in the order of preference stated above insofar as the associated programs are a requirement for the specific system or equipment and shall reflect program constraints and limitations as specified.

5.1.2 Contractor's LOR Organization. The LOR Program Plan shall identify the interrelationship of contractor related organizational functions and the appropriate positions responsible for conducting the LOR program. A new contractor organization is not required.

5.1.3 Contractor's LOR Program Plan. The contractor's proposed LOR Program Plan shall be included as part of his response to the RFP (Request For Proposal). The plan shall describe how the contractor will conduct the LOR program to fulfill the requirements of this standard. The LOR Program Plan, as approved or modified by the procuring activity, will be incorporated in the contract and will become the basis for contractual compliance. As a minimum, the LOR Program Plan shall include the tasks and schedules as specified on DID (Data Item Description) DI-ILSS- , unless otherwise specified by the procuring activity.

5.1.4 LOR Reviews. The LOR Program Plan shall include provisions for the contractor and the procuring activity to review the LOR progress and results at preplanned check-points. Formal reviews of LOR analyses and recommendations will be presented to the procuring activity for approval. These reviews shall be conducted after the initial and final LOR analyses required in 5.3 and as set forth in the approved LOR Program Plan. Furthermore, any LOR analysis presented to the procuring activity for review should incorporate the approved recommendations which have been suggested for earlier analyses. The minutes of the LOR Reviews shall be made available to the procuring activity upon request.

5.2 LOR Data Elements. The required data elements and associated values will be developed in accordance with the appropriate tasks. Data elements shall be tabulated in a section of the program plan by the contractor. All contractor furnished values, as well as changes to Navy furnished values, shall be subject to approval of the procuring activity.

5.3 LOR Analyses. The techniques listed in the appropriate tasks shall be utilized unless otherwise provided for in the approved program plan. The issuance of this standard does not preclude the use of techniques other than the ones proposed herein if these techniques can prove cost effective, are technically sound, are justified in the proposal, and are approved by the procuring activity.

5.3.1 Types of LOR Analyses. There are two basic types of LOR analyses.

5.3.1.1 Economic Analysis. An economic analysis is a method of collecting and computing the logistic costs associated with maintenance alternatives from which LOR recommendations can be made. This type of analysis consists of computing various cost elements (i.e., cost of inventory, cost of training, cost of support equipment, etc.) for discard and all repair alternatives, summing these cost elements by alternative, comparing the sums and selecting the lowest as the least cost decision alternative.

5.3.1.1.1 Economic LOR Computer Programs. Associated with each of the LOR economic mathematical models described in the tasks is a computer program to perform the mathematical computations. The program may be requested from the procuring activity.

5.3.1.2 Non-Economic Analysis. A non-economic analysis is a method of evaluating significant non-economic pre-empting factors from which LOR decisions are made. Examples of pre-empting factors include safety, readiness, policy, mission success, etc. This analysis is performed without regard to cost considerations. Any LOR recommendations based upon this type of analysis should also include an economic analysis so as to assign some economic value to the non-economic recommendation.

5.3.2 Scheduling of LOR Analyses. The LOR analyses shall be scheduled such that the LOR analyses results are available and used in making provisioning decisions.

5.3.2.1 Initial LOR Analysis. The initial LOR analysis should be conducted as soon as possible but no later than the end of Demonstration and Validation (D&V) phases or equivalent. This analysis is performed to isolate those items that should be clearly designed for discard from those that may be designed for repair. When adequate data is available, this analysis may be included in the contractor's proposal. The initial LOR analysis would not be required for items in production.

5.3.2.2 Final LOR Analysis. The final LOR analysis shall be submitted prior to the provisioning conference as specified on a Data Item Description. The results of this analysis shall be included as a part of the item maintenance plan and as a minimum it will be utilized to determine the maintenance portion of SM&R (Source, Maintenance, and Recoverability) codes. The output of this analysis determines whether the item should be discarded or repaired at the depot, PIMA, intermediate, or organizational level.

5.3.2.3 Requirements for Updating Analyses. The LOR process is iterative; that is, it begins with the initial LOR analysis and continues, with required updating, until submission of the final LOR analysis. Updating will be required when there are:

a. Significant changes in data elements.

b. Significant changes in support equipment requirements, capabilities, utilization rates, costs, etc.

c. Requirements for long lead items.

d. Other requirements imposed by contract.

e. Changes directed by the government.

Significant changes to approved recommendations will result from engineering changes and the requirements for modifying the LOR analyses or initiating additional analyses should be included in the ECP (Engineering Change Proposal) or change order.

5.3.3 Equipment Item Indenture Levels for LOR Analyses. Prior to performing LOR analyses, the specific equipment indenture for these analyses must be determined. The particular equipment division will be specified in the RFP and contract. LOR analyses would not be applicable to a non-repairable piece part such as a resistor, a bracket or a capacitor.

5.4 LOR Data Requirements. The following LOR data requirements will normally be prepared and forwarded to the procuring activity in accordance with the corresponding DID's and with the CDRL (Contract Data Requirement List).

5.4.1 LOR Program Plan. After the award of a contract an updated Program Plan, DID Number DI-ILSS- , will be submitted to the procuring activity. (5.1.3)

5.4.2 LOR Analyses Report. Unless otherwise specified by the procuring activity the results of the LOR analyses shall be submitted to the procuring activity in accordance with the CDRL and DID Number DI-ILSS- . The results shall include all data elements used, a summary of the calculations, and the contractor LOR recommendations.

5.4.3 LOR Performance Options. At the discretion of the procuring activity, either of two options may be exercised for performance of the required LOR analyses. First, the contractor is contractually responsible for complete LOR analyses performance to include input data derivation, analyses performance, and report preparation. Detailed requirements for this option have been delineated in section 5. Second, the contractor is contractually responsible solely for input data derivation for Navy performance of the required LOR analyses. Requirements for this option are described in section 6.

5.4.4 LOR Program Plan. The contractor's proposed LOR program plan shall be included as part of his response to the RFP. The plan shall describe how the contractor will prepare an input data report to fulfill the requirements of this standard. The LOR program plan, as approved or modified by the procuring activity, will be incorporated in the contract and will become the basis for contractual compliance. As a minimum, the LOR program plan shall describe the input derivation task and scheduling thereof.

5.4.5 LOR Input Data Report. Unless otherwise specified by the procuring activity a LOR input data report shall be submitted to the procuring activity in accordance with the CDRL and DID Number DI-ILSS- . As a minimum, the report shall include the data elements and values developed in accordance with the requirements of a specific LORA.

5.4.6 Sensitivity Analysis. A sensitivity analysis is a means of varying some data elements, in the LOR analysis, to see their effect on the calculated logistic support costs and corresponding LOR recommendations.

5.4.7 Output Reports. The results of the LOR analyses are presented in the output reports. In evaluating these reports, identification of item and cost category drivers are the first step in the feedback that should result in maintenance related design decisions.

6. INFORMATION FOR GUIDANCE ONLY

6.1 Intended Use. This standard is intended for incorporation in whole or in part, by reference or appendage to contracts and for use internally by the procuring activity for weapons, hardware systems, or equipments operationally in use or being procured for future use. Every time this standard is used each of its paragraphs must be considered by the Government for applicability of, deviation from, or supplementary requirements to each paragraph (see 1.2).

6.2 Issue of DoDISS. When this standard is used in acquisition, the applicable issue of the DoDISS must be cited in the solicitation (see 2.1.1).

6.3 Consideration of Data Requirements. The following Data Item Descriptions (DIDs) must be listed, as applicable, on the Contract Data Requirement List (DD 1423) when this standard is applied on a contract, in order to obtain the data, except where DoD FAR Supplement 27.410-6 exempts the requirement for a DD 1423.

Reference Paragraph	DID Number	DID Title	Suggested Tailoring
5.1/5.1.3/ 5.4.1/5.4.4	DI-ILSS-	LOR Analysis Program Plan	
5.4.2	DI-ILSS-	LOR Analysis Report	
5.4.5	DI-ILSS-	LOR Analysis Input Data Report	

The above DIDs were those cleared as of the date of this standard. The current issue of DOD 5010.12-2, Acquisition Management Systems and Data Requirements Control List (AMSDL), must be researched to ensure that only current, cleared DIDs are cited on the DD 1423.

6.4 Security Classification. Every effort shall be made by the contractor to limit the need for classifying the data furnished in accordance with the requirements of this document. Classified information shall be made a separate supplement to the report to which it applies.

6.5 Subject Term (key word) Listing.

Integrated Logistics Support Analysis (ILSA)
Maintenance alternatives
Mean-Time Between Failures (MTBF)
Support Equipment (SE)

SECTION 100

LEVEL OF REPAIR
FOR
NAVAL AIR SYSTEMS COMMAND

TASK 101

LOR Analytical Techniques for
NavaL Air Systems Command Equipments

10. SCOPE

10.1 Purpose. This task specifies the mathematical equations for performing LOR analyses for avionic, electrical, and mechanical equipments under the cognizance of the Naval Air Systems Command. The equations determine, at the analyst's option, the logistics support costs associated with any of three assembly indenture levels.

10.2 General. The economic LOR analytical techniques allocate costs to six major categories: (1) inventory which includes inventory administration; rotatable pool, attrition, and system stock inventories; repair material; scrap material; and transportation; (2) support equipment which includes hardware cost and support of the hardware; (3) space required by inventory storage, repair work, and support equipment; (4) labor; (5) training; and (6) documentation.

10.2.1 Classification of Equipment into Indenture Levels. The equipment under analysis may be classified into four hardware indenture levels: (1) the equipment, (2) the WRA (Weapon Replaceable Assembly), (3) the SRA (Shop Replaceable Assembly), and (4) the sub-SRA. Logistic support costs associated with WRAs, SRAs, and sub-SRAs are computed by the LOR analytical techniques.

10.2.2 LOR Code Assignments. Each item of assembly indenture classification may be assigned one of four LOR codes: (1) I (Intermediate Repair), (2) P (Prime Intermediate Repair), (3) D (Depot Repair), and (4) X (Discard).

10.2.2.1 Repair Definition. The repair of an item is defined as the removal and replacement of a failed lower indenture assembly to include fault verification of the item, fault isolation and replacement of the failed lower assembly, and item test.

10.2.2.1.1 Intermediate Repair. Failures occurring at an operational site (CV (Carrier) or NAS (Naval Air Station)) are repaired at the intermediate maintenance facility of the site.

10.2.2.1.2 Prime Intermediate Repair. Failures removed at operational sites are sent to selected NAS's and depots for repair. The selected NAS's are identified as PIMA (Prime Intermediate Maintenance Activity) sites. (Failures removed at the PIMA's and depots are repaired at the same sites.)

10.2.2.1.3 Depot Repair. Failures removed at operational sites are sent to depot maintenance facilities for repair.

10.2.2.2 Discard Definition. Verified failures are discarded at the designated site.

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10.2.3 LOR BCM Actions. Equipment failures occur at CV, NAS, and PIMA operational sites. Assemblies that are BCM (Beyond the Capability of Maintenance) at a particular site are sent to designated sites authorized to perform the repairs.

10.2.3.1 Equipment Failures Occurring at CV Sites. Items that are BCM at a CV site are sent to designated PIMA and depot facilities for repair. The proportion of BCM items sent to each facility is determined by input specifications.

10.2.3.2 Equipment Failures Occurring at NAS Sites. Items that are BCM at a NAS site are sent to designated PIMA and depot facilities for repair. The proportion of BCM items sent to each facility is determined by input specifications.

10.2.3.3 Equipment Failures Occurring at PIMA Sites. Items that are BCM at a PIMA site are sent to designated depot facilities for repair. The proportion of BCM items sent to each depot is determined by input specifications.

10.2.4 LOR Technique Assumptions.

10.2.4.1 PIMA Definition. The PIMA site is defined as an NAS with additional capability for repair of items that are BCM from other operational sites. The PIMA therefore performs a collateral function. It is considered as an IMA (Intermediate Maintenance Activity) in support of its local operating aircraft and as a PIMA for the BCM items that are forwarded to it. The total logistics support cost for performing maintenance functions at a PIMA is the sum of the costs associated with the IMA and PIMA segments.

10.2.4.2 Maintenance Alternatives. Maintenance alternatives for the assemblies of the equipment under analysis are selected through LOR code assignments (20.1.2). A general description of the code assignment procedure is given with Figure 1.

10.2.5 Required Parameters. Thirteen parameters are utilized within the cost element equations: (1) discount factors; (2) annual number of items for disposition at a site; (3) annual number of real failures removed at a site; (4) annual number of real failures sent from a site; (5) annual number of items sent from a site; (6) annual number of real failures received by a site; (7) annual number of items received by a site; (8) annual number of items sent from all CV's to a PIMA; (9) annual number of items sent from all NAS's to a PIMA; (10) annual number of items sent from all CV's to a depot; (11) annual number of items sent from all NAS's to a depot; (12) annual number of items sent from all PIMA's to a depot; (13) annual number of repairs of an item at a site.

10.2.5.1 Discount Factors. The computation of a discount factor involves a discount rate. The discount rate accounts for the time value of money and determines the actual present value of a cost element for the purpose of

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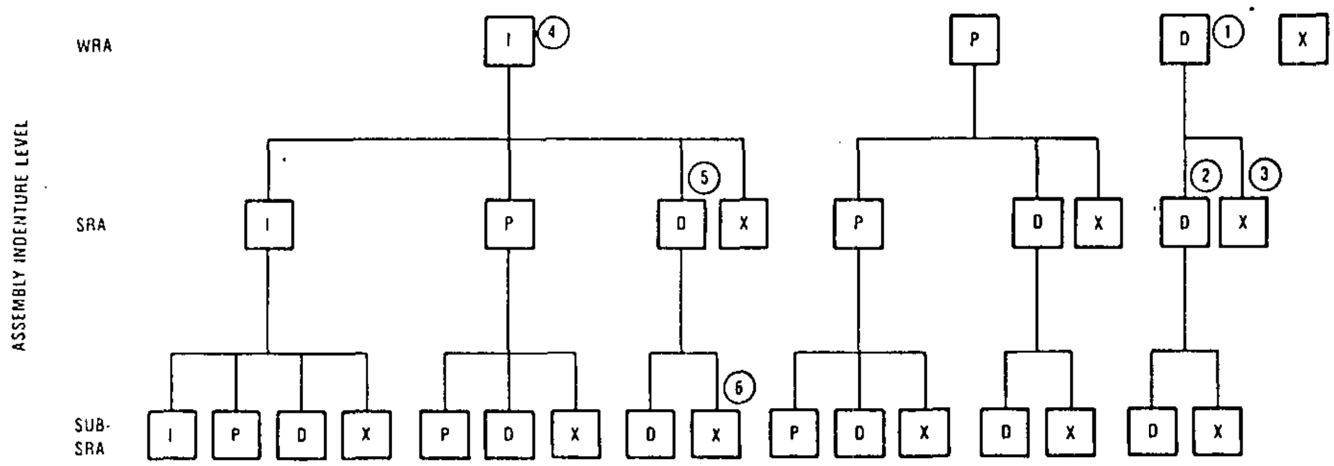
evaluating different payment schedules. Three discount factors are calculated: (1) the normal discount factor used with equal payment series starting one year hence and terminating at the end of the life cycle; (2) the present discount factor used with equal payment series starting at the present and terminating one year prior to the end of the life cycle; and (3) the reduced discount factor used with equal payment series starting two years hence and terminating at the end of the life cycle.



(LOR CODE ASSIGNMENTS)

- I = IMA REPAIR
- P = PIMA REPAIR
- D = DEPOT REPAIR
- X = DISCARD

*DEFINITION OF NUMBERED ITEMS AND A GENERAL DESCRIPTION OF THE LOR CODE ASSIGNMENT PROCEDURE ARE GIVEN ON PAGE 23.

FIGURE 1. Maintenance alternatives.

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Description of LOR Code Assignment Procedure for Selecting Maintenance Alternatives

There is an inherent limitation on the assignment of LOR codes to sub-assemblies: no subassembly can be assigned to a lower level repair facility than the assembly including it. For example, in Figure 1 if a WRA is assigned to depot repair (LOR code = D), ① * then the only choices available for its SRA's are depot (LOR code = D) ② and discard (LOR code - X) ③ A complication arises from the fact that some of the costs associated with the code assignments of sub-assemblies depend on the assignments of the assemblies in which they are included. Because of these considerations, although there are only four cost computations for each WRA, there are nine for each SRA, corresponding to the nine feasible combinations of assignments for it and the WRA including it, and sixteen cost computations for each sub-SRA. Figure 1 illustrates the totality of such combinations; each such combination is referred to as a case. For example, in Figure 1, SRA (LOR code = D) ② and ⑤ define two separate cases: Case ② indicates SRA depot repair when the WRA is assigned a D LOR code ① ; case ⑤ indicates SRA depot repair when the WRA is assigned an I LOR code ④ . In this task, input and equational parameters whose values vary with the case under consideration are indicated by the symbol (+).

A maintenance alternative is defined as a particular set of LOR cases for all items whose higher assemblies are not discarded. In Figure 1 cases ④ , ⑤ , and ⑥ together define a maintenance alternative indicating WRA IMA repair, SRA depot repair, and sub-SRA discard. An important assumption that must be considered when constructing an alternative is that an LOR code assigned to an item is independent of which lower indenture level part caused the failure.

*Circled numbers refer to Figure 1.

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10.2.5.1.1 Normal Discount Factor. The normal discount factor is used with expenditures occurring as equal payment series starting one year hence and terminating at the end of the life cycle.

$$\left(\begin{array}{c}\text{Normal}\\ \text{Discount}\\ \text{Factor}\end{array}\right) = \left[\frac{(1.0 + \text{Discount Rate})^{\left(\begin{array}{c}\text{Number of}\\ \text{Years per}\\ \text{Life Cycle}\end{array}\right)} - 1.0}{(\text{Discount Rate})\,(1.0 + \text{Discount Rate})^{\left(\begin{array}{c}\text{Number of}\\ \text{Years per}\\ \text{Life Cycle}\end{array}\right)}}\right]$$

10.2.5.1.2 Present Discount Factor. The present discount factor is used with expenditures occurring as equal payment series starting at the present and terminating one year prior to the end of the life cycle.

$$\left(\begin{array}{c}\text{Present}\\ \text{Discount}\\ \text{Factor}\end{array}\right) = \left[\frac{(1.0 + \text{Discount Rate})^{\left(\begin{array}{c}\text{Number of}\\ \text{Years per}\\ \text{Life Cycle}\end{array}\right)} - 1.0}{(\text{Discount Rate})\,(1.0 + \text{Discount Rate})^{\left[\left(\begin{array}{c}\text{Number of}\\ \text{Years per}\\ \text{Life Cycle}\end{array}\right) - 1.0\right]}}\right]$$

10.2.5.1.3 Reduced Discount Factor. The reduced discount factor is used with expenditures occurring as equal payment series starting two years hence and terminating at the end of the life cycle.

$$\left(\begin{array}{c}\text{Reduced}\\ \text{Discount}\\ \text{Factor}\end{array}\right) = \left[\frac{(1.0 + \text{Discount Rate})^{\left[\left(\begin{array}{c}\text{Number of}\\ \text{Years per}\\ \text{Life Cycle}\end{array}\right) - 1.0\right]} - 1.0}{(\text{Discount Rate})\,(1.0 + \text{Discount Rate})^{\left(\begin{array}{c}\text{Number of}\\ \text{Years per}\\ \text{Life Cycle}\end{array}\right)}}\right]$$

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10.2.5.2 The Annual Number of Items for Disposition at a Site. The annual number of items for disposition at a site is the total annual number of removals to include real failures plus false removals less the annual number of detected false removals at a site.

$$\begin{pmatrix}\text{Annual Number}\\ \text{of Items for}\\ \text{Disposition}\\ \text{at the } a^{th} \text{ Site}\end{pmatrix}^{\dagger} = \left[\begin{pmatrix}\text{Annual Number}\\ \text{of Real Failures}\\ \text{Removed at}\\ \text{the } a^{th} \text{ Site}\end{pmatrix}^{\dagger} + \begin{pmatrix}\text{Annual Number}\\ \text{of Real Failures}\\ \text{Removed at}\\ \text{the } a^{th} \text{ Site}\end{pmatrix}^{\dagger} \begin{pmatrix}\text{Fraction of}\\ \text{Items Falsely}\\ \text{Removed}\end{pmatrix}\right] - \left[\begin{pmatrix}\text{Annual Number}\\ \text{of Real Failures}\\ \text{Removed at}\\ \text{the } a^{th} \text{ Site}\end{pmatrix}^{\dagger} \begin{pmatrix}\text{Fraction of}\\ \text{Items Falsely}\\ \text{Removed}\end{pmatrix} \begin{pmatrix}\text{Fraction of}\\ \text{False Removals}\\ \text{Detected as Such}\end{pmatrix}\right]$$

† Input and equational parameters whose values vary with the case under consideration.

a = an index element denoting the a^{th} site to include CV, NAS, PIMA, and depot sites.

10.2.5.3 The Annual Number of Real Failures Removed at a Site. The annual number of real failures removed at a site is the annual number of failed items removed from their next higher assembly at the site. For the IMA sites, removals refer to the failed items from the locally operating aircraft. For the PIMA and depot sites, removals of the item are from higher indenture assemblies that were BCM from the sites with operating aircraft and forwarded to the higher level maintenance facilities. For computational purposes, it is convenient to consider the PIMA as two separate sites: as an IMA for those items originating from its operating aircraft, and as a PIMA for those BCM items forwarded to it from other sites.

$$\begin{pmatrix}\text{Annual Number}^{*}\\ \text{of Real Failures}\\ \text{Removed at}\\ \text{the } a^{th} \text{ Site}\end{pmatrix}^{\dagger} = \left[\frac{\begin{pmatrix}\text{Annual Number of}^{**}\\ \text{Repairs to the Next}\\ \text{Higher Assembly}\\ \text{at the } a^{th} \text{ Site}\end{pmatrix}^{\dagger} \begin{pmatrix}\text{Predicted Mean}\\ \text{Time Between}\\ \text{Failures of the Next}\\ \text{Higher Assembly}\end{pmatrix} \begin{pmatrix}\text{Number of}\\ \text{Identical Items}\\ \text{per Avionic System}\end{pmatrix} \begin{pmatrix}\text{Item Ratio of}\\ \text{Operating Hours}\\ \text{to Flight Hours}\end{pmatrix}}{\begin{pmatrix}\text{Predicted Mean}\\ \text{Time Between}\\ \text{Failures of the Item}\end{pmatrix} \begin{pmatrix}\text{Number of}\\ \text{Identical Next}\\ \text{Higher Assemblies}\\ \text{per Avionic System}\end{pmatrix} \begin{pmatrix}\text{Ratio of Operating}\\ \text{Hours to Flight Hours}\\ \text{of the Next}\\ \text{Higher Assembly}\end{pmatrix}}\right]$$

*This equation refers to the SRA or Sub-SRA as applicable to the indenture level under consideration. Corresponding WRA equation is given on the following page.

**This term refers to repairs from failures originating at the site if the a^{th} site is an IMA and to repairs from failures originating at lower level maintenance facilities if the a^{th} site is a PIMA or depot.

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$$\left(\begin{array}{c}\text{Annual Number}^{***}\\ \text{of Real Failures}\\ \text{Removed at}\\ \text{the } a^{th} \text{ Site}\end{array}\right)^{\dagger} = \left[\frac{\left(\begin{array}{c}\text{Number of}\\ \text{Identical}\\ \text{WRA's per}\\ \text{Avionic System}\end{array}\right)\left(\begin{array}{c}\text{WRA Ratio}\\ \text{of Operating}\\ \text{Hours to}\\ \text{Flight Hours}\end{array}\right)\left(\begin{array}{c}\text{12 Months}\\ \text{per}\\ \text{Year}\end{array}\right)\sum_{b=1}^{c}\left[\left(\begin{array}{c}\text{Monthly}\\ \text{Flight Hour}\\ \text{Program}\\ \text{at } a^{th} \text{ Site}\end{array}\right)_{b}\left(\begin{array}{c}\text{Number of}\\ \text{Aircraft at}\\ a^{th} \text{ Site}\end{array}\right)_{b}\left(\begin{array}{c}\text{Aircraft Type}\\ \text{Deployment}\\ \text{Factor for}\\ \text{the } a^{th} \text{ Site}\end{array}\right)_{b}\right]}{\left(\begin{array}{c}\text{Predicted Mean}\\ \text{Time Between}\\ \text{Failures of the Item}\end{array}\right)\left(\begin{array}{c}\text{Degradation}\\ \text{Factor}\end{array}\right)}\right]$$

***This equation refers to the WRA's, which are always removed at the operating sites.

b = an index element denoting the b^{th} aircraft type.

c = the number of different aircraft types.

10.2.5.4 <u>The Annual Number of Real Failures Sent from a Site</u>. The annual number of real failures sent from a site is the annual number of failures of an item that are BCM at the site and sent to a higher level maintenance facility for repair. Two parameters are defined to account for real failures sent from IMA's and from PIMA's.

10.2.5.4.1 <u>The Annual Number of Real Failures Sent from an IMA</u>.

$$\left(\begin{array}{c}\text{Annual Number of}\\ \text{Real Failures Sent}\\ \text{from the } d^{th} \text{ IMA}\end{array}\right)^{\dagger} = \left[\sum_{e=1}^{f}\left(\begin{array}{c}\text{Annual Number of Real}\\ \text{Failures Sent from the}\\ d^{th} \text{ IMA to the } e^{th} \text{ PIMA}\end{array}\right)^{\dagger}_{e} + \sum_{g=1}^{h}\left(\begin{array}{c}\text{Annual Number of Real}\\ \text{Failures Sent from the}\\ d^{th} \text{ IMA to the } g^{th} \text{ Depot}\end{array}\right)^{\dagger}_{g}\right]$$

where,

$$\left(\begin{array}{c}\text{Annual Number of Real}\\ \text{Failures Sent from the}\\ d^{th} \text{ IMA to the } e^{th} \text{ PIMA}\end{array}\right)^{\dagger} = \left[\left(\begin{array}{c}\text{Annual Number of Real}\\ \text{Failures Removed at}\\ \text{the } d^{th} \text{ IMA}\end{array}\right)^{\dagger}\left(\begin{array}{c}\text{BCM Rate of the}\\ \text{Item at the IMA}\end{array}\right)\left(\begin{array}{c}\text{Fraction of BCM Items}\\ \text{that are Forwarded}\\ \text{to the } e^{th} \text{ PIMA}\end{array}\right)\right]$$

$$\left(\begin{array}{c}\text{Annual Number of Real}\\ \text{Failures Sent from the}\\ d^{th} \text{ IMA to the } g^{th} \text{ Depot}\end{array}\right)^{\dagger} = \left[\left(\begin{array}{c}\text{Annual Number of Real}\\ \text{Failures Removed at}\\ \text{the } d^{th} \text{ IMA}\end{array}\right)^{\dagger}\left(\begin{array}{c}\text{BCM Rate of the}\\ \text{Item at the IMA}\end{array}\right)\left(\begin{array}{c}\text{Fraction of BCM Items}\\ \text{that are Forwarded}\\ \text{to the } g^{th} \text{ Depot}\end{array}\right)\right]$$

and

d = an index element denoting the d^{th} IMA.

e = an index element denoting the e^{th} PIMA.

f = the total number of PIMA's.

g = an index element denoting the g^{th} depot.

h = the total number of depots.

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10.2.5.4.2 <u>The Annual Number of Real Failures Sent from a PIMA.</u>

$$\begin{pmatrix}\text{Annual Number of}\\ \text{Real Failures Sent}\\ \text{From the } e^{th} \text{ PIMA}\end{pmatrix}^t = \sum_{g=1}^{h} \left[\begin{pmatrix}\text{Annual Number of}\\ \text{Real Failures Sent}\\ \text{from the } e^{th} \text{ PIMA}\\ \text{to the } g^{th} \text{ Depot}\end{pmatrix}^t\right]_g$$

where,

$$\begin{pmatrix}\text{Annual Number of}\\ \text{Real Failures Sent}\\ \text{from the } e^{th} \text{ PIMA}\\ \text{to the } g^{th} \text{ Depot}\end{pmatrix}^t = \left[\begin{pmatrix}\text{Annual Number}\\ \text{of Real Failures}\\ \text{Removed at}\\ \text{the } e^{th} \text{ PIMA}\end{pmatrix}^t = \begin{pmatrix}\text{Annual Number}\\ \text{of Real Failures}\\ \text{Received by}\\ \text{the } e^{th} \text{ PIMA}\end{pmatrix}^t\right] \begin{pmatrix}\text{BCM Rate of the}\\ \text{Item at the PIMA}\end{pmatrix} \begin{pmatrix}\text{Fraction of BCM Items}\\ \text{that are Forwarded}\\ \text{to the } g^{th} \text{ Depot}\end{pmatrix}$$

10.2.5.5 <u>The Annual Number of Items Sent from a Site</u>. The annual number of items sent from a site is the annual number of items that are coded for repair at the site but are beyond the limit of maintenance capability and sent off-base for repair of the annual number of suspected failures of an item at a site where off-base repair is indicated by the LOR code. Two parameters are defined to account for items sent from IMA's and from PIMA's.

10.2.5.5.1 <u>The Annual Number of Items Sent from an IMA.</u>

$$\begin{pmatrix}\text{Annual Number of}\\ \text{Items Sent from}\\ \text{the } d^{th} \text{ IMA}\end{pmatrix}^t = \left[\sum_{e=1}^{f} \begin{pmatrix}\text{Annual Number}\\ \text{of Items Sent}\\ \text{from the } d^{th} \text{ IMA}\\ \text{to the } e^{th} \text{ PIMA}\end{pmatrix}_e^t + \sum_{g=1}^{h} \begin{pmatrix}\text{Annual Number}\\ \text{of Items Sent}\\ \text{from the } d^{th} \text{ IMA}\\ \text{to the } g^{th} \text{ Depot}\end{pmatrix}_g^t\right]$$

where,

$$\begin{pmatrix}\text{Annual Number}\\ \text{of Items Sent}\\ \text{from the } d^{th} \text{ IMA}\\ \text{to the } e^{th} \text{ PIMA}\end{pmatrix}^t = \left[\begin{pmatrix}\text{Annual Number}\\ \text{of Items for}\\ \text{Disposition}\\ \text{at the } d^{th} \text{ IMA}\end{pmatrix}^t \begin{pmatrix}\text{BCM Rate of the}\\ \text{Item at the IMA}\end{pmatrix} \begin{pmatrix}\text{Fraction of BCM Items}\\ \text{that are Forwarded}\\ \text{to the } e^{th} \text{ PIMA}\end{pmatrix}\right]$$

$$\begin{pmatrix}\text{Annual Number}\\ \text{of Items Sent}\\ \text{from the } d^{th} \text{ IMA}\\ \text{to the } g^{th} \text{ Depot}\end{pmatrix}^t = \left[\begin{pmatrix}\text{Annual Number}\\ \text{of Items for}\\ \text{Disposition}\\ \text{at the } d^{th} \text{ IMA}\end{pmatrix}^t \begin{pmatrix}\text{BCM Rate of the}\\ \text{Item at the IMA}\end{pmatrix} \begin{pmatrix}\text{Fraction of BCM Items}\\ \text{that are Forwarded}\\ \text{to the } g^{th} \text{ Depot}\end{pmatrix}\right]$$

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10.2.5.5.2 The Annual Number of Items Sent from a PIMA.

$$\begin{pmatrix}\text{Annual Number of}\\ \text{Items Sent from}\\ \text{the } e^{th} \text{ PIMA}\end{pmatrix}^{t} = \left[\sum_{g=1}^{h}\begin{pmatrix}\text{Annual Number}\\ \text{of Items Sent}\\ \text{from the } e^{th} \text{ PIMA}\\ \text{to the } g^{th} \text{ Depot}\end{pmatrix}_{g}^{t}\right]$$

where,

$$\begin{pmatrix}\text{Annual Number of}\\ \text{Items Sent}\\ \text{from the } e^{th} \text{ PIMA}\\ \text{to the } g^{th} \text{ Depot}\end{pmatrix}^{t} = \left[\begin{pmatrix}\text{Annual Number}\\ \text{of Items for}\\ \text{Disposition}\\ \text{at the } e^{th} \text{ PIMA}\end{pmatrix}^{t}\begin{pmatrix}\text{BCM Rate of the}\\ \text{Item at the PIMA}\end{pmatrix}\begin{pmatrix}\text{Fraction of BCM Items}\\ \text{that are Forwarded}\\ \text{to the } g^{th} \text{ Depot}\end{pmatrix}\right]$$

10.2.5.6 The Annual Number of Real Failures Received by a Site. The annual number of real failures received by a site is the annual number of failures of an item that are BCM at lower level maintenance facilities and forwarded to the site for repair. Two parameters are defined to account for real failures received by a site: PIMA's receive failures from IMA's while depots receive failures from IMA's and PIMA's.

10.2.5.6.1 The Annual Number of Real Failures Received by a PIMA.

$$\begin{pmatrix}\text{Annual Number of}\\ \text{Real Failures Received}\\ \text{by the } e^{th} \text{ PIMA}\end{pmatrix}^{t} = \left[\sum_{d=1}^{i}\begin{pmatrix}\text{Annual Number of Real}\\ \text{Failures Sent from the}\\ d^{th} \text{ IMA to the } e^{th} \text{ PIMA}\end{pmatrix}_{d}^{t}\right]$$

i = total number of IMA's.

10.2.5.6.2 The Annual Number of Real Failures Received by a Depot.

$$\begin{pmatrix}\text{Annual Number}\\ \text{Real Failures Received}\\ \text{by the } g^{th} \text{ Depot}\end{pmatrix}^{t} = \left[\sum_{d=1}^{i}\begin{pmatrix}\text{Annual Number of Real}\\ \text{Failures Sent from the}\\ d^{th} \text{ IMA to the } g^{th} \text{ Depot}\end{pmatrix}_{d}^{t} + \sum_{e=1}^{f}\begin{pmatrix}\text{Annual Number of Real}\\ \text{Failures Sent from the}\\ e^{th} \text{ PIMA to the } g^{th} \text{ Depot}\end{pmatrix}_{e}^{t}\right]$$

10.2.5.7 The Annual Number of Items Received by a Site. The annual number of items received by a site is the annual number of BCM items or suspected failures sent to the higher level maintenance facility. Two parameters are defined to account for items received by PIMA's and depot's.

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10.2.5.7.1 The Annual Number of Items Received by a PIMA.

$$\begin{pmatrix}\text{Annual Number of}\\ \text{of Items Received}\\ \text{by the } e^{th} \text{ PIMA}\end{pmatrix}_t = \left[\sum_{d=1}^{j}\begin{pmatrix}\text{Annual Number}\\ \text{of Items Sent}\\ \text{from the } d^{th} \text{ IMA}\\ \text{to the } e^{th} \text{ PIMA}\end{pmatrix}_d^t\right]$$

10.2.5.7.2 The Annual Number of Items Received by a Depot.

$$\begin{pmatrix}\text{Annual Number}\\ \text{of Items Received}\\ \text{by the } g^{th} \text{ Depot}\end{pmatrix}_t = \left[\sum_{d=1}^{j}\begin{pmatrix}\text{Annual Number}\\ \text{of Items Sent}\\ \text{from the } d^{th} \text{ IMA}\\ \text{to the } g^{th} \text{ Depot}\end{pmatrix}_d^t + \sum_{e=1}^{i}\begin{pmatrix}\text{Annual Number}\\ \text{of Items Sent}\\ \text{from the } e^{th} \text{ PIMA}\\ \text{to the } g^{th} \text{ Depot}\end{pmatrix}_e^t\right]$$

10.2.5.8 The Annual Number of Items Sent from all CV's to a PIMA.

$$\begin{pmatrix}\text{Annual Number}\\ \text{of Items Sent}\\ \text{from All CV's}\\ \text{to the } e^{th} \text{ PIMA}\end{pmatrix}_t = \left[\sum_{k=1}^{l}\begin{pmatrix}\text{Annual Number}\\ \text{of Items Sent}\\ \text{from the } k^{th} \text{ CV}\\ \text{to the } e^{th} \text{ PIMA}\end{pmatrix}_k^t\right]$$

k = an index element denoting the k^{th} CV.
l = total number of CV's.

10.2.5.9 The Annual Number of Items Sent from all NAS's to a PIMA.

$$\begin{pmatrix}\text{Annual Number}\\ \text{of Items Sent}\\ \text{from All NAS's}\\ \text{to the } e^{th} \text{ PIMA}\end{pmatrix}_t = \left[\sum_{m=1}^{n}\begin{pmatrix}\text{Annual Number}\\ \text{of Items Sent}\\ \text{from the } m^{th} \text{ NAS}\\ \text{to the } e^{th} \text{ PIMA}\end{pmatrix}_m^t\right]$$

m = an index element denoting the m^{th} NAS.
n = total number of NAS's.

10.2.5.10 The Annual Number of Items Sent from all CV's to a Depot.

$$\begin{pmatrix}\text{Annual Number}\\ \text{of Items Sent}\\ \text{from All CV's}\\ \text{to the } g^{th} \text{ Depot}\end{pmatrix}_t = \left[\sum_{k=1}^{l}\begin{pmatrix}\text{Annual Number}\\ \text{of Items Sent}\\ \text{from the } k^{th} \text{ CV}\\ \text{to the } g^{th} \text{ Depot}\end{pmatrix}_k^t\right]$$

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10.2.5.11 The Annual Number of Items Sent from all NAS's to a Depot.

$$\begin{pmatrix}\text{Annual Number}\\ \text{of Items Sent}\\ \text{from All NAS's}\\ \text{to the } g^{th} \text{ Depot}\end{pmatrix}^{t} = \left[\sum_{m=1}^{m}\begin{pmatrix}\text{Annual Number}\\ \text{of Items Sent}\\ \text{from the } m^{th} \text{ NAS}\\ \text{to the } g^{th} \text{ Depot}\end{pmatrix}^{t}_{m}\right]$$

10.2.5.12 The Annual Number of Items Sent from all PIMA's to a Depot.

$$\begin{pmatrix}\text{Annual Number}\\ \text{of Items Sent}\\ \text{from All PIMA's}\\ \text{to the } g^{th} \text{ Depot}\end{pmatrix}^{t} = \left[\sum_{e=1}^{f}\begin{pmatrix}\text{Annual Number}\\ \text{of Items Sent}\\ \text{from the } e^{th} \text{ PIMA}\\ \text{to the } g^{th} \text{ Depot}\end{pmatrix}^{t}_{e}\right]$$

10.2.5.13 The Annual Number of Repairs of an Item at a Site. This is the annual number of items inducted into the repair process at the site. In the repair process malfunctioning lower level parts are removed and replaced. Three parameters are defined to account for repair of items at IMA's, PIMA's, and depots.

10.2.5.13.1 The Annual Number of Repairs of an Item at an IMA.

$$\begin{pmatrix}\text{Annual Number}\\ \text{of Repairs to an}\\ \text{Item at the } d^{th} \text{ IMA}\end{pmatrix}^{t} = \left[\begin{pmatrix}\text{Annual Number}\\ \text{of Real Failures}\\ \text{Removed at}\\ \text{the } d^{th} \text{ IMA}\end{pmatrix}^{t}\left[1.0 - \begin{pmatrix}\text{BCM Rate}\\ \text{of the Item}\\ \text{at the IMA}\end{pmatrix}\right]\left[1.0 - \begin{pmatrix}\text{Fraction of Item}\\ \text{Failures Scrapped}\\ \text{at the IMA}\end{pmatrix}\right]\right]$$

10.2.5.13.2 The Annual Number of Repairs of an Item at a PIMA.

$$\begin{pmatrix}\text{Annual Number}\\ \text{of Repairs}\\ \text{to an Item at}\\ \text{the } e^{th} \text{ PIMA}\end{pmatrix}^{t} = \left[\begin{pmatrix}\text{Annual Number}\\ \text{of Real Failures}\\ \text{Removed at}\\ \text{the } e^{th} \text{ PIMA}\end{pmatrix}^{t} + \begin{pmatrix}\text{Annual Number}\\ \text{of Real Failures}\\ \text{Received by}\\ \text{the } e^{th} \text{ PIMA}\end{pmatrix}^{t}\right]\left[1.0 - \begin{pmatrix}\text{BCM Rate}\\ \text{of the Item}\\ \text{at the PIMA}\end{pmatrix}\right]\left[1.0 - \begin{pmatrix}\text{Fraction of Item}\\ \text{Failures Scrapped}\\ \text{at the PIMA}\end{pmatrix}\right]$$

10.2.5.13.3 The Annual Number of Repairs of an Item at a Depot.

$$\begin{pmatrix}\text{Annual Number}\\ \text{of Repairs to an}\\ \text{Item at the } g^{th} \text{ Depot}\end{pmatrix}^{t} = \left[\begin{pmatrix}\text{Annual Number}\\ \text{of Real Failures}\\ \text{Removed at}\\ \text{the } g^{th} \text{ Depot}\end{pmatrix}^{t} + \begin{pmatrix}\text{Annual Number of}\\ \text{Real Failures Received}\\ \text{by the } g^{th} \text{ Depot}\end{pmatrix}^{t}\right]\left[1.0 - \begin{pmatrix}\text{Fraction of Item}\\ \text{Failures Scrapped}\\ \text{at the Depot}\\ \text{Repair Facility}\end{pmatrix}\right]$$

TASK 101 (Continued)

10.3 Cost Element Equations.

10.3.1 Inventory Costs.

10.3.1.1 Inventory Administration Cost. Inventory administration cost is the cost associated with entering an item into the supply system and retaining it there over its life cycle. The LOR analytical techniques treat the inventory administration cost as proportional to the number of equipment peculiar items entered in the NSN (National Stock Number) system. The cost is a function of three separate costs: item entry, item retention, and field supply administration. Item entry is a one-time cost per peculiar NSN, incurred during the inventory procurement process to establish a NSN for the item. Item retention is a recurring cost per NSN incurred throughout the life cycle. It is a per year cost due to maintaining the item in the NSN system. Field supply administration is a per site cost annually incurred for local management of the item.

10.3.1.1.1 Inventory Administration Cost Equation for the Discard Cases. The administrative cost incurred for discard is the cost of local management, entry, and retention of the discarded item in the NSN system.

$$\begin{pmatrix}\text{Inventory}\\ \text{Administration}\\ \text{Cost for Discard}\end{pmatrix}^{\dagger} = \begin{pmatrix}\text{Item*}\\ \text{Entry}\\ \text{Cost}\end{pmatrix} + \left[\begin{pmatrix}\text{Item*}\\ \text{Retention}\\ \text{Cost}\end{pmatrix} + \begin{pmatrix}\text{Field Supply}\\ \text{Administration}\\ \text{Cost per Item}\\ \text{per Site per Year}\end{pmatrix}\begin{pmatrix}\text{Number of}\\ \text{Sites}\\ \text{Discarding}\\ \text{the Item}\end{pmatrix}^{\dagger}\right]\begin{pmatrix}\text{Normal}\\ \text{Discount}\\ \text{Factor}\end{pmatrix}$$

*Item refers to either the WRA, SRA, or sub-SRA as applicable to the indenture level under analyses.

10.3.1.1.2 Inventory Administration Cost Equation for the Repair Cases. The administrative cost incurred for repair is the cost of local management, entry, and retention of the repairable item and its peculiar components or piece parts in the NSN system. The cost equation is comprised of two segments to account for administrative costs associated with each repairable item and with its peculiar components excluding those lower indenture parts under analysis.

$$\begin{pmatrix}\text{Inventory}\\ \text{Administration}\\ \text{Cost for Repair}\end{pmatrix}^{\dagger} = \begin{pmatrix}\text{Item}\\ \text{Entry}\\ \text{Cost}\end{pmatrix} + \left[\begin{pmatrix}\text{Item}\\ \text{Retention}\\ \text{Cost}\end{pmatrix} + \begin{pmatrix}\text{Field Supply}\\ \text{Administration}\\ \text{Cost per Item}\\ \text{per Site per Year}\end{pmatrix}\begin{pmatrix}\text{Number of Sites}\\ \text{Fault Isolating to and/or}\\ \text{Repairing the Item}\end{pmatrix}\right]^{\dagger}\begin{pmatrix}\text{Normal}\\ \text{Discount}\\ \text{Factor}\end{pmatrix} +$$

$$\left[\begin{pmatrix}\text{Item}\\ \text{Entry}\\ \text{Cost}\end{pmatrix} + \left[\begin{pmatrix}\text{Item}\\ \text{Retention}\\ \text{Cost}\end{pmatrix} + \begin{pmatrix}\text{Field Supply}\\ \text{Administration}\\ \text{Cost per Item}\\ \text{per Site per Year}\end{pmatrix}\begin{pmatrix}\text{Number of}\\ \text{Sites}\\ \text{Repairing}\\ \text{the Item}\end{pmatrix}^{\dagger}\right]\begin{pmatrix}\text{Normal}\\ \text{Discount}\\ \text{Factor}\end{pmatrix}\right]\begin{pmatrix}\text{Number of Peculiar*}\\ \text{Components in the}\\ \text{NSN System}\end{pmatrix}$$

*Components refer to the parts which are used to repair the item and are not included in the analysis.

TASK 101 (Continued)

10.3.1.2 Spares Inventory Cost Equations.

10.3.1.2.1 Inventory Quantity Equation for Discard. The discard inventory is the number of spares required during the system life cycle to account for discard maintenance actions. The inventory quantity for each item to be discarded is calculated on an annual basis by individual site. LB (Land-Based) sites have the demands on the IMA and PIMA, if collocated, added together to calculate the discard quantity.

10.3.1.2.1.1 Annual Inventory Quantity for Discard at a CV Site.

$$\left(\begin{array}{c}\text{Annual Inventory}\\ \text{Quantity for Discard}\\ \text{at the } k^{th} \text{ CV Site}\end{array}\right)^{t} = \left[\left(\begin{array}{c}\text{Annual Number of}\\ \text{Items for Disposition}\\ \text{at the } k^{th} \text{ CV Site}\end{array}\right)^{t}\right]$$

10.3.1.2.1.2 Annual Inventory Quantity for Discard at a LB Site.

$$\left(\begin{array}{c}\text{Annual Inventory}\\ \text{Quantity for Discard}\\ \text{at the } p^{th} \text{ LB Site}\end{array}\right)^{t} = \left[\left(\begin{array}{c}\text{Annual Number of}\\ \text{Items for Disposition}\\ \text{at the NAS Located}\\ \text{at the } p^{th} \text{ LB Site}\end{array}\right)^{t} + \left(\begin{array}{c}\text{Annual Number of}^{*}\\ \text{Items for Disposition}\\ \text{at the PIMA Located}\\ \text{at the } p^{th} \text{ LB Site}\end{array}\right)^{t}\right]$$

p = an index element denoting the p^{th} LB site which includes NAS's and NAS's collocated with PIMA's.

*The term may = 0, as applicable to the site under consideration.

10.3.1.2.1.3 Annual Inventory Quantity for Discard at a Depot.

$$\left(\begin{array}{c}\text{Annual Inventory}\\ \text{Quantity for Discard}\\ \text{at the } g^{th} \text{ Depot}\end{array}\right)^{t} = \left[\left(\begin{array}{c}\text{Annual Number of}\\ \text{Items for Disposition}\\ \text{at the } g^{th} \text{ Depot}\end{array}\right)^{t}\right]$$

10.3.1.2.1.4 Inventory Cost Equation for Discard.

$$\left(\begin{array}{c}\text{Inventory Cost}\\ \text{for Discard}\\ \text{at the } v^{th} \text{ Site}\end{array}\right)^{t} = \left[\left(\begin{array}{c}\text{Unit}\\ \text{Cost of}\\ \text{Item}\end{array}\right)\left(\begin{array}{c}\text{Annual Inventory}\\ \text{Quantity for Discard}\\ \text{at the } v^{th} \text{ Site}\end{array}\right)^{t}\left(\begin{array}{c}\text{Present}\\ \text{Discount}\\ \text{Factor}\end{array}\right)\right]$$

v = an index element denoting the v^{th} site to include CV, LB, and depot sites.

TASK 101 (Continued)

10.3.1.2.2 Repairable Inventory Quantity. The repairable quantity consists of the rotatable pool quantity, attrition quantity, and system stock quantity.

10.3.1.2.2.1 Rotatable Pool Quantity Equation. The rotatable pool is stocked at the sites where aircraft operate to allow immediate replacement of items repaired at that site. A rotatable pool quantity is determined for each operational site in accordance with the criteria of Figure 2 and the integerization rules of Table I. The integerization rules operate on raw or non-integerized rotatable pool quantities calculated for each CV and LB operational site.

10.3.1.2.2.1.1 Raw Rotatable Pool Quantity at a CV Site.

$$\left(\begin{array}{c}\text{Raw Rotatable}\\ \text{Pool Quantity}\\ \text{at the } k^{th} \text{ CV Site}\end{array}\right)^{\dagger} = \left[\frac{\left(\begin{array}{c}\text{Annual Number of}\\ \text{Repairs to an Item}\\ \text{at the } k^{th} \text{ CV Site}\end{array}\right)^{\dagger}\left(\begin{array}{c}\text{Repair Cycle Time}\\ \text{at the IMA}\end{array}\right)}{\left(\begin{array}{c}\text{365 Days}\\ \text{per}\\ \text{Year}\end{array}\right)\left(\begin{array}{c}\text{Carrier}\\ \text{Deployment Factor}\\ \text{for the } k^{th} \text{ CV Site}\end{array}\right)}\right]$$

where,

$$\left(\begin{array}{c}\text{Carrier}\\ \text{Deployment Factor}\\ \text{for the } k^{th} \text{ CV Site}\end{array}\right) = \left[\frac{\sum_{b=1}^{c}\left(\begin{array}{c}\text{Number of Aircraft}\\ \text{that Deploy to the}\\ k^{th} \text{ Carrier per}\\ \text{Aircraft Type}\end{array}\right)_b\left(\begin{array}{c}\text{Aircraft Type}\\ \text{Deployment Factor}\\ \text{for the } k^{th} \text{ Carrier}\end{array}\right)_b}{\sum_{b=1}^{c}\left(\begin{array}{c}\text{Number of Aircraft}\\ \text{that Deploy to the}\\ k^{th} \text{ Carrier per}\\ \text{Aircraft Type}\end{array}\right)_b}\right]$$

10.3.1.2.2.1.2 Raw Rotatable Pool Quantity at a LB Site.

$$\left(\begin{array}{c}\text{Raw Rotatable}\\ \text{Pool Quantity}\\ \text{at the } p^{th} \text{ LB Site}\end{array}\right)^{\dagger} = \left[\frac{\left(\begin{array}{c}\text{Annual Number of}\\ \text{Repairs to an Item}\\ \text{Originating}\\ \text{at the } p^{th} \text{ LB Site}\end{array}\right)^{\dagger}\left(\begin{array}{c}\text{Repair Cycle Time}\\ \text{at the IMA}\end{array}\right)}{\left(\begin{array}{c}\text{365 Days}\\ \text{per}\\ \text{Year}\end{array}\right)}\right]$$

where,

$$\left(\begin{array}{c}\text{Annual Number of}\\ \text{Repairs to an}\\ \text{Item Originating}\\ \text{at the } p^{th} \text{ LB Site}\end{array}\right)^{\dagger} = \left(\begin{array}{c}\text{Annual Number of}\\ \text{Repairs to an Item}\\ \text{at the NAS Located}\\ \text{at the } p^{th} \text{ LB Site}\end{array}\right)^{\dagger} + \left(\begin{array}{c}\text{Annual Number of}\\ \text{Real Failures Removed}\\ \text{at the PIMA Located}\\ \text{at the } p^{th} \text{ LB Site}\end{array}\right)^{\dagger}\left[1.0 - \left(\begin{array}{c}\text{Fraction of Item}\\ \text{Failures Scrapped}\\ \text{at the PIMA}\end{array}\right)\right]\left[1.0 - \left(\begin{array}{c}\text{BCM Rate}\\ \text{of the Item}\\ \text{at the PIMA}\end{array}\right)\right]$$

TASK 101 (Continued)

Table I. Integerization rules for computing Rotatable Pool quantities.

If (Raw Rotatable Pool Quantity Per Site)	(Rotatable Pool Quantity per Site)
<.10	0
.11- .59	1
.60-1.29	2
1.30-2.09	3
2.10-2.89	4
2.90-3.89	5
≥3.90	INT* {(Raw Rotatable Pool Quantity per Site) + 1.0}

*INT means round off to nearest integer.

10.3.1.2.2.2 Attrition Quantity Equation. The attrition quantity is a replenishment quantity stocked at the sites where aircraft operate to replace those items not repairable or restorable to an RFI (Ready For Issue) status at the sites. These items are BCM or scrapped and, therefore, not available to the site's supply system. The attrition quantity, computed for the individual sites, is subject to the integerization rules of Table II and the criteria of Figure 2 which operate on raw or non-integerized attrition quantities.

10.3.1.2.2.2.1 Raw Attrition Quantity Equation for a CV Performing Local Repairs.

$$\begin{pmatrix}\text{Raw}\\\text{Attrition}\\\text{Quantity}\\\text{at the }k^{th}\\\text{CV Site}\end{pmatrix}^{\dagger} = \left[\frac{\left[\begin{pmatrix}\text{Annual Number}\\\text{of Items for}\\\text{Disposition at}\\\text{the }k^{th}\text{ CV Site}\end{pmatrix}^{\dagger}\begin{pmatrix}\text{BCM Rate}\\\text{of Item at}\\\text{the IMA}\end{pmatrix}+\begin{pmatrix}\text{Annual Number}\\\text{of Real Failures}\\\text{Removed at the}\\k^{th}\text{ CV Site}\end{pmatrix}^{\dagger}\left[1.0-\begin{pmatrix}\text{BCM Rate}\\\text{of Item at}\\\text{the IMA}\end{pmatrix}\right]\begin{pmatrix}\text{Fraction of}\\\text{Item Failures}\\\text{Scrapped}\\\text{at the IMA}\end{pmatrix}\right]\begin{pmatrix}\text{Required}\\\text{Days of}\\\text{Stock}\\\text{at the IMA}\end{pmatrix}}{\begin{pmatrix}\text{365 Days}\\\text{per}\\\text{Year}\end{pmatrix}\begin{pmatrix}\text{Carrier Deployment}\\\text{Factor for the}\\k^{th}\text{ CV Site}\end{pmatrix}}\right]$$

10.3.1.2.2.2.2 Raw Attrition Quantity Equation for a CV when Off-Site Repair is Indicated.

$$\begin{pmatrix}\text{Raw Attrition}\\\text{Quantity at the}\\k^{th}\text{ CV Site}\end{pmatrix}^{\dagger} = \left[\frac{\begin{pmatrix}\text{Annual Number}\\\text{of Items for}\\\text{Disposition at}\\\text{the }k^{th}\text{ CV Site}\end{pmatrix}^{\dagger}\begin{pmatrix}\text{Required}\\\text{Days of Stock}\\\text{at the IMA}\end{pmatrix}}{\begin{pmatrix}\text{365 Days}\\\text{per}\\\text{Year}\end{pmatrix}\begin{pmatrix}\text{Carrier Deployment}\\\text{Factor for the}\\k^{th}\text{ CV Site}\end{pmatrix}}\right]$$

TASK 101 (Continued)

10.3.1.2.2.2.3 <u>Raw Attrition Quantity Equation for a LB Performing Local Repairs.</u>

$$\begin{pmatrix}\text{Raw}\\\text{Attrition}\\\text{Quantity}\\\text{at the}\\p^{th}\text{ LB Site}\end{pmatrix}^{\dagger} = \left[\frac{\left[\left[\begin{pmatrix}\text{Annual Number}\\\text{of Items for}\\\text{Disposition at the}\\\text{NAS Located at}\\\text{the }p^{th}\text{ LB Site}\end{pmatrix}^{\dagger}\begin{pmatrix}\text{BCM Rate}\\\text{of Item at}\\\text{the IMA}\end{pmatrix} + \begin{pmatrix}\text{Annual Number}\\\text{of Real Failures}\\\text{Removed at the}\\\text{NAS Located at}\\\text{the }p^{th}\text{ LB Site}\end{pmatrix}^{\dagger}\left[1.0 - \begin{pmatrix}\text{BCM Rate}\\\text{of Item at}\\\text{the IMA}\end{pmatrix}\right]\right]\begin{pmatrix}\text{Fraction of}\\\text{Item Failures}\\\text{Scrapped}\\\text{at the IMA}\end{pmatrix}\right]\begin{pmatrix}\text{Required}\\\text{Days of}\\\text{Stock}\\\text{at the IMA}\end{pmatrix}}{\begin{pmatrix}\text{365 Days}\\\text{per}\\\text{Year}\end{pmatrix}}\right]$$

$$+ \left[\frac{\left[\begin{pmatrix}\text{Annual Number}\\\text{of Items for}\\\text{Disposition at the}\\\text{PIMA Located at}\\\text{the }p^{th}\text{ LB Site}\end{pmatrix}^{\dagger} + \begin{pmatrix}\text{Annual Number}\\\text{of Real Failures}\\\text{Received by the}\\\text{PIMA Located at}\\\text{the }p^{th}\text{ LB Site}\end{pmatrix}^{\dagger}\right]\begin{pmatrix}\text{BCM Rate}\\\text{of Item at}\\\text{the PIMA}\end{pmatrix}\begin{pmatrix}\text{Required}\\\text{Days of Stock}\\\text{at the PIMA}\end{pmatrix}}{\begin{pmatrix}\text{365 Days}\\\text{per}\\\text{Year}\end{pmatrix}}\right]$$

$$+ \left[\frac{\left[\begin{pmatrix}\text{Annual Number}\\\text{of Real Failures}\\\text{Removed at the}\\\text{PIMA Located at}\\\text{the }p^{th}\text{ LB Site}\end{pmatrix}^{\dagger} + \begin{pmatrix}\text{Annual Number}\\\text{of Real Failures}\\\text{Received by the}\\\text{PIMA Located at}\\\text{the }p^{th}\text{ LB Site}\end{pmatrix}^{\dagger}\right]\left[1.0 - \begin{pmatrix}\text{BCM Rate}\\\text{of Item at}\\\text{the PIMA}\end{pmatrix}\right]\begin{pmatrix}\text{Required}\\\text{Days of Stock}\\\text{at the PIMA}\end{pmatrix}}{\begin{pmatrix}\text{365 Days}\\\text{per}\\\text{Year}\end{pmatrix}}\right]$$

10.3.1.2.2.2.4 <u>Raw Attrition Quantity Equation for a LB when Off-Site Repair is Indicated.</u>

$$\begin{pmatrix}\text{Raw Attrition}\\\text{Quantity at}\\\text{the }p^{th}\text{ LB Site}\end{pmatrix}^{\dagger} = \left[\frac{\begin{pmatrix}\text{Annual Number of}\\\text{Items for Disposition}\\\text{at the NAS Located}\\\text{at the }p^{th}\text{ LB Site}\end{pmatrix}^{\dagger}\begin{pmatrix}\text{Required}\\\text{Days of Stock}\\\text{at the IMA}\end{pmatrix}}{\begin{pmatrix}\text{365 Days}\\\text{per}\\\text{Year}\end{pmatrix}}\right]$$

TASK 101 (Continued)

TABLE II. Integerization rules for computing attrition quantities.

Cost Range Criteria
Recommended Attrition Quantity per Site

Raw Attrition Quantity per Site (20.2.1.2.2.2)

There is no attrition quantity for raw quantities less than .34.					
.34	L $.11 4	$.12 - $1.10 3	$1.11 - $ 9.80 2	$ 9.81 - $ 74.00 1	G $ 74.01 1
.35	L .12 4	.13 - 1.20 3	1.21 - 10.00 2	10.01 - 76.00 1	G 76.01 1
.36	L .15 4	.16 - 1.25 3	1.26 - 10.50 2	10.51 - 78.00 1	G 78.01 1
.37	L .16 4	.17 - 1.40 3	1.41 - 11.10 2	11.11 - 79.00 1	G 79.01 1
.38	L .17 4	.18 - 1.50 3	1.51 - 12.00 2	12.01 - 81.00 1	G 81.01 1
.39	L .18 4	.19 - 1.60 3	1.61 - 12.50 2	12.51 - 84.00 1	G 84.01 1
.40	L .19 4	.20 - 1.70 3	1.71 - 13.00 2	13.01 - 86.00 1	G 86.01 1
.42	L .22 4	.23 - 1.90 3	1.91 - 14.00 2	14.01 - 89.00 1	G 89.01 1
.44	L .26 4	.27 - 2.10 3	2.11 - 15.00 2	15.01 - 94.00 1	G 94.01 1
.46	L .35 4	.36 - 2.40 3	2.41 - 16.00 2	16.01 - 96.00 1	G 96.01 1
.48	L .38 4	.39 - 2.70 3	2.71 - 18.00 2	18.01 - 98.00 1	G 98.01 1
.50	L .40 4	.41 - 2.95 3	2.96 - 19.00 2	19.01 - 100.00 1	G 100.01 1
.52	L .46 4	.47 - 3.20 3	3.21 - 21.00 2	21.01 - 100.00 1	G 100.01 1
.54	L .52 4	.53 - 3.60 3	3.61 - 22.00 2	22.01 - 100.00 1	G 100.01 1
.56	L .58 4	.59 - 3.90 3	3.91 - 24.00 2	24.01 - 100.00 1	G 100.01 1
.58	L .66 4	.67 - 4.30 3	4.31 - 26.00 2	26.01 - 100.00 1	G 100.01 1
.60	L .76 4	.77 - 4.80 3	4.81 - 27.00 2	27.01 - 100.00 1	G 100.01 1
.62	L .85 4	.86 - 5.00 3	5.01 - 28.00 2	28.01 - 100.00 1	G 100.01 1

Note: L means "less than or equal to".
G means "greater than or equal to".

Example: If an item costs between $11.11 and $79.00 with a raw quantity per site of .37 then the recommended attrition quantity per site is 1. This table is applied for each site type of section 20.2.1.2.2.2; i.e., for CV and LB sites performing either local or off-site repairs. Whether the recommended quantity is stocked at a site is dependent on the criteria of Figure 2.

TASK 101 (Continued)

TABLE II. Integerization rules for computing attrition quantities (Continued).

Cost Range Criteria
Recommended Attrition Quantity per Site

Raw Attrition Quantity per Site (10.2.1.2.2.2)

.64	L $.11 5	$.12 - $ .90 4	$ .91 - $ 5.20 3	$ 5.21 - $29.00 2	$29.01 - $100.00 1	G $100.01 1
.66	L .14 5	.15 - 1.05 4	1.06 - 6.20 3	6.21 - 32.00 2	32.01 - 100.00 1	G 100.01 1
.68	L .15 5	.16 - 1.10 4	1.11 - 6.50 3	6.51 - 34.00 2	34.01 - 100.00 1	G 100.01 1
.70	L .17 5	.18 - 1.25 4	1.26 - 7.00 3	7.01 - 36.00 2	36.01 - 100.00 1	G 100.01 1
.72	L .19 5	.20 - 1.40 4	1.41 - 7.80 3	7.81 - 38.00 2	38.01 - 100.00 1	G 100.01 1
.74	L .22 5	.23 - 1.50 4	1.51 - 8.00 3	8.01 - 39.00 2	39.01 - 100.00 1	G 100.01 1
.76	L .24 5	.25 - 1.65 4	1.66 - 8.50 3	8.51 - 40.00 2	40.01 - 100.00 1	G 100.01 1
.78	L .28 5	.29 - 1.80 4	1.81 - 9.00 3	9.01 - 43.00 2	43.01 - 100.00 1	G 100.01 1
.80	L .33 5	.34 - 2.00 4	2.01 - 10.00 3	10.01 - 43.50 2	43.51 - 100.00 1	G 100.01 1
.82	L .37 5	.38 - 2.20 4	2.21 - 10.50 3	10.51 - 44.50 2	44.51 - 100.00 1	G 100.01 1
.84	L .41 5	.42 - 2.40 4	2.41 - 11.50 3	11.51 - 47.00 2	47.01 - 100.00 1	G 100.01 1
.86	L .45 5	.46 - 2.60 4	2.61 - 12.50 3	12.51 - 50.00 2	50.01 - 100.00 1	G 100.01 1
.88	L .49 5	.50 - 2.80 4	2.81 - 13.00 3	13.01 - 53.00 2	53.01 - 100.00 1	G 100.01 1
.90	L .52 5	.53 - 3.00 4	3.01 - 13.50 3	13.51 - 56.00 2	56.01 - 100.00 1	G 100.01 1
.92	L .61 5	.62 - 3.25 4	3.26 - 14.00 3	14.01 - 58.00 2	58.01 - 100.00 1	G 100.01 1
.94	L .70 5	.71 - 3.50 4	3.51 - 14.50 3	14.51 - 60.00 2	60.01 - 100.00 1	G 100.01 1
.96	L .79 5	.80 - 3.75 4	3.76 - 15.00 3	15.01 - 62.00 2	62.01 - 100.00 1	G 100.01 1
.98	L .86 5	.87 - 4.00 4	4.01 - 16.00 3	16.01 - 65.00 2	65.01 - 100.00 1	G 100.01 1
.99	L .95 5	.96 - 4.20 4	4.21 - 17.50 3	17.51 - 68.00 2	68.01 - 100.00 1	G 100.01 1

Example: The raw attrition quantity is rounded to the nearest even hundredth. If an item costs between $1.51-$8.00 with a raw quantity per site at .73 then the recommended attrition quantity per site is 3. Whether the recommended quantity is stocked at a site is dependent on the criteria of Figure 2.

TASK 101 (Continued)

TABLE II. Integerization rules for computing attrition quantities (Continued).

Cost Range Criteria
Recommended Attrition Quantity per Site

Raw Attrition Quantity per Site (20.2.1.2.2.2)					
1	L $ .15 6	$ .16-$ .85 5	$ .86-$ 4.20 4	$ 4.21-$ 17.00 3	$17.01-$ 70.00 2
1	70.01- 100.00 1	G 100.01 1			
2	L .23 8	.24- .90 7	.91- 3.10 6	3.11- 9.00 5	9.01- 25.00 4
2	25.01- 50.00 3	50.01- 100.00 2	G 100.01 2		
3	L .22 10	.23- .68 9	.69- 2.00 8	2.01- 5.75 7	5.76- 13.00 6
3	13.01- 27.00 5	27.01- 45.00 4	45.01- 100.00 3	G 100.01 3	
4	L .50 * 13-11	.51- 1.40 10	1.41- 3.20 9	3.21- 8.00 8	8.01- 17.00 7
4	17.01- 28.00 6	28.01- 44.00 5	44.01- 100.00 4	G. 100.01 4	
5	L 1.90 15-11	1.91- 4.80 10	4.81- 9.50 9	9.51- 17.00 8	17.01- 28.00 7
5	28.01- 40.00 6	40.01- 100.00 5	G 100.01 5		
6	L .11 17-16	.12- 6.00 15-11	6.01- 13.00 10	13.01- 19.00 9	19.01- 28.00 8
6	28.01- 37.00 7	37.01- 100.00 6	G 100.01 6		
7	L .35 18-16	.35- 13.00 15-11	13.01- 19.00 10	19.01- 28.00 9	28.01- 36.00 8
7	36.01- 100.00 7	G 100.01 7			
8	L - 1.00 20-16	1.01- 20.00 15-11	20.01- 27.00 10	27.01- 35.00 9	35.01- 100.00 8
8	G 100.01				
9	L 2.50 20-16	2.51- 25.00 15-11	25.01- 34.00 10	34.01- 100.00 9	G 100.01 9
10	L .25 23-21	.26- 6.00 20-16	6.01- 100.00 15-11	31.01- 100.00 10	G 100.01 10
11	L .60 24-21	.61- 10.00 20-16	10.01- 100.00 15-11	G 100.01 11	
12	L 1.30 25-21	1.31- 15.00 20-16	15.01- 100.00 15-11	G 100.01 12	

Example: Raw quantities between 1 and 25 are rounded to the nearest whole integer. If an item costs between $8.01 and $17.00 with a raw quantity per site of 3.73 then the recommended attrition quantity per site is 7. Whether the recommended quantity is stocked at a site is dependent on the criteria of Figure 2.

*See example on page 39 for interpolation techniques applied for attrition quantity ranges.

TASK 101 (Continued)

TABLE II. Integerization rules for computing attrition quantities (Continued).

Cost Range Criteria
Recommended Attrition Quantity per Site

Raw Attrition Quantity per Site (20.2.1.2.2.2)				
13	L $ 2.70 27-21	$ 2.71-$ 19.00 20-16	$19.01- 100.00 15-11	G $100.01 13
14	L 5.00 28-21	5.01- 24.00 20-16	24.01- 100.00 15-11	G 100.01 14
15	L 7.50 29-21	7.51- 28.00 20-16	28.01- 100.00 15-11	G 100.01 15
16	L 11.00 30-21	11.01- 100.00 20-16	G - 100.01 16	
17	L .18 33-31	.19- 14.00 30-21	14.01- 100.00 20-16	G 100.01 17
18	L .40 34-31	.41- 18.00 30-21	18.01- 100.00 20-16	G 100.01 18
19	L .70 35-31	.71- 20.00 30-21	20.01- 100.00 20-16	G 100.01 19
20	L 1.20 36-31	1.21- 22.00 30-21	22.01- 100.00 20-16	G 100.01 20
21	L 2.00 37-31	2.01- 100.00 30-21	G 100.01 21	
22	L 3.80 39-31	3.81- 100.00 30-21	G 100.01 22	
23	L 5.80 40-31	5.81- 100.00 30-21	G 100.01 23	
24	L .15 43-41	.16- 8.00 40-31	8.01- 100.00 30-21	G 100.01 24

Example: The raw attrition is rounded to the nearest whole integer. For any rounded raw quantity the recommended attrition quantity is obtained through a linear interpolation of the applicable cost and quantity ranges. If an item costs $37.00 with a raw quantity of 16.3 then the recommended attrition quantity is 19. This value is obtained first by rounding 16.3 down to 16, and then selecting the appropriate cost range [$11.01 - $100.00]. The cost range is linearly interpolated in conjunction with its quantity range [20 - 16] as $17.80 per unit. Expanding the cost range in integral steps of $17.80 yields the following:

11.01-100.00 20-16	=	11.01-28.81 20	28.82-46.61 19	46.62-64.40 18	64.41-82.20 17	82.21-100.00 16

The unit cost of $37.00 falls in the cost range [$28.82 - $46.41] for which the recommended attrition quantity is 19. Whether the recommended quantity is stocked at a site is dependent on the criteria of Figure 2.

TASK 101 (Continued)

TABLE II. Integerization rules for computing attrition quantities (Continued).

Cost Range Criteria
Recommended Attrition Quantity per Site

Raw Attrition Quantity per Size (20.2.1.2.2.2)				
25	L $ .25 45-41	$ .26-$ 10.00 40-31	$10.01-$100.00 30-21	G $100.01 25
30	L 2.50 50-41	2.51- 19.00 40-31	19.01- 100.00 30-21	G 100.01 30
35	L .60 75-51	.61- 9.00 50-41	9.01- 100.00 40-31	G 100.01 35
40	L 5.00 75-51	5.01- 100.00 50-41	G 100.01 40	
45	L 9.00 75-51	9.01- 100.00 50-41	G 100.01 45	
50	L 14.00 75-51	41.01- 100.00 50-41	G 100.01 50	
55	L .40 100-76	.41- 100.00 75-51	G 100.01 55	
60	L 1.50 100-76	1.51- 100.00 75-51	G 100.01 60	
65	L 5.00 100-76	5.01- 100.00 75-51	G 100.01 65	
70	L 7.50 100-76	7.51- 100.00 75-51	G 100.01 70	
75	L .20 100	.21- 12.00 100-76	12.01- 100.00 75-51	G 100.01 75
80	L .70 100	.71- 100.00 100-76	G 100.01 80	
85	L 2.50 100	2.51- 100.00 100-76	G 100.01 85	
90	L 4.25 100	4.26- 100.00 100-76	G 100.01 90	
95	L 7.00 100	7.01- 100.00 100-76	G 100.01 95	
Round raw quantities greater than 100 to nearest whole integer. Recommended attrition quantity is equal to integer.				

Example: Raw quantities between 25 and 100 are rounded to the nearest whole integer which is divisible by 5. For any rounded raw quantity the recommended attrition quantity is obtained through a linear interpolation of the applicable cost and quantity ranges (example p. 39) Whether the recommended quantity is stocked at a site is dependent on the criteria of Figure 2.

TASK 101 (Continued)

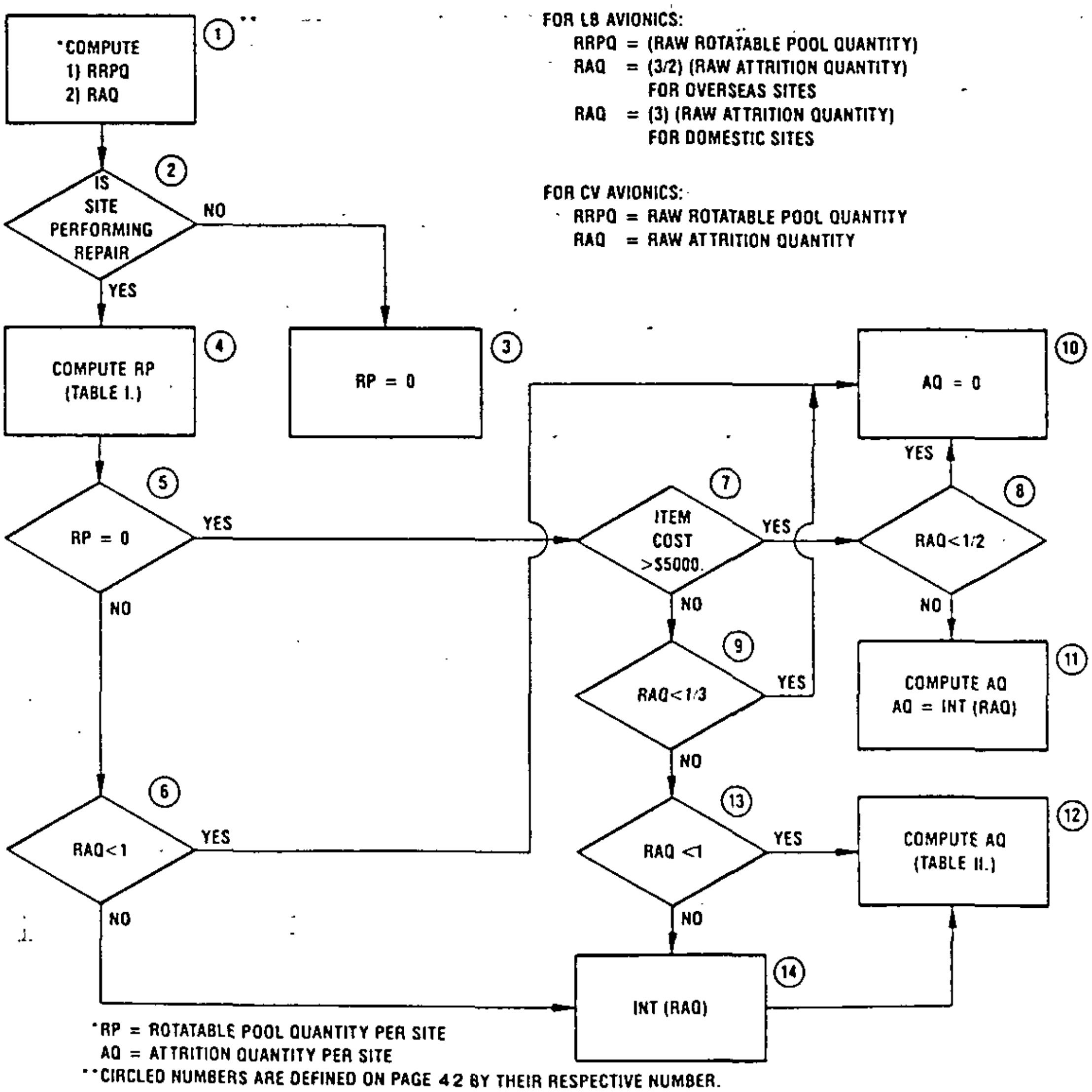


FIGURE 2. Rotatable pool and attrition quantity computations.

TASK 101 - Figure 2 (Continued)

Description of the Rotatable Pool and Attrition Quantity Computations

Figure 2 presents the criteria used in determining per site RP (Rotatable Pool) and AQ (Attrition Quantity) values. The flow diagram is based on range and quantity criteria derived by the Aviation Supply Office for computing allowance quantities.

A RRPQ (Raw Rotatable Pool Quantity) and a RAQ (Raw Attrition Quantity) are computed as in sections 10.3.1.2.2.1 and 10.3.1.2.2.2 (1) *. Raw or non-integerized quantities for the RP and AQ are calculated for each CV and LB operational site. A criterion for the existence of an RP at a site is whether the site is authorized to repair the item under analysis (2) . If the item is not repairable at the site the RP quantity is zero (3) . If the site can repair the item an RP is computed in accordance with the RRPQ integerization rules of Table I (4) . Various criteria may be used to calculate the AQ; the criteria used are dependent on the RP existence (5) . For items with a non-zero RP the AQ determination is based on an initial RAQ criterion of 1 (6) ; for items with a zero RP the AQ determination is based on an initial cost criterion of $5000 (7) . If the initial cost criterion is satisfied then a RAQ criterion of 1/2 is applied (8) , if not a RAQ criterion of 1/3 is applied (9) . Consequently, there is no AQ (10) for items that: (1) have an RP but have an RAQ less than 1, (2) have no RP, cost more than $5000, and have an RAQ less than 1/2, (3) have no RP, cost less than $5000, and have an RAQ less than 1/3. AQs are computed for items that do not satisfy the above criterial sequence such that the AQ is equal to the RAQ rounded off to the nearest whole integer for items not meeting the 1/2 criterion (11) ; the AQs for the remaining items are computed according to the rules of Table II (12) which operate only on RAQs greater than 1/3. RAQs greater than 1, 6 and (13) , are rounded off to the nearest whole integer (14) before inclusion in Table II, RAQs less than 1 are not rounded off.

*Numbers refer to the blocks in Figure 2.

TASK 101 (Continued)

10.3.1.2.2.3 System Stock Quantity Equation. The system stock is a safety inventory quantity procured to satisfy demands due to anticipated losses during the procurement cycle and pipeline quantities to account for repair cycle times exceeding required days of stock. The system stock is stored at designated inventory control resupply points or depots.

$$
\begin{aligned}
\begin{pmatrix}\text{System}\\ \text{Stock}\\ \text{of an}\\ \text{Item}\end{pmatrix} = \text{INT}\Bigg\{ & \Bigg[\left[\begin{pmatrix}\text{Procurement}\\ \text{Lead Time}\\ \text{in Years}\end{pmatrix} + \begin{pmatrix}\text{Safety}\\ \text{Level}\\ \text{in Years}\end{pmatrix}\right]\left[\sum_{d=1}^{i}\begin{pmatrix}\text{Annual Number}\\ \text{of Real Failures}\\ \text{Removed at}\\ \text{the d}^{\text{th}}\text{ IMA}\end{pmatrix}_{d}^{t}\left[1.0 - \begin{pmatrix}\text{BCM Rate}\\ \text{of Item at}\\ \text{the IMA}\end{pmatrix}\right]\begin{pmatrix}\text{Fraction of Item}\\ \text{Failures Scrapped}\\ \text{at the IMA}\end{pmatrix}\right] \\
& + \sum_{e=1}^{f}\left[\begin{pmatrix}\text{Annual Number}\\ \text{of Real Failures}\\ \text{Removed at}\\ \text{the e}^{\text{th}}\text{ PIMA}\end{pmatrix}_{e}^{t} + \begin{pmatrix}\text{Annual Number}\\ \text{of Real Failures}\\ \text{Received by}\\ \text{the e}^{\text{th}}\text{ PIMA}\end{pmatrix}_{e}^{t}\right]\left[1.0 - \begin{pmatrix}\text{BCM Rate}\\ \text{of Item at}\\ \text{the PIMA}\end{pmatrix}\right]\begin{pmatrix}\text{Fraction of Item}\\ \text{Failures Scrapped}\\ \text{at the PIMA}\end{pmatrix} \\
& + \sum_{g=1}^{h}\left[\left[\begin{pmatrix}\text{Annual Number}\\ \text{of Real Failures}\\ \text{Removed at}\\ \text{the g}^{\text{th}}\text{ Depot}\end{pmatrix}_{g}^{t} + \begin{pmatrix}\text{Annual Number}\\ \text{of Real Failures}\\ \text{Received by}\\ \text{the g}^{\text{th}}\text{ Depot}\end{pmatrix}_{g}^{t}\right]\begin{pmatrix}\text{Fraction of Item}\\ \text{Failures Scrapped}\\ \text{at the Depot}\\ \text{Repair Facility}\end{pmatrix}\right]\Bigg]\Bigg\} \\
& + \Bigg\{\left[\begin{pmatrix}\text{Repair Cycle}\\ \text{Time from the}\\ \text{CV to PIMA}\\ \text{in Years}\end{pmatrix} - \begin{pmatrix}\text{Required}\\ \text{Years}\\ \text{Stock at CV}\end{pmatrix}\right]^{*}\sum_{e=1}^{f}\begin{pmatrix}\text{Annual Number}\\ \text{of Items Sent}\\ \text{from All CV's}\\ \text{to the e}^{\text{th}}\text{ PIMA}\end{pmatrix}_{e}^{t}\left[1.0 - \begin{pmatrix}\text{BCM Rate}\\ \text{of Item at}\\ \text{the PIMA}\end{pmatrix}\right] \\
& + \left[\begin{pmatrix}\text{Repair Cycle}\\ \text{Time from the}\\ \text{NAS to PIMA}\\ \text{in Years}\end{pmatrix} - \begin{pmatrix}\text{Required}\\ \text{Years}\\ \text{Stock at NAS}\end{pmatrix}\right]^{*}\sum_{e=1}^{f}\begin{pmatrix}\text{Annual Number}\\ \text{of Items sent}\\ \text{from All NAS's}\\ \text{to the e}^{\text{th}}\text{ PIMA}\end{pmatrix}_{e}^{t}\left[1.0 - \begin{pmatrix}\text{BCM Rate}\\ \text{of Item at}\\ \text{the PIMA}\end{pmatrix}\right] \\
& + \left[\begin{pmatrix}\text{Repair Cycle}\\ \text{Time from the}\\ \text{CV to Depot}\\ \text{in Years}\end{pmatrix} - \begin{pmatrix}\text{Required}\\ \text{Years}\\ \text{Stock at CV}\end{pmatrix}\right]^{*}\sum_{g=1}^{h}\begin{pmatrix}\text{Annual Number}\\ \text{of Items Sent}\\ \text{from All CV's}\\ \text{to the g}^{\text{th}}\text{ Depot}\end{pmatrix}_{g}^{t} \\
& + \left[\begin{pmatrix}\text{Repair Cycle}\\ \text{Time from the}\\ \text{NAS to Depot}\\ \text{in Years}\end{pmatrix} - \begin{pmatrix}\text{Required}\\ \text{Years}\\ \text{Stock at NAS}\end{pmatrix}\right]^{*}\sum_{g=1}^{h}\begin{pmatrix}\text{Annual Number}\\ \text{of Items Sent}\\ \text{from All NAS's}\\ \text{to the g}^{\text{th}}\text{ Depot}\end{pmatrix}_{g}^{t} \\
& + \left[\begin{pmatrix}\text{Repair Cycle}\\ \text{Time from the}\\ \text{PIMA to Depot}\\ \text{in Years}\end{pmatrix} - \begin{pmatrix}\text{Required}\\ \text{Years}\\ \text{Stock at NAS}\end{pmatrix}\right]^{*}\sum_{g=1}^{h}\begin{pmatrix}\text{Annual Number}\\ \text{of Items Sent}\\ \text{from All PIMA's}\\ \text{to the g}^{\text{th}}\text{ Depot}\end{pmatrix}_{g}^{t}\Bigg\}
\end{aligned}
$$

*Negative quantities are not allowed; if term is less than zero a zero quantity is computed. Yearly parameters for stockage and repair times are input as days and converted to years by the computer model.

TASK 101 (Continued)

10.3.1.2.2.4 Total Repairable Inventory Quantity Equation. The total repairable inventory quantity is the summation of the rotatable pool, attrition, and system stock quantities. Since the rotatable pool and attrition quantities are computed by site, the quantities must be totaled across all sites.

$$\begin{pmatrix}\text{Total}\\\text{Repairable}\\\text{Inventory}\\\text{Quantity}\end{pmatrix}^{t} = \sum_{k=1}^{l}\left[\begin{pmatrix}\text{Rotatable}\\\text{Pool Quantity}\\\text{at the }k^{th}\text{ CV}\\\text{Site}\end{pmatrix}^{t}_{k} + \begin{pmatrix}\text{Attrition}\\\text{Quantity}\\\text{at the }k^{th}\\\text{CV Site}\end{pmatrix}^{t}_{k}\right] + \sum_{p=1}^{q}\left[\begin{pmatrix}\text{Rotatable}\\\text{Pool Quantity}\\\text{at the }p^{th}\text{ LB}\\\text{Site}\end{pmatrix}^{t}_{p} + \begin{pmatrix}\text{Attrition}\\\text{Quantity}\\\text{at the }p^{th}\\\text{LB Site}\end{pmatrix}^{t}_{p}\right] + \begin{pmatrix}\text{System}\\\text{Stock of}\\\text{the Item}\end{pmatrix}^{t}$$

q = total number of LB sites which includes NAS's and NAS's collocated with PIMA's.

10.3.1.2.2.4.1 Total Repairable Inventory Cost Equation.

$$\begin{pmatrix}\text{Total}\\\text{Repairable}\\\text{Inventory}\\\text{Cost}\end{pmatrix}^{t} = \left[\begin{pmatrix}\text{Unit}\\\text{Cost of}\\\text{Item}\end{pmatrix}\begin{pmatrix}\text{Total}\\\text{Repairable}\\\text{Inventory}\\\text{Quantity}\end{pmatrix}^{t}\right]$$

10.3.1.3 Repair Scrap Quantity Equation. The repair scrap quantity is the inventory procured throughout the life cycle to replenish the system stock quantity. Replenishment of the system stock is necessary to account for losses in the supply system caused by items being scrapped during the repair process. A repair scrap quantity is computed for each repair site.

10.3.1.3.1 The Annual Repair Scrap Quantity at a CV Site. This quantity accounts for the contribution to the total repair scrap quantity of losses occurring at each CV site.

$$\begin{pmatrix}\text{Annual Repair}\\\text{Scrap Quantity}\\\text{at the }k^{th}\text{ CV Site}\end{pmatrix}^{t} = \left[\begin{pmatrix}\text{Annual Number}\\\text{of Real Failures}\\\text{Removed at the}\\k^{th}\text{ CV Site}\end{pmatrix}^{t}\left[1.0 - \begin{pmatrix}\text{BCM Rate}\\\text{of Item at}\\\text{the IMA}\end{pmatrix}\right]\begin{pmatrix}\text{Fraction of Item}\\\text{Failures Scrapped}\\\text{at the IMA}\end{pmatrix}\right]$$

10.3.1.3.2 <u>The Annual Repair Scrap Quantity at a LB Site</u>. This quantity accounts for the contribution to the total repair scrap quantity of losses occurring at each LB site.

$$\begin{pmatrix}\text{Annual Repair}\\ \text{Scrap Quantity}\\ \text{at the } p^{th}\\ \text{LB Site}\end{pmatrix}^{t} = \begin{pmatrix}\text{Annual Number of}\\ \text{Real Failures Removed}\\ \text{at the NAS Located}\\ \text{at the } p^{th} \text{ LB Site}\end{pmatrix}^{t} \left[1.0 - \begin{pmatrix}\text{BCM Rate}\\ \text{of Item at}\\ \text{the IMA}\end{pmatrix}\right] \begin{pmatrix}\text{Fraction of Item}\\ \text{Failures Scrapped}\\ \text{at the IMA}\end{pmatrix}$$

$$\left[\begin{pmatrix}\text{Annual Number}\\ \text{of Real Failures}\\ \text{Removed at the}\\ \text{PIMA Located at}\\ \text{the } p^{th} \text{ PIMA Site}\end{pmatrix}^{t} + \begin{pmatrix}\text{Annual Number}\\ \text{of Real Failures}\\ \text{Received by the}\\ \text{PIMA Located at}\\ \text{the } p^{th} \text{ PIMA Site}\end{pmatrix}^{t}\right] \left[1.0 - \begin{pmatrix}\text{BCM Rate}\\ \text{of Item at}\\ \text{the PIMA}\end{pmatrix}\right] \begin{pmatrix}\text{Fraction of Item}\\ \text{Failures Scrapped}\\ \text{at the PIMA}\end{pmatrix}$$

10.3.1.3.3 <u>The Annual Repair Scrap Quantity at a Depot Site</u>. This quantity accounts for the contribution to the total repair scrap quantity of losses occurring at each depot site.

$$\begin{pmatrix}\text{Annual Repair}\\ \text{Scrap Quantity}\\ \text{at the } g^{th}\\ \text{Depot Site}\end{pmatrix}^{t} = \left[\begin{pmatrix}\text{Annual Number}\\ \text{of Real Failures}\\ \text{Removed at the}\\ g^{th} \text{ Depot Site}\end{pmatrix}^{t} + \begin{pmatrix}\text{Annual Number}\\ \text{of Real Failures}\\ \text{Received by the}\\ g^{th} \text{ Depot Site}\end{pmatrix}^{t}\right] \begin{pmatrix}\text{Fraction of Item}\\ \text{Failures Scrapped}\\ \text{at the Depot}\\ \text{Repair Facility}\end{pmatrix}$$

10.3.1.3.4 <u>Repair Scrap Cost Equation</u>.

$$\begin{pmatrix}\text{Repair}\\ \text{Scrap}\\ \text{Cost}\end{pmatrix}^{t} = \sum_{v=1}^{r} \left[\begin{pmatrix}\text{Annual Repair}\\ \text{Scrap Quantity}\\ \text{at the } v^{th} \text{ Site}\end{pmatrix}^{t}_{v}\right] \begin{pmatrix}\text{Unit}\\ \text{Cost of}\\ \text{Item}\end{pmatrix} \begin{pmatrix}\text{Present}\\ \text{Discount}\\ \text{Factor}\end{pmatrix}$$

r = number of repair facilities to include IMA's, PIMA's, and depots.

10.3.1.4 <u>Repair Material Cost Equation</u>. The repair material cost accounts for the cost of parts required per repair action, excluding those which are included in the analysis. The total repair material cost is the summation of the costs at all sites.

10.3.1.4.1 <u>Repair Material Cost at a CV Site</u>.

$$\begin{pmatrix}\text{Repair Material}\\ \text{Cost at the}\\ k^{th} \text{ CV Site}\end{pmatrix}^{t} = \left[\begin{pmatrix}\text{Annual Number of}\\ \text{Repairs to an Item}\\ \text{at the } k^{th} \text{ CV Site}\end{pmatrix}^{t} \begin{pmatrix}\text{Unit}\\ \text{Cost of}\\ \text{Item}\end{pmatrix} \begin{pmatrix}\text{Repair}\\ \text{Material Rate}\\ \text{at the IMA}\end{pmatrix} \begin{pmatrix}\text{Present}\\ \text{Discount}\\ \text{Factor}\end{pmatrix}\right]$$

10.3.1.4.2 Repair Material Cost at a LB Site.

$$\begin{pmatrix}\text{Repair Material}\\\text{Cost at the}\\p^{th}\text{ LB Site}\end{pmatrix}^{\dagger} = \left[\begin{pmatrix}\text{Annual Number of}\\\text{Repairs to an Item}\\\text{at the NAS Located}\\\text{at the }p^{th}\text{ LB Site}\end{pmatrix}^{\dagger}\begin{pmatrix}\text{Repair}\\\text{Material Rate}\\\text{at the IMA}\end{pmatrix} + \begin{pmatrix}\text{Annual Number of}\\\text{Repairs to an Item}\\\text{at the PIMA Located}\\\text{at the }p^{th}\text{ LB Site}\end{pmatrix}^{\dagger}\begin{pmatrix}\text{Repair}\\\text{Material Rate}\\\text{at the PIMA}\end{pmatrix}\right]\begin{pmatrix}\text{Unit}\\\text{Cost of}\\\text{Item}\end{pmatrix}\begin{pmatrix}\text{Present}\\\text{Discount}\\\text{Factor}\end{pmatrix}$$

10.3.1.4.3 Repair Material Cost at a Depot Site.

$$\begin{pmatrix}\text{Repair Material}\\\text{Cost at the}\\g^{th}\text{ Depot Site}\end{pmatrix}^{\dagger} = \left[\begin{pmatrix}\text{Annual Number of}\\\text{Repairs to an Item}\\\text{at the }g^{th}\text{ Depot Site}\end{pmatrix}^{\dagger}\begin{pmatrix}\text{Unit}\\\text{Cost of}\\\text{Item}\end{pmatrix}\begin{pmatrix}\text{Repair}\\\text{Material Rate}\\\text{at the Depot}\end{pmatrix}\begin{pmatrix}\text{Present}\\\text{Discount}\\\text{Factor}\end{pmatrix}\right].$$

10.3.1.4.4 Total Repair Material Cost Equation.

$$\begin{pmatrix}\text{Repair}\\\text{Material}\\\text{Cost}\end{pmatrix}^{\dagger} = \sum_{v=1}^{r}\left[\begin{pmatrix}\text{Repair}\\\text{Material Cost}\\\text{at the }v^{th}\text{ Site}\end{pmatrix}^{\dagger}_{v}\right]$$

10.3.1.5 Transportation Costs. These are the costs of packaging, handling and transporting for purposes of repair or replenishment, item inventories to and from operational, repair, and resupply sites. The costs are functions of packaging and handling rates per cubic foot and transportation rates per pound from site to site, and are computed by site.

10.3.1.5.1 Transportation Cost Equation for the Discard Cases.

$$\begin{pmatrix}\text{Transportation}\\\text{Cost}\\\text{for Discard}\end{pmatrix}^{\dagger} = \begin{pmatrix}\text{Normal}\\\text{Discount}\\\text{Factor}\end{pmatrix}\left\{\sum_{v=1}^{r}\sum_{s=1}^{t}\left[\begin{pmatrix}\text{Annual Number}\\\text{of Items for}\\\text{Disposition at}\\\text{the }v^{th}\text{ Site}\end{pmatrix}^{\dagger}_{v}\left[\begin{pmatrix}\text{Transportation}\\\text{Rate per Pound}\\\text{from the }s^{th}\text{ Site}\\\text{to the }v^{th}\text{ Site}\end{pmatrix}_{s,v}\begin{pmatrix}\text{Weight}\\\text{of the}\\\text{Item}\end{pmatrix}\begin{pmatrix}\text{Fraction of}\\\text{the }v^{th}\text{ Site}\\\text{Resupply}\\\text{from the }s^{th}\text{ Site}\end{pmatrix}_{s,v} + \begin{pmatrix}\text{Packaging and}\\\text{Handling Rate}\\\text{per Cubic Foot}\end{pmatrix}\begin{pmatrix}\text{Inventory}\\\text{Storage Space}\\\text{per Item in}\\\text{Cubic Feet}\end{pmatrix}\right]\right]\right\}$$

where,

$$\begin{pmatrix}\text{Annual Number}\\\text{of Items for}\\\text{Disposition}\\\text{at the }p^{th}\text{ LB Site}\end{pmatrix}^{\dagger} = \left[\begin{pmatrix}\text{Annual Number of}\\\text{Items for Disposition}\\\text{at the NAS Located}\\\text{at the }p^{th}\text{ LB Site}\end{pmatrix}^{\dagger} + \begin{pmatrix}\text{Annual Number of}\\\text{Items for Disposition}\\\text{at the PIMA Located}\\\text{at the }p^{th}\text{ LB Site}\end{pmatrix}^{\dagger}\right]$$

s = an index element denoting the s^{th} resupply depot.
t = number of resupply depots.

TASK 101 (Continued)

10.3.1.5.2 <u>Transportation Cost Equation for the Repair Cases.</u>

$$\left(\begin{array}{c}\text{Transportation}\\ \text{Cost}\\ \text{for Repair}\end{array}\right)^{t} =$$

$$\left(\begin{array}{c}\text{Normal}\\ \text{Discount}\\ \text{Factor}\end{array}\right)\Bigg\{\, 2\sum_{d=1}^{j}\sum_{e=1}^{f}\left[\left(\begin{array}{c}\text{Annual Number of}\\ \text{Items Sent from}\\ \text{the } d^{th} \text{ IMA to}\\ \text{the } e^{th} \text{ PIMA}\end{array}\right)^{t}_{e,d}\left[\left(\begin{array}{c}\text{Transportation}\\ \text{Rate per Pound}\\ \text{from the } d^{th} \text{ IMA}\\ \text{to the } e^{th} \text{ PIMA}\end{array}\right)_{e,d}\left(\begin{array}{c}\text{Weight}\\ \text{of the}\\ \text{Item}\end{array}\right)+\left(\begin{array}{c}\text{Packaging and}\\ \text{Handling Rate}\\ \text{per Cubic Foot}\end{array}\right)\left(\begin{array}{c}\text{Inventory}\\ \text{Storage Space}\\ \text{per Item in}\\ \text{Cubic Feet}\end{array}\right)\right]\right]$$

$$+\,2^{*}\sum_{d=1}^{j}\sum_{g=1}^{h}\left[\left(\begin{array}{c}\text{Annual Number of}\\ \text{Items Sent from}\\ \text{the } d^{th} \text{ IMA to}\\ \text{the } g^{th} \text{ Depot}\end{array}\right)^{t}_{g,d}\left[\left(\begin{array}{c}\text{Transportation}\\ \text{Rate per Pound}\\ \text{from the } d^{th} \text{ IMA}\\ \text{to the } g^{th} \text{ Depot}\end{array}\right)_{g,d}\left(\begin{array}{c}\text{Weight}\\ \text{of the}\\ \text{Item}\end{array}\right)+\left(\begin{array}{c}\text{Packaging and}\\ \text{Handling Rate}\\ \text{per Cubic Foot}\end{array}\right)\left(\begin{array}{c}\text{Inventory}\\ \text{Storage Space}\\ \text{per Item in}\\ \text{Cubic Feet}\end{array}\right)\right]\right]$$

$$+\,2\sum_{e=1}^{f}\sum_{g=1}^{h}\left[\left(\begin{array}{c}\text{Annual Number of}\\ \text{Items Sent from}\\ \text{the } e^{th} \text{ PIMA to}\\ \text{the } g^{th} \text{ Depot}\end{array}\right)^{t}_{g,e}\left[\left(\begin{array}{c}\text{Transportation}\\ \text{Rate per Pound}\\ \text{from the } e^{th} \text{ PIMA}\\ \text{to the } g^{th} \text{ Depot}\end{array}\right)_{g,e}\left(\begin{array}{c}\text{Weight}\\ \text{of the}\\ \text{Item}\end{array}\right)+\left(\begin{array}{c}\text{Packaging and}\\ \text{Handling Rate}\\ \text{per Cubic Foot}\end{array}\right)\left(\begin{array}{c}\text{Inventory}\\ \text{Storage Space}\\ \text{per Item in}\\ \text{Cubic Feet}\end{array}\right)\right]\right]$$

$$+\sum_{k=1}^{l}\sum_{s=1}^{t}\left[\left(\begin{array}{c}\text{Annual Repair}\\ \text{Scrap Quantity}\\ \text{at the } k^{th}\\ \text{CV Site}\end{array}\right)^{t}_{k}\left[\left(\begin{array}{c}\text{Transportation}\\ \text{Rate per Pound}\\ \text{from the } s^{th} \text{ Site}\\ \text{to the } k^{th} \text{ CV Site}\end{array}\right)_{s,k}\left(\begin{array}{c}\text{Weight}\\ \text{of the}\\ \text{Item}\end{array}\right)\left(\begin{array}{c}\text{Fraction of}\\ \text{the } k^{th} \text{ CV's}\\ \text{Resupply}\\ \text{from } s^{th} \text{ Site}\end{array}\right)_{s,k}+\left(\begin{array}{c}\text{Packaging and}\\ \text{Handling Rate}\\ \text{per Cubic Foot}\end{array}\right)\left(\begin{array}{c}\text{Inventory}\\ \text{Storage Space}\\ \text{per Item in}\\ \text{Cubic Feet}\end{array}\right)\right]\right]$$

$$+\sum_{p=1}^{q}\sum_{s=1}^{t}\left[\left(\begin{array}{c}\text{Annual Repair}\\ \text{Scrap Quantity}\\ \text{at the } p^{th}\\ \text{LB Site}\end{array}\right)^{t}_{p}\left[\left(\begin{array}{c}\text{Transportation}\\ \text{Rate per Pound}\\ \text{from the } s^{th} \text{ Site}\\ \text{to the } p^{th} \text{ LB Site}\end{array}\right)_{s,p}\left(\begin{array}{c}\text{Weight}\\ \text{of the}\\ \text{Item}\end{array}\right)\left(\begin{array}{c}\text{Fraction of}\\ \text{the } p^{th} \text{ LB's}\\ \text{Resupply}\\ \text{from } s^{th} \text{ Site}\end{array}\right)_{s,p}+\left(\begin{array}{c}\text{Packaging and}\\ \text{Handling Rate}\\ \text{per Cubic Foot}\end{array}\right)\left(\begin{array}{c}\text{Inventory}\\ \text{Storage Space}\\ \text{per Item in}\\ \text{Cubic Feet}\end{array}\right)\right]\right]$$

$$+\sum_{g=1}^{h}\sum_{s=1}^{t}\left[\left(\begin{array}{c}\text{Annual Repair}\\ \text{Scrap Quantity}\\ \text{at the } g^{th}\\ \text{Depot Site}\end{array}\right)^{t}_{g}\left[\left(\begin{array}{c}\text{Transportation}\\ \text{Rate per Pound}\\ \text{from the } s^{th} \text{ Site}\\ \text{to the } g^{th} \text{ Depot Site}\end{array}\right)_{s,g}\left(\begin{array}{c}\text{Weight}\\ \text{of the}\\ \text{Item}\end{array}\right)\left(\begin{array}{c}\text{Fraction of}\\ \text{the } g^{th} \text{ Depot's}\\ \text{Resupply}\\ \text{from } s^{th} \text{ Site}\end{array}\right)_{s,g}+\left(\begin{array}{c}\text{Packaging and}\\ \text{Handling Rate}\\ \text{per Cubic Foot}\end{array}\right)\left(\begin{array}{c}\text{Inventory}\\ \text{Storage Space}\\ \text{per Item in}\\ \text{Cubic Feet}\end{array}\right)\right]\right]\Bigg\}$$

TASK 101 (Continued)

10.3.2 Support Equipment Cost. Two types of support equipment are considered in LOR decisions. First, the item may require PSE (Peculiar Support Equipment) for fault isolation or verification. The contractor would design a specific equipment to service the item. Second, the contractor may design an equipment that services a group of items, in which case the equipment is required if at least one member of the group is assigned to some level requiring the equipment.

10.3.2.1 Peculiar Support Equipment Cost Equations. When performing an analysis at the item's indenture level, allocatable and/or non-allocatable costs may be incurred. For PSE peculiar to an individual item, the cost is assigned entirely to the item as an allocatable cost. For PSE designed for a group of items, the cost is assigned to the group of items as non-allocatable cost. Within the following equations, the word item refers to an item that has PSE specifically designed for it or to the items in a group that have PSE designed for the group. In the PSE cost equations that follow the total cost of one PSE set is defined to include the initial unit cost and annually recurring support costs.

$$\left(\begin{array}{c}\text{Unit and}\\ \text{Support}\\ \text{Cost of}\\ \text{a PSE}\end{array}\right)^{*} = \left(\begin{array}{c}\text{Unit Cost}\\ \text{of the}\\ \text{PSE}\end{array}\right)\left[1.0 + \frac{\left(\begin{array}{c}\text{Support of the}\\ \text{Support Equipment}\\ \text{Rate for the}\\ \text{First Year}\end{array}\right)}{(1.0 + \text{Discount Rate})} + \left(\begin{array}{c}\text{Support of the}\\ \text{Support Equipment}\\ \text{Rate for the}\\ \text{Succeeding Years}\end{array}\right)\left(\begin{array}{c}\text{Reduced}\\ \text{Discount}\\ \text{Factor}\end{array}\right)\right]$$

*Applicable to repair and discard PGSE as required by the LOR case under consideration.

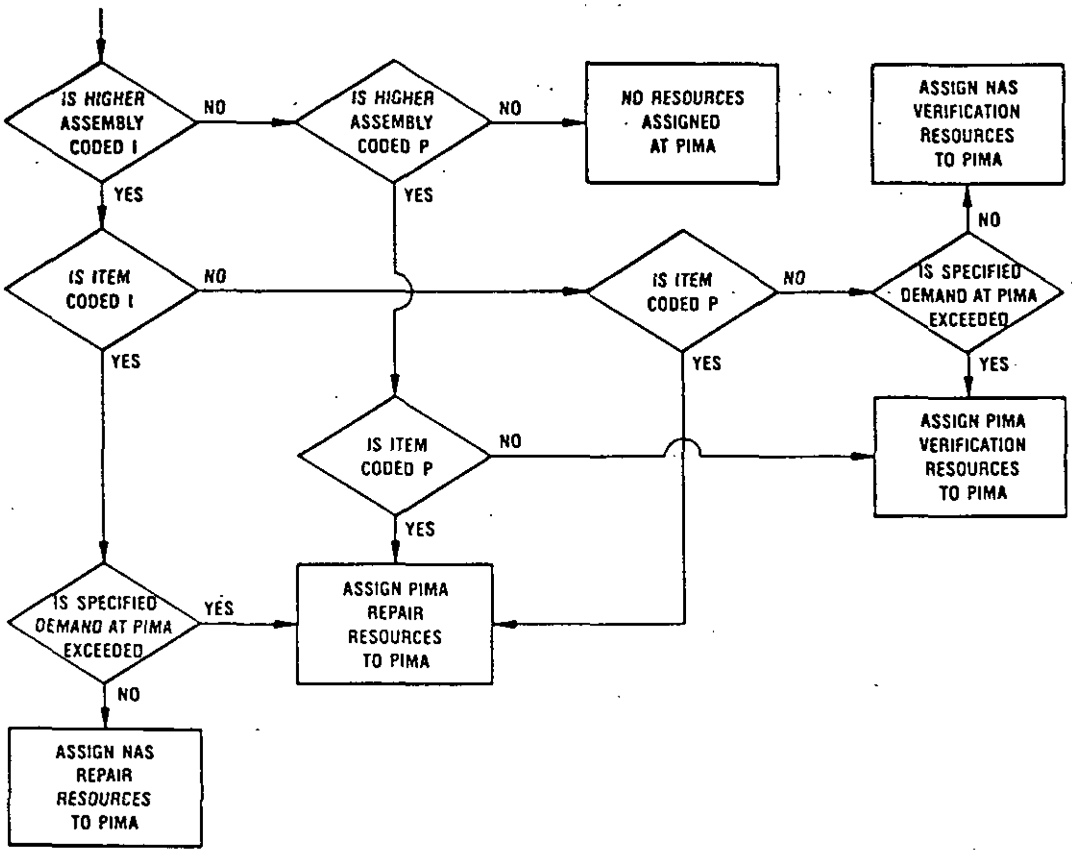
10.3.2.1.1 Peculiar Support Equipment Cost Equation for the Discard Cases. Discard or verification PSE may be used at the item level to check and test an item's failure.

$$\left(\begin{array}{c}\text{Item PSE}\\ \text{Cost for}\\ \text{Discard}\end{array}\right)^{\dagger} = \left[\left(\begin{array}{c}\text{Unit and Support}\\ \text{Cost per Discard}\\ \text{PSE at CV to}\\ \text{Verify Item}\\ \text{Failure}\end{array}\right)\left(\begin{array}{c}\text{Number of*}\\ \text{Discard PSE}\\ \text{Required}\\ \text{per CV}\end{array}\right)\left(\begin{array}{c}\text{Number}\\ \text{of}\\ \text{CV's}\end{array}\right)^{\dagger} + \left(\begin{array}{c}\text{Unit and Support}\\ \text{Cost per Discard}\\ \text{PSE at NAS to}\\ \text{Verify Item}\\ \text{Failure}\end{array}\right)\left(\begin{array}{c}\text{Number of*}\\ \text{Discard PSE}\\ \text{Required}\\ \text{per NAS}\end{array}\right)\left(\begin{array}{c}\text{Number of}\\ \text{non-PIMA}\\ \text{NAS's}\end{array}\right)^{\dagger} + \right.$$

$$\left.\left(\begin{array}{c}\text{Unit and Support**}\\ \text{Cost per Discard}\\ \text{PSE at PIMA to}\\ \text{Verify Item}\\ \text{Failure}\end{array}\right)\left(\begin{array}{c}\text{Number of*}\\ \text{Discard PSE}\\ \text{Required}\\ \text{per PIMA}\end{array}\right)^{**}\left(\begin{array}{c}\text{Number}\\ \text{of}\\ \text{PIMA's}\end{array}\right)^{\dagger} + \left(\begin{array}{c}\text{Unit and Support**}\\ \text{Cost per Discard}\\ \text{PSE at Depot}\\ \text{to Verify Item}\\ \text{Failure}\end{array}\right)\left(\begin{array}{c}\text{Number of*}\\ \text{Discard PSE}\\ \text{Required}\\ \text{per Depot}\end{array}\right)^{**}\left(\begin{array}{c}\text{Number of}\\ \text{Depots}\end{array}\right)^{\dagger}\right]$$

*The term = 0 if the higher assembly is not repaired at the site, as applicable to the LOR case under consideration. The determination as to whether CV, non-PIMA, NAS, or PIMA sites require support equipment is dependent upon where the higher assembly is repaired.

**The type of support equipment resources, full or back-up, at the PIMA and Depot sites is dependent on the LOR case and work-load at the sites. The determination of full or back-up resources is based on the criteria of Figures 3 and 4.



*DECISION CRITERIA ARE DEFINED ON PAGE 50.

FIGURE 3. Criteria for full or back-up resources at PIMA sites.

TASK 101 - Figure 3 (Continued)

Description of the Criteria for Full or Back-up Resources at PIMA Sites

The LOR analytical techniques allow one or two types of support resources (support equipment, personnel, and documentation requirements, support equipment and repair work space) to be used at PIMA repair facilities. The mode of operation of a PIMA to support the item under analysis depends upon the LOR code assignment of the item. A PIMA services repairables generated at the PIMA due to its local operating aircraft as well as those forwarded to it from other operating sites. Full PIMA resources are always provided for items which are coded PIMA repair, or for higher level assemblies coded PIMA repair; the resource determination for other items depends on the workload experienced at the PIMA. If the workload does not exceed a specified percentage of the locally generated workload the PIMA operates under a reduced mode and back-up NAS resources are provided. If the workload exceeds the specified percentage the PIMA operates under a full mode and full PIMA resources are required. The decision criteria used for the determination of full or back-up repair and verification resources for PIMA facilities as a function of the LOR code assignment are given in Figure 3.

TASK 101 (Continued)

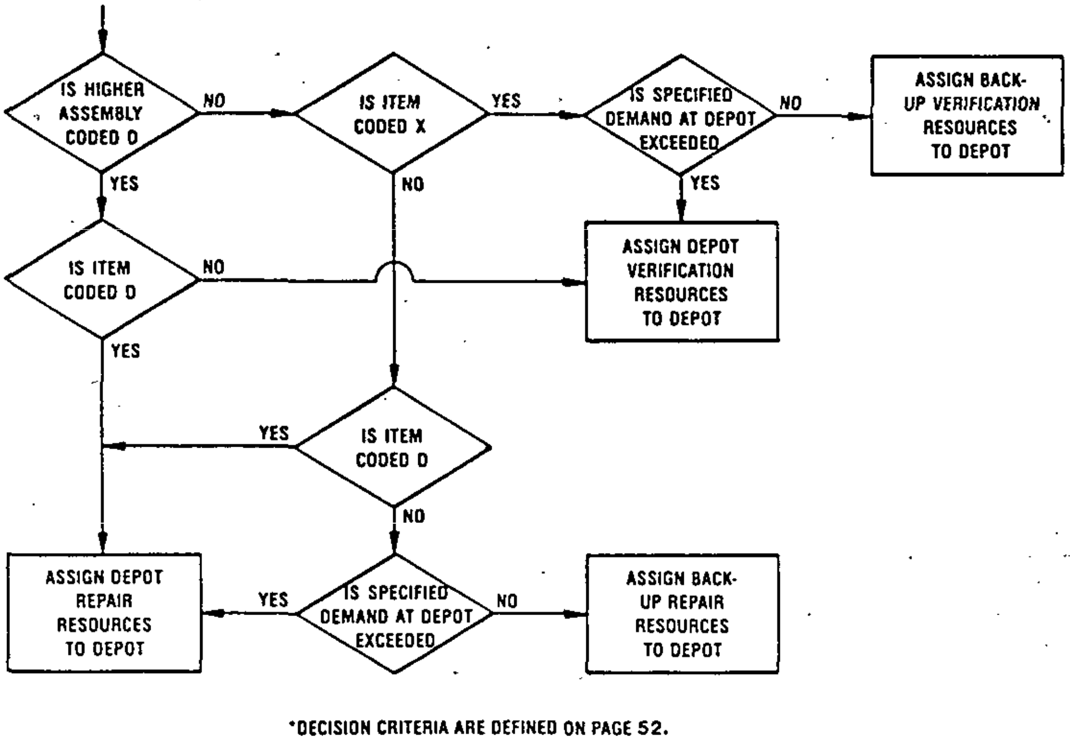


FIGURE 4. Criteria for full or back-up resources at depot sites.

TASK 101 - Figure 4 (Continued)

Description of the Criteria for Full or Back-up Resources at a Depot Site

The LOR analytical techniques allow one or two types of support resources to be used at depot repair facilities. The mode of operation of a depot to support the item under analysis depends on the LOR code assignment of the item. A depot services repairables forwarded to it from other repair sites. Full depot resources are always provided for items which are coded depot repair, or for higher level assemblies coded depot repair; the resources determination for other items depends on the workload experienced at the depot. If the workload does not exceed a specified percentage then the depot operates under a limited mode and back-up depot resources are required. If the workload exceeds the specified percentage the depot operates under a full mode and full depot resources are provided. The decision criteria for the determination of full or back-up repair and verification resources at depot facilities as a function of the LOR code assignment are given in Figure 4.

TASK 101 (Continued)

10.3.2.1.2 <u>Peculiar Support Equipment Cost Equation for the Repair Intermediate Cases</u>. Repair PSE at intermediate repair facilities can verify the item failure and fault isolate to the next lower assembly. The repair PSE is more complex than its discard counterpart and the complexity is reflected in different costs for the required PSE. The assignment of the PSE cost as allocatable/non-allocatable and the resource type determination are the same as that for discard.

$$\begin{pmatrix}\text{Item PSE}\\ \text{Cost for}\\ \text{Intermediate}\\ \text{Repair}\end{pmatrix} = \left[\begin{pmatrix}\text{Unit and Support}\\ \text{Cost per Repair}\\ \text{PSE at CV to}\\ \text{Repair Item}\\ \text{Failure}\end{pmatrix}\begin{pmatrix}\text{Number of}\\ \text{Repair PSE}\\ \text{Required}\\ \text{per CV}\end{pmatrix}\begin{pmatrix}\text{Number}\\ \text{of}\\ \text{CV's}\end{pmatrix}^{\dagger} + \begin{pmatrix}\text{Unit and Support}\\ \text{Cost per Repair}\\ \text{PSE at NAS}\\ \text{to Repair Item}\\ \text{Failure}\end{pmatrix}\begin{pmatrix}\text{Number of}\\ \text{Repair PSE}\\ \text{Required}\\ \text{per NAS}\end{pmatrix}\begin{pmatrix}\text{Number of}\\ \text{non-PIMA}\\ \text{NAS's}\end{pmatrix}^{\dagger} + \begin{pmatrix}\text{Unit and Support*}\\ \text{Cost per Repair}\\ \text{PSE at PIMA}\\ \text{to Repair}\\ \text{Item Failure}\end{pmatrix}\begin{pmatrix}\text{Number of*}\\ \text{Repair PSE}\\ \text{Required}\\ \text{per PIMA}\end{pmatrix}\begin{pmatrix}\text{Number}\\ \text{of}\\ \text{PIMA's}\end{pmatrix}^{\dagger} + \begin{pmatrix}\text{Unit and Support*}\\ \text{Cost per Repair}\\ \text{PSE at Depot}\\ \text{to Repair}\\ \text{Item Failure}\end{pmatrix}\begin{pmatrix}\text{Number of*}\\ \text{Repair PSE}\\ \text{Required}\\ \text{per Depot}\end{pmatrix}\begin{pmatrix}\text{Number of}\\ \text{Depots}\end{pmatrix}^{\dagger}\right]$$

*The determination of full or back-up resources is based on the criteria of Figures 3 and 4.

10.3.2.1.3 <u>Peculiar Support Equipment Cost Equation for the Repair PIMA Cases</u>. For the repair PIMA cases, support equipment for fault verification may be required at the operational site if the higher assembly was repaired there. The assignment of the PSE cost as allocatable/non-allocatable is the same as that for the discard and repair intermediate cases.

$$\begin{pmatrix}\text{Item PSE}\\ \text{Cost for}\\ \text{PIMA}\\ \text{Repair}\end{pmatrix}^{\dagger} = \left[\begin{pmatrix}\text{Unit and Support}\\ \text{Cost per Discard}\\ \text{PSE at CV to}\\ \text{Verify Item}\\ \text{Failure}\end{pmatrix}\begin{pmatrix}\text{Number of*}\\ \text{Discard PSE}\\ \text{Required}\\ \text{per CV}\end{pmatrix}\begin{pmatrix}\text{Number}\\ \text{of}\\ \text{CV's}\end{pmatrix}^{\dagger} + \begin{pmatrix}\text{Unit and Support}\\ \text{Cost per Repair}\\ \text{PSE at NAS}\\ \text{to Verify Item}\\ \text{Failure}\end{pmatrix}\begin{pmatrix}\text{Number of*}\\ \text{Discard PSE}\\ \text{Required}\\ \text{per NAS}\end{pmatrix}\begin{pmatrix}\text{Number of}\\ \text{non-PIMA}\\ \text{NAS's}\end{pmatrix}^{\dagger} + \begin{pmatrix}\text{Unit and Support}\\ \text{Cost per Repair}\\ \text{PSE at PIMA}\\ \text{to Repair}\\ \text{Item Failure}\end{pmatrix}\begin{pmatrix}\text{Number of}\\ \text{Repair PSE}\\ \text{Required}\\ \text{per PIMA}\end{pmatrix}\begin{pmatrix}\text{Number}\\ \text{of}\\ \text{PIMA's}\end{pmatrix}^{\dagger} + \begin{pmatrix}\text{Unit and Support}\\ \text{Cost per Repair}\\ \text{PSE at Depot}\\ \text{to Repair}\\ \text{Item Failure}\end{pmatrix}\begin{pmatrix}\text{Number of}\\ \text{Repair PSE}\\ \text{Required}\\ \text{per Depot}\end{pmatrix}\begin{pmatrix}\text{Number of}\\ \text{Depots}\end{pmatrix}^{\dagger}\right]$$

*The term = 0 if the higher assembly is not repaired at the site, as applicable to the LOR case under consideration.

TASK 101 (Continued)

10.3.2.1.4 Peculiar Support Equipment Cost Equation for the Repair Depot Cases. For the repair depot cases, support equipment for fault verification may be required at the operational site or PIMA if the higher assembly was repaired there. The assignment of the PSE as allocatable/non-allocatable is the same as that for the discard, repair intermediate, and repair PIMA cases.

$$\begin{pmatrix}\text{Item PSE}\\ \text{Cost for}\\ \text{Depot}\\ \text{Repair}\end{pmatrix}^{\dagger} = \left[\begin{pmatrix}\text{Unit and Support}\\ \text{Cost per Discard}\\ \text{PSE at CV to}\\ \text{Verify Item}\\ \text{Failure}\end{pmatrix}\begin{pmatrix}\text{Number of*}\\ \text{Discard PSE}\\ \text{Required}\\ \text{per CV}\end{pmatrix}\begin{pmatrix}\text{Number}\\ \text{of}\\ \text{CV's}\end{pmatrix}^{\dagger} + \begin{pmatrix}\text{Unit and Support}\\ \text{Cost per Discard}\\ \text{PSE at NAS to}\\ \text{Verify Item}\\ \text{Failure}\end{pmatrix}\begin{pmatrix}\text{Number of*}\\ \text{Discard PSE}\\ \text{Required}\\ \text{per NAS}\end{pmatrix}\begin{pmatrix}\text{Number of}\\ \text{non-PIMA}\\ \text{NAS's}\end{pmatrix} + \right.$$

$$\left.\begin{pmatrix}\text{Unit and Support}\\ \text{Cost per Discard}\\ \text{PSE at PIMA}\\ \text{to Verify}\\ \text{Item Failure}\end{pmatrix}\begin{pmatrix}\text{Number of*}\\ \text{Discard PSE}\\ \text{Required}\\ \text{per PIMA}\end{pmatrix}\begin{pmatrix}\text{Number}\\ \text{of}\\ \text{PIMA's}\end{pmatrix}^{\dagger} + \begin{pmatrix}\text{Unit and Support}\\ \text{Cost per Repair}\\ \text{PSE at Depot}\\ \text{to Repair}\\ \text{Item Failure}\end{pmatrix}\begin{pmatrix}\text{Number of}\\ \text{Repair PSE}\\ \text{Required}\\ \text{per Depot}\end{pmatrix}\begin{pmatrix}\text{Number of}\\ \text{Depots}\end{pmatrix}^{\dagger}\right]$$

*The term = 0 if the higher assembly is not repaired at the site, as applicable to the LOR case under consideration.

10.3.3 Space Cost. For each case, total space cost is the summation of three separate costs: cost of inventory storage space, cost of support equipment space, and cost of repair work space.

10.3.3.1 Inventory Storage Space Cost. This is the cost of inventory storage space associated with the discard inventory; attrition, rotatable pool, and system stock quantities.

10.3.3.1.1 Inventory Storage Space Cost Equation for the Discard Cases. For carrier based aircraft, the storage quantity is adjusted to account for the fact that failures occur only during the carrier's deployments. This adjustment is carried out through division by the carrier deployment factor.

$$\begin{pmatrix}\text{Cost of Inventory}\\ \text{Storage Space}\\ \text{for Discard}\end{pmatrix}^{\dagger} = \sum_{v=1}^{r}\left[\begin{pmatrix}\text{Inventory Reserved}\\ \text{for the Required}\\ \text{Days of Stock at}\\ \text{the } v^{th} \text{ Site}\end{pmatrix}^{\dagger}_{v}\begin{pmatrix}\text{Cost of Space per}\\ \text{Cubic Foot per Year}\\ \text{at the } v^{th} \text{ Site}\end{pmatrix}_{v}\right]\begin{pmatrix}\text{Inventory}\\ \text{Storage Space}\\ \text{per Item in}\\ \text{Cubic Feet}\end{pmatrix}\begin{pmatrix}\text{Normal}\\ \text{Discount}\\ \text{Factor}\end{pmatrix}$$

where,

$$\begin{pmatrix}\text{Inventory Reserved}\\ \text{for the Required}\\ \text{Days of Stock at}\\ \text{the } v^{th} \text{ Site}\end{pmatrix}^{\dagger} = \text{INT}\left\{\frac{\begin{pmatrix}\text{Annual Inventory}\\ \text{Quantity for Discard}\\ \text{at the } v^{th} \text{ Site}\end{pmatrix}^{\dagger}\begin{pmatrix}\text{Required Days}\\ \text{of Stock at}\\ \text{the } v^{th} \text{ Site}\end{pmatrix}}{\begin{pmatrix}\text{365 Days}\\ \text{per}\\ \text{Year}\end{pmatrix}\begin{pmatrix}\text{Carrier*}\\ \text{Deployment}\\ \text{Factor}\end{pmatrix}}\right\}$$

*For LB sites no deployment factor is required.

TASK 101 (Continued)

10.3.3.1.2 Inventory Space Cost Equation for the Repair Cases.

$$\begin{aligned}\left(\begin{array}{c}\text{Cost of Inventory}\\ \text{Storage Space}\\ \text{per Item}\\ \text{for Repair}\end{array}\right)^{t} = \Bigg[& \sum_{k=1}^{t}\left[\left(\begin{array}{c}\text{Rotatable}\\ \text{Pool Quantity}\\ \text{at the } k^{th}\\ \text{CV Site}\end{array}\right)_{k}^{t} + \left(\begin{array}{c}\text{Attrition}\\ \text{Quantity}\\ \text{at the } k^{th}\\ \text{CV Site}\end{array}\right)_{k}^{t}\right]\left(\begin{array}{c}\text{Cost of Space}\\ \text{per Cubic Foot}\\ \text{per Year for}\\ \text{CV Sites}\end{array}\right) \\ & + \sum_{p=1}^{q}\left[\left(\begin{array}{c}\text{Rotatable}\\ \text{Pool Quantity}\\ \text{at the } p^{th}\\ \text{LB Site}\end{array}\right)_{p}^{t} + \left(\begin{array}{c}\text{Attrition}\\ \text{Quantity}\\ \text{at the } p^{th}\\ \text{LB Site}\end{array}\right)_{p}^{t}\right]\left(\begin{array}{c}\text{Cost of Space}\\ \text{per Cubic Foot}\\ \text{per Year for}\\ \text{LB Sites}\end{array}\right) \\ & + \left(\begin{array}{c}\text{System}\\ \text{Stock of}\\ \text{the Item}\end{array}\right)^{t}\left(\begin{array}{c}\text{Cost of Space}\\ \text{per Cubic Foot}\\ \text{per Year for}\\ \text{Depot Sites}\end{array}\right)\Bigg]\left(\begin{array}{c}\text{Inventory Storage}\\ \text{Space per Item}\\ \text{in Cubic Feet}\end{array}\right)\left(\begin{array}{c}\text{Normal}\\ \text{Discount}\\ \text{Factor}\end{array}\right)\end{aligned}$$

10.3.3.2 Support Equipment Space Cost.

10.3.3.2.1 Support Equipment Space Cost Equation. This is the cost of PSE space allocated to an item or a group of items. It is determined as a function of the number of required PSE, the PSE deck space, and the cost of space at the facility. The deck space includes both the space occupied by the PSE and the working space necessary to operate the equipment. The assignment of the space cost to an item or group of items and the determination of type of resource are the same as that for support equipment. Within the following equations, the word item refers to an item that has PSE specifically designed for it or to the group of items that have PSE designed for the group.

$$\begin{aligned}\left(\begin{array}{c}\text{Cost of}\\ \text{PSE Space}\end{array}\right)^{t} = \Bigg[& \left[\left(\begin{array}{c}\text{Number of}\\ \text{PSE Required}\\ \text{per CV Site}\end{array}\right)^{t}\left(\begin{array}{c}\text{Space}\\ \text{Required}\\ \text{per PSE}\end{array}\right)\left(\begin{array}{c}\text{Number of}\\ \text{CV Sites}\end{array}\right)^{t}\left(\begin{array}{c}\text{Cost of Space}\\ \text{per Square Foot}\\ \text{per Year for}\\ \text{CV Sites}\end{array}\right)\right] \\ & + \left[\left(\begin{array}{c}\text{Number of}\\ \text{PSE Required}\\ \text{per NAS}\end{array}\right)^{t}\left(\begin{array}{c}\text{Space}\\ \text{Required}\\ \text{per PSE}\end{array}\right)\left(\begin{array}{c}\text{Number of}\\ \text{non-PIMA}\\ \text{NAS's}\end{array}\right)^{t}\left(\begin{array}{c}\text{Cost of Space}\\ \text{per Square Foot}\\ \text{per Year for}\\ \text{LB Sites}\end{array}\right)\right] \\ & + \left[\left(\begin{array}{c}\text{Number of}\\ \text{PSE Required}\\ \text{per PIMA}\end{array}\right)^{t}\left(\begin{array}{c}\text{Space}\\ \text{Required}\\ \text{per PSE}\end{array}\right)\left(\begin{array}{c}\text{Number of}\\ \text{PIMA's}\end{array}\right)^{t}\left(\begin{array}{c}\text{Cost of Space}\\ \text{per Square Foot}\\ \text{per Year for}\\ \text{PIMA Sites}\end{array}\right)\right] \\ & + \left[\left(\begin{array}{c}\text{Number of}\\ \text{PSE Required}\\ \text{per Depot}\end{array}\right)^{t}\left(\begin{array}{c}\text{Space}\\ \text{Required}\\ \text{per PSE}\end{array}\right)\left(\begin{array}{c}\text{Number of}\\ \text{Depots}\end{array}\right)^{t}\left(\begin{array}{c}\text{Cost of Space}\\ \text{per Square Foot}\\ \text{per Year for}\\ \text{Depot Sites}\end{array}\right)\right]\Bigg]\left(\begin{array}{c}\text{Normal}\\ \text{Discount}\\ \text{Factor}\end{array}\right)\end{aligned}$$

TASK 101 (Continued)

10.3.3.3 Repair Work Space Cost.

10.3.3.3.1 Repair Work Space Cost Equation. Repair work space is defined as that space dedicated solely for maintenance actions of an item or group of items exclusive of the support equipment space. The assignment of the space cost as allocatable/non-allocatable and determination of type of resource is the same as that for support equipment. The word item, within the following equations, refers to the item or the items in a group that uniquely have the space set aside for maintenance actions.

$$\begin{pmatrix}\text{Repair Work}\\ \text{Space Cost}\end{pmatrix}^{\dagger} = \Bigg[\Bigg[\begin{pmatrix}\text{Item Repair}\\ \text{Work Space}\\ \text{Required at}\\ \text{the CV Site}\end{pmatrix}^{\dagger}\begin{pmatrix}\text{Number}\\ \text{of}\\ \text{CV Sites}\end{pmatrix}^{\dagger}\begin{pmatrix}\text{Cost of Space}\\ \text{per Square Foot}\\ \text{per Year for}\\ \text{CV Sites}\end{pmatrix}\Bigg]$$

$$+\Bigg[\begin{pmatrix}\text{Item Repair}\\ \text{Work Space}\\ \text{Required at}\\ \text{the NAS}\end{pmatrix}^{\dagger}\begin{pmatrix}\text{Number of}\\ \text{non-PIMA}\\ \text{NAS's}\end{pmatrix}\begin{pmatrix}\text{Cost of Space}\\ \text{per Square Foot}\\ \text{per Year for}\\ \text{LB Sites}\end{pmatrix}\Bigg]$$

$$+\Bigg[\begin{pmatrix}\text{Item Repair}\\ \text{Work Space}\\ \text{Required at}\\ \text{the PIMA}\end{pmatrix}^{\dagger}\begin{pmatrix}\text{Number}\\ \text{of}\\ \text{PIMA's}\end{pmatrix}\begin{pmatrix}\text{Cost of Space}\\ \text{per Square Foot}\\ \text{per Year for}\\ \text{PIMA Sites}\end{pmatrix}\Bigg]$$

$$+\Bigg[\begin{pmatrix}\text{Item Repair}\\ \text{Work Space}\\ \text{Required at}\\ \text{the Depot}\end{pmatrix}^{\dagger}\begin{pmatrix}\text{Number}\\ \text{of}\\ \text{Depots}\end{pmatrix}\begin{pmatrix}\text{Cost of Space}\\ \text{per Square Foot}\\ \text{per Year for}\\ \text{Depot Sites}\end{pmatrix}\Bigg]\Bigg]\begin{pmatrix}\text{Normal}\\ \text{Discount}\\ \text{Factor}\end{pmatrix}$$

10.3.3.4 Total Space Cost Equation. The total space cost is the summation of the inventory, support equipment, and repair work space costs.

$$\begin{pmatrix}\text{Total}\\ \text{Space}\\ \text{Cost}\end{pmatrix}^{\dagger} = \left[\begin{pmatrix}\text{Inventory}\\ \text{Storage}\\ \text{Space Cost}\end{pmatrix}^{\dagger} + \begin{pmatrix}\text{Support}\\ \text{Equipment}\\ \text{Space Cost}\end{pmatrix}^{\dagger} + \begin{pmatrix}\text{Repair}\\ \text{Work}\\ \text{Space Cost}\end{pmatrix}^{\dagger}\right]$$

TASK 101 (Continued)

10.3.4 Labor Cost Equations. These express the labor costs incurred for discard and repair actions.

10.3.4.1 Labor Cost for the Discard Cases.

$$
\begin{aligned}
\begin{pmatrix}\text{Cost of}\\ \text{Labor for}\\ \text{Discard}\end{pmatrix}^{t} = \Bigg[& \sum_{k=1}^{l} \left[\begin{pmatrix}\text{Annual Number}\\ \text{of Real Failures}\\ \text{Removed at the}\\ k^{th}\text{ CV Site}\end{pmatrix}_{k}^{t} \begin{pmatrix}\text{Direct Maintenance}\\ \text{Man Hours at CV}\\ \text{per Discard Action}\end{pmatrix} \begin{pmatrix}\text{Labor Cost}\\ \text{per Hour}\\ \text{at the CV}\end{pmatrix} \right] \\
& + \sum_{m=1}^{n} \left[\begin{pmatrix}\text{Annual Number}\\ \text{of Real Failures}\\ \text{Removed at the}\\ m^{th}\text{ NAS Site}\end{pmatrix}_{m}^{t} \begin{pmatrix}\text{Direct Maintenance}\\ \text{Man Hours at NAS}\\ \text{per Discard Action}\end{pmatrix} \begin{pmatrix}\text{Labor Cost}\\ \text{per Hour}\\ \text{at the NAS}\end{pmatrix} \right] \\
& + \sum_{e=1}^{l} \left[\begin{pmatrix}\text{Annual Number}\\ \text{of Real Failures}\\ \text{Removed at the}\\ e^{th}\text{ PIMA Site}\end{pmatrix}_{e}^{t} \begin{pmatrix}\text{Direct Maintenance}\\ \text{Man Hours at PIMA}\\ \text{per Discard Action}\end{pmatrix} \begin{pmatrix}\text{Labor Cost}\\ \text{per Hour}\\ \text{at the PIMA}\end{pmatrix} \right] \\
& + \sum_{g=1}^{h} \left[\begin{pmatrix}\text{Annual Number}\\ \text{of Real Failures}\\ \text{Removed at the}\\ g^{th}\text{ Depot Site}\end{pmatrix}_{g}^{t} \begin{pmatrix}\text{Direct Maintenance}\\ \text{Man Hours at Depot}\\ \text{per Discard Action}\end{pmatrix} \begin{pmatrix}\text{Labor Cost}\\ \text{per Hour}\\ \text{at the Depot}\end{pmatrix} \right] \left[1.0 + \begin{pmatrix}\text{Fraction of}\\ \text{Items Falsely}\\ \text{Removed}\end{pmatrix} \right] \begin{pmatrix}\text{Normal}\\ \text{Discount}\\ \text{Factor}\end{pmatrix} \Bigg]
\end{aligned}
$$

TASK 101 (Continued).

10.3.4.2 Labor Cost Equation for the Repair Intermediate Cases.

$$
\begin{aligned}
\begin{pmatrix}\text{Cost of}\\ \text{Labor for}\\ \text{Intermediate}\\ \text{Repair}\end{pmatrix}^{t} = \Bigg[& \sum_{k=1}^{l} \begin{pmatrix}\text{Annual Number}\\ \text{of Real Failures}\\ \text{Removed at the}\\ k^{th}\text{ CV Site}\end{pmatrix}^{t}_{k} \begin{pmatrix}\text{Labor Cost}\\ \text{per Hour}\\ \text{at the CV}\end{pmatrix} \Bigg\{ \begin{pmatrix}\text{Fraction of}\\ \text{Items Falsely}\\ \text{Removed}\end{pmatrix} \begin{pmatrix}\text{Fraction of Item}\\ \text{False Removals}\\ \text{Detected as Such}\end{pmatrix} \begin{pmatrix}\text{Direct Maintenance}\\ \text{Man Hours at CV}\\ \text{per Discard Action}\end{pmatrix} \\
& + \left[1.0 + \begin{pmatrix}\text{Fraction of}\\ \text{Items Falsely}\\ \text{Removed}\end{pmatrix} \left[1.0 - \begin{pmatrix}\text{Fraction of Item}\\ \text{False Removals}\\ \text{Detected as Such}\end{pmatrix} \right] \right] \begin{pmatrix}\text{Direct Maintenance}\\ \text{Man Hours at CV}\\ \text{per Repair Action}\end{pmatrix} \Bigg\} \\
& + \sum_{m=1}^{n} \begin{pmatrix}\text{Annual Number}\\ \text{of Real Failures}\\ \text{Removed at the}\\ m^{th}\text{ NAS Site}\end{pmatrix}^{t}_{m} \begin{pmatrix}\text{Labor Cost}\\ \text{per Hour}\\ \text{at the NAS}\end{pmatrix} \Bigg\{ \begin{pmatrix}\text{Fraction of}\\ \text{Items Falsely}\\ \text{Removed}\end{pmatrix} \begin{pmatrix}\text{Fraction of Item}\\ \text{False Removals}\\ \text{Detected as Such}\end{pmatrix} \begin{pmatrix}\text{Direct Maintenance}\\ \text{Man Hours at NAS}\\ \text{per Discard Action}\end{pmatrix} \\
& + \left[1.0 + \begin{pmatrix}\text{Fraction of}\\ \text{Items Falsely}\\ \text{Removed}\end{pmatrix} \left[1.0 - \begin{pmatrix}\text{Fraction of Item}\\ \text{False Removals}\\ \text{Detected as Such}\end{pmatrix} \right] \right] \begin{pmatrix}\text{Direct Maintenance}\\ \text{Man Hours at NAS}\\ \text{per Repair Action}\end{pmatrix} \Bigg\} \\
& + \sum_{e=1}^{f} \begin{pmatrix}\text{Annual Number}\\ \text{of Real Failures}\\ \text{Removed at the}\\ e^{th}\text{ PIMA Site}\end{pmatrix}^{t}_{e} \begin{pmatrix}\text{Labor Cost}\\ \text{per Hour}\\ \text{at the NAS}\end{pmatrix} \Bigg\{ \begin{pmatrix}\text{Fraction of}\\ \text{Items Falsely}\\ \text{Removed}\end{pmatrix} \begin{pmatrix}\text{Fraction of Item}\\ \text{False Removals}\\ \text{Detected as Such}\end{pmatrix} \begin{pmatrix}\text{Direct Maintenance}\\ \text{Man Hours at PIMA}\\ \text{per Discard Action}\end{pmatrix} \\
& + \left[1.0 + \begin{pmatrix}\text{Fraction of}\\ \text{Items Falsely}\\ \text{Removed}\end{pmatrix} \left[1.0 - \begin{pmatrix}\text{Fraction of Item}\\ \text{False Removals}\\ \text{Detected as Such}\end{pmatrix} \right] \right] \begin{pmatrix}\text{Direct Maintenance}\\ \text{Man Hours at PIMA}\\ \text{per Repair Action}\end{pmatrix} \Bigg\} \\
& + \sum_{g=1}^{h} \begin{pmatrix}\text{Annual Number}\\ \text{of Real Failures}\\ \text{Removed at the}\\ g^{th}\text{ Depot Site}\end{pmatrix}^{t}_{g} \begin{pmatrix}\text{Labor Cost}\\ \text{per Hour}\\ \text{at the Depot}\end{pmatrix} \Bigg\{ \begin{pmatrix}\text{Fraction of}\\ \text{Items Falsely}\\ \text{Removed}\end{pmatrix} \begin{pmatrix}\text{Fraction of Item}\\ \text{False Removals}\\ \text{Detected as Such}\end{pmatrix} \begin{pmatrix}\text{Direct Maintenance}\\ \text{Man Hours at Depot}\\ \text{per Discard Action}\end{pmatrix} \\
& + \left[1.0 + \begin{pmatrix}\text{Fraction of}\\ \text{Items Falsely}\\ \text{Removed}\end{pmatrix} \left[1.0 - \begin{pmatrix}\text{Fraction of Item}\\ \text{False Removals}\\ \text{Detected as Such}\end{pmatrix} \right] \right] \begin{pmatrix}\text{Direct Maintenance}\\ \text{Man Hours at Depot}\\ \text{per Repair Action}\end{pmatrix} \Bigg\} \\
& + \sum_{e=1}^{f} \begin{pmatrix}\text{Annual Number}\\ \text{of Items}\\ \text{Received by the}\\ e^{th}\text{ PIMA Site}\end{pmatrix}^{t}_{e} \begin{pmatrix}\text{Direct Maintenance}\\ \text{Man Hours at PIMA}\\ \text{per Repair Action}\end{pmatrix} \\
& + \sum_{g=1}^{h} \begin{pmatrix}\text{Annual Number}\\ \text{of Items}\\ \text{Received by the}\\ g^{th}\text{ Depot Site}\end{pmatrix}^{t}_{g} \begin{pmatrix}\text{Direct Maintenance}\\ \text{Man Hours at Depot}\\ \text{per Repair Action}\end{pmatrix} \Bigg] \begin{pmatrix}\text{Normal}\\ \text{Discount}\\ \text{Factor}\end{pmatrix}
\end{aligned}
$$

10.3.4.3 Labor Cost Equation for the Repair PIMA Cases. Two labor cost equations are presented. One is applicable if the higher assembly is repaired at intermediate level; the other is applicable if the higher assembly is repaired at PIMA level.

10.3.4.3.1 Labor Cost Equation for the Repair PIMA Case if Higher Assembly is Coded Intermediate Repair.

$$
\begin{aligned}
\left(\begin{array}{c}\text{Cost of Labor for}\\ \text{PIMA Repair if}\\ \text{Higher Assembly}\\ \text{is Intermediate}\\ \text{Repair}\end{array}\right)^{t} = \Bigg[& \sum_{k=1}^{I} \left(\begin{array}{c}\text{Annual Number}\\ \text{of Real Failures}\\ \text{Removed at the}\\ k^{th}\ \text{CV Site}\end{array}\right)^{t}_{k} \left[1.0 + \left(\begin{array}{c}\text{Fraction of}\\ \text{Items Falsely}\\ \text{Removed}\end{array}\right)\right] \left(\begin{array}{c}\text{Labor Cost}\\ \text{per Hour}\\ \text{at the CV}\end{array}\right) \left(\begin{array}{c}\text{Direct Maintenance}\\ \text{Man Hours at CV}\\ \text{per Discard Action}\end{array}\right) \\
& + \sum_{w=1}^{x} \left(\begin{array}{c}\text{Annual Number}\\ \text{of Real Failures}\\ \text{Removed at the}\\ w^{th}\ \text{NAS Site}\end{array}\right)^{t}_{w} \left[1.0 + \left(\begin{array}{c}\text{Fraction of}\\ \text{Items Falsely}\\ \text{Removed}\end{array}\right)\right] \left(\begin{array}{c}\text{Labor Cost}\\ \text{per Hour}\\ \text{at the NAS}\end{array}\right) \left(\begin{array}{c}\text{Direct Maintenance}\\ \text{Man Hours at NAS}\\ \text{per Discard Action}\end{array}\right) \\
& + \sum_{y=1}^{z} \left(\begin{array}{c}\text{Annual Number}\\ \text{of Real Failures}\\ \text{Removed at the}\\ y^{th}\ \text{NAS Site}\end{array}\right)^{t}_{y} \left(\begin{array}{c}\text{Labor Cost}\\ \text{per Hour}\\ \text{at the NAS}\end{array}\right) \Bigg\{ \left(\begin{array}{c}\text{Fraction of}\\ \text{Items Falsely}\\ \text{Removed}\end{array}\right) \left(\begin{array}{c}\text{Fraction of Item}\\ \text{False Removals}\\ \text{Detected as Such}\end{array}\right) \left(\begin{array}{c}\text{Direct Maintenance}\\ \text{Man Hours at NAS}\\ \text{per Discard Action}\end{array}\right) \\
& + \left[1.0 + \left(\begin{array}{c}\text{Fraction of}\\ \text{Items Falsely}\\ \text{Removed}\end{array}\right)\right] \left[1.0 - \left(\begin{array}{c}\text{Fraction of Item}\\ \text{False Removals}\\ \text{Detected as Such}\end{array}\right)\right] \left(\begin{array}{c}\text{Direct Maintenance}\\ \text{Man Hours at NAS}\\ \text{per Repair Action}\end{array}\right) \Bigg\} \\
& + \sum_{e=1}^{f} \left(\begin{array}{c}\text{Annual Number}\\ \text{of Real Failures}\\ \text{Removed at the}\\ e^{th}\ \text{PIMA Site}\end{array}\right)^{t}_{e} \left(\begin{array}{c}\text{Labor Cost}\\ \text{per Hour}\\ \text{at the NAS}\end{array}\right) \Bigg\{ \left(\begin{array}{c}\text{Fraction of}\\ \text{Items Falsely}\\ \text{Removed}\end{array}\right) \left(\begin{array}{c}\text{Fraction of Item}\\ \text{False Removals}\\ \text{Detected as Such}\end{array}\right) \left(\begin{array}{c}\text{Direct Maintenance}\\ \text{Man Hours at PIMA}\\ \text{per Discard Action}\end{array}\right) \\
& + \left[1.0 + \left(\begin{array}{c}\text{Fraction of}\\ \text{Items Falsely}\\ \text{Removed}\end{array}\right)\right] \left[1.0 - \left(\begin{array}{c}\text{Fraction of Item}\\ \text{False Removals}\\ \text{Detected as Such}\end{array}\right)\right] \left(\begin{array}{c}\text{Direct Maintenance}\\ \text{Man Hours at PIMA}\\ \text{per Repair Action}\end{array}\right) \Bigg\} \\
& + \sum_{g=1}^{h} \left(\begin{array}{c}\text{Annual Number}\\ \text{of Real Failures}\\ \text{Removed at the}\\ g^{th}\ \text{Depot Site}\end{array}\right)^{t}_{g} \left(\begin{array}{c}\text{Labor Cost}\\ \text{per Hour}\\ \text{at the Depot}\end{array}\right) \Bigg\{ \left(\begin{array}{c}\text{Fraction of}\\ \text{Items Falsely}\\ \text{Removed}\end{array}\right) \left(\begin{array}{c}\text{Fraction of Item}\\ \text{False Removals}\\ \text{Detected as Such}\end{array}\right) \left(\begin{array}{c}\text{Direct Maintenance}\\ \text{Man Hours at Depot}\\ \text{per Discard Action}\end{array}\right) \\
& + \left[1.0 + \left(\begin{array}{c}\text{Fraction of}\\ \text{Items Falsely}\\ \text{Removed}\end{array}\right)\right] \left[1.0 - \left(\begin{array}{c}\text{Fraction of Item}\\ \text{False Removals}\\ \text{Detected as Such}\end{array}\right)\right] \left(\begin{array}{c}\text{Direct Maintenance}\\ \text{Man Hours at Depot}\\ \text{per Repair Action}\end{array}\right) \Bigg\} \\
& + \sum_{g=1}^{f} \left(\begin{array}{c}\text{Annual Number}\\ \text{of Items Received}\\ \text{by the } e^{th}\ \text{PIMA}\\ \text{Site}\end{array}\right)^{t}_{e} \left(\begin{array}{c}\text{Direct Maintenance}\\ \text{Man Hours at PIMA}\\ \text{per Repair Action}\end{array}\right) \left(\begin{array}{c}\text{Labor Cost}\\ \text{per Hour}\\ \text{at the NAS}\end{array}\right) \\
& + \sum_{g=1}^{h} \left(\begin{array}{c}\text{Annual Number}\\ \text{of Items Received}\\ \text{by the } g^{th}\ \text{Depot}\\ \text{Site}\end{array}\right)^{t}_{g} \left(\begin{array}{c}\text{Direct Maintenance}\\ \text{Man Hours at Depot}\\ \text{per Repair Action}\end{array}\right) \left(\begin{array}{c}\text{Labor Cost}\\ \text{per Hour}\\ \text{at the Depot}\end{array}\right) \Bigg] \left(\begin{array}{c}\text{Normal}\\ \text{Discount}\\ \text{Factor}\end{array}\right)
\end{aligned}
$$

TASK 101 (Continued)

where,

w = an index element denoting the w^{th} non-PIMA NAS.
y = an index element denoting the y^{th} PIMA NAS.
x = the number of non-PIMA NAS's.
z = the number of PIMA NAS's.

10.3.4.3.2 Labor Cost Equation for the Repair PIMA Case if Higher Assembly is Coded PIMA Repair.

$$
\begin{aligned}
\left(\begin{array}{c}\text{Cost of Labor for}\\ \text{PIMA Repair if}\\ \text{Higher Assembly}\\ \text{is PIMA Repair}\end{array}\right)^{\dagger} = \Bigg[& \sum_{y=1}^{z} \left(\begin{array}{c}\text{Annual Number}\\ \text{of Real Failures}\\ \text{Removed at the}\\ y^{th}\text{ NAS Site}\end{array}\right)_{y}^{\dagger} \left(\begin{array}{c}\text{Labor Cost}\\ \text{per Hour}\\ \text{at the NAS}\end{array}\right) \Bigg\{ \left(\begin{array}{c}\text{Fraction of}\\ \text{Items Falsely}\\ \text{Removed}\end{array}\right) \left(\begin{array}{c}\text{Fraction of Item}\\ \text{False Removals}\\ \text{Detected as Such}\end{array}\right) \left(\begin{array}{c}\text{Direct Maintenance}\\ \text{Man Hours at NAS}\\ \text{per Discard Action}\end{array}\right) \\
& + \left[1.0 + \left(\begin{array}{c}\text{Fraction of}\\ \text{Items Falsely}\\ \text{Removed}\end{array}\right)\left[1.0 - \left(\begin{array}{c}\text{Fraction of Item}\\ \text{False Removals}\\ \text{Detected as Such}\end{array}\right)\right]\right] \left(\begin{array}{c}\text{Direct Maintenance}\\ \text{Man Hours at NAS}\\ \text{per Repair Action}\end{array}\right) \Bigg\} \\
& + \sum_{e=1}^{f} \left(\begin{array}{c}\text{Annual Number}\\ \text{of Real Failures}\\ \text{Removed at the}\\ e^{th}\text{ PIMA Site}\end{array}\right)_{e}^{\dagger} \left(\begin{array}{c}\text{Labor Cost}\\ \text{per Hour}\\ \text{at the NAS}\end{array}\right) \Bigg\{ \left(\begin{array}{c}\text{Fraction of}\\ \text{Items Falsely}\\ \text{Removed}\end{array}\right) \left(\begin{array}{c}\text{Fraction of Item}\\ \text{False Removals}\\ \text{Detected as Such}\end{array}\right) \left(\begin{array}{c}\text{Direct Maintenance}\\ \text{Man Hours at PIMA}\\ \text{per Discard Action}\end{array}\right) \\
& + \left[1.0 + \left(\begin{array}{c}\text{Fraction of}\\ \text{Items Falsely}\\ \text{Removed}\end{array}\right)\left[1.0 - \left(\begin{array}{c}\text{Fraction of Item}\\ \text{False Removals}\\ \text{Detected as Such}\end{array}\right)\right]\right] \left(\begin{array}{c}\text{Direct Maintenance}\\ \text{Man Hours at PIMA}\\ \text{per Repair Action}\end{array}\right) \Bigg\} \\
& + \sum_{g=1}^{h} \left(\begin{array}{c}\text{Annual Number}\\ \text{of Real Failures}\\ \text{Removed at the}\\ g^{th}\text{ Depot Site}\end{array}\right)_{g}^{\dagger} \left(\begin{array}{c}\text{Labor Cost}\\ \text{per Hour}\\ \text{at the Depot}\end{array}\right) \Bigg\{ \left(\begin{array}{c}\text{Fraction of}\\ \text{Items Falsely}\\ \text{Removed}\end{array}\right) \left(\begin{array}{c}\text{Fraction of Item}\\ \text{False Removals}\\ \text{Detected as Such}\end{array}\right) \left(\begin{array}{c}\text{Direct Maintenance}\\ \text{Man Hours at Depot}\\ \text{per Discard Action}\end{array}\right) \\
& + \left[1.0 + \left(\begin{array}{c}\text{Fraction of}\\ \text{Items Falsely}\\ \text{Removed}\end{array}\right)\left[1.0 - \left(\begin{array}{c}\text{Fraction of Item}\\ \text{False Removals}\\ \text{Detected as Such}\end{array}\right)\right]\right] \left(\begin{array}{c}\text{Direct Maintenance}\\ \text{Man Hours at Depot}\\ \text{per Repair Action}\end{array}\right) \Bigg\} \\
& + \sum_{g=1}^{h} \left(\begin{array}{c}\text{Annual Number}\\ \text{of Items Received}\\ \text{by the } g^{th}\text{ Depot}\\ \text{Site}\end{array}\right)_{g}^{\dagger} \left(\begin{array}{c}\text{Direct Maintenance}\\ \text{Man Hours at Depot}\\ \text{per Repair Action}\end{array}\right) \left(\begin{array}{c}\text{Labor Cost}\\ \text{per Hour}\\ \text{at the Depot}\end{array}\right) \Bigg] \left(\begin{array}{c}\text{Normal}\\ \text{Discount}\\ \text{Factor}\end{array}\right)
\end{aligned}
$$

TASK 101 (Continued)

10.3.4.4 Labor Cost Equation for the Repair Depot Cases. Three labor cost equations are presented, one each for the next higher assembly repaired at intermediate, PIMA or depot level.

10.3.4.4.1 Labor Cost Equation for the Repair Depot Case if Higher Assembly is Coded Intermediate Repair.

$$
\begin{aligned}
&\begin{pmatrix}\text{Cost of Labor for}\\ \text{Depot Repair if}\\ \text{Higher Assembly}\\ \text{is Intermediate}\\ \text{Repair}\end{pmatrix}^{t} = \Bigg[\Bigg\{ \sum_{k=1}^{i} \begin{pmatrix}\text{Annual Number}\\ \text{of Real Failures}\\ \text{Removed at the}\\ k^{th}\text{ CV Site}\end{pmatrix}_{k}^{t} \begin{pmatrix}\text{Direct Maintenance}\\ \text{Man Hours at CV}\\ \text{per Discard Action}\end{pmatrix} \begin{pmatrix}\text{Labor Cost}\\ \text{per Hour}\\ \text{at the CV}\end{pmatrix} \\
&\quad + \sum_{m=1}^{n} \begin{pmatrix}\text{Annual Number}\\ \text{of Real Failures}\\ \text{Removed at the}\\ m^{th}\text{ NAS Site}\end{pmatrix}_{m}^{t} \begin{pmatrix}\text{Direct Maintenance}\\ \text{Man Hours at NAS}\\ \text{per Discard Action}\end{pmatrix} \begin{pmatrix}\text{Labor Cost}\\ \text{per Hour}\\ \text{at the NAS}\end{pmatrix} \\
&\quad + \sum_{e=1}^{f} \begin{pmatrix}\text{Annual Number}\\ \text{of Real Failures}\\ \text{Removed at the}\\ e^{th}\text{ PIMA Site}\end{pmatrix}_{e}^{t} \begin{pmatrix}\text{Direct Maintenance}\\ \text{Man Hours at PIMA}\\ \text{per Discard Action}\end{pmatrix} \begin{pmatrix}\text{Labor Cost}\\ \text{per Hour}\\ \text{at the PIMA}\end{pmatrix} \Bigg\} \left[1.0 + \begin{pmatrix}\text{Fraction of}\\ \text{Items Falsely}\\ \text{Removed}\end{pmatrix}\right] \\
&\quad + \sum_{g=1}^{h} \begin{pmatrix}\text{Annual Number}\\ \text{of Real Failures}\\ \text{Removed at the}\\ g^{th}\text{ Depot Site}\end{pmatrix}_{g}^{t} \begin{pmatrix}\text{Labor Cost}\\ \text{per Hour}\\ \text{at the Depot}\end{pmatrix} \Bigg\{ \begin{pmatrix}\text{Fraction of}\\ \text{Items Falsely}\\ \text{Removed}\end{pmatrix} \begin{pmatrix}\text{Fraction of Item}\\ \text{False Removals}\\ \text{Detected as Such}\end{pmatrix} \begin{pmatrix}\text{Direct Maintenance}\\ \text{Man Hours at Depot}\\ \text{per Discard Action}\end{pmatrix} \\
&\quad + \left[1.0 + \begin{pmatrix}\text{Fraction of}\\ \text{Items Falsely}\\ \text{Removed}\end{pmatrix}\right] \left[1.0 - \begin{pmatrix}\text{Fraction of Item}\\ \text{False Removals}\\ \text{Detected as Such}\end{pmatrix}\right] \Bigg] \begin{pmatrix}\text{Direct Maintenance}\\ \text{Man Hours at Depot}\\ \text{per Repair Action}\end{pmatrix} \Bigg\} \\
&\quad + \sum_{g=1}^{h} \begin{pmatrix}\text{Annual Number}\\ \text{of Items Received}\\ \text{by the } g^{th}\text{ Depot}\\ \text{Site}\end{pmatrix}_{g}^{t} \begin{pmatrix}\text{Direct Maintenance}\\ \text{Man Hours at Depot}\\ \text{per Repair Action}\end{pmatrix} \begin{pmatrix}\text{Labor Cost}\\ \text{per Hour}\\ \text{at the Depot}\end{pmatrix} \Bigg] \begin{pmatrix}\text{Normal}\\ \text{Discount}\\ \text{Factor}\end{pmatrix}
\end{aligned}
$$

TASK 101 (Continued)

10.3.4.4.2 <u>Labor Cost Equation for the Repair Depot Case if Higher Assembly is Coded PIMA Repair.</u>

$$\begin{aligned}
\begin{pmatrix}\text{Cost of Labor for}\\ \text{Depot Repair if}\\ \text{Higher Assembly}\\ \text{is PIMA Repair}\end{pmatrix}^{t} = & \Bigg[\Bigg\{ \sum_{y=1}^{z} \begin{pmatrix}\text{Annual Number}\\ \text{of Real Failures}\\ \text{Removed at the}\\ \text{y}^{\text{th}}\text{ NAS Site}\end{pmatrix}_{y}^{t} \begin{pmatrix}\text{Direct Maintenance}\\ \text{Man Hours at NAS}\\ \text{per Discard Action}\end{pmatrix} \\
& + \sum_{e=1}^{f} \begin{pmatrix}\text{Annual Number}\\ \text{of Real Failures}\\ \text{Removed at the}\\ \text{e}^{\text{th}}\text{ PIMA Site}\end{pmatrix}_{e}^{t} \begin{pmatrix}\text{Direct Maintenance}\\ \text{Man Hours at PIMA}\\ \text{per Discard Action}\end{pmatrix} \Bigg\} \left[1.0 + \begin{pmatrix}\text{Fraction of}\\ \text{Items Falsely}\\ \text{Removed}\end{pmatrix} \right] \begin{pmatrix}\text{Labor Cost}\\ \text{per Hour}\\ \text{at the PIMA}\end{pmatrix} \\
& + \sum_{g=1}^{h} \begin{pmatrix}\text{Annual Number}\\ \text{of Real Failures}\\ \text{Removed at the}\\ \text{g}^{\text{th}}\text{ Depot Site}\end{pmatrix}_{g}^{t} \begin{pmatrix}\text{Labor Cost}\\ \text{per Hour}\\ \text{at the Depot}\end{pmatrix} \Bigg\{ \begin{pmatrix}\text{Fraction of}\\ \text{Items Falsely}\\ \text{Removed}\end{pmatrix} \begin{pmatrix}\text{Fraction of Item}\\ \text{False Removals}\\ \text{Detected as Such}\end{pmatrix} \begin{pmatrix}\text{Direct Maintenance}\\ \text{Man Hours at Depot}\\ \text{per Discard Action}\end{pmatrix} \\
& + \left[1.0 + \begin{pmatrix}\text{Fraction of}\\ \text{Items Falsely}\\ \text{Removed}\end{pmatrix} \left[1.0 - \begin{pmatrix}\text{Fraction of Item}\\ \text{False Removals}\\ \text{Detected as Such}\end{pmatrix} \right] \right] \begin{pmatrix}\text{Direct Maintenance}\\ \text{Man Hours at Depot}\\ \text{per Repair Action}\end{pmatrix} \Bigg\} \\
& + \sum_{g=1}^{h} \begin{pmatrix}\text{Annual Number}\\ \text{of Items Received}\\ \text{by the g}^{\text{th}}\text{ Depot}\\ \text{Site}\end{pmatrix}_{g}^{t} \begin{pmatrix}\text{Direct Maintenance}\\ \text{Man Hours at Depot}\\ \text{per Repair Action}\end{pmatrix} \begin{pmatrix}\text{Labor Cost}\\ \text{per Hour}\\ \text{at the Depot}\end{pmatrix} \Bigg] \begin{pmatrix}\text{Normal}\\ \text{Discount}\\ \text{Factor}\end{pmatrix}
\end{aligned}$$

10.3.4.4.3 <u>Labor Cost Equation for the Repair Depot Case if Higher Assembly is Coded Depot Repair.</u>

$$\begin{aligned}
\begin{pmatrix}\text{Cost of Labor for}\\ \text{Depot Repair if}\\ \text{Higher Assembly}\\ \text{is Depot Repair}\end{pmatrix}^{t} = & \Bigg[\sum_{g=1}^{h} \begin{pmatrix}\text{Annual Number}\\ \text{of Real Failures}\\ \text{Removed at the}\\ \text{g}^{\text{th}}\text{ Depot Site}\end{pmatrix}_{g}^{t} \begin{pmatrix}\text{Labor Cost}\\ \text{per Hour}\\ \text{at the Depot}\end{pmatrix} \Bigg\{ \begin{pmatrix}\text{Fraction of}\\ \text{Items Falsely}\\ \text{Removed}\end{pmatrix} \begin{pmatrix}\text{Fraction of Item}\\ \text{False Removals}\\ \text{Detected as Such}\end{pmatrix} \begin{pmatrix}\text{Direct Maintenance}\\ \text{Man Hours at Depot}\\ \text{per Discard Action}\end{pmatrix} \\
& + \left[1.0 + \begin{pmatrix}\text{Fraction of}\\ \text{Items Falsely}\\ \text{Removed}\end{pmatrix} \left[1.0 - \begin{pmatrix}\text{Fraction of Item}\\ \text{False Removals}\\ \text{Detected as Such}\end{pmatrix} \right] \right] \begin{pmatrix}\text{Direct Maintenance}\\ \text{Man Hours at Depot}\\ \text{per Repair Action}\end{pmatrix} \Bigg\} \Bigg] \begin{pmatrix}\text{Normal}\\ \text{Discount}\\ \text{Factor}\end{pmatrix}
\end{aligned}$$

TASK 101 (Continued)

10.3.5 Training Cost Equation.

$$\left(\begin{array}{c}\text{Cost of}\\ \text{Training}\end{array}\right)^{\dagger} = \left[\left(\begin{array}{c}\text{Total Number of}\\ \text{Squadron Men}\\ \text{Trained}\end{array}\right)^{\dagger}\left(\begin{array}{c}\text{Training Cost}\\ \text{per}\\ \text{Squadron Man}\end{array}\right)^{\dagger} + \left(\begin{array}{c}\text{Total Number of}\\ \text{CV Men}\\ \text{Trained}\end{array}\right)^{\dagger}\left(\begin{array}{c}\text{Training Cost}\\ \text{per}\\ \text{CV Man}\end{array}\right)^{\dagger}\right.$$

$$\left. + \left(\begin{array}{c}\text{Total Number of}\\ \text{NAS Men}\\ \text{Trained}\end{array}\right)^{\dagger}\left(\begin{array}{c}\text{Training Cost}\\ \text{per}\\ \text{NAS Man}\end{array}\right)^{*} + \left(\begin{array}{c}\text{Total Number of}\\ \text{PIMA Men}\\ \text{Trained}\end{array}\right)^{\dagger}\left(\begin{array}{c}\text{Training Cost}\\ \text{per}\\ \text{PIMA Man}\end{array}\right)^{\dagger}\right]\left[1.0 + \left(\begin{array}{c}\text{Navy}\\ \text{Personnel}\\ \text{Attrition}\\ \text{Rate}\end{array}\right)\right]\left(\begin{array}{c}\text{Present}\\ \text{Discount}\\ \text{Factor}\end{array}\right)$$

$$+ \left(\begin{array}{c}\text{Total Number of}\\ \text{Depot Men}\\ \text{Trained}\end{array}\right)^{\dagger}\left(\begin{array}{c}\text{Training Cost}\\ \text{per}\\ \text{Depot Man}\end{array}\right)^{*}\left[1.0 + \left(\begin{array}{c}\text{Depot}\\ \text{Personnel}\\ \text{Attrition}\\ \text{Rate}\end{array}\right)\right]\left(\begin{array}{c}\text{Present}\\ \text{Discount}\\ \text{Factor}\end{array}\right)$$

*Full or back-up resources based on the criteria of Figures 3 and 4.

10.3.5.1 Training Cost Equation for the Intermediate Repair Cases. For the intermediate repair case, a repair training cost is incurred for each operational site; for the PIMA and depot repair facilities either full or back-up resources are required based on the criteria of Figures 3 and 4.

10.3.5.2 Training Cost Equation for the PIMA Repair Cases. For the PIMA repair cases, a repair training cost is incurred for each PIMA and depot facility; discard training cost is incurred for each IMA site if the higher assembly is repaired at the IMA site.

10.3.5.3 Training Cost Equation for the Depot Repair Cases. For the Depot repair cases, repair training costs are incurred for the depot facilities and discard training costs are incurred for the sites other than the depots which repair the higher assembly.

10.3.5.4 Training Cost Equation for the Discard Cases. For the discard cases, discard training costs are incurred for the sites which repair the higher assembly. The PIMA and depot sites are subject to the criteria of Figures 3 and 4.

10.3.6 Documentation Cost Equation. A cost value is predetermined for the case under consideration. Documentation includes the following elements: the drawings and specifications which make up the avionic system technical manual; the LSA (Logistic Support Analysis) preparation; and support equipment requirement sheets, lists, software, etc. The determination of applicable costs is the same as that for training.

$$\left(\begin{array}{c}\text{Cost of}\\ \text{Documentation}\end{array}\right)^{\dagger} = \left[\left(\begin{array}{c}\text{Documentation}\\ \text{Cost at IMA}\end{array}\right) + \left(\begin{array}{c}\text{Documentation}\\ \text{Cost at PIMA}\end{array}\right) + \left(\begin{array}{c}\text{Documentation}\\ \text{Cost at Depot}\end{array}\right)\right]$$

TASK 101 (Continued)

10.4 Combination of Cost Elements. The costs element equations are combined for each item for the alternative under consideration. The cost of an LOR alternative for an equipment is the summation of the costs associated with the items in the equipment. For an avionic equipment different alternatives may be recommended for the different items; the higher assembly, however, must always be assigned to the same case when evaluating all the next lower assemblies contained in it. When making individual recommendations for a group of items which have non-allocatable costs associated with them, redundant costing must be compensated for. If part of the group requires verification at a site and the remainder requires repair at the same site, the verification cost is deleted since it is assumed that the capability to verify is acquired with the capability to repair. Similarly, back-up costs at a site are ignored if full repair capability is collocated with it.

10.5 Table of Data Elements. Table III contains the various LOR data elements, the LSA interface, the associated units required and the data element sources as input to the LOR model for Naval Air Systems Command equipments.

TASK 101 (Continued)

TABLE III. Naval Air Systems Command LOR data elements.

Input Format	Data Elements	LSA	Unit Required	Data Source
I	Next Higher Assembly			
	WRA	Yes	System	Contractor
	SRA	Yes	WRA	Contractor
	SSRA	Yes	SRA	Contractor
L	Predicted MTBF:			
	WRA	Yes	Hours	Contractor
	SRA	Yes	Hours	Contractor
	SSRA	Yes	Hours	Contractor
Y	Degradation Factor		Fraction	Navy
I	Part No.	Yes	P/N	Contractor
I	Nomenclature	Yes	Name	Contractor
I	Identical Items per System:			
	WRA	Yes	WRAs	Contractor
	SRA	Yes	SRAs	Contractor
	SSRA	Yes	SRAs	Contractor
L	Cost per Item:			
	WRA	Yes	Dollars	Contractor
	SRA	Yes	Dollars	Contractor
	SSRA	Yes	Dollars	Contractor
L	Item Weight:			
	WRA	Yes	Pounds	Contractor
	SRA	Yes	Pounds	Contractor
	SSRA	Yes	Pounds	Contractor
L	Item Volume:			
	WRA	Yes	Ft^3	Contractor
	SRA	Yes	Ft^3	Contractor
	SSRA	Yes	Ft^3	Contractor
L	BCM Rate at IMA:			
	WRA		Fraction	Contractor
	SRA		Fraction	Contractor
	SSRA		Fraction	Contractor
L	BCM Rate at PIMA:			
	WRA		Fraction	Contractor
	SRA		Fraction	Contractor
	SSRA		Fraction	Contractor
S	Number of Aircraft per Type:			
	CV		Aircraft/ Type/Site	Navy
	NAS		Aircraft/ Type/Site	Navy
	PIMA		Aircraft Type/Site	Navy

TASK 101 (Continued)

TABLE III. Naval Air Systems Command LOR data elements. (Continued)

Input Format	Data Elements	LSA	Unit Required	Data Source
S	Flight Hour Per Month			
	CV	Yes	Hrs/Month/ Aircraft Type/ Site	Navy
	NAS	Yes	Hrs/Month/ Aircraft Type/ Site	Navy
	PIMA	Yes	Hrs/Month/ Aircraft Type/ Site	Navy
S	Aircraft Type Deployment Factor:			
	CV		Fraction	Navy
	NAS		Fraction	Navy
	PIMA		Fraction	Navy
S	Number of Aircraft Operational Sites:			
	CV		CVs	Navy
	NAS		NASs	Navy
	PIMA		PIMAs	Navy
S	Number of Repair Facilities:			
	CV		CVs	Navy
	NAS		NASs	Navy
	PIMA		PIMAs	Navy
	Depot		Depots	Navy
Y/Z	RCT for Repair:			
	Intermediate Repair			
	(CV-CV)	Yes	Days	Navy
	(NAS-NAS)	Yes	Days	Navy
	PIMA Repair			
	(CV-PIMA)	Yes	Days	Navy
	(NAS-PIMA)	Yes	Days	Navy
	(PIMA-PIMA)	Yes	Days	Navy
	(CV-PIMA-Depot)	Yes	Days	Navy
	(NAS-PIMA-Depot)	Yes	Days	Navy
	Depot Repair			
	(CV-Depot)	Yes	Days	Navy
	(NAS-Depot)	Yes	Days	Navy
	(PIMA-Depot)	Yes	Days	
S	RDS at Intermediate Repair Facility:			
	CV		Days	Navy
	NAS		Days	Navy
	PIMA		Days	Navy

TASK 101 (Continued)

TABLE III. Naval Air Systems Command LOR data elements. (Continued)

Input Format	Data Elements	LSA	Unit Required	Data Source
Y	RDS for Discard			
	CV		Days	Navy
	NAS		Days	Navy
	PIMA		Days	Navy
Z	Item Repair Work Space:			
	CV		$/Ft^2/Site	Navy
	*LB		$/Ft^2/Site	Navy
	Depot		$/Ft^2/Site	Navy
Z	Inventory Storage Cost			
	CV		$/Ft^3/Site	Navy
	*LB		$/Ft^3/Site	Navy
	Depot		$/Ft^3/Site	Navy
Z	Labor Rate:			
	CV		Dollars/Hour	Navy
	*LB		Dollars/Hour	Navy
	Depot		Dollars/Hour	Navy
L	Repair Material Rate:			
	IMA		Fraction	Contractor
	PIMA		Fraction	Contractor
	Depot		Fraction	Contractor
L	Scrap Rate at IMA:			
	WRA		Fraction	Contractor
	SRA		Fraction	Contractor
	SSRA		Fraction	Contractor
L	Scrap Rate at PIMA:			
	WRA		Fraction	Contractor
	SRA		Fraction	Contractor
	SSRA		Fraction	Contractor
L	Scrap Rate at Depot:			
	WRA		Fraction	Contractor
	SRA		Fraction	Contractor
	SSRA		Fraction	Contractor
L	Operating Hours to Flight Hour Rate:			
	WRA	Yes	Fraction	Navy
	SRA	Yes	Fraction	Navy
	SSRA	Yes	Fraction	Navy
L	False Removal Rate:			
	WRA	Yes	Fraction	Contractor
	SRA	Yes	Fraction	Contractor
	SSRA	Yes	Fraction	Contractor

*LB accounts for NAS and PIMA sites if the value of the applicable data element is identical for the site types.

TASK 101 (Continued)

TABLE III. Naval Air Systems Command LOR data elements. (Continued)

Input Format	Data Elements	LSA	Unit Required	Data Source
L	False Removal Detection Rate:			
	WRA	Yes	Fraction	Contractor
	SRA	Yes	Fraction	Contractor
	SSRA	Yes	Fraction	Contractor
L	Rate of BCM Items forwarded to PIMA		Fraction	Navy
T	Direct Maintenance Man-Hours for Repair:			
	(WRA)			
	CV	Yes	Hours	Contractor
	NAS	Yes	Hours	Contractor
	PIMA	Yes	Hours	Contractor
	Depot	Yes	Hours	Contractor
	(SRA)			
	CV	Yes	Hours	Contractor
	NAS	Yes	Hours	Contractor
	PIMA	Yes	Hours	Contractor
	Depot	Yes	Hours	Contractor
	(SSRA)			
	CV	Yes	Hours	Contractor
	NAS	Yes	Hours	Contractor
	PIMA	Yes	Hours	Contractor
	Depot	Yes	Hours	Contractor
T	Direct Maintenance Man-Hours for Verify (Options Identical to Man-Hours for Repair)		Hours	Contractor
S	Transportation Rate:			
	IMA-PIMA		Dollars/Pound	Navy
	IMA-Depot		Dollars/Pound	Navy
	PIMA-Depot		Dollars/Pound	Navy
	Resupply-CV		Dollars/Pound	Navy
	Resupply-NAS		Dollars/Pound	Navy
	Resupply-PIMA		Dollars/Pound	Navy
	Resupply-Depot		Dollars/Pound	Navy
T	Unit Cost of Repair PSE:			
	CV		Dollars/PSE	Contractor
	NAS		Dollars/PSE	Contractor
	PIMA		Dollars/PSE	Contractor
	Depot		Dollars/PSE	Contractor
T	Unit Cost of Verify PSE (Options Identical to Repair PSE)		Dollars/PSE	Contractor
T	Number of Verify/Repair PSE:			
	CV	Yes	PSE	Contractor
	NAS	Yes	PSE	Contractor
	PIMA	Yes	PSE	Contractor
	Depot	Yes	PSE	Contractor
T	SE Development Cost	Yes	Dollars	Contractor
T	SE Training Hardware Cost		Dollars	Contractor
	CV			
	NAS			
	PIMA			
	Depot			

TASK 101 (Continued)

TABLE III. Naval Air Systems Command LOR data elements. (Continued)

Input Format	Data Elements	LSA	Unit Required	Data Source
T	Space Required for Repair PSE:			
	CV	Yes	Ft^2/PSE	Contractor
	NAS	Yes	Ft^2/PSE	Contractor
	PIMA	Yes	Ft^2/PSE	Contractor
	Depot	Yes	Ft^2/PSE	Contractor
T	Space Required for Verify PSE (Options Identical to Repair PSE)	Yes	Ft^2/PSE	Contractor
T	Additional Work Space Cost		Ft^2	Contractor
T	Documentation Cost:			
	IMA		Dollars	Contractor
	PIMA		Dollars	Contractor
	Depot		Dollars	Contractor
M	Number of Men Trained:			
	CV		Men	Navy
	NAS		Men	Navy
	PIMA		Men	Navy
	Depot		Men	Navy
M	Training Cost:			
	CV	Yes	$/Man	Navy/Contractor
	NAS	Yes	$/Man	Navy/Contractor
	PIMA	Yes	$/Man	Navy/Contractor
	Depot	Yes	$/Man	Navy/Contractor
M	Personnel Attrition Rate:			
	Naval		Fraction/Year	Navy
	Civilian		Fraction/Year	Navy
L	Number of New Items Entered in NSN System		Units	Contractor
Y	Item Entry Cost		Dollars/NSN	Navy
Y	Item Retention Cost		Dollars/NSN/Year	Navy
I	Field Supply Administration Cost		Dollars/NSN/Site/Year	Navy
Y	Packaging and Handling Rate		Dollars/Ft^3	Navy
Y	Life Cycle		Years	Navy
Y	Procurement Lead Time		Weeks	Contractor
Y	Safety Level		Weeks	Navy
Y	Discount Rate		Fraction	Navy
T	SE Support Factor (first year)		Fraction/Year	Contractor
T	SE Support Factor (succeeding year)		Fraction/Year	Contractor

TASK 102

LOR Analytical Techniques for Naval Air Systems Command Gas Turbine Engines

10. SCOPE.

10.1 Purpose. The Gas Turbine Engine Level of Repair (GTE-LOR) analytic techniques were developed to provide a means of examining all feasible repair alternatives for gas turbine engines within the constraints of existing Navy maintenance policies. The objective of the techniques is to determine the most economical maintenance concepts and plans for gas turbine engines.

10.2 General. The analyses performed incorporate several factors when establishing feasible repair alternatives. These include: (1) the inherent failure and repair characteristics of an item; (2) the indenture level or parts breakdown for discard, remove and replace, and repair actions; and, (3) the minimum maintenance level capable of performing these actions. The economic analytic techniques then allocate the repair alternatives costs in five major categories: (1) inventory which includes inventory administration; rotatable pool, attrition, and system stock inventories; repair materials; scrap material; and transportation; (2) support equipment which includes hardware cost and support of the hardware; (3) support required by inventory, repair work, and support equipment; (4) labor and training; (5) documentation.

10.2.1 Classification of Gas Turbine Engine into Indenture Levels. The basic gas turbine engine can be classified into five discrete indenture levels: the engine, EM (Engine Module), SEM (Sub-Engine Module), SSEM (Sub-Sub-Engine Module), and SSSEM (Sub-Sub-Sub-Engine Module).

10.2.1.1 Engine. The engine is the end article functional subsystem composed of EM's, SEM's, SSEM's, and SSSEM's.

10.2.1.2 Engine Module. An EM is a unit of the engine with the compressor, combustion section, and turbine sections as examples. Certain engines might also have fans as in the case of a turbo-fan engine and more than one turbine such as a low and high pressure turbine. These items are also considered EM's. All engines contain accessories necessary to the operation of the engine. Included in the accessories are fuel pumps, fuel controls, hydraulic pumps, generators, starters, and lubrication pumps. All accessories are classified as EM's.

10.2.1.3 Sub-Engine Module. The SEM is an assembly of the EM. Included in this group are compressor rotors and stators and turbine rotors and stators, turbine transition assemblies, etc.

10.2.1.4 Sub-Sub-Engine Module. The SSEM is a sub-assembly of the EM. SSEM's are items such as fan, compressor, and turbine blades, compressor rotor discs, combustion chamber liners, etc.

TASK 102 (Continued)

10.2.1.5 Sub-Sub-Sub-Engine Module. The SSSEM is a sub-sub-assembly of the EM.

10.2.2 Maintenance Assignments.

10.2.2.1 Repair Definition. For the purposes of these analyses, the repair of an item is defined as the removal and replacement of a failed lower indenture assembly to include fault verification, fault isolation, and replacement of the failed lower assembly and test.

10.2.2.2 Discard Definition. Failures removed from a higher assembly are discarded at sites of a designated maintenance capability. Discard includes any required fault verification or demilitarization actions.

10.2.2.3 Three Degrees of Intermediate Maintenance. The intermediate maintenance level is divided into three unique levels of repair capability: first degree, second degree, and third degree. The engine LOR analytic techniques may show that certain remove and replace, repair, and discard functions presently assigned a specific degree of failure classification may be performed more economically if assigned a different degree of failure classification.

10.2.2.3.1 First Degree Intermediate Maintenance. First degree maintenance is the repair of gas turbine engines to a depth which includes and goes beyond that repair authorized for second and third degree IMA's (Intermediate Maintenance Activities), but not to the extent required to perform overhaul. First degree repair is also CER (Complete Engine Repair), which includes compressor rotor replacement or disassembly to the extent that the compressor rotor assembly can be removed. Activities specifically designated as first degree repair sites will be outfitted to accomplish CER as well as lesser degree of repair including incorporation of all technical directives (changes or bulletins) below the depot level of maintenance.

10.2.2.3.2 Second Degree Intermediate Maintenance. Second degree maintenance is the repair of a damaged or non-operating engine, its accessories or components to an acceptable operating condition. Repair by designated IMA's includes the repair and replacement of turbine rotors and combustion sections, including afterburners. Also authorized are the replacement of externally damaged, deteriorated or time limited components, gearboxes or accessories, and conducting engine calendar or equivalent inspections. In addition, minor repair to the compressor section is authorized. In the case of turbo-shaft engines the repair or replacement of reduction gearboxes and torque shafts which are considered repairable within the limits of the approved intermediate maintenance handbooks shall be done by second degree IMA's. Activities authorized to perform second degree repair will also have third degree repair capability.

TASK 102 (Continued)

10.2.2.3.3 Third Degree Intermediate Maintenance. Third degree maintenance is the repair of a damaged, or non-operating engine, its accessories or components to an acceptable operating condition as cited in second degree repair. However, certain functions that require high maintenance manhours and are of low incident rate will be deleted from third degree repair responsibilities.

TASK 102 (Continued)

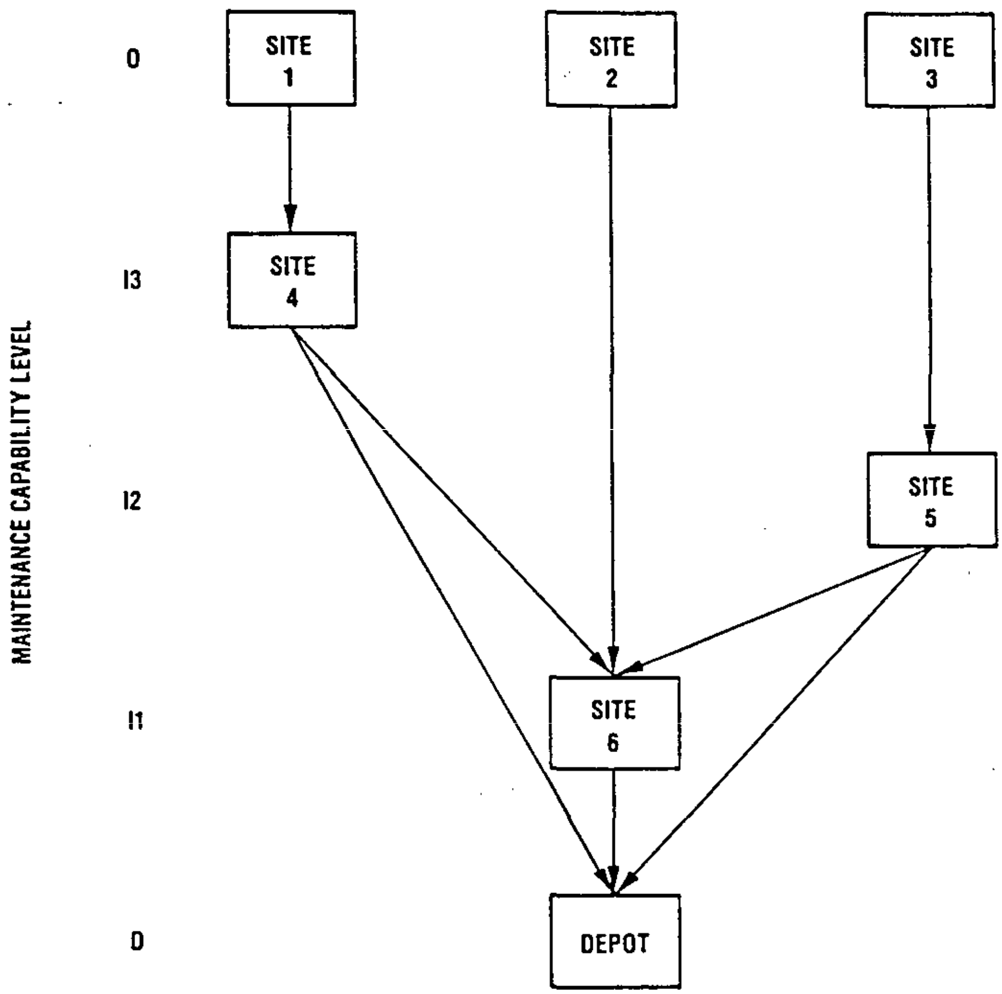


FIGURE 1. Site configuration.

TASK 102 (Continued)

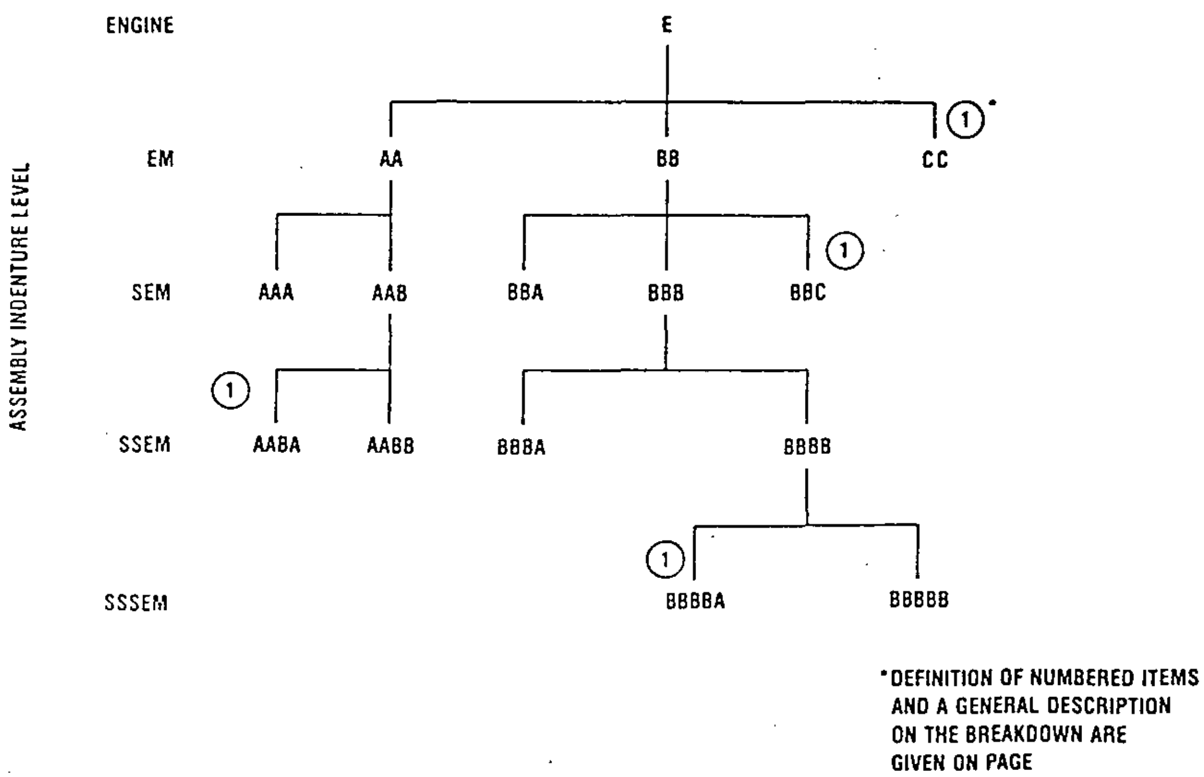


FIGURE 2. Engine breakdown.

TASK 102 (Continued)

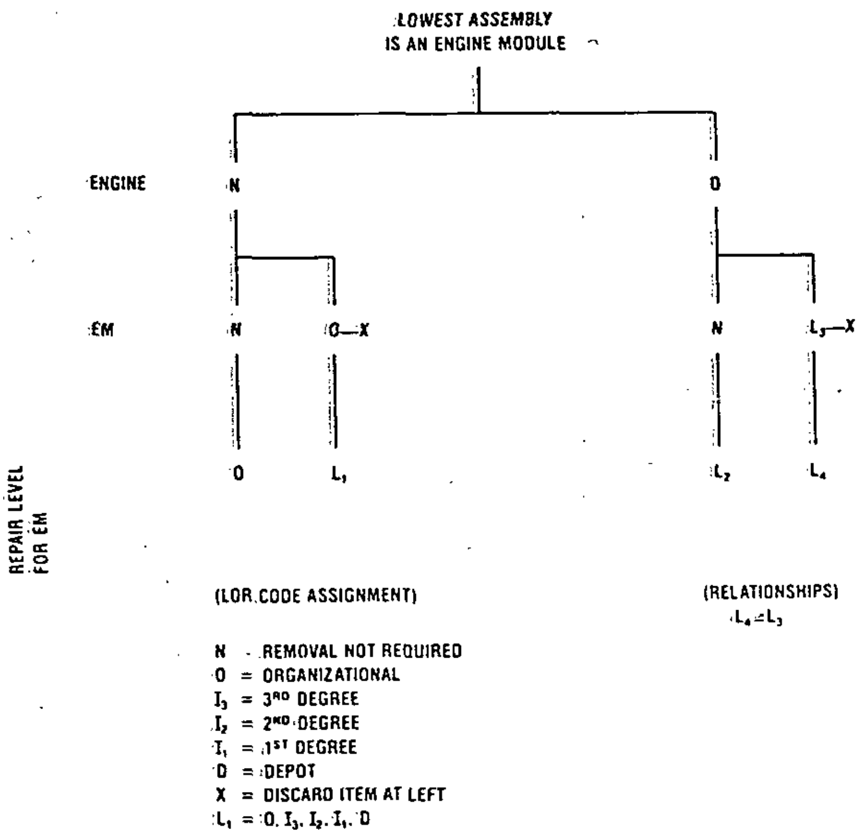
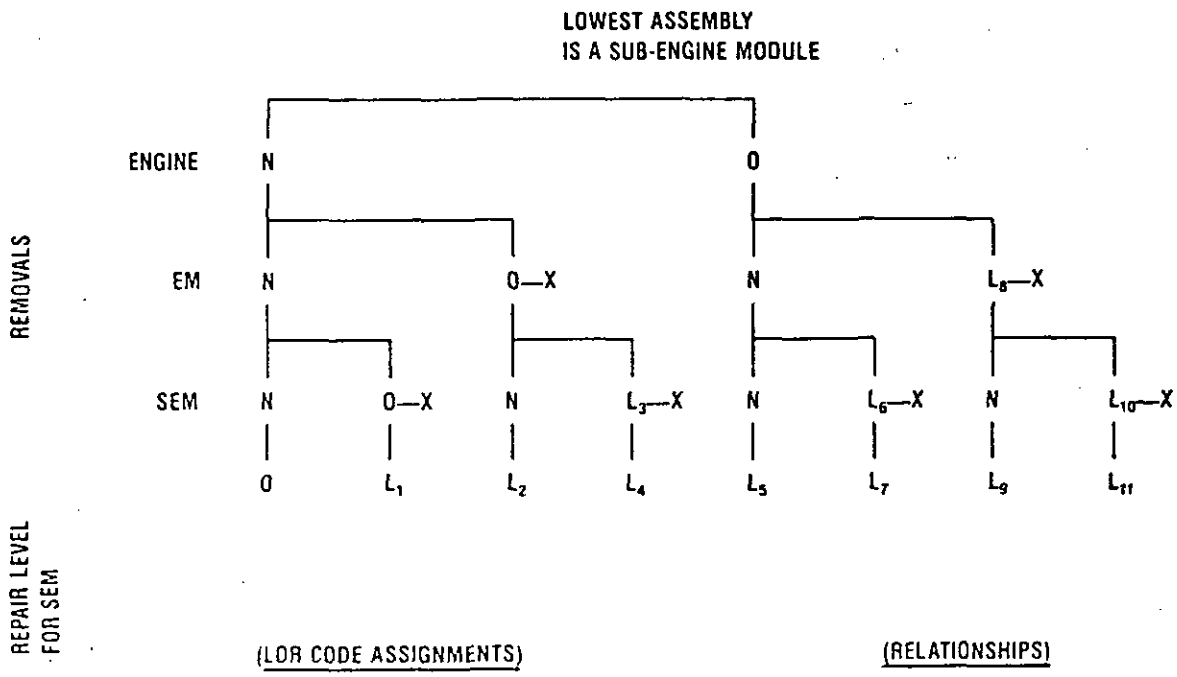


FIGURE 3. Maintenance alternatives for lowest assembly engine modules.

TASK 102 (Continued)



(LOR CODE ASSIGNMENTS)

N = REMOVAL NOT REQUIRED
O = ORGANIZATIONAL
I_3 = 3RD DEGREE
I_2 = 2ND DEGREE
I_1 = 1ST DEGREE
D = DEPOT
X = DISCARD ITEM AT LEFT
L_i = O, I_3, I_2, I_1, D

(RELATIONSHIPS)

$L_4 \geq L_3$ $L_9 \geq L_8$
$L_7 \geq L_6$ $L_{11} \geq L_{10} \geq L_9$

FIGURE 4. Maintenance alternatives for lowest assembly sub-engine modules.

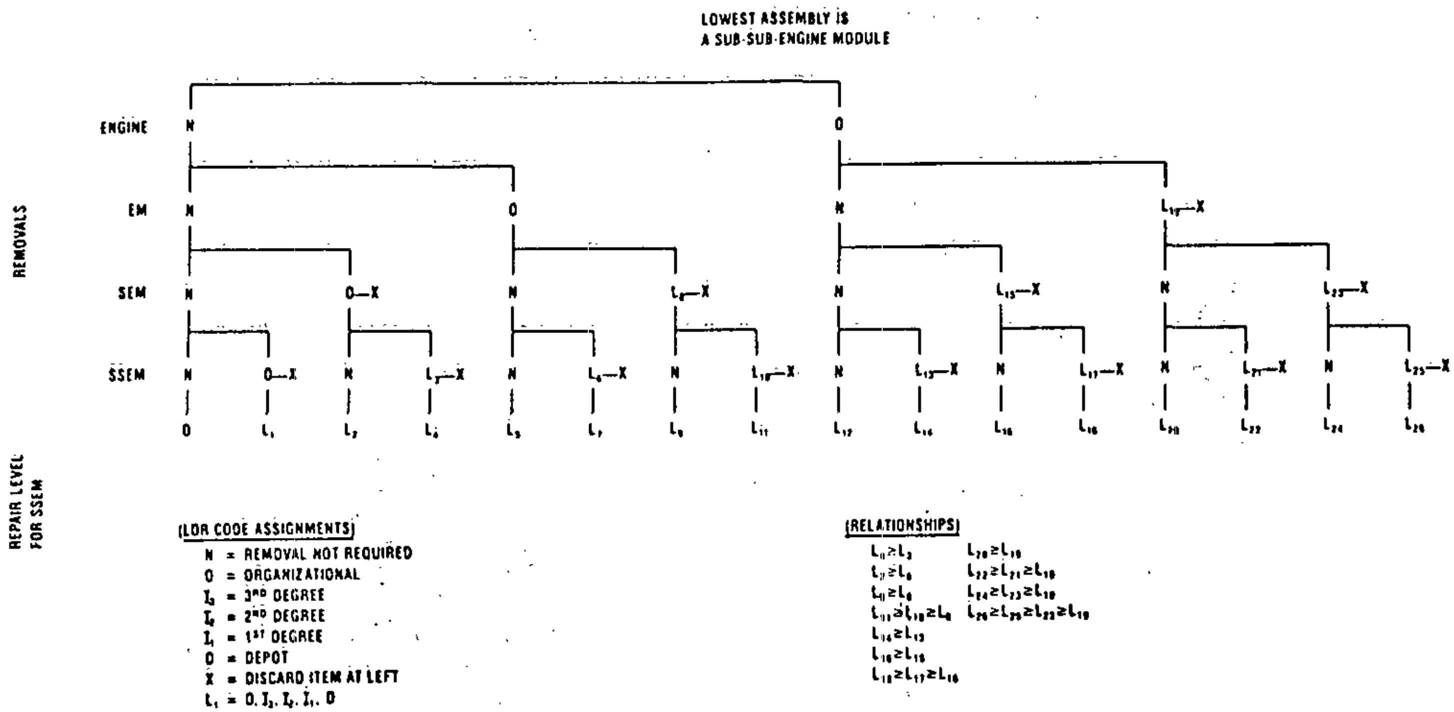


FIGURE 5. Maintenance alternatives for a sub-sub-engine lowest assemblies.

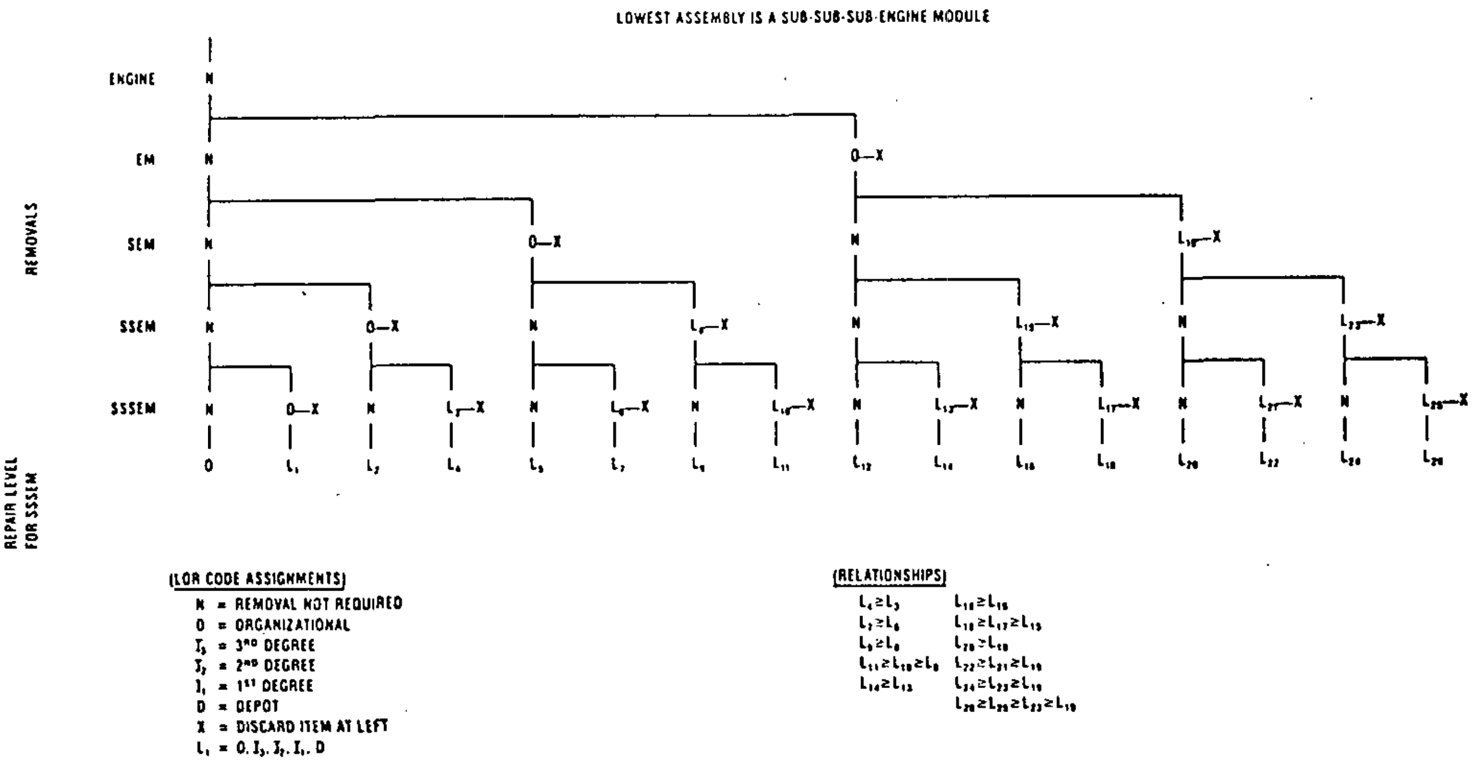
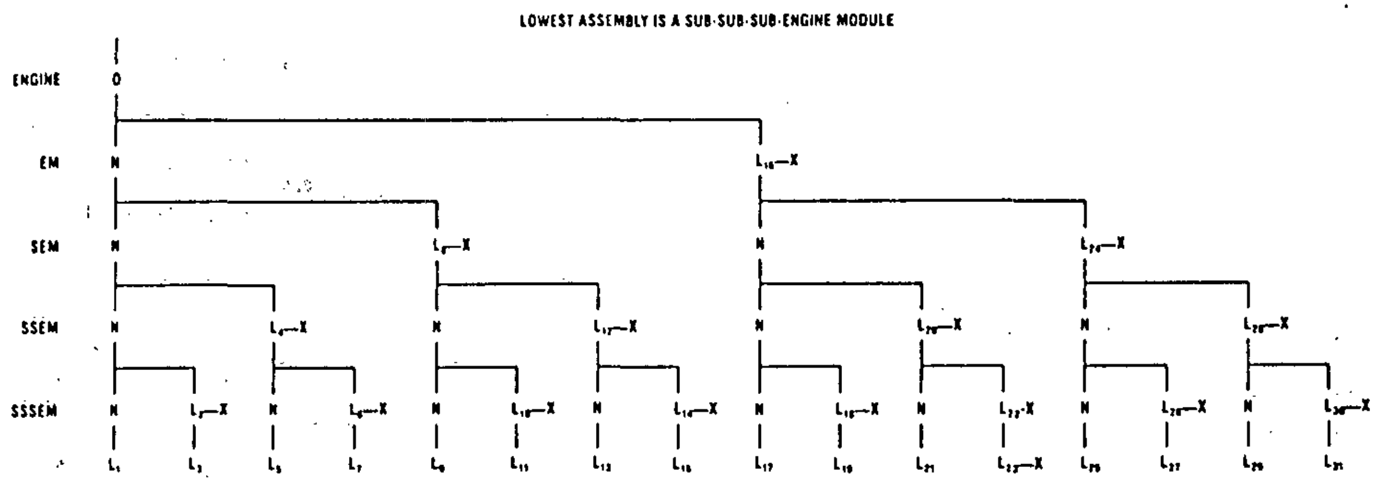


FIGURE 6. Maintenance alternatives for a sub-sub-sub-engine module lowest assembly when engine removal is not required.



REPAIR LEVEL FOR SSEM

(LOR CODE ASSIGNMENTS)

- N = REMOVAL NOT REQUIRED
- O = ORGANIZATIONAL
- I_3 = 3RD DEGREE
- I_2 = 2ND DEGREE
- I_1 = 1ST DEGREE
- D = DEPOT
- X = DISCARD ITEM AT LEFT
- L_n = O, I_3, I_2, I_1, D

(RELATIONSHIPS)

$L_3 \geq L_2$
$L_5 \geq L_4$
$L_7 \geq L_6 \geq L_4$
$L_9 \geq L_8$
$L_{11} \geq L_{10} \geq L_8$
$L_{13} \geq L_{12} \geq L_8$
$L_{15} \geq L_{14} \geq L_{12} \geq L_8$
$L_{17} \geq L_{16}$
$L_{19} \geq L_{18} \geq L_{16}$
$L_{21} \geq L_{20} \geq L_{16}$
$L_{23} \geq L_{22} \geq L_{20} \geq L_{16}$
$L_{25} \geq L_{24} \geq L_{16}$
$L_{27} \geq L_{26} \geq L_{24} \geq L_{16}$
$L_{29} \geq L_{28} \geq L_{24} \geq L_{16}$
$L_{31} \geq L_{30} \geq L_{28} \geq L_{24} \geq L_{16}$

FIGURE 7. Maintenance alternatives for a sub-sub-sub-engine module lowest assembly when engine removal is required.

TASK 102 (Continued)

Description of LOR Code Assignment Procedure for Selecting Maintenance Alternatives

The repair actions listed in the maintenance alternatives given in Figures 3 through 7 refer only to those assemblies for which there are no lower indenture parts under consideration in these analyses. These assemblies are designated lowest assemblies. For instance, in Figure 2, CC, BBC, and BBBBA are all lowest assemblies. For all other items, repair consists of the removal and replacement of a lower assembly.

Every failure is assumed to be caused by the failure of a lowest assembly. The trees in Figures 3 through 7 give all possible maintenance alternatives generated by the failure of a lowest assembly. The branches of the tree are translated in the analyses to a maintenance allocation vector for each lowest assembly. The vector has six positions. The first five positions indicate whether removal of the item in that node of the engine breakdown tree is required so that the action indicated in the sixth position can be performed. If removal is not required the position is filled with an N, otherwise it is filled with the maintenance level authorized to perform the removal and replacement. If the breakdown does not go to the fifth level, all positions not needed are filled with 99's. If the sixth position is positive, the lowest assembly will be repaired at any site which is of this authorized level or greater. If the sixth position is negative, the last item given in the vector as being removed and replaced will be discarded at sites of the indicated level of maintenance.

There are found in both the trees given in the figures and in the maintenance allocation vectors described above. The first action that appears in a branch of the tree or in the vector must occur at the organizational site. Second, the maintenance level chosen to perform an action must be at least as capable as the level chosen for the previous action. In the figures this requirement is given as a listing of relationships.

As an example:

Engine=E, EM=AA, SEM=AAB, SSEM=AABA

Maintenance Allocation	E	EM	SEM	SSEM	SSSEM	R/D
Vector for AABA	O	I3	N	I2	99	D

The above maintenance allocation vector indicates that removal of the engine at the O = organizational level is required. The EM must also be removed and the I3 = third degree intermediate level is authorized. The SEM need not be removed, but the SSEM is removed and the authorized level is I2 = second degree intermediate level. The 99 in the SSSEM position indicates that AABA the SSEM is the lowest assembly on this branch of the engine breakdown. The positive D in the sixth position indicates that the SSEM is repaired at the D = depot level.

TASK 102 (Continued)

Maintenance Allocation Vector for AABA	E	EM	SEM	SSEM	SSSEM	R/D
	0	I3	N	98	99	D

All positions are the same except for the SSEM. Its position is now filled with a 98 which indicates that its repair does not require its removal from the engine module.

Maintenance Allocation Vector for AABA	E	EM	SEM	SSEM	SSSEM	R/D
	0	I3	I2	N	99	-I2

The failure of the SSEM = AABA is corrected by removing the engine at the organizational level. The EM at a third degree or greater site, the removal of the SEM at a second degree or greater site, and the discard of the SEM at that site.

TASK 102 (Continued)

10.2.3 LOR Technique Assumptions.

10.2.3.1 Logistic Support Costs. The technique considers the logistic support cost associated with the cost elements and does not consider research and development, or production costs.

10.2.3.2 Site Configuration. Each site under consideration in the analyses is assigned to a site of higher capability to form a site by maintenance capability tree as in Figure 1.

10.2.3.3 LOR Beyond Capability of Maintenance Actions. Gas turbine engine failures and the resulting actions occur aboard CV's (Aircraft Carriers), at NAS's (Naval Air Stations), and at MCAS's (Marine Corps Air Stations). Each CV, NAS, and MCAS is assigned a specific degree IMA. If a repair cannot be performed at a particular site, the entire engine or a unit, assembly, subassembly, or a sub-subassembly (EM, SEM, SSEM, or SSSEM respectively) of that engine is sent to the site designated in the site configuration as being authorized to perform the repair. It is not assumed that a site performs all authorized repairs. A rate for each item and designated maintenance level is given as input to account for Beyond Capability of Maintenance (BCM) Action Taken Codes 2 to 8.

10.2.3.4 Maintenance Alternatives. An equipment breakdown and possible maintenance alternatives are given in Figures 2 through 7.

10.2.4 Basic Parameters.

10.2.4.1 Discount Rates. The discount rate accounts for the time value of money and determines the actual present value of a cost element. Costs within each cost element are calculated on a yearly basis and adjusted by using the appropriate discount rate.

10.2.4.2 Failure Rates. Each lowest assembly is assigned two values essential to determining the failure rate of the item. They are the failure category, and the inherent repair characteristics.

10.2.4.2.1 Failure Category. There are three failure categories and they indicate how the failure or impending failure of a part is to be handled.

10.2.4.2.1.1 Category I. Category I items are removed and replaced immediately upon failure.

10.2.4.2.1.2 Category II. Category II items are removed and replaced only at predesignated intervals. The failure does not degrade the performance to a degree that immediate action is needed to preserve mission readiness, for instance, the item may be one item in a redundant set.

10.2.4.2.1.3 Category III. Category III items are mission critical and cannot be allowed to fail. The items are inspected at predesignated intervals and are removed when in a degraded state.

TASK 102 (Continued)

10.2.4.2.2 Inherent Repair Characteristics. There are three inherent repair classifications.

10.2.4.2.2.1 Class A. Class A items are consumables.

10.2.4.2.2.2 Class B. Class B items are repaired to a pre-failure condition, that is, upon repair items in Class B will have the same hazard rate as identical items of the same age which have not undergone repair.

10.2.4.2.2.3 Class C. Class C items are repaired to a zero-time condition, that is, upon repair the Class C item will have the same hazard rate as new items.

10.2.4.3 Failure Rates for Lowest Assemblies. Failure rates as a function of operating hours are calculated using the assumption that the assembly's failure distribution is Weibull. The technique uses the assembly's Weibull shape parameter, its mean time between failure, the failure category, and the inherent repair class to generate the function.

10.2.4.4 Annual Failures of the j^{th} Lowest Assembly at the i^{th} User Site.

10.2.4.4.1 Annual j^{th} Lowest Assembly Operating Hours at the i^{th} User Site.

$$ANOP(i,j) = \begin{pmatrix}\text{Ratio of Engine} \\ \text{Operating Hours} \\ \text{to Flight Hours}\end{pmatrix} \begin{pmatrix}\text{Flight Utilization} \\ \text{Factor of } j^{th} \\ \text{Lowest Assembly}\end{pmatrix} \begin{pmatrix}\text{12 months} \\ \text{per year}\end{pmatrix} \begin{pmatrix}\text{Avg. No. of Flight Hours} \\ \text{per Month per Engine at} \\ i^{th} \text{ User Site}\end{pmatrix} \begin{pmatrix}i^{th} \text{ User Site} \\ \text{Deployment} \\ \text{Factor}\end{pmatrix}$$

10.2.4.4.2 Annual Failure of a j^{th} Lowest Assembly in its k^{th} Year of Operation at the i^{th} User Site. The analytical technique establishes the array B (i,j,k) by determining the age in operating hours of the j^{th} lowest assembly in its k^{th} year of operation at the i^{th} user site.

10.2.4.4.3 Number of j^{th} Lowest Assemblies Entering Service at the i^{th} User Site During the k^{th} Year of the Engine Lifecycle.

$$A(i,j,k) = \begin{pmatrix}\text{No. of Engines Placed in Service} \\ \text{at the } i^{th} \text{ User Site During the} \\ k^{th} \text{ Year of the Engine Lifecycle}\end{pmatrix} \begin{pmatrix}\text{No. of Identical} \\ j^{th} \text{ Lowest Assemblies} \\ \text{per Engine}\end{pmatrix}$$

TASK 102 (Continued)

10.2.4.4.4 Number of Failures of j^{th} Lowest Assemblies at the i^{th} User Site in the n^{th} Year of the Engine Lifecycle.

$$D(i,j,n) = \sum_{k=1}^{n} \left[\left(A(i,j,k) \right) \left(B(i,j,n-k+1) \right) \right]$$

$$= \sum_{k=1}^{n} \left[\left(\begin{array}{c} \text{No. of } j^{th} \text{ Lowest Assemblies} \\ \text{Entering Service in Year k} \\ \text{at the } i^{th} \text{ User Site} \end{array} \right) \left(\begin{array}{c} \text{Annual Failures of } j^{th} \text{ Lowest} \\ \text{Assemblies During Its } (n\text{-}k)^{th} \text{ Year} \\ \text{of Operation at the } i^{th} \text{ User Site} \end{array} \right) \right]$$

10.2.4.5 Annual Removals of an Item. The annual number of removals of an item is generated by real failures to lowest assemblies. The value calculated takes into consideration false removals and scrap rates for higher assemblies removed. The calculation is done lowest assembly by lowest assembly and for each lowest assembly's failures, removals are calculated recursively down the engine tree from the engine to the lowest assembly.

10.2.4.5.1 The Number of Removals of Failed Item a in Year k at the Site s Generated by the Failure of the j^{th} Lowest Assembly at the i^{th} User Site. If a is the engine or the first item removed, then

$$T(a,k,s,i,j) = D(i,j,n)$$

else

$$T(a,k,s,i,j) = \left(\begin{array}{c} \text{No. of Item a}\sim \text{ Awaiting Restoration} \\ \text{at Site s in Year k Due to} \\ \text{Failures of the } j^{th} \text{ Lowest Assembly} \\ \text{at the } i^{th} \text{ User Site} \end{array} \right) \left[1 - \left(\begin{array}{c} \text{Beyond Capability of} \\ \text{Maintenance Rate for} \\ \text{Item a}\sim \text{ at site s} \end{array} \right) \right]$$

where a~ is the higher assembly from which a is removed.

10.2.4.5.2 Annual Removals of Item a in Year k at Site s Generated by the Failure of the j^{th} Lowest Assembly at the i^{th} User Site.

$$R(a,k,s,i,j) = T(a,k,s,i,j) \left[1 + \left(\begin{array}{c} \text{False Removal} \\ \text{Rate for Item a} \end{array} \right) \right]$$

R(a,k,s,i,j) is the total number of removals.

10.2.4.5.3 Disposition of Removed Item a. For item a there are two possibilities, restoration to ready for issue status and discard.

TASK 102 (Continued)

10.2.4.5.3.1 Number of Item a Discards Generated at Site s in the k^{th} Year Due to Failure of the j^{th} Lowest Assembly at the i^{th} User Site. If the maintenance option for disposition of item a due to failures of the j^{th} lowest assembly is discard the value is equal to the number of removals.

$$DS(a,k,s,i,j) = R(a,k,s,i,j)$$

10.2.4.5.3.2 Number of Item a at Site s Awaiting Restoration to Ready for Issue Status in the k^{th} Year Due to Failures of j^{th} Lowest Assembly at the i^{th} User Site. If the maintenance option for disposition of item a due to failures of the j^{th} lowest assembly is restoration of to ready for issue status, the number of removals must be adjusted to account for scrappage, and then for items found to be beyond capability of maintenance.

$$RS(a,k,s,i,j) = \left\{ R(a,k,s,i,j) \left[1 - \begin{pmatrix} \text{Scrap Rate} \\ \text{for Item a} \end{pmatrix} \right] + \begin{pmatrix} \text{No. of Item a Sent to Site s From Lower} \\ \text{Sites Due to Failures of the } j^{th} \text{ Lowest} \\ \text{Assembly in Year k at the } i^{th} \text{ User Site} \end{pmatrix} \right\} \left[1 - \begin{pmatrix} \text{Beyond Capability of Maintenance} \\ \text{Rate for Item a at Site s} \end{pmatrix} \right]$$

If a is not a lowest assembly, restoration to ready for issue status involves removal and replacement of lower assemblies, if a is the j^{th} lowest assembly RS(a,k,s,i,j) is the number of repairs of the j^{th} lowest assembly at site s.

10.2.4.5.3.3 Number of Item a at Site s Scrapped in Year k Due to Failures of the j^{th} Lowest Assembly at the i^{th} User Site.

$$S(a,k,s,i,j) = R(a,k,s,i,j) \left[1 - \begin{pmatrix} \text{Scrap Rate} \\ \text{for Item a} \end{pmatrix} \right]$$

10.2.4.5.4 Number of Removals of Item a at Site s in Year k.

$$RT(a,k,s) = \sum_{\substack{\text{User} \\ \text{Site} \\ i}} \sum_{\substack{\text{Lowest} \\ \text{Assembly} \\ j}} R(a,k,s,i,j)$$

Where R(a,k,s,i,j) will be zero if the i^{th} user site does not ship to site s, and if j is not a or a lower assembly of a.

TASK 102 (Continued)

10.2.4.5.5 Number of Item a at Site s to be Discarded in Year k.

$$DST(a,k,s) = \sum_{\substack{\text{User Site}\\ i}} \sum_{\substack{\text{Lowest Assembly}\\ j}} DS(a,k,s,i,j)$$

Where DS(a,k,s,i,j) will be zero if the i^{th} user site does not ship to site s, and if j is not a or a lower assembly of a.

10.2.4.5.6 Number of Item a at Site s Awaiting Restoration to Ready for Issue Status in Year k.

$$RST(a,k,s) = \sum_{\substack{\text{User Site}\\ i}} \sum_{\substack{\text{Lowest Assembly}\\ j}} RS(a,k,s,i,j)$$

Where RS(a,k,s,i,j) will be zero if the i^{th} user site does not ship to site s, and if j is not a or a lower assembly of a.

10.2.4.5.7 Number of Item a at Site s to be Scrapped in Year k.

$$ST(a,k,s) = \sum_{\substack{\text{User Site}\\ i}} \sum_{\substack{\text{Lowest Assembly}\\ j}} S(a,k,s,i,j)$$

Where S(a,k,s,i,j) will be zero if the i^{th} user site does not ship to site s, and if j is not a or a lower assembly of a.

10.3 Cost Element Equations.

10.3.1 Inventory Costs.

10.3.1.1 Inventory Administration Cost. Inventory administration cost is the cost associated with entering an item into the supply system and retaining it there over its lifecycle. The LOR analytical techniques treat the inventory cost as proportional to the number of equipment peculiar items entered in the NSN (National Stock Number) system. The cost is a function of three separate costs: item entry, item retention, and field supply administration. Item entry is a one-time cost per peculiar NSN incurred during the inventory procurement process to establish a NSN for an item. Item retention is a

TASK 102 (Continued)

recurring cost due to maintaining the item in the NSN system. Field Supply Administration is a per site cost annually incurred for local management of the item.

10.3.1.1.1 Inventory Administration Cost for the Discard Cases. The administration cost incurred for discard of local and system management of the discarded item in the NSN system. The cost is calculated on a yearly basis for each year of the lifecycle.

$$\begin{pmatrix}\text{Inventory}\\ \text{Administration}\\ \text{Cost for Discard}\end{pmatrix} = \begin{pmatrix}\text{NSN System}\\ \text{Cost Per}\\ \text{Number}\end{pmatrix} + \left[\begin{pmatrix}\text{Field Supply}\\ \text{Administration}\\ \text{Cost Per Number}\end{pmatrix}\begin{pmatrix}\text{No. of Sites}\\ \text{Removing and/or}\\ \text{Discarding Item}\end{pmatrix}\right]$$

where,

$$\begin{pmatrix}\text{NSN System}\\ \text{Cost Per}\\ \text{Number}\end{pmatrix} = \begin{cases}\text{Item Entry Cost} & \text{if Year} = 1\\ \text{Item Retention Cost} & \text{otherwise.}\end{cases}$$

10.3.1.1.2 Inventory Administration Cost Equation for the Restoration/Repair Case. The administration cost incurred for repair is the cost of local management, entry, and retention of the repairable item and its peculiar components or piece parts in the NSN system excluding those lower indenture parts under analysis.

$$\begin{pmatrix}\text{Inventory}\\ \text{Administration}\\ \text{Cost for Repair}\end{pmatrix} = \left\{\begin{pmatrix}\text{NSN System}\\ \text{Cost Per}\\ \text{Number}\end{pmatrix} + \left[\begin{pmatrix}\text{Field Supply}\\ \text{Administration}\\ \text{Cost Per Number}\end{pmatrix}\begin{pmatrix}\text{No. of Sites}\\ \text{Removing and/or}\\ \text{Discarding Item}\end{pmatrix}\right]\right\}\left[\begin{pmatrix}\text{No. of Peculiar}\\ \text{Components in}\\ \text{NSN System}\end{pmatrix} + 1\right]$$

where:

$$\begin{pmatrix}\text{NSN System}\\ \text{Cost Per}\\ \text{Number}\end{pmatrix} = \begin{cases}\text{Item Entry Cost} & \text{if Year} = 1\\ \text{Item Retention Cost} & \text{otherwise.}\end{cases}$$

10.3.1.1.3 Annual Inventory Administration Cost.

$$\begin{pmatrix}\text{Total Inventory}\\ \text{Administration}\\ \text{Cost for Item a}\\ \text{in Year k}\end{pmatrix} = \left[\begin{pmatrix}\text{Inventory}\\ \text{Administration}\\ \text{Cost for Repair}\\ \text{of Item a in Year k}\end{pmatrix} + \begin{pmatrix}\text{Inventory}\\ \text{Administration}\\ \text{Cost for Discard}\\ \text{of Item a in Year k}\end{pmatrix}\right]\begin{pmatrix}\text{Discount Rate}\\ \text{for Year k}\end{pmatrix}$$

TASK 102 (Continued)

10.3.1.2 Spares Inventory Cost Equations.

10.3.1.2.1 Inventory Quantity for Discard. The discard inventory quantity is the number of spares required during the system lifecycle to account for discard maintenance actions. The inventory quantity for each item to be discarded is calculated on an annual basis for each site. Collocated sites have their demands combined and assigned to the site of lowest capability.

10.3.1.2.1.1 Annual Inventory Cost for Discard of an Item.

$$\begin{pmatrix}\text{Total Inventory Cost}\\ \text{for Discard of Item a}\\ \text{in Year k}\end{pmatrix} = \left[\begin{pmatrix}\text{Unit Cost}\\ \text{of Item a}\end{pmatrix} - \begin{pmatrix}\text{Salvage Value}\\ \text{of Item a}\end{pmatrix}\right]\begin{pmatrix}\text{Discount}\\ \text{Rate for}\\ \text{Year k}\end{pmatrix}\sum_{\substack{\text{Site}\\ s}} \text{DST(a,k,s)}$$

10.3.1.2.2 Repairable Inventory Quantity Equation. The repairable inventory quantity consists of a rotatable pool quantity, attrition quantity, and a system stock quantity.

10.3.1.2.2.1 Rotatable Pool Quantity Equation. The rotatable pool is stocked at the sites where aircraft operate to allow immediate replacement of items repaired at the site. A rotatable pool quantity is determined for each operational site in accordance with Figure 8. The rule works on the raw or non-integerized pool quantities.

$$\text{RRP(a,k,i)} = \begin{pmatrix}\text{Raw Rotatable Pool}\\ \text{Quantity of the a}^{\text{th}}\\ \text{Item in the k}^{\text{th}}\text{ Year}\end{pmatrix}$$

$$= \frac{\displaystyle\sum_{\substack{\text{lowest}\\ \text{assembly}\\ j}} \left\{ [\text{RS(a,k,i,i,j)} + \text{RS(a,k,s,i,j)}] \begin{pmatrix}\text{Repair Cycle at}\\ \text{User Site i/}\\ \text{Collocated Higher}\\ \text{Capable Site s}\end{pmatrix} \right\}}{(\text{365 Days Per Year}) \begin{pmatrix}\text{User Site i's}\\ \text{Deployment Factor}\end{pmatrix}}$$

Site s is a collocated site of higher capability. If s does not exist RS(a,k,s,i,j) is zero for each j.

TASK 102 (Continued)

10.3.1.2.2.2 Attrition Quantity Equation. The attrition quantity is a replenishment quantity stocked at sites where aircraft operate to replace those items not repairable or restorable to ready for issue status at the site. These items are BCM or scrapped and, therefore, not available to the site's supply system. The attrition quantity is computed for individual sites, and determined from the raw attrition quantity by the method given as Figure 8.

$$RAR(a,k,i) = \begin{pmatrix} \text{Raw Attrition Quantity of} \\ \text{the } a^{th} \text{ Item in the } k^{th} \\ \text{Year at the } i^{th} \text{ User Site} \end{pmatrix}$$

$$= \left[\sum_{\substack{\text{lowest} \\ \text{assembly} \\ j}} \left\{ [R(a,k,i,i,j) + R(a,k,s,i,j)] \begin{pmatrix} \text{Scrap Rate} \\ \text{for } a^{th} \text{ Item} \end{pmatrix} \right\} \right] \frac{\left[1 + \begin{pmatrix} \text{Beyond Capability} \\ \text{Rate of the } a^{th} \text{ Item} \\ \text{at site } s' \end{pmatrix} \right] \begin{pmatrix} \text{Required Days} \\ \text{of Stock at} \\ \text{User Site } i \end{pmatrix}}{(365 \text{ Days Per Year}) \begin{pmatrix} \text{User Site i's} \\ \text{Deployment Factor} \end{pmatrix}}$$

Site s is the collocated site of higher capability. If s exists, S' = S; otherwise, s' = i and the R(a,k,s,i,j) are zero for all j.

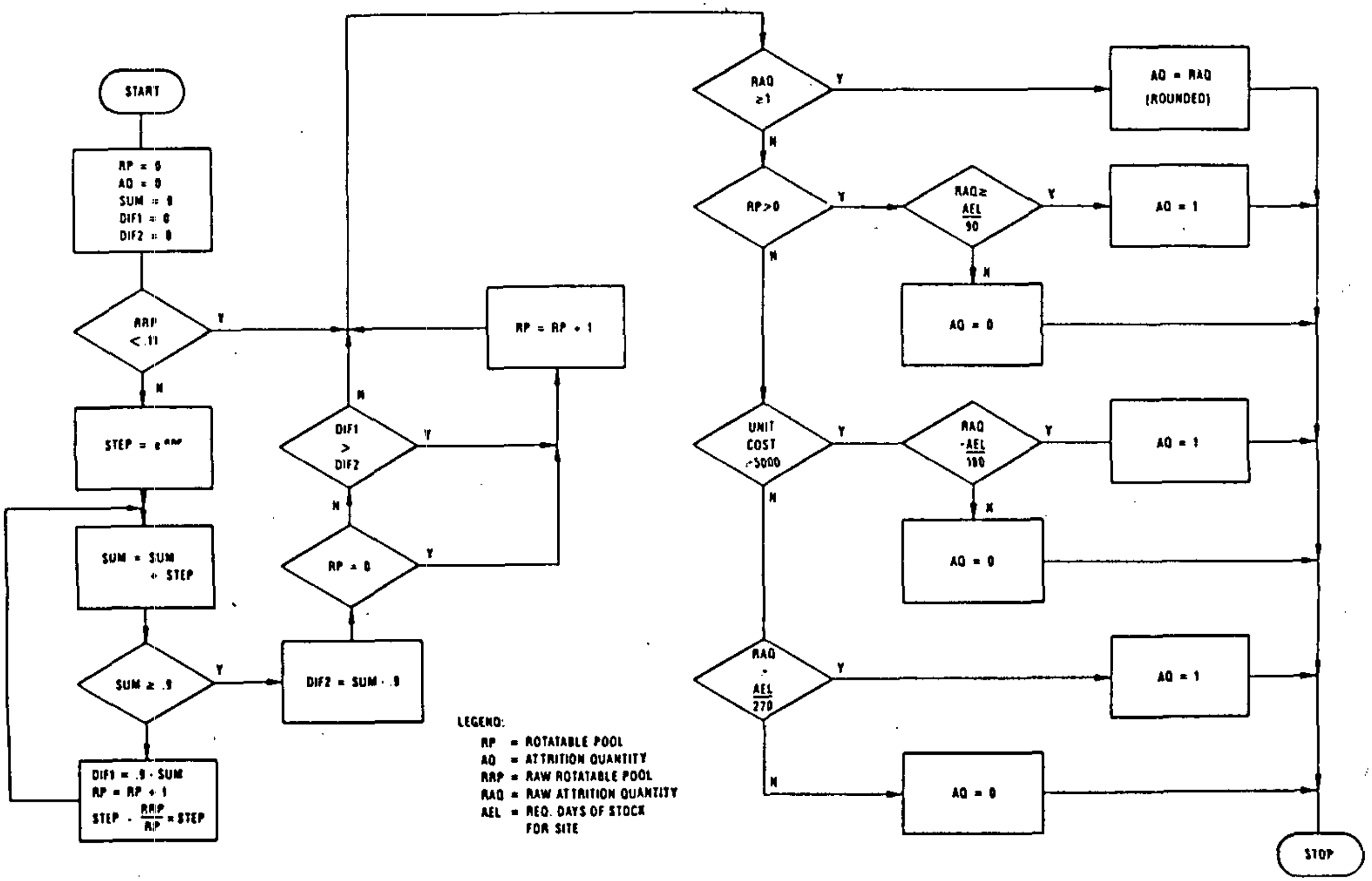


FIGURE 8. Computation of local allowances.

TASK 102 (Continued)

10.3.1.2.2.3 System Stock Quantity Equation. The system stock is a safety stock inventory quantity procured to satisfy demands due to anticipated losses during the procurement cycle, and pipeline quantities to account for repair cycle times exceeding required days of stock.

$$SYS(a,k) = \begin{pmatrix} \text{System Stock} \\ \text{of Item a} \\ \text{in Year k} \end{pmatrix}$$

$$= \left[\sum_{k}^{k+(P+SF)/52} \sum_{\substack{\text{Site} \\ s}} S(a,k,s) \right]$$

$$+ \left[\sum_{\substack{\text{Site} \\ s}} \sum_{\substack{\text{User} \\ \text{Site} \\ i}} \left\{ RS(a,k,s,i,j) \left[\begin{pmatrix} \text{Repair Cycle} \\ \text{Time From} \\ \text{Site i to s} \end{pmatrix} - \begin{pmatrix} \text{Required} \\ \text{Days of} \\ \text{Stock at i} \end{pmatrix} \right]^{*} \right\} \right]$$

P is the procurement lead time in weeks and SF is the systems safety lead given in weeks. If (P + SF)/52 is not an integer, the S(a,k,s) tasks for the final year are prorated.

*If the value of this term is negative, it is reset to zero.

10.3.1.2.2.4 Annual Repairable Inventory Quantity Equation. The total repairable inventory quantity is the summation of the rotatable pool, attrition, and system stock quantities.

$$\begin{pmatrix} \text{Total Repairable} \\ \text{Inventory Quantity} \\ \text{of Item a in Year k} \end{pmatrix} = \begin{pmatrix} \text{System Stock} \\ \text{Allowance of} \\ \text{Item a in} \\ \text{Year k} \end{pmatrix} + \sum_{\substack{\text{Site} \\ s}} \left[RP(a,k,s) + AQ(a,k,s) \right]$$

10.3.1.2.2.5 Annual Cost of Repairable Inventory. The total inventory allowance is calculated on an annual basis. The cost of the allowance is determined by considering the net change in the allowance. If the allowance has increased, the difference over the previous year's allowance is purchased. If the allowance has decreased no purchase is made and the net change is available to decrease the purchase of repair scrap.

$$\begin{pmatrix} \text{Total Repairable} \\ \text{Inventory Cost of} \\ \text{Item a in Year k} \end{pmatrix} = \begin{pmatrix} \text{Net Change Repairable} \\ \text{Inventory Quantity} \\ \text{of Item a in Year k} \end{pmatrix} \begin{pmatrix} \text{Unit Cost} \\ \text{of Item a} \end{pmatrix} \begin{pmatrix} \text{Discount} \\ \text{Rate for} \\ \text{Year k} \end{pmatrix}$$

TASK 102 (Continued)

10.3.1.3 Annual Cost of Repair Scrap. The repair scrap quantity is the inventory procured to replenish system stock. The annual cost is determined by finding the total number of the item scrapped during the year. If the net repairable allowance has decreased for the year, the excess allowance is charged against the purchase to replenish the system stock.

$$\begin{pmatrix}\text{Total Purchase}\\ \text{of Item a Repair}\\ \text{Scrap in Year k}\end{pmatrix} = \left(\sum_{\substack{\text{Site}\\ s}} ST(a,k,s)\right) + \begin{pmatrix}\text{Net change in Repairable}\\ \text{Inventory Quantity of}\\ \text{Item a in Year k}\end{pmatrix}^{*}$$

$$\begin{pmatrix}\text{Total Cost}\\ \text{of Item a Repair}\\ \text{Scrap in Year k}\end{pmatrix} = \begin{pmatrix}\text{Total Purchase}\\ \text{of Item a Repair}\\ \text{Scrap in Year k}\end{pmatrix}^{\#} \left[\begin{pmatrix}\text{Unit Cost}\\ \text{of Item a}\end{pmatrix} - \begin{pmatrix}\text{Salvage}\\ \text{Value of}\\ \text{Item a}\end{pmatrix}\right] \left(\sum_{\substack{\text{Site}\\ s}} ST(a,k,s)\right) \begin{pmatrix}\text{Discount}\\ \text{Rate for}\\ \text{Year k}\end{pmatrix}$$

* This term is included only when its value is negative.

\# If the total purchase is negative, this term is set to zero.

10.3.1.4 Repair Material Cost Equation. The repair material cost accounts for the cost of parts required per maintenance action, excluding those which are included in the analysis. The repair material cost is calculated on an annual basis.

10.3.1.4.1 Repair Material Cost Associated with Removal and Replacement of an Item.

$$\begin{pmatrix}\text{Annual Cost for}\\ \text{Material to}\\ \text{R\&R Item a}\\ \text{in Year k}\end{pmatrix} = \begin{pmatrix}\text{Unit Cost of}\\ \text{Material to}\\ \text{R\&R Item a}\end{pmatrix} \begin{pmatrix}\text{Discount}\\ \text{Rate for}\\ \text{Year k}\end{pmatrix} \sum_{\substack{\text{Site}\\ s}} RT(a,k,s)$$

10.3.1.4.2 Material Cost Associated with Discard or Scrapping of an Item.

$$\begin{pmatrix}\text{Annual Cost for}\\ \text{Material to}\\ \text{Discard Item a}\\ \text{in Year k}\end{pmatrix} = \begin{pmatrix}\text{Unit Cost of}\\ \text{Material to}\\ \text{Discard Item a}\end{pmatrix} \begin{pmatrix}\text{Discount}\\ \text{Rate for}\\ \text{Year k}\end{pmatrix} \sum_{\substack{\text{Site}\\ s}} \left[DST(a,k,s) + ST(a,k,s)\right]$$

TASK 102 (Continued)

10.3.1.4.3 Repair Material Cost Associated with Repair of Lowest Assemblies.

$$\begin{pmatrix}\text{Annual Cost for}\\ \text{Material to}\\ \text{Repair Item a}\\ \text{in Year k}\end{pmatrix} = \begin{pmatrix}\text{Unit Cost of}\\ \text{Material to}\\ \text{Repair Item a}\end{pmatrix}\begin{pmatrix}\text{Discount}\\ \text{Rate for}\\ \text{Year k}\end{pmatrix}\sum_{\substack{\text{Site}\\ s}}\ \sum_{\substack{\text{User Site}\\ i}} RS(a,k,s,i,a)$$

10.3.1.4.4 Annual Cost of Repair Material.

$$\begin{pmatrix}\text{Total Cost of}\\ \text{Repair Material}\\ \text{Associated with}\\ \text{Item a in Year k}\end{pmatrix} = \begin{pmatrix}\text{Annual Cost for}\\ \text{Material to R\&R}\\ \text{Item a in Year k}\end{pmatrix} + \begin{pmatrix}\text{Annual Cost for}\\ \text{Material to Discard}\\ \text{Item a in Year k}\end{pmatrix} + \begin{pmatrix}\text{Annual Cost for}\\ \text{Material to Repair}\\ \text{Item a in Year k}\end{pmatrix}^{*}$$

*This term is zero for all but the lowest assemblies.

10.3.1.5 Transportation Costs. These are the costs of packaging, handling, and transporting for purposes of repair or replenishment, item inventories to and from operational, repair, and resupply sites. The costs are functions of packaging and handling rates per item and transportation rates per pound from site to site, and are computed by site.

$$\begin{pmatrix}\text{Total Cost of}\\ \text{Transportation}\\ \text{for Item a in}\\ \text{Year k}\end{pmatrix} = \left[2 \times \sum_{\substack{\text{Site}\\ s}}\ \sum_{\substack{\text{Site}\\ r}} \left\{\begin{pmatrix}\text{Number of Item a}\\ \text{Sent from Site r}\\ \text{to Site s in Year k}\end{pmatrix}\begin{pmatrix}\text{Discount}\\ \text{Rate for}\\ \text{Year k}\end{pmatrix}\left[\begin{pmatrix}\text{Cost per Pound to}\\ \text{Ship from Site r}\\ \text{to Site s}\end{pmatrix}\begin{pmatrix}\text{Weight of}\\ \text{Item a}\end{pmatrix} + \begin{pmatrix}\text{Packing}\\ \text{Cost for}\\ \text{Item a}\end{pmatrix}\right]^{*}\right\}\right]$$

$$+ \sum_{\substack{\text{Site}\\ s}} \left\{\left[S(a,k,s) + DS(a,k,s)\right]\begin{pmatrix}\text{Discount}\\ \text{Rate for}\\ \text{Year k}\end{pmatrix}\left[\begin{pmatrix}\text{Cost per Pound to}\\ \text{Ship from Site s}\\ \text{to the Depot}\end{pmatrix}\begin{pmatrix}\text{Weight of}\\ \text{Item a}\end{pmatrix} + \begin{pmatrix}\text{Packing}\\ \text{Cost for}\\ \text{Item a}\end{pmatrix}\right]^{*}\right\}$$

*If the sites are collocated there is no transportation cost and the packing term is also set to zero.

TASK 102 (Continued)

10.3.1.6 Total Inventory Cost.

$$\begin{pmatrix}\text{Total}\\\text{Inventory}\\\text{Cost}\end{pmatrix} = \sum_{\substack{\text{Year}\\k}} \sum_{\substack{\text{Item}\\a}} \left[\begin{pmatrix}\text{Total Cost of Inventory}\\\text{Administration for Item}\\a\text{ in Year }k\end{pmatrix} + \begin{pmatrix}\text{Total Inventory Cost}\\\text{for Discard of Item}\\a\text{ in Year }k\end{pmatrix} + \begin{pmatrix}\text{Total Repairable}\\\text{Inventory Cost of}\\\text{Item }a\text{ in Year }k\end{pmatrix} + \begin{pmatrix}\text{Total Cost of}\\\text{Item }a\text{ Repair}\\\text{Scrap in Year }k\end{pmatrix} + \begin{pmatrix}\text{Total Cost of}\\\text{Item }a\text{ Repair}\\\text{Material in Year }k\end{pmatrix} + \begin{pmatrix}\text{Total Cost of}\\\text{Transportation}\\\text{for Item }a\text{ in Year }k\end{pmatrix} \right]$$

10.3.2 Support Equipment Cost. Support equipment costs include the cost to procure support equipment, the cost to set up the support equipment, and the cost to maintain the equipment. The cost is determined by year and site. Figure 9 gives the method for determining each maintenance level's support equipment needs.

10.3.2.1 First Year Support Equipment Cost. The first year support equipment cost is calculated per site. The first year of the life cycle that maintenance actions are performed at the site is determined and the cost of establishing and supporting the equipment is determined for that year.

$$\begin{pmatrix}\text{Cost of Support}\\\text{Equipment at Site}\\s\text{ in year }k\end{pmatrix} = \sum_{\substack{\text{Support}\\\text{Equipment}\\h}} \left\{ \begin{pmatrix}\text{Unit Cost}\\\text{of Equipment}\\h\end{pmatrix} \left[TT\begin{pmatrix}\text{level of}\\\text{Site }s\end{pmatrix},h \right] \left[1 + \begin{pmatrix}\text{Initial Support}\\\text{Cost Rate for }h\end{pmatrix} \right] \begin{pmatrix}\text{Discount Rate}\\\text{for Year }k\end{pmatrix} \right\}$$

10.3.2.2 Subsequent Support of Support Equipment. The subsequent cost of support equipment refers to the maintenance costs associated with the equipment for each year of the lifecycle beyond the first year the equipment is used at the site.

$$\begin{pmatrix}\text{Cost of Support}\\\text{Equipment at Site}\\s\text{ in year }k\end{pmatrix} = \sum_{\substack{\text{Support}\\\text{Equipment}\\h}} \left[\begin{pmatrix}\text{Unit Cost}\\\text{of Equipment}\\h\end{pmatrix} \left[TT\begin{pmatrix}\text{level of}\\\text{Site }s\end{pmatrix},h \right] \begin{pmatrix}\text{Subsequent Support}\\\text{Cost Rate for }h\end{pmatrix} \begin{pmatrix}\text{Discount Rate}\\\text{for Year }k\end{pmatrix} \right]$$

TASK 102 (Continued)

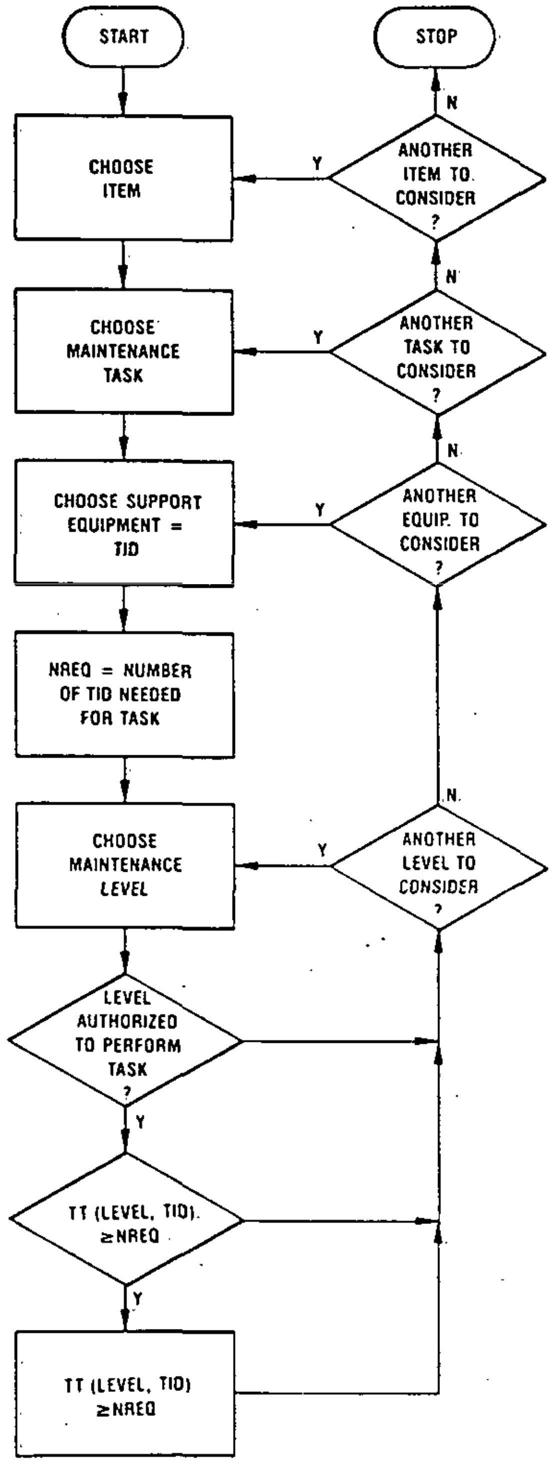


FIGURE 9. Determination of support equipment allocation.

TASK 102 (Continued)

Description of the Criteria for the Determination
of Support and Test Equipment Allocations

The LOR analytical technique allows up to three maintenance tasks to be assigned to each item under consideration: remove and replace, discard, and repair. During evaluation of feasible LOR recommendations, the analytical technique determines the maintenance tasks which have been included in the recommendation. For each type of support and test equipment listed under the task, the number needed to perform the task is determined. The support equipment allocation for each maintenance level authorized under the recommendation to perform the task is evaluated to ensure that the resources exceed the task's requirement. If not, the allocation is adjusted to reflect this need.

TASK 102 (Continued)

10.3.2.3 Annual Support Equipment Costs.

$$\begin{pmatrix}\text{Cost of Support}\\ \text{Equipment in}\\ \text{Year } k\end{pmatrix} = \sum_{\substack{\text{Site}\\ s}} \begin{pmatrix}\text{Cost of Support}\\ \text{Equipment at Site}\\ s \text{ in Year } k\end{pmatrix}$$

10.3.2.4 Total Support Equipment Cost.

$$\begin{pmatrix}\text{Total}\\ \text{Support}\\ \text{Equipment}\\ \text{Cost}\end{pmatrix} = \sum_{\substack{\text{Year}\\ k}} \begin{pmatrix}\text{Cost of Support}\\ \text{Equipment in}\\ \text{Year } k\end{pmatrix}$$

10.3.3 Space Cost. Space cost is the summation of three separate costs: cost of inventory storage space, cost of support equipment space, and the cost of repair work space.

10.3.3.1 Inventory Storage Space Cost. This is the cost of inventory storage space associated with the discard inventory, attrition, rotatable pool, and system stock quantities.

10.3.3.1.1 Inventory Storage Space Cost Equation for Discards.

$$\begin{pmatrix}\text{Cost of Inventory}\\ \text{Storage Space for}\\ \text{Item } a \text{ in Year } k\\ \text{at the } i^{th} \text{ User}\\ \text{Site for Discard}\end{pmatrix} = DST(a,k,i) \begin{pmatrix}\text{Cost per Cubic}\\ \text{Foot for Inventory}\\ \text{Storage at the } i^{th}\\ \text{User Site}\end{pmatrix} \begin{pmatrix}\text{Discount}\\ \text{Rate for}\\ \text{Year } k\end{pmatrix} \frac{\begin{pmatrix}\text{Size of Item}\\ a \text{ in Cubic}\\ \text{Feet}\end{pmatrix} \begin{pmatrix}\text{Required Days}\\ \text{of Stock for}\\ \text{Discard at}\\ \text{User site } i\end{pmatrix}}{\begin{pmatrix}\text{365 Days}\\ \text{per}\\ \text{Year}\end{pmatrix} \begin{pmatrix}\text{Site } i\text{'s}\\ \text{Deployment}\\ \text{Factor}\end{pmatrix}}$$

TASK 102 (Continued)

10.3.3.1.2 Inventory Storage Space Cost Equation for Repairables.

$$\begin{pmatrix}\text{Cost of Inventory}\\\text{Storage Space for}\\\text{Item a in Year k}\\\text{at the } i^{th} \text{ User}\\\text{Site for Repair}\end{pmatrix} = \begin{pmatrix}\text{Cost per Cubic}\\\text{Foot for Inventory}\\\text{Storage at the } i^{th}\\\text{User Site}\end{pmatrix}\begin{pmatrix}\text{Discount}\\\text{Rate for}\\\text{Year k}\end{pmatrix}\begin{pmatrix}\text{Size of}\\\text{Item a in}\\\text{Cubic}\\\text{Feet}\end{pmatrix}\frac{\left(RP(a,k,i) + AQ(a,k,i)\right)}{\begin{pmatrix}\text{365 Days}\\\text{per}\\\text{Year}\end{pmatrix}\begin{pmatrix}\text{Site i's}\\\text{Deployment}\\\text{Factor}\end{pmatrix}}$$

10.3.3.1.3 Inventory Storage Space Cost Equation for System Stock.

$$\begin{pmatrix}\text{Cost of Inventory}\\\text{Storage Space for}\\\text{System Stock of}\\\text{Item a in Year k}\end{pmatrix} = \begin{pmatrix}\text{Cost per Cubic}\\\text{Foot for Inventory}\\\text{Storage at the } i^{th}\\\text{User Site}\end{pmatrix}\begin{pmatrix}\text{Discount}\\\text{Rate for}\\\text{Year k}\end{pmatrix}\begin{pmatrix}\text{Size of}\\\text{Item a in}\\\text{Cubic}\\\text{Feet}\end{pmatrix}\left(SYS(a,k)\right)$$

10.3.3.1.4 Annual Inventory Storage Space Cost.

$$\begin{pmatrix}\text{Total Inventory}\\\text{Storage Space}\\\text{Cost in Year k}\end{pmatrix} = \sum_{\substack{\text{Item}\\a}}\begin{pmatrix}\text{Cost Inventory}\\\text{Storage Space for}\\\text{System Stock of}\\\text{Item a in Year k}\end{pmatrix} + \left\{\sum_{\substack{\text{Site}\\i}}\left[\begin{pmatrix}\text{Cost of Inventory}\\\text{Storage Space for}\\\text{Item a in Year k}\\\text{at Site i for Discard}\end{pmatrix} + \begin{pmatrix}\text{Cost of Inventory}\\\text{Storage Space for}\\\text{Item a in Year k}\\\text{at Site i for Repair}\end{pmatrix}\right]\right\}$$

10.3.3.2 Support Equipment Space Cost.

10.3.3.2.1 Support Equipment Space Cost Equation. The space cost for support equipment is determined on a per year per site basis. It is a function of the deck space required for the equipment, the number of the equipment allocated to a site, and the deck space cost for site. The deck space includes the space occupied by the equipment and the working space necessary to operate the equipment. The space cost is incurred only during those years that the site is supporting engines.

$$\begin{pmatrix}\text{Cost of Support}\\\text{Equipment Space}\\\text{at Site s in}\\\text{Year k}\end{pmatrix} = \sum_{\substack{\text{Support}\\\text{Equipment}\\h}}\left[\left(TT(\text{echelon level of s,h})\right)\begin{pmatrix}\text{Space Required}\\\text{for Support}\\\text{Equipment h}\end{pmatrix}\begin{pmatrix}\text{Cost per}\\\text{Square Foot}\\\text{for Space at}\\\text{Site s}\end{pmatrix}\begin{pmatrix}\text{Dicount}\\\text{Rate for}\\\text{Year k}\end{pmatrix}\right]$$

TASK 102 (Continued)

10.3.3.2.2 Annual Support Equipment Space Cost for Year k.

$$\begin{pmatrix}\text{Total Cost of}\\ \text{Support Equipment}\\ \text{Space in Year k}\end{pmatrix} = \sum_{\substack{\text{Site}\\ s}} \begin{pmatrix}\text{Cost of Support}\\ \text{Equipment Space in}\\ \text{Year k at Site s}\end{pmatrix}$$

10.3.3.3 Repair Work Space. Repair work space is defined as space that is dedicated solely for a specific maintenance task exclusive of support equipment space. The cost is determined by year and site. Figure 10 gives the method for determining each maintenance level's dedicated repair work space requirement. The cost is incurred at a site only for those years that the site is supporting the engine.

10.3.3.3.1 Repair Work Space Cost Equation.

$$\begin{pmatrix}\text{Cost of Repair}\\ \text{Space at Site s}\\ \text{in Year k}\end{pmatrix} = \left(RSP(s,k)\right) \begin{pmatrix}\text{Cost per Square}\\ \text{Foot for Space}\\ \text{at Site s}\end{pmatrix} \begin{pmatrix}\text{Discount}\\ \text{Rate for}\\ \text{Year k}\end{pmatrix}$$

10.3.3.3.2 Annual Repair Space Cost.

$$\begin{pmatrix}\text{Total Repair}\\ \text{Space Cost}\\ \text{in Year k}\end{pmatrix} = \sum_{\substack{\text{Site}\\ s}} \begin{pmatrix}\text{Cost of Repair}\\ \text{Space at Site s}\\ \text{in Year k}\end{pmatrix}$$

TASK 102 (Continued)

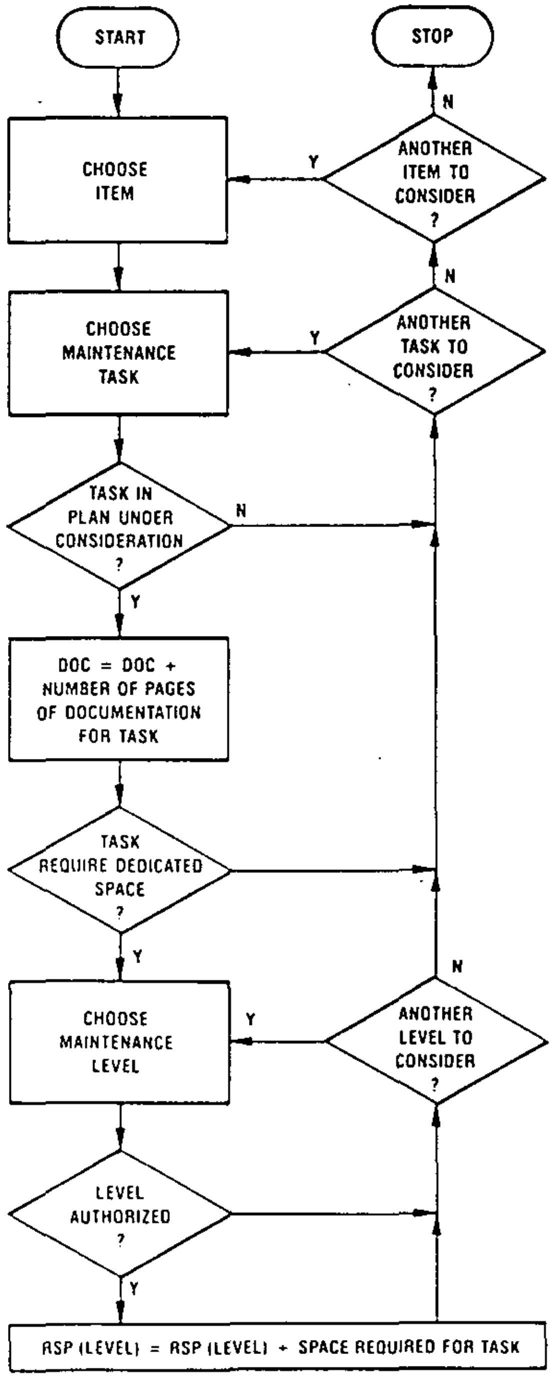


FIGURE 10. Determination of repair space and documentation requirements.

TASK 102 (Continued)

Description of the Criteria for the Determination of Repair Workspace and Documentation Requirements

The LOR analytical technique allows up to three maintenance tasks to be assigned to each item under consideration: remove and replace, repair, and discard. During evaluation of feasible LOR recommendations, the analytical technique determines the tasks which have been included in the recommendation. If these tasks require dedicated workspace, the dedicated workspace is added to the total workspace requirement of each maintenance level authorized to perform the task under the recommendation. The total number of pages of documentation required to perform the task is added to the total number of pages associated with the recommendation.

TASK 102 (Continued)

10.3.3.4 Total Space Cost.

$$\begin{pmatrix}\text{Total}\\\text{Space}\\\text{Cost}\end{pmatrix} = \sum_{\substack{\text{Year}\\k}} \begin{pmatrix}\text{Total Repair}\\\text{Space Cost}\\\text{in Year k}\end{pmatrix} + \begin{pmatrix}\text{Total Support}\\\text{Equipment Space}\\\text{Cost in Year k}\end{pmatrix} + \begin{pmatrix}\text{Total Inventory}\\\text{Storage Space}\\\text{Cost in Year k}\end{pmatrix}$$

10.3.4 Labor and Training Cost. Labor and training costs are charged directly for each type of maintenance action. The costs are calculated by site and year.

10.3.4.1 Labor Cost to Perform Remove and Replace Actions.

10.3.4.1.1 Total Number of Mantype l Performing Task in Year k.

$$MRR(a,k,s,l) = \begin{pmatrix}\text{Total Number of}\\\text{Mantype 1 Performing}\\\text{Remove and Replacement}\\\text{of Item a in Year k}\\\text{at Site s}\end{pmatrix} = \left(RT(a,k,s)\right)\frac{\begin{pmatrix}\text{Number of Hours}\\\text{to Perform Remove}\\\text{and Replacement of}\\\text{Item a}\end{pmatrix}\begin{pmatrix}\text{Number of}\\\text{Mantype 1}\\\text{Personnel Required}\\\text{to Perform Task}\end{pmatrix}}{\begin{pmatrix}\text{Annual Operating}\\\text{Hours for Site s}\end{pmatrix}}$$

10.3.4.1.2 Annual Labor Cost to Perform Removal and Replacement of Item a at Site s.

$$\begin{pmatrix}\text{Total Labor Cost to}\\\text{Perform R\&R of}\\\text{Item a in Year k}\\\text{at Site s}\end{pmatrix} = \sum_{\substack{\text{Mantype}\\1}} \left[\left(MRR(a,k,s,l)\right)\begin{pmatrix}\text{Unit Cost}\\\text{of Mantype 1}\\\text{at Site s}\end{pmatrix}\begin{pmatrix}\text{Discount}\\\text{Rate for}\\\text{Year k}\end{pmatrix}\right]$$

10.3.4.2 Labor Cost to Perform Discard Actions.

10.3.4.2.1 Total Number of Mantype l Performing Task in Year k at Site s.

$$MDS(a,k,s,l) = \begin{pmatrix}\text{Total Number of}\\\text{Mantype 1 Performing}\\\text{Discard of Item a}\\\text{in Year k at Site s}\end{pmatrix} = \left(DST(a,k,s)\right)\frac{\begin{pmatrix}\text{Number of Hours}\\\text{to Perform Discard}\\\text{of Item a}\end{pmatrix}\begin{pmatrix}\text{Number of}\\\text{Mantype 1}\\\text{Personnel Required}\\\text{to Perform Task}\end{pmatrix}}{\begin{pmatrix}\text{Annual Operating}\\\text{Hours for Site s}\end{pmatrix}}$$

TASK 102 (Continued)

10.3.4.2.2 Annual Labor Cost to Perform Discard of Item a at Site s.

$$\left(\begin{array}{c}\text{Total Labor Cost to}\\ \text{Perform Discard of}\\ \text{Item a in Year k}\\ \text{at Site s}\end{array}\right) = \sum_{\substack{\text{Mantype}\\ 1}} \left[\left(MDS(a,k,s,l)\right) \left(\begin{array}{c}\text{Unit Cost}\\ \text{of Mantype 1}\\ \text{at Site s}\end{array}\right) \left(\begin{array}{c}\text{Discount}\\ \text{Rate for}\\ \text{Year k}\end{array}\right) \right]$$

10.3.4.3 Labor Cost to Perform Repair Actions.

10.3.4.3.1 Total Number of Mantype 1 Performing Task in Year k at Site s.

$$MRP(j,k,s,l) = \left(\begin{array}{c}\text{Total Number of}\\ \text{Mantype 1 Performing}\\ \text{Repair of Item j}\\ \text{in Year k at Site s}\end{array}\right) = \left(RST(j,k,s)\right) \frac{\left(\begin{array}{c}\text{Number of Hours}\\ \text{to Perform Repair}\\ \text{of Item j}\end{array}\right)\left(\begin{array}{c}\text{Number of}\\ \text{Mantype 1}\\ \text{Personnel Required}\\ \text{to Perform Task}\end{array}\right)}{\left(\begin{array}{c}\text{Annual Operating}\\ \text{Hours for Site s}\end{array}\right)}$$

10.3.4.3.2 Annual Labor Cost to Perform Repair of Item j at Site s.

$$\left(\begin{array}{c}\text{Total Labor Cost to}\\ \text{Perform Repair of}\\ \text{Item j in Year k}\\ \text{at Site s}\end{array}\right) = \sum_{\substack{\text{Mantype}\\ 1}} \left[\left(MRP(j,k,s,l)\right) \left(\begin{array}{c}\text{Unit Cost}\\ \text{of Mantype 1}\\ \text{at Site s}\end{array}\right) \left(\begin{array}{c}\text{Discount}\\ \text{Rate for}\\ \text{Year k}\end{array}\right) \right]$$

10.3.4.4 Training Cost to Perform Remove and Replace Actions.

10.3.4.4.1 Number of Mantype 1 to Train in Year k to Perform Removal and Replacement of Item a at Site s.

$$TRR(a,k,s,l) = \left(MRR(a,k,s,l) - PRR(a,k,s,l)\right) \left[1 - \left(\begin{array}{c}\text{Attrition Rate}\\ \text{for Mantype 1}\end{array}\right) \right]$$

where

$$PRR(a,k,s,l) = \begin{cases} MRR(a,k-1,s,l) \quad \text{if } MRR(a,k-1,s,l) > PRR(a,k-2,s,l) \left[1 - \left(\begin{array}{c}\text{Attrition Rate}\\ \text{for Mantype 1}\end{array}\right) \right] \\ \left(PRR(a,k-2,s,l)\right) \left[1 - \left(\begin{array}{c}\text{Attrition Rate}\\ \text{for Mantype 1}\end{array}\right) \right], \text{ otherwise} \end{cases}$$

PRR(a,k,s,l) is zero for all k less than or equal to 0.

TASK 102 (Continued)

10.3.4.4.2 Annual Training Cost to Perform Removal and Replacement of Item a at Site s.

$$\begin{pmatrix}\text{Total Training Cost}\\ \text{to Perform R\&R of}\\ \text{Item a in Year k}\\ \text{at Site s}\end{pmatrix} = \sum_{\substack{\text{Mantype}\\ 1}} \left[\Big(TRR(a,k,s,l)\Big) \begin{pmatrix}\text{Cost to}\\ \text{Train}\\ \text{Mantype 1}\end{pmatrix} \begin{pmatrix}\text{Discount}\\ \text{Rate for}\\ \text{Year k}\end{pmatrix} \right]$$

10.3.4.5 Training Cost to Perform Discard Actions.

10.3.4.5.1 Number of Mantype 1 to Train in Year k to Perform Discard of Item a at Site s.

$$TDS(a,k,s,l) = \Big(MDS(a,k,s,l) - PDS(a,k,s,l)\Big) \left[1 - \begin{pmatrix}\text{Attrition Rate}\\ \text{for Mantype 1}\end{pmatrix} \right]$$

where

$$PDS(a,k,s,l) = \begin{cases} MDS(a,k-1,s,l) & \text{if } MDS(a,k-1,s,l) > PDS(a,k-2,s,l) \left[1 - \begin{pmatrix}\text{Attrition Rate}\\ \text{for Mantype 1}\end{pmatrix} \right] \\ \Big(PDS(a,k-2,s,l)\Big) \left[1 - \begin{pmatrix}\text{Attrition Rate}\\ \text{for Mantype 1}\end{pmatrix} \right], & \text{otherwise} \end{cases}$$

PDS(a,k,s,l) is zero for all k less than or equal to 0.

10.3.4.5.2 Annual Training Cost to Perform Discard of Item a at Site s.

$$\begin{pmatrix}\text{Total Training Cost}\\ \text{to Perform Discard of}\\ \text{Item a in Year k}\\ \text{at Site s}\end{pmatrix} = \sum_{\substack{\text{Mantype}\\ 1}} \left[\Big(TDS(a,k,s,l)\Big) \begin{pmatrix}\text{Cost to}\\ \text{Train}\\ \text{Mantype 1}\end{pmatrix} \begin{pmatrix}\text{Discount}\\ \text{Rate for}\\ \text{Year k}\end{pmatrix} \right]$$

TASK 102 (Continued)

10.3.4.6 Training Cost to Perform Repair Actions.

10.3.4.6.1 Number of Mantype 1 to Train in Year k to Perform Repair of Item a at Site s.

$$TRP(a,k,s,l) = \left(MRP(a,k,s,l) - PRP(a,k,s,l)\right)\left[1 - \left(\begin{matrix}\text{Attrition Rate}\\\text{for Mantype 1}\end{matrix}\right)\right]$$

where

$$PRP(a,k,s,l) = \begin{cases} MRP(a,k-1,s,l) \quad \text{if } MRP(a,k-1,s,l) > PRP(a,k-2,s,l)\left[1 - \left(\begin{matrix}\text{Attrition Rate}\\\text{for Mantype 1}\end{matrix}\right)\right] \\ \left(PRP(a,k-2,s,l)\right)\left[1 - \left(\begin{matrix}\text{Attrition Rate}\\\text{for Mantype 1}\end{matrix}\right)\right], \text{ otherwise}\end{cases}$$

PRP(a,k,s,l) is zero for all k less than or equal to 0.

10.3.4.6.2 Annual Training Cost to Perform Repair of Item a at Site s.

$$\left(\begin{matrix}\text{Total Training Cost}\\\text{to Perform Repair}\\\text{of Item a in Year k}\\\text{at Site s}\end{matrix}\right) = \sum_{\substack{\text{Mantype}\\1}}\left[\left(TRP(a,k,s,l)\right)\left(\begin{matrix}\text{Cost to}\\\text{Train}\\\text{Mantype 1}\end{matrix}\right)\left(\begin{matrix}\text{Discount}\\\text{Rate for}\\\text{Year k}\end{matrix}\right)\right]$$

10.3.4.7 Total Labor and Training Cost.

$$\left(\begin{matrix}\text{Total Labor}\\\text{and Training}\\\text{Cost}\end{matrix}\right) = \left\{\sum_{\substack{\text{Year}\\k}}\sum_{\substack{\text{Site}\\s}}\sum_{\substack{\text{Item}\\a}}\left[\left(\begin{matrix}\text{Total Labor Cost}\\\text{to R\&R Item a in}\\\text{Year k at Site s}\end{matrix}\right) + \left(\begin{matrix}\text{Total Training}\\\text{Cost to R\&R}\\\text{Item a in Year k}\\\text{at Site s}\end{matrix}\right) + \left(\begin{matrix}\text{Total Labor}\\\text{Cost to Discard}\\\text{Item a in Year}\\\text{k at Site s}\end{matrix}\right) + \left(\begin{matrix}\text{Total Training}\\\text{Cost to Discard}\\\text{Item a in Year}\\\text{k at Site s}\end{matrix}\right)\right]\right\}$$

$$+ \sum_{\substack{\text{Year}\\k}}\sum_{\substack{\text{Site}\\s}}\sum_{\substack{\text{Lowest}\\\text{Assembly}\\j}}\left[\left(\begin{matrix}\text{Total Labor Cost}\\\text{to Repair Item j}\\\text{in Year k at Site s}\end{matrix}\right) + \left(\begin{matrix}\text{Total Training}\\\text{Cost to Repair}\\\text{Item j in Year}\\\text{k at Site s}\end{matrix}\right)\right]$$

TASK 102 (Continued)

10.3.5 Documentation Cost. Documentation includes the following: the drawings and specifications which make up the weapons system technical manual; the logistic support analysis preparation; and the various support equipment requirement sheets, lists, etc. The cost is based on an average cost per page for documentation and the total number of pages required to perform all tasks under consideration. The method used by the LOR analytic technique to determine the total number of pages of documentation is given in Figure 10.

10.3.5.1 Cost of Documentation for the First Year.

$$\begin{pmatrix}\text{Documentation}\\ \text{Cost for Year 1}\end{pmatrix} = (\text{DOCT}) \begin{pmatrix}\text{Cost per}\\ \text{Page}\end{pmatrix}$$

10.3.5.2 Subsequent Years Cost of Documentation.

$$\begin{pmatrix}\text{Documentation}\\ \text{Cost for Year k}\end{pmatrix} = (\text{DOCT}) \begin{pmatrix}\text{Cost per}\\ \text{Page}\end{pmatrix} \begin{pmatrix}\text{Annual}\\ \text{Documentation}\\ \text{Revision Factor}\end{pmatrix} \begin{pmatrix}\text{Discount}\\ \text{Rate for}\\ \text{Year k}\end{pmatrix}$$

10.3.5.3 Total Documentation Cost.

$$\begin{pmatrix}\text{Total}\\ \text{Documentation}\\ \text{Cost}\end{pmatrix} = \sum_{\substack{\text{Year}\\ k}} \begin{pmatrix}\text{Documentation}\\ \text{Cost for Year k}\end{pmatrix}$$

10.3.6 Total Maintenance Plan Cost.

$$\begin{pmatrix}\text{Total}\\ \text{Maintenance}\\ \text{Plan Cost}\end{pmatrix} = \begin{pmatrix}\text{Total}\\ \text{Inventory}\\ \text{Cost}\end{pmatrix} + \begin{pmatrix}\text{Total}\\ \text{Support}\\ \text{Equipment}\\ \text{Cost}\end{pmatrix} + \begin{pmatrix}\text{Total}\\ \text{Space}\\ \text{Cost}\end{pmatrix} + \begin{pmatrix}\text{Total}\\ \text{Labor \&}\\ \text{Training}\\ \text{Cost}\end{pmatrix} + \begin{pmatrix}\text{Total}\\ \text{Documentation}\\ \text{Cost}\end{pmatrix}$$

TASK 102 (Continued)

TABLE I. Naval Air Systems Command LOR data elements.

Input Format	Data Element Number	Data Element Name	LSA	Units	Data Sources
V	1	Run Identification		None	Navy
G	1	Life Cycle	Yes	Years	Navy
G	2	Operating/Flight Hours Ratio	Yes	Fraction	Navy
G	3	Discount Rate		Fraction	Navy
G	4	Item Entry Cost		$/NSN Number	Navy
G	5	Item Retention Cost		$/NSN Number	Navy
G	6	Field Supply Admin. Cost		$/Site/NSN Number	Navy
G	7	Average Documentation Cost		$/Page	Navy
G	8	Subsequent Documentation Cost Factor		Fraction	Navy
G	9	Procurement Leadtime		Weeks	Contractor
G	10	Safety Level		Weeks	Navy
R	1	Repair Cycle - CV	Yes	Days	Contractor
R	2	Repair Cycle - Landbased (I3/I2)	Yes	Days	Contractor
R	3	Repair Cycle - I1	Yes	Days	Contractor
R	4	Repair Cycle - CV to I1	Yes	Days	Contractor
R	5	Repair Cycle - CV to Depot	Yes	Days	Contractor
R	6	Repair Cycle - Landbased to I1	Yes	Days	Contractor
R	7	Repair Cycle - Landbased to Depot	Yes	Days	Contractor
R	8	Repair Cycle - CV to I1 to Depot	Yes	Days	Contractor
R	9	Repair Cycle - LB to I1 to Depot	Yes	Days	Contractor
I	1	Item Reference Number		None	Contractor
I	2	Commonality Number		None	Contractor
I	3	Nomenclature/Part Number		None	Contractor
I	4	Number of New NSN Numbers	Yes	Unit	Contractor
H,L	2	Unit Cost	Yes	$/Item	Contractor
H	3	Hours Between Rework	Yes	Operating Hours	Contractor
L	3	Hardtime Requirement		Operating Hours	Contractor
H,L	4	Number per Next Higher Assembly	Yes	Unit	Contractor
H,L	5	Flight Utilization Factor		Fraction	Contractor
H	6	MTBMA	Yes	Hours	Contractor
H	7	False Removal Rate		Fraction	Navy
L	11	False Removal Rate		Fraction	Navy
L	6	MTBF	Yes	Hours	Contractor
L	7	Degradation Factor		Fraction	Navy
L	8	Weibull Shape Parameter		None	Contractor
L	9	Maintenance Category		None	Contractor
L	10	Time Between Inspections - Org.		Operating Hours	Contractor
M	2	Minimum Capability to R&R Item		None	Navy/ Contractor
M	3	Minimum Capability to Repair Item		None	Navy/ Contractor
M	4	Minimum Capability to Discard Item		None	Navy/ Contractor
M	5	Removal Requirements - Repair	Yes	None	Contractor
M	6	Removal Requirements - Discard	Yes	None	Contractor
S	2	Weight of Item and Container	Yes	lbs.	Contractor
S	3	Packing Cost	Yes	$/Item	Navy
B	2	BCM Rate - Organizational		Fraction	Navy
B	3	BCM Rate - Intermediate 3rd Degree		Fraction	Navy
B	4	BCM Rate - Intermediate 2nd Degree		Fraction	Navy
B	5	BCM Rate - Intermediate 1st Degree		Fraction	Navy
B	6	Scrap Rate	Yes	Fraction	Navy
B	7	Salvage Value		$/Item	Contractor
A	1	Site Name		None	Navy
A	2	Echelon Level		None	Navy
A	3	Number of Locations	Yes	None	Navy
A	4	Operating Hours		hrs./year	Navy

TASK 102 (Continued)

TABLE I. Naval Air Systems Command LOR data elements (Continued).

Input Format	Data Element Number	Data Element Name	LSA	Units	Data Sources
A	5	Available Inventory Storage		cu.ft.	Navy
A	6	Available Repair Workspace		sq.ft.	Navy
A	7	Required days of Stock - Repair	Yes	Days	Navy
A	8	Required days of Stock - Discard	Yes	Days	Navy
A	9	Repair Space Cost		$/sq.ft.	Navy
A	10	Inventory Space Cost		$/cu.ft.	Navy
C	2	Next Site of Higher Capability		None	Navy
C	3	Collocation Indicator		None	Navy
C	4	Shipping Cost - Conus		$/lbs.	Navy
C	5	Shipping Cost - Non-Co		$/lbs.	Navy
O	3	Engine Delivery Schedule - Year 1		Unit	Navy
O	4	Engine Delivery Schedule - Year 2		Unit	Navy
O	5	Engine Delivery Schedule - Year 3		Unit	Navy
O	6	Engine Delivery Schedule - Year 4		Unit	Navy
O	7	Engine Delivery Schedule - Year 5		Unit	Navy
O	8	Engine Delivery Schedule - Year 6		Unit	Navy
O	9	Engine Delivery Schedule - Year 7		Unit	Navy
O	10	Flight Hours	Yes	hrs./mos.	Navy
O	11	Deployment Factor	Yes	Fraction	Navy
W	2	Task		None	Contractor
W	3	Elapsed Time to Perform Task	Yes	Hours	Contractor
W	4	Workspace Required (Dedicated)	Yes	sq.ft.	Contractor
W	5	Number of Unique Types of Support Equipment and Men to Perform Task		None	Contractor
W	6	Pages of Documentation		Pages	Contractor
T	4	Tool or Man Code		None	Contractor
T	3	Number of Tools or Men Required	Yes	None	Contractor
E	2	Unit Cost of Support Equipment	Yes	$/Equip.	Navy/ Contractor
E	3	Setup Factor for Support Equipment		Fraction	Navy/ Contractor
E	4	Maintenance Factor for Support Equipment		Fraction	Navy/ Contractor
E	5	Space Required by Support Equipment	Yes	sq.ft.	Navy/ Contractor
E	6	Nomenclature/Support Equipment Number	Yes	None	Navy/ Contractor
F	2	Labor Rate - Shipboard		$/yr.	Navy
F	2	Labor Rate - Ashore		$/yr.	Navy
F	2	Labor Rate - Civilian		$/yr.	Navy
F	3	Training Cost - Serviceman		$/Man	Navy
F	3	Training Cost - Civilian		$/Man	Navy
F	4	Initial Training Required Indicator		None	Navy
F	5	Site Indicator		None	Navy
F	6	Manpower Description		None	Navy

TASK 103

LOR Analytical Techniques for Naval Air Systems Command
Avionic PSE (Peculiar Support Equipment)

10. SCOPE

10.1 Purpose. This task specifies the mathematical equations for performing LOR analyses for avionic support equipment under the cognizance of the Naval Air Systems Command. The equations determine, at the analyst's option, the logistics support costs associated with any of three assembly indenture levels.

10.2 General. The economic LOR analytical techniques allocate costs to six major categories: (1) inventory which includes inventory administration; rotatable pool, attrition, and system stock inventories; repair material; scrap material; and transportation; (2) support equipment which includes hardware cost and support of the hardware; (3) space required by inventory storage, repair work, and support equipment; (4) labor; (5) training; and (6) documentation.

10.2.1 Classification of Equipment into Indenture Levels. The equipment under analysis may be classified into four hardware indenture levels: (1) the equipment, (2) the WRA (Weapon Replaceable Assembly), (3) the SRA (Shop Replaceable Assembly), and (4) the sub-SRA. Logistic support costs associated with WRAs, SRAs, and sub-SRAs are computed by the LOR analytical techniques.

10.2.2 LOR Code Assignments. Each item of assembly indenture classification may be assigned one of three LOR codes: (1) I (Intermediate Repair), (2) D (Depot Repair), and (3) X (Discard).

10.2.2.1 Repair Definition. The repair of an item is defined as the removal and replacement of a failed lower indenture assembly to include fault verification of the item, fault isolation and replacement of the failed lower assembly, and item test.

10.2.2.1.1 Intermediate Repair. Failures occurring at an operational site (CV (Carrier) or NAS (Naval Air Station)) are repaired at the intermediate maintenance facility of the site.

10.2.2.1.2 Depot Repair. Failures removed at operational sites are sent to depot maintenance facilities for repair.

10.2.2.2 Discard Definition. Verified failures are discarded at the removal site.

10.2.3 LOR BCM Actions. Equipment failures occur at CV and NAS operational sites. Lower indenture assemblies that are BCM (Beyond the Capability of Maintenance) at a particular site are sent to designated sites authorized to perform the repairs.

TASK 103 (Continued)

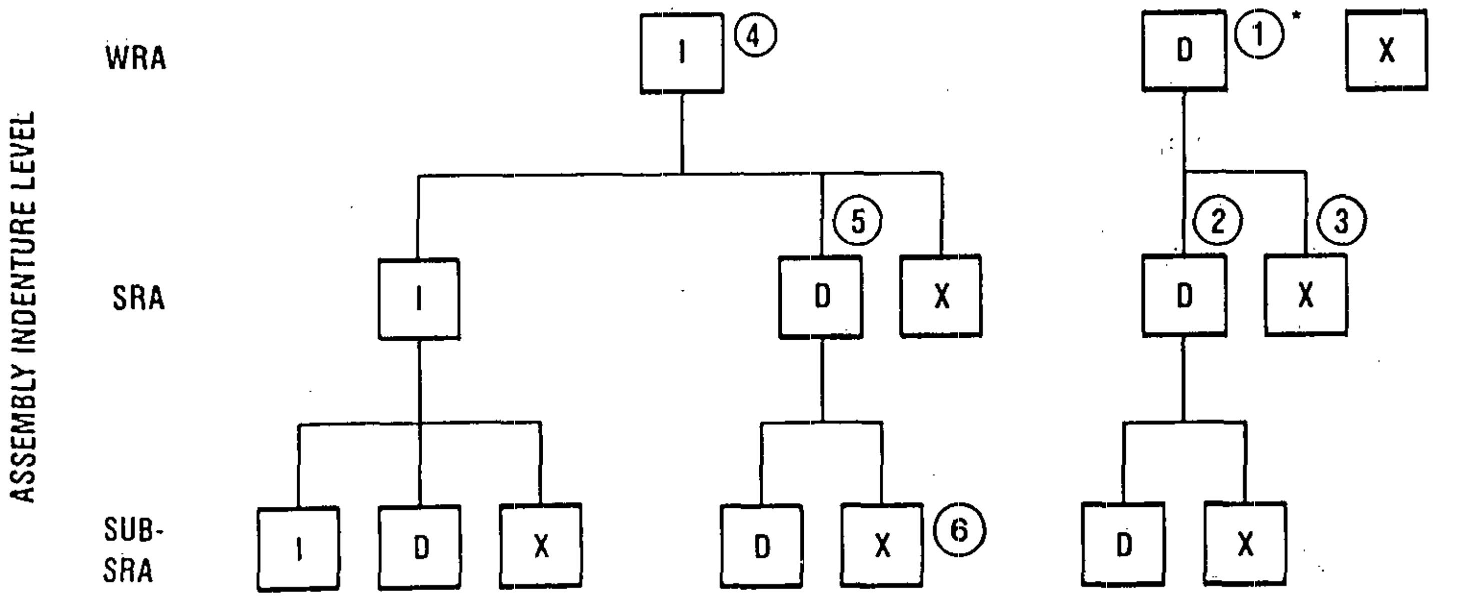
10.2.3.1 Equipment Failures Occurring at CV Sites. Items that are BCM at a CV site are sent to designated depot facilities for repair. The proportion of BCM items sent to each facility is determined by input specifications.

10.2.3.2 Equipment Failures Occurring at NAS Sites. Items that are BCM at a NAS site are sent to designated depot facilities for repair. The proportion of BCM items sent to each facility is determined by input specifications.

10.2.4 LOR Technique Assumptions.

10.2.4.1 Maintenance Alternatives. Maintenance alternatives for the assemblies of the equipment under analysis are selected through LOR code assignments (10.2.2). A general description of the code assignment procedure is given with Figure 1.

10.2.5 Discount Factors. The computation of a discount factor involves a discount rate. The discount rate accounts for the time value of money and determines the actual present value of a cost element for the purpose of evaluating different payment schedules. Three discount factors are calculated: (1) the normal discount factor used with equal payment series starting one year hence and terminating at the end of the life cycle; (2) the present discount factor used with equal payment series starting at the present and terminating one year prior to the end of the life cycle; and (3) the reduced discount factor used with equal payment series starting two years hence and terminating at the end of the life cycle.



(LOR CODE ASSIGNMENTS)

I = IMA REPAIR
D = DEPOT REPAIR
X = DISCARD

*DEFINITION OF NUMBERED ITEMS AND A GENERAL DESCRIPTION OF THE LOR CODE ASSIGNMENT PROCEDURE ARE GIVEN ON PAGE 112.

FIGURE 1. Maintenance alternatives.

TASK 103 - Figure 1 (Continued)

Description of LOR Code Assignment Procedure for
Selecting Maintenance Alternatives

There is an inherent limitation on the assignment of LOR codes to sub-assemblies; no subassembly can be assigned to a lower level repair facility than the assembly including it. For example, in Figure 1 if a WRA is assigned to depot repair (LOR code = D), ① * then the only choices available for its SRA's are depot (LOR code = D) ② and discard (LOR code = X) ③ A complication arises from the fact that some of the costs associated with the code assignments of sub-assemblies depend on the assignments of the assemblies in which they are included. Because of these considerations, although there are only three cost computations for each WRA, there are five for each SRA, corresponding to the five feasible combinations of assignments for it and the WRA including it, and seven cost computations for each sub-SRA. Figure 1 illustrates the totality of such combinations; each such combination is referred to as a case. For example, in Figure 1, SRA (LOR code = D) ② and ⑤ define two separate cases: Case ② indicates SRA depot repair when the WRA is assigned a D LOR code ① ; case ⑤ indicates SRA depot repair when the WRA is assigned an I LOR code ④ . In this appendix, input and equational parameters whose values vary with the case under consideration are indicated by the symbol (†).

A maintenance alternative is defined as a particular set of LOR cases for all the items whose higher assemblies are not discarded. In Figure 1 cases ④ , ⑤ , and ⑥ together define a maintenance alternative indicating WRA IMA repair, SRA depot repair, and sub-SRA discard. An important assumption that must be considered when constructing an alternative is that an LOR code assigned to an item is independent of which lower indenture level part caused the failure.

*Circled numbers refer to Figure 1.

TASK 103 (Continued)

10.2.5.1 Normal Discount Factor. The normal discount factor is used with expenditures occurring as equal payment series starting one year hence and terminating at the end of the life cycle.

$$\begin{pmatrix}\text{Normal}\\ \text{Discount}\\ \text{Factor}\end{pmatrix} = \left[\frac{(1.0 + \text{Discount Rate})^{\begin{pmatrix}\text{Number of}\\ \text{Years per}\\ \text{Life Cycle}\end{pmatrix}} - 1.0}{(\text{Discount Rate})\,(1.0 + \text{Discount Rate})^{\begin{pmatrix}\text{Number of}\\ \text{Years per}\\ \text{Life Cycle}\end{pmatrix}}}\right]$$

10.2.5.1.1 Present Discount Factor. The present discount factor is used with expenditures occurring as equal payment series starting at the present and terminating one year prior to the end of the life cycle.

$$\begin{pmatrix}\text{Present}\\ \text{Discount}\\ \text{Factor}\end{pmatrix} = \left[\frac{(1.0 + \text{Discount Rate})^{\begin{pmatrix}\text{Number of}\\ \text{Years per}\\ \text{Life Cycle}\end{pmatrix}} - 1.0}{(\text{Discount Rate})\,(1.0 + \text{Discount Rate})^{\left[\begin{pmatrix}\text{Number of}\\ \text{Years per}\\ \text{Life Cycle}\end{pmatrix} - 1.0\right]}}\right]$$

10.2.5.1.2 Reduced Discount Factor. The reduced discount factor is used with expenditures occurring as equal payment series starting two years hence and terminating at the end of the life cycle.

$$\begin{pmatrix}\text{Reduced}\\ \text{Discount}\\ \text{Factor}\end{pmatrix} = \left[\frac{(1.0 + \text{Discount Rate})^{\left[\begin{pmatrix}\text{Number of}\\ \text{Years per}\\ \text{Life Cycle}\end{pmatrix} - 1.0\right]} - 1.0}{(\text{Discount Rate})\,(1.0 + \text{Discount Rate})^{\begin{pmatrix}\text{Number of}\\ \text{Years per}\\ \text{Life Cycle}\end{pmatrix}}}\right]$$

TASK 103 (Continued)

10.2.5.2 <u>The Annual Number of Items for Disposition at a Site</u>. The annual number of items for disposition at a site is the total annual number of removals to include real failures plus false removals less the annual number of detected false removals at a site.

$$\begin{pmatrix}\text{Annual Number}\\ \text{of Items for}\\ \textit{Disposition}\\ \text{at the } a^{th}\text{ Site}\end{pmatrix}^{\dagger} = \left[\begin{pmatrix}\text{Annual Number}\\ \text{of Real Failures}\\ \textit{Removed at}\\ \text{the } a^{th}\text{ Site}\end{pmatrix}^{\dagger} + \begin{pmatrix}\text{Annual Number}\\ \text{of Real Failures}\\ \textit{Removed at}\\ \text{the } a^{th}\text{ Site}\end{pmatrix}^{\dagger}\begin{pmatrix}\text{Fraction of}\\ \text{Items Falsely}\\ \text{Removed}\end{pmatrix}\right] - \left[\begin{pmatrix}\text{Annual Number}\\ \text{of Real Failures}\\ \text{Removed at}\\ \text{the } a^{th}\text{ Site}\end{pmatrix}^{\dagger}\begin{pmatrix}\text{Fraction of}\\ \text{Items Falsely}\\ \text{Removed}\end{pmatrix}\begin{pmatrix}\text{Fraction of}\\ \text{False Removals}\\ \text{Detected as Such}\end{pmatrix}\right]$$

† Input and equational parameters whose values vary with the case under consideration.
a = an index element denoting the a^{th} site to include CV, NAS, and depot sites.

10.2.5.3 <u>The Annual Number of Real Failures Removed at a Site</u>. The annual number of real failures removed at a site is the annual number of failed items removed from their next higher assembly at the site. For the IMA sites, removals refer to the failed items from the locally operating aircraft.

$$\begin{pmatrix}\text{Annual Number}^{*}\\ \text{of } \textit{Real Failures}\\ \text{Removed at}\\ \text{the } a^{th}\text{ Site}\end{pmatrix}^{\dagger} = \left[\frac{\begin{pmatrix}\text{Annual Number of}^{**}\\ \text{Repairs to the Next}\\ \text{Higher Assembly}\\ \textit{at the } a^{th}\textit{ Site}\end{pmatrix}^{\dagger}\begin{pmatrix}\text{Predicted Mean}\\ \text{Time Between}\\ \text{Failures of the Next}\\ \textit{Higher Assembly}\end{pmatrix}\begin{pmatrix}\text{Number of}\\ \text{Identical Items}\\ \text{per SE System}\end{pmatrix}\begin{pmatrix}\text{Item Ratio of}\\ \text{Item Operating}\end{pmatrix}}{\begin{pmatrix}\text{Predicted Mean}\\ \text{Time Between}\\ \text{Failures of the Item}\end{pmatrix}\begin{pmatrix}\text{Number of}\\ \text{Identical Next}\\ \text{Higher Assemblies}\\ \text{per SE System}\end{pmatrix}\begin{pmatrix}\text{Ratio of Item Operating}\\ \text{at the Next}\\ \text{Higher Assembly}\end{pmatrix}}\right]$$

*This equation refers to the SRA or Sub-SRA as applicable to the indenture level under consideration. Corresponding WRA equation is given on the following page.

**This term refers to repairs from failures originating at the site if the a^{th} site is an IMA and to repairs from failures originating at lower level maintenance facilities if the a^{th} site is a depot.

TASK 103 (Continued)

$$\left(\begin{matrix}\text{Annual Number***}\\\text{of Real Failures}\\\text{Removed at}\\\text{the } a^{th} \text{ Site}\end{matrix}\right)^{\dagger} = \left[\frac{\left(\begin{matrix}\text{Number of}\\\text{Identical}\\\text{WRA's per}\\\text{SE System}\end{matrix}\right)\left(\begin{matrix}\text{WRA Ratio}\\\text{of Item}\\\text{Operating}\end{matrix}\right)\left(\begin{matrix}\text{12 Months}\\\text{per}\\\text{Year}\end{matrix}\right)\sum_{b=1}^{c}\left(\begin{matrix}\text{Monthly}\\\text{Operating}\\\text{Program}\\\text{at } a^{th} \text{ Site}\end{matrix}\right)_b\left(\begin{matrix}\text{Number of}\\\text{SE at}\\a^{th} \text{ Site}\end{matrix}\right)_b\left(\begin{matrix}\text{SE Type}\\\text{Deployment}\\\text{Factor for}\\\text{the } a^{th} \text{ Site}\end{matrix}\right)_b}{\left(\begin{matrix}\text{Predicted Mean}\\\text{Time Between}\\\text{Failures of the Item}\end{matrix}\right)\left(\begin{matrix}\text{Degradation}\\\text{Factor}\end{matrix}\right)}\right]$$

***This equation refers to the WRA's, which are always removed at the operating sites.

b = an index element denoting the b^{th} aircraft type.

c = the number of different aircraft types.

10.2.5.4 <u>The Annual Number of Real Failures Sent from a site</u>. The annual number of real failures sent from a site is the annual number of failures of an item that are BCM at the site and sent to a higher level maintenance facility for repair. One parameter is defined to account for real failures sent from IMA's.

10.2.5.4.1 <u>The Annual Number of Real Failures Sent from an IMA</u>.

$$\left(\begin{matrix}\text{Annual Number of}\\\text{Real Failures Sent}\\\text{from the } d^{th} \text{ IMA}\end{matrix}\right)^{\dagger} = \left[\sum_{g=1}^{h}\left(\begin{matrix}\text{Annual Number of Real}\\\text{Failures Sent from the}\\d^{th} \text{ IMA to the } g^{th} \text{ Depot}\end{matrix}\right)_g^{\dagger}\right]$$

where,

$$\left(\begin{matrix}\text{Annual Number of Real}\\\text{Failures Sent from the}\\d^{th} \text{ IMA to the } g^{th} \text{ Depot}\end{matrix}\right)^{\dagger} = \left[\left(\begin{matrix}\text{Annual Number of Real}\\\text{Failures Removed at}\\\text{the } d^{th} \text{ IMA}\end{matrix}\right)^{\dagger}\left(\begin{matrix}\text{BCM Rate of the}\\\text{Item at the IMA}\end{matrix}\right)\left(\begin{matrix}\text{Fraction of BCM Items}\\\text{that are Forwarded}\\\text{to the } g^{th} \text{ Depot}\end{matrix}\right)\right]$$

and

d = an index element denoting the d^{th} IMA.

g = an index element denoting the g^{th} depot.

h = the total number of depots.

TASK 103 (Continued)

10.2.5.5 The Annual Number of Items Sent from a Site. The annual number of items sent from a site is the annual number of items that are coded for repair at the site but are beyond the limit of maintenance capability and sent off-base for repair or the annual number of suspected failures of an item at a site where off-base repair is indicated by the LOR code. One parameter is defined to account for items sent from IMA's.

10.2.5.5.1 The Annual Number of Items Sent from an IMA.

$$\left(\begin{array}{c}\text{Annual Number of}\\ \text{Items Sent from}\\ \text{the } d^{th} \text{ IMA}\end{array}\right)^{t} = \left[\sum_{g=1}^{h}\left(\begin{array}{c}\text{Annual Number}\\ \text{of Items Sent}\\ \text{from the } d^{th} \text{ IMA}\\ \text{to the } g^{th} \text{ Depot}\end{array}\right)^{t}_{g}\right]$$

where,

$$\left(\begin{array}{c}\text{Annual Number}\\ \text{of Items Sent}\\ \text{from the } d^{th} \text{ IMA}\\ \text{to the } g^{th} \text{ Depot}\end{array}\right)^{t} = \left[\left(\begin{array}{c}\text{Annual Number}\\ \text{of Items for}\\ \text{Disposition}\\ \text{at the } d^{th} \text{ IMA}\end{array}\right)^{t}\left(\begin{array}{c}\text{BCM Rate of the}\\ \text{Item at the IMA}\end{array}\right)\left(\begin{array}{c}\text{Fraction of BCM Items}\\ \text{that are Forwarded}\\ \text{to the } g^{th} \text{ Depot}\end{array}\right)\right]$$

10.2.5.6 The Annual Number of Real Failures Received by a Site. The annual number of real failures received by a site is the annual number of failures of an item that are BCM at lower level maintenance facilities and forwarded to the site for repair. One parameter is defined to account for real failures received by a site: depots receive failures from IMA's.

10.2.5.6.1 The Annual Number of Real Failures Received by a Depot.

$$\left(\begin{array}{c}\text{Annual Number}\\ \text{Real Failures Received}\\ \text{by the } g^{th} \text{ Depot}\end{array}\right)^{t} = \sum_{d=1}^{i}\left(\begin{array}{c}\text{Annual Number of Real}\\ \text{Failures Sent from the}\\ d^{th} \text{ IMA to the } g^{th} \text{ Depot}\end{array}\right)^{t}_{d}$$

10.2.5.7 The Annual Number of Items Received by a Site. The annual number of items received by a site is the annual number of BCM items or suspected failures sent to the higher level maintenance facility. One parameter is defined to account for items received by depot's.

10.2.5.7.1 The Annual Number of Items Received by a Depot.

$$\left(\begin{array}{c}\text{Annual Number}\\ \text{of Items Received}\\ \text{by the } g^{th} \text{ Depot}\end{array}\right)^{t} = \left[\sum_{d=1}^{i}\left(\begin{array}{c}\text{Annual Number}\\ \text{of Items Sent}\\ \text{from the } d^{th} \text{ IMA}\\ \text{to the } g^{th} \text{ Depot}\end{array}\right)^{t}_{d}\right]$$

TASK 103 (Continued)

10.2.5.8 The Annual Number of Items Sent from All CV's to a Depot.

$$\begin{pmatrix}\text{Annual Number}\\ \text{of Items Sent}\\ \text{from All CV's}\\ \text{to the } g^{th} \text{ Depot}\end{pmatrix}^{t} = \left[\sum_{k=1}^{l} \begin{pmatrix}\text{Annual Number}\\ \text{of Items Sent}\\ \text{from the } k^{th} \text{ CV}\\ \text{to the } g^{th} \text{ Depot}\end{pmatrix}^{t}_{k}\right]$$

10.2.5.9 The Annual Number of Items Sent from All NAS's to a Depot.

$$\begin{pmatrix}\text{Annual Number}\\ \text{of Items Sent}\\ \text{from All NAS's}\\ \text{to the } g^{th} \text{ Depot}\end{pmatrix}^{t} = \left[\sum_{m=1}^{m} \begin{pmatrix}\text{Annual Number}\\ \text{of Items Sent}\\ \text{from the } m^{th} \text{ NAS}\\ \text{to the } g^{th} \text{ Depot}\end{pmatrix}^{t}_{m}\right]$$

10.2.5.10 The Annual Number of Repairs of an Item at a Site. This is the annual number of items inducted into the repair process at the site. In the repair process malfunctioning lower level parts are removed and replaced. Two parameters are defined to account for repair of items at IMA's, and depots.

10.2.5.10.1 The Annual Number of Repairs of an Item at an IMA.

$$\begin{pmatrix}\text{Annual Number}\\ \text{of Repairs to an}\\ \text{Item at the } d^{th} \text{ IMA}\end{pmatrix}^{t} = \left[\begin{pmatrix}\text{Annual Number}\\ \text{of Real Failures}\\ \text{Removed at}\\ \text{the } d^{th} \text{ IMA}\end{pmatrix}^{t} \left[1.0 - \begin{pmatrix}\text{BCM Rate}\\ \text{of the Item}\\ \text{at the PIMA}\end{pmatrix}\right]\left[1.0 - \begin{pmatrix}\text{Fraction of Item}\\ \text{Failures Scrapped}\\ \text{at the IMA}\end{pmatrix}\right]\right]$$

10.2.5.10.2 The Annual Number of Repairs of an Item at a Depot.

$$\begin{pmatrix}\text{Annual Number}\\ \text{of Repairs to an}\\ \text{Item at the } g^{th} \text{ Depot}\end{pmatrix}^{t} = \left[\left(\begin{pmatrix}\text{Annual Number}\\ \text{of Real Failures}\\ \text{Removed at}\\ \text{the } g^{th} \text{ Depot}\end{pmatrix}^{t} + \begin{pmatrix}\text{Annual Number of}\\ \text{Real Failures Received}\\ \text{by the } g^{th} \text{ Depot}\end{pmatrix}^{t}\right)\left[1.0 - \begin{pmatrix}\text{Fraction of Item}\\ \text{Failures Scrapped}\\ \text{at the Depot}\\ \text{Repair Facility}\end{pmatrix}\right]\right]$$

10.3 Cost Element Equations.

10.3.1 Inventory Costs.

10.3.1.1 Inventory Administration Cost. Inventory administration cost is the cost associated with entering an item into the supply system and retaining it there over its life cycle. The LOR analytical techniques treat the inventory administration cost as proportional to the number of equipment peculiar items entered in the NSN (National Stock Number) system. The cost is a function of three separate costs: item entry, item retention, and field supply

TASK 103 (Continued)

administration. Item entry is a one-time cost per peculiar NSN, incurred during the inventory procurement process to establish a NSN for the item. Item retention is a recurring cost per NSN incurred throughout the life cycle. It is a per year cost due to maintaining the item in the NSN system. Field supply administration is a per site cost annually incurred for local management of the item.

10.3.1.1.1 Inventory Administration Cost Equation for the Discard Cases. The administrative cost incurred for discard is the cost of local management, entry, and retention of the discarded item in the NSN system.

$$\begin{pmatrix}\text{Inventory}\\ \text{Administration}\\ \text{Cost for Discard}\end{pmatrix}^{\dagger} = \begin{pmatrix}\text{Item}^{*}\\ \text{Entry}\\ \text{Cost}\end{pmatrix} + \left[\begin{pmatrix}\text{Item}\\ \text{Retention}\\ \text{Cost}\end{pmatrix} + \begin{pmatrix}\text{Field Supply}\\ \text{Administration}\\ \text{Cost per Item}\\ \text{per Site per Year}\end{pmatrix}\begin{pmatrix}\text{Number of}\\ \text{Sites}\\ \text{Discarding}\\ \text{the Item}\end{pmatrix}^{\dagger}\right]\begin{pmatrix}\text{Normal}\\ \text{Discount}\\ \text{Factor}\end{pmatrix}$$

*Item refers to either the WRA, SRA, or sub-SRA as applicable to the indenture level under analyses.

10.3.1.1.2 Inventory Administration Cost Equation for the Repair Cases. The administrative cost incurred for repair is the cost of local management, entry, and retention of the repairable item and its peculiar components or piece parts in the NSN system. The cost equation is comprised of two segments to account for administrative costs associated with each repairable item and with its peculiar components excluding those lower indenture parts under analysis.

$$\begin{pmatrix}\text{Inventory}\\ \text{Administration}\\ \text{Cost for Repair}\end{pmatrix}^{\dagger} = \begin{pmatrix}\text{Item}\\ \text{Entry}\\ \text{Cost}\end{pmatrix} + \left[\begin{pmatrix}\text{Item}\\ \text{Retention}\\ \text{Cost}\end{pmatrix} + \begin{pmatrix}\text{Field Supply}\\ \text{Administration}\\ \text{Cost per Item}\\ \text{per Site per Year}\end{pmatrix}\begin{pmatrix}\text{Number of Sites}\\ \text{Fault Isolating to and/or}\\ \text{Repairing the Item}\end{pmatrix}\right]^{\dagger}\begin{pmatrix}\text{Normal}\\ \text{Discount}\\ \text{Factor}\end{pmatrix} +$$

$$\left[\begin{pmatrix}\text{Item}\\ \text{Entry}\\ \text{Cost}\end{pmatrix} + \left[\begin{pmatrix}\text{Item}\\ \text{Retention}\\ \text{Cost}\end{pmatrix} + \begin{pmatrix}\text{Field Supply}\\ \text{Administration}\\ \text{Cost per Item}\\ \text{per Site per Year}\end{pmatrix}\begin{pmatrix}\text{Number of}\\ \text{Sites}\\ \text{Repairing}\\ \text{the Item}\end{pmatrix}^{\dagger}\right]\begin{pmatrix}\text{Normal}\\ \text{Discount}\\ \text{Factor}\end{pmatrix}\right]\begin{pmatrix}\text{Number of Peculiar}^{*}\\ \text{Components in the}\\ \text{NSN System}\end{pmatrix}$$

*Components refer to the parts which are used to repair the item and are not included in the analysis.

10.3.1.2 Spares Inventory Cost Equations.

10.3.1.2.1 Inventory Quantity Equation for Discard. The discard inventory is the number of spares required during the system life cycle to account for discard maintenance actions. The inventory quantity for each item to be discarded is calculated on an annual basis by individual site.

TASK 103 (Continued)

10.3.1.2.1.1 <u>Annual Inventory Quantity for Discard at a CV Site.</u>

$$\begin{pmatrix}\text{Annual Inventory}\\ \text{Quantity for Discard}\\ \text{at the } k^{th} \text{ CV Site}\end{pmatrix}^{\dagger} = \left[\begin{pmatrix}\text{Annual Number of}\\ \text{Items for Disposition}\\ \text{at the } k^{th} \text{ CV Site}\end{pmatrix}^{\dagger}\right]$$

10.3.1.2.1.2 <u>Annual Inventory Quantity for Discard at a LB Site.</u>

$$\begin{pmatrix}\text{Annual Inventory}\\ \text{Quantity for Discard}\\ \text{at the } p^{th} \text{ LB Site}\end{pmatrix}^{\dagger} = \begin{pmatrix}\text{Annual Number of}\\ \text{Items for Disposition}\\ \text{at the NAS Located}\\ \text{at the } p^{th} \text{ LB Site}\end{pmatrix}^{\dagger}$$

p = an index element denoting the p^{th} LB site which includes NAS's.
*The term may = 0, as applicable to the site under consideration.

10.3.1.2.1.3 <u>Annual Inventory Quantity for Discard at a Depot.</u>

$$\begin{pmatrix}\text{Annual Inventory}\\ \text{Quantity for Discard}\\ \text{at the } g^{th} \text{ Depot}\end{pmatrix}^{\dagger} = \left[\begin{pmatrix}\text{Annual Number of}\\ \text{Items for Disposition}\\ \text{at the } g^{th} \text{ Depot}\end{pmatrix}^{\dagger}\right]$$

10.3.1.2.1.4 <u>Inventory Cost Equation for Discard.</u>

$$\begin{pmatrix}\text{Inventory Cost}\\ \text{for Discard}\\ \text{at the } v^{th} \text{ Site}\end{pmatrix}^{\dagger} = \left[\begin{pmatrix}\text{Unit}\\ \text{Cost of}\\ \text{Item}\end{pmatrix}\begin{pmatrix}\text{Annual Inventory}\\ \text{Quantity for Discard}\\ \text{at the } v^{th} \text{ Site}\end{pmatrix}^{\dagger}\begin{pmatrix}\text{Present}\\ \text{Discount}\\ \text{Factor}\end{pmatrix}\right]$$

v = an index element denoting the v^{th} site to include CV, LB, and depot sites.

10.3.1.2.2 <u>Repairable Inventory Quantity</u>. The repairable inventory quantity consists of the rotatable pool quantity, attrition quantity, and system stock quantity.

TASK 103 (Continued)

10.3.1.2.2.1 Rotatable Pool Quantity Equation. The rotatable pool is stocked at the sites where aircraft operate to allow immediate replacement of items repaired at that site. A rotatable pool quantity is determined for each operational site in accordance with the criteria of Figure 2 and the integerization rules of Table I. The integerization rules operate on raw or non-integerized rotatable pool quantities calculated for each CV and LB operational site.

10.3.1.2.2.1.1 Raw Rotatable Pool Quantity at a CV Site.

$$\left(\begin{array}{c}\text{Raw Rotatable}\\ \text{Pool Quantity}\\ \text{at the } k^{th} \text{ CV Site}\end{array}\right)^{\dagger} = \left[\frac{\left(\begin{array}{c}\text{Annual Number of}\\ \text{Repairs to an Item}\\ \text{at the } k^{th} \text{ CV Site}\end{array}\right)^{\dagger}\left(\begin{array}{c}\text{Repair Cycle Time}\\ \text{at the IMA}\end{array}\right)}{\left(\begin{array}{c}\text{365 Days}\\ \text{per}\\ \text{Year}\end{array}\right)\left(\begin{array}{c}\text{Carrier}\\ \text{Deployment Factor}\\ \text{for the } k^{th} \text{ CV Site}\end{array}\right)}\right]$$

where,

$$\left(\begin{array}{c}\text{Carrier}\\ \text{Deployment Factor}\\ \text{for the } k^{th} \text{ CV Site}\end{array}\right) = \left[\frac{\sum_{b=1}^{c}\left(\begin{array}{c}\text{Number of Aircraft}\\ \text{that Deploy to the}\\ k^{th} \text{ Carrier per}\\ \text{Aircraft Type}\end{array}\right)_b\left(\begin{array}{c}\text{Aircraft Type}\\ \text{Deployment Factor}\\ \text{for the } k^{th} \text{ Carrier}\end{array}\right)_b}{\sum_{b=1}^{c}\left(\begin{array}{c}\text{Number of Aircraft}\\ \text{that Deploy to the}\\ k^{th} \text{ Carrier per}\\ \text{Aircraft Type}\end{array}\right)_b}\right]$$

10.3.1.2.2.1.2 Raw Rotatable Pool Quantity at a LB Site.

$$\left(\begin{array}{c}\text{Raw Rotatable}\\ \text{Pool Quantity}\\ \text{at the } p^{th} \text{ LB Site}\end{array}\right)^{\dagger} = \left[\frac{\left(\begin{array}{c}\text{Annual Number of}\\ \text{Repairs to an Item}\\ \text{Originating}\\ \text{at the } p^{th} \text{ LB Site}\end{array}\right)^{\dagger}\left(\begin{array}{c}\text{Repair Cycle Time}\\ \text{at the IMA}\end{array}\right)}{\left(\begin{array}{c}\text{365 Days}\\ \text{per}\\ \text{Year}\end{array}\right)}\right]$$

where,

$$\left(\begin{array}{c}\text{Annual Number of}\\ \text{Repairs to an}\\ \text{Item Originating}\\ \text{at the } p^{th} \text{ LB Site}\end{array}\right)^{\dagger} = \left(\begin{array}{c}\text{Annual Number of}\\ \text{Repairs to an Item}\\ \text{at the NAS Located}\\ \text{at the } p^{th} \text{ LB Site}\end{array}\right)^{\dagger}$$

TASK 103 (Continued)

TABLE I. Integerization rules for computing rotatable pool quantities.

If (Raw Rotatable Pool Quantity Per Site)	(Rotatable Pool Quantity per Site)
<.10	0
.11- .59	1
.60–1.29	2
1.30–2.09	3
2.10–2.89	4
2.90–3.89	5
≥3.90	$\text{INT}^{*}\left\{\left(\begin{array}{c}\text{Raw Rotatable}\\ \text{Pool Quantity}\\ \text{per Site}\end{array}\right) + 1.0\right\}$

*INT means round off to nearest integer.

10.3.1.2.2.2 Attrition Quantity Equation. The attrition quantity is a replenishment quantity stocked at the sites where aircraft operate to replace those items not repairable or restorable to an RFI (Ready For Issue) status at the sites. These items are BCM or scrapped and, therefore, not available to the site's supply system. The attrition quantity, computed for the individual sites, is subject to the integerization rules of Table II and the criteria of Figure 2 which operate on raw or non-integerized attrition quantities.

10.3.1.2.2.2.1 Raw Attrition Quantity Equation for a CV Performing Local Repairs.

$$\left(\begin{array}{c}\text{Raw}\\ \text{Attrition}\\ \text{Quantity}\\ \text{at the } k^{th}\\ \text{CV Site}\end{array}\right)^{\dagger} = \left[\frac{\left[\left[\left(\begin{array}{c}\text{Annual Number}\\ \text{of Items for}\\ \text{Disposition at}\\ \text{the } k^{th} \text{ CV Site}\end{array}\right)^{\dagger}\left(\begin{array}{c}\text{BCM Rate}\\ \text{of Item at}\\ \text{the IMA}\end{array}\right) + \left(\begin{array}{c}\text{Annual Number}\\ \text{of Real Failures}\\ \text{Removed at the}\\ k^{th} \text{ CV Site}\end{array}\right)^{\dagger}\left[1.0 - \left(\begin{array}{c}\text{BCM Rate}\\ \text{of Item at}\\ \text{the IMA}\end{array}\right)\right]\left(\begin{array}{c}\text{Fraction of}\\ \text{Item Failures}\\ \text{Scrapped}\\ \text{at the IMA}\end{array}\right)\right]\left(\begin{array}{c}\text{Required}\\ \text{Days of}\\ \text{Stock}\\ \text{at the IMA}\end{array}\right)\right]}{\left(\begin{array}{c}\text{365 Days}\\ \text{per}\\ \text{Year}\end{array}\right)\left(\begin{array}{c}\text{Carrier Deployment}\\ \text{Factor for the}\\ k^{th} \text{ CV Site}\end{array}\right)}\right]$$

TASK 103 (Continued)

10.3.1.2.2.2.2 Raw Attrition Quantity Equation for a CV when Off-Site Repair is Indicated.

$$\left(\begin{array}{c}\text{Raw Attrition}\\ \text{Quantity at the}\\ \text{k}^{\text{th}}\text{ CV Site}\end{array}\right)^{\dagger} = \left[\frac{\left(\begin{array}{c}\text{Annual Number}\\ \text{of Items for}\\ \text{Disposition at}\\ \text{the k}^{\text{th}}\text{ CV Site}\end{array}\right)^{\dagger}\left(\begin{array}{c}\text{Required}\\ \text{Days of Stock}\\ \text{at the IMA}\end{array}\right)}{\left(\begin{array}{c}\text{365 Days}\\ \text{per}\\ \text{Year}\end{array}\right)\left(\begin{array}{c}\text{Carrier Deployment}\\ \text{Factor for the}\\ \text{k}^{\text{th}}\text{ CV Site}\end{array}\right)}\right]$$

10.3.1.2.2.2.3 Raw Attrition Quantity Equation for a LB Performing Local Repairs.

$$\left(\begin{array}{c}\text{Raw}\\ \text{Attrition}\\ \text{Quantity}\\ \text{at the}\\ \text{p}^{\text{th}}\text{ LB Site}\end{array}\right)^{\dagger} = \left[\frac{\left[\left(\begin{array}{c}\text{Annual Number}\\ \text{of Items for}\\ \text{Disposition at the}\\ \text{NAS Located at}\\ \text{the p}^{\text{th}}\text{ LB Site}\end{array}\right)^{\dagger}\left(\begin{array}{c}\text{BCM Rate}\\ \text{of Item at}\\ \text{the IMA}\end{array}\right) + \left(\begin{array}{c}\text{Annual Number}\\ \text{of Real Failures}\\ \text{Removed at the}\\ \text{NAS Located at}\\ \text{the p}^{\text{th}}\text{ LB Site}\end{array}\right)^{\dagger}\left[1.0 - \left(\begin{array}{c}\text{BCM Rate}\\ \text{of Item at}\\ \text{the IMA}\end{array}\right)\right]\left(\begin{array}{c}\text{Fraction of}\\ \text{Item Failures}\\ \text{Scrapped}\\ \text{at the IMA}\end{array}\right)\right]\left(\begin{array}{c}\text{Required}\\ \text{Days of}\\ \text{Stock}\\ \text{at the IMA}\end{array}\right)}{\left(\begin{array}{c}\text{365 Days}\\ \text{per}\\ \text{Year}\end{array}\right)}\right]$$

10.3.1.2.2.2.4 Raw Attrition Quantity Equation for a LB when Off-Site Repair is Indicated.

$$\left(\begin{array}{c}\text{Raw Attrition}\\ \text{Quantity at}\\ \text{the p}^{\text{th}}\text{ LB Site}\end{array}\right)^{\dagger} = \left[\frac{\left(\begin{array}{c}\text{Annual Number of}\\ \text{Items for Disposition}\\ \text{at the NAS Located}\\ \text{at the p}^{\text{th}}\text{ LB Site}\end{array}\right)^{\dagger}\left(\begin{array}{c}\text{Required}\\ \text{Days of Stock}\\ \text{at the IMA}\end{array}\right)}{\left(\begin{array}{c}\text{365 Days}\\ \text{per}\\ \text{Year}\end{array}\right)}\right]$$

TASK 103 (Continued)

TABLE II. Integerization rules for computing attrition quantities.

Cost Range Criteria
Recommended Attrition Quantity per Site

Raw Attrition Quantity per Site (60.2.1.2.2.2)

There is no attrition quantity for raw quantities less than .34.					
.34	L $ .11 4	$ .12-$ 1.10 3	$ 1.11-$ 9.80 2	$ 9.81-$ 74.00 1	G $ 74.01 1
.35	L .12 4	.13- 1.20 3	1.21- 10.00 2	10.01- 76.00 1	G 76.01 1
.36	L .15 4	.16- 1.25 3	1.26- 10.50 2	10.51- 78.00 1	G 78.01 1
.37	L .16 4	.17- 1.40 3	1.41- 11.10 2	11.11- 79.00 1	G 79.01 1
.38	L .17 4	.18- 1.50 3	1.51- 12.00 2	12.01- 81.00 1	G 81.01 1
.39	L .18 4	.19- 1.60 3	1.61- 12.50 2	12.51- 84.00 1	G 84.01 1
.40	L .19 4	.20- 1.70 3	1.71- 13.00 2	13.01- 86.00 1	G 86.01 1
.42	L .22 4	.23- 1.90 3	1.91- 14.00 2	14.01- 89.01 1	G 89.01 1
.44	L .26 4	.27- 2.10 3	2.11- 15.00 2	15.01- 94.00 1	G 94.01 1
.46	L .35 4	.36- 2.40 3	2.41- 16.00 2	16.01- 96.00 1	G 96.01 1
.48	L .38 4	.39- 2.70 3	2.71- 18.00 2	18.01- 98.00 1	G 98.01 1
.50	L .40 4	.41- 2.95 3	2.96- 19.00 2	19.01- 100.00 1	G 100.01 1
.52	L .46 4	.47- 3.20 3	3.21- 21.00 2	21.01- 100.00 1	G 100.01 1
.54	L .52 4	.53- 3.60 3	3.61- 22.00 2	22.01- 100.00 1	G 100.01 1
.56	L .58 4	.59- 3.90 3	3.91- 24.00 2	24.01- 100.00 1	G 100.01 1
.58	L .66 4	.67- 4.30 3	4.31- 26.00 2	26.01- 100.00 1	G 100.01 1
.60	L .76 4	.77- 4.80 3	4.81- 27.00 2	27.01- 100.00 1	G 100.01 1
.62	L .85 4	.86- 5.00 3	5.01- 28.00 2	28.01- 100.00 1	G 100.01 1

Note: L means "less than or equal to".
G means "greater than or equal to".

Example: If an item costs between $11.11 and $79.00 with a raw quantity per site of .37 then the recommended attrition quantity per site is 1. This table is applied for each site type of section 20.2.1.2.2.2; i.e. for CV and LB sites performing either local or off-site repairs. Whether the recommended quantity is stocked at a site is dependent on the criteria of Figure 2.

TASK 103 (Continued)

TABLE II. Integerization rules for computing attrition quantities (Continued).

Cost Range Criteria
Recommended Attrition Quantity per Site

Raw Attrition Quantity per Site (60.2.1.2.2.2)							
.64	L $ .11 5	$ .12-$ .90 4	$ .91-$ 5.20 3	$ 5.21-$ 29.00 2	$29.01-$100.00 1	G	$100.01 1
.66	L .14 5	.15- 1.05 4	1.06- 6.20 3	6.21- 32.00 2	32.01- 100.00 1	G	100.01 1
.68	L .15 5	.16- 1.10 4	1.11- 6.50 3	6.51- 34.00 2	34.01- 100.00 1	G	100.01 1
.70	L .17 5	.18- 1.25 4	1.26- 7.00 3	7.01- 36.00 2	36.01- 100.00 1	G	100.01 1
.72	L .19 5	.20- 1.40 4	1.41- 7.80 3	7.81- 38.00 2	38.01- 100.00 1	G	100.01 1
.74	L .22 5	.23- 1.50 4	1.51- 8.00 3	8.01- 39.00 2	39.01- 100.00 1	G	100.01 1
.76	L .24 5	.25- 1.65 4	1.66- 8.50 3	8.51- 40.00 2	40.01- 100.00 1	G	100.01 1
.78	L .28 5	.29- 1.80 4	1.81- 9.00 3	9.01- 43.00 2	43.01- 100.00 1	G	100.01 1
.80	L .33 5	.34- 2.00 4	2.01- 10.00 3	10.01- 43.50 2	43.51- 100.00 1	G	100.01 1
.82	L .37 5	.38- 2.20 4	2.21- 10.50 3	10.51- 44.50 2	44.51- 100.00 1	G	100.01 1
.84	L .41 5	.42- 2.40 4	2.41- 11.50 3	11.51- 47.00 2	47.01- 100.00 1	G	100.01 1
.86	L .45 5	.46- 2.60 4	2.61- 12.50 3	12.51- 50.00 2	50.01- 100.00 1	G	100.01 1
.88	L .49 5	.50- 2.80 4	2.81- 13.00 3	13.01- 53.00 2	53.01- 100.00 1	G	100.01 1
.90	L .52 5	.53- 3.00 4	3.01- 13.50 3	13.51- 56.00 2	56.01- 100.00 1	G	100.01 1
.92	L .61 5	.62- 3.25 4	3.26- 14.00 3	14.01- 58.00 2	58.01- 100.00 1	G	100.01 1
.94	L .70 5	.71- 3.50 4	3.51- 14.50 3	14.51- 60.00 2	60.01- 100.00 1	G	100.01 1
.96	L .79 5	.80- 3.75 4	3.76- 15.00 3	15.01- 62.00 2	62.01- 100.00 1	G	100.01 1
.98	L .86 5	.87- 4.00 4	4.01- 16.00 3	16.01- 65.00 2	65.01- 100.00 1	G	100.01 1
.99	L .95 5	.96- 4.20 4	4.21- 17.50 3	17.51- 68.00 2	68.01- 100.00 1	G	100.01 1

Example: The raw attrition quantity is rounded to the nearest even hundredth. If an item costs between $1.51-$8.00 with a raw quantity per site at .73 then the recommended attrition quantity per site is 3. Whether the recommended quantity is stocked at a site is dependent on the criteria of Figure 2.

TASK 103 (Continued)

TABLE II. Integerization rules for computing attrition quantities (Continued).

Raw Attrition Quantity per Site (60.2.1.2.2.2)	Cost Range Criteria Recommended Attrition Quantity per Site				
1	L $ .15 6	$ .16-$ .85 5	$ .86-$ 4.20 4	$ 4.21-$ 17.00 3	$17.01-$ 70.00 2
1	70.01- 100.00 1	G 100.00 1			
2	L .23 8	.24- .90 7	.91- 3.10 6	3.11- 9.00 5	9.01- 25.00 4
2	25.01- 50.00 3	50.01- 100.00 2	G 100.01 2		
3	L .22 10	.23- .68 9	.69- 2.00 8	2.01- 5.75 7	5.76- 13.00 6
3	13.01- 27.00 5	27.01- 45.00 4	45.01- 100.00 3	G 100.00 3	
4	L .50 * 13-11	.51- 1.40 10	1.41- 3.20 9	3.21- 8.00 8	8.01- 17.00 7
4	17.01- 28.00 6	28.01- 44.00 5	44.01- 100.00 4	G 100.01 4	
5	L 1.90 15-11	1.91- 4.80 10	4.81- 9.50 9	9.51- 17.00 8	17.01- 28.00 7
5	28.01- 40.00 6	40.01- 100.00 5	G - 100.01 5		
6	L .11 17-16	.12- 6.00 15-11	6.01- 13.00 10	13.01- 19.00 9	19.01- 28.00 8
6	28.01- 37.00 7	37.01- 100.00 6	G 100.01 6		
7	L .35 18-16	.35- 13.00 15-11	13.01- 19.00 10	19.01- 28.00 9	28.01- 36.00 8
7	36.01- 100.00 7	G 100.01 7			
8	L 1.00 20-16	1.01- 20.00 15-11	20.01- 27.00 10	27.01- 35.00 9	35.01- 100.00 8
8	G 100.01 8				
9	L 2.50 20-16	2.51- 25.00 15-11	25.01- 34.00 10	34.01- 100.00 9	G 100.01 9
10	L .25 23-21	.26- 6.00 20-16	6.01- 31.00 15-11	31.01- 100.00 10	G 100.01 10
11	L .60 24-21	.61- 10.00 20-16	10.01- 100.00 15-11	G 100.01 11	
12	L 1.30 25-21	1.31- 15.00 20-16	15.01- 100.00 15-11	G 100.01 12	

Example: Raw quantities between 1 and 25 are rounded to the nearest whole integer. If an item costs between $8.01 and $17.00 with a raw quantity per site of 3.73 then the recommended attrition quantity per site is 7. Whether the recommended quantity is stocked at a site is dependent on the criteria of Figure 2.

*See example on page 126 for interpolation techniques applied for attrition quantity ranges.

TASK 103 (Continued)

TABLE II. Integerization rules for computing attrition quantities (Continued).

Cost Range Criteria
Recommended Attrition Quantity per Site

Raw Attrition Quantity per Site (60.2.1.2.2.2)				
13	L $ 2.70 27-21	$ 2.71-$ 19.00 20-16	$19.01-$100.00 15-11	G $100.01 13
14	L 5.00 28-21	5.01- 24.00 20-16	24.01- 100.00 15-11	G 100.01 14
15	L 7.50 29-21	7.51- 28.00 20-16	28.01- 100.00 15-11	G 100.01 15
16	L 11.00 30-21	11.01- 100.00 20-16	G 100.01 16	
17	L .18 33-31	.19- 14.00 30-21	14.01- 100.00 20-16	G 100.01 17
18	L .40 34-31	.41- 18.00 30-21	18.01- 100.00 20-16	G 100.01 18
19	L .70 35-31	.71- 20.00 30-21	20.01- 100.00 20-16	G 100.01 19
20	L 1.20 36-31	1.21- 22.00 30-21	22.01- 100.00 20-16	G 100.01 20
21	L 2.00 37-31	2.01- 100.00 30-21	G 100.01 21	
22	L 3.80 39-31	3.81- 100.00 30-21	G 100.01 22	
23	L 5.80 40-31	5.81- 100.00 30-21	G 100.01 23	
24	L .15 43-41	.16- 8.00 40-31	8.01- 100.00 30-21	G 100.01 24

Example: The raw attrition quantity is rounded to the nearest whole integer. For any rounded raw quantity the recommended attrition quantity is obtained through a linear interpolation of the applicable cost and quantity ranges. If an item costs $37.00 with a raw quantity of 16.3 then the recommended attrition quantity is 19. This value is obtained first by rounding 16.3 down to 16, and then selecting the appropriate cost range [$11.01-$100.00]. The cost range is linearly interpolated in conjunction with its quantity range [20-16] as $17.80 per unit. Expanding the cost range in integral steps of $17.80 yields the following:

$11.01-$100.00 20-16	=	$11.01-$28.81 20	$28.82-$46.61 19	$46.62-$64.00 18	$64.41-$82.20 17	$82.21-$100.00 16

The unit cost of $37.00 falls in the cost range [$28.82-$46.61] for which the recommended attrition quantity is 19. Whether the recommended quantity is stocked at a site is dependent on the criteria of Figure 2.

TASK 103 (Continued)

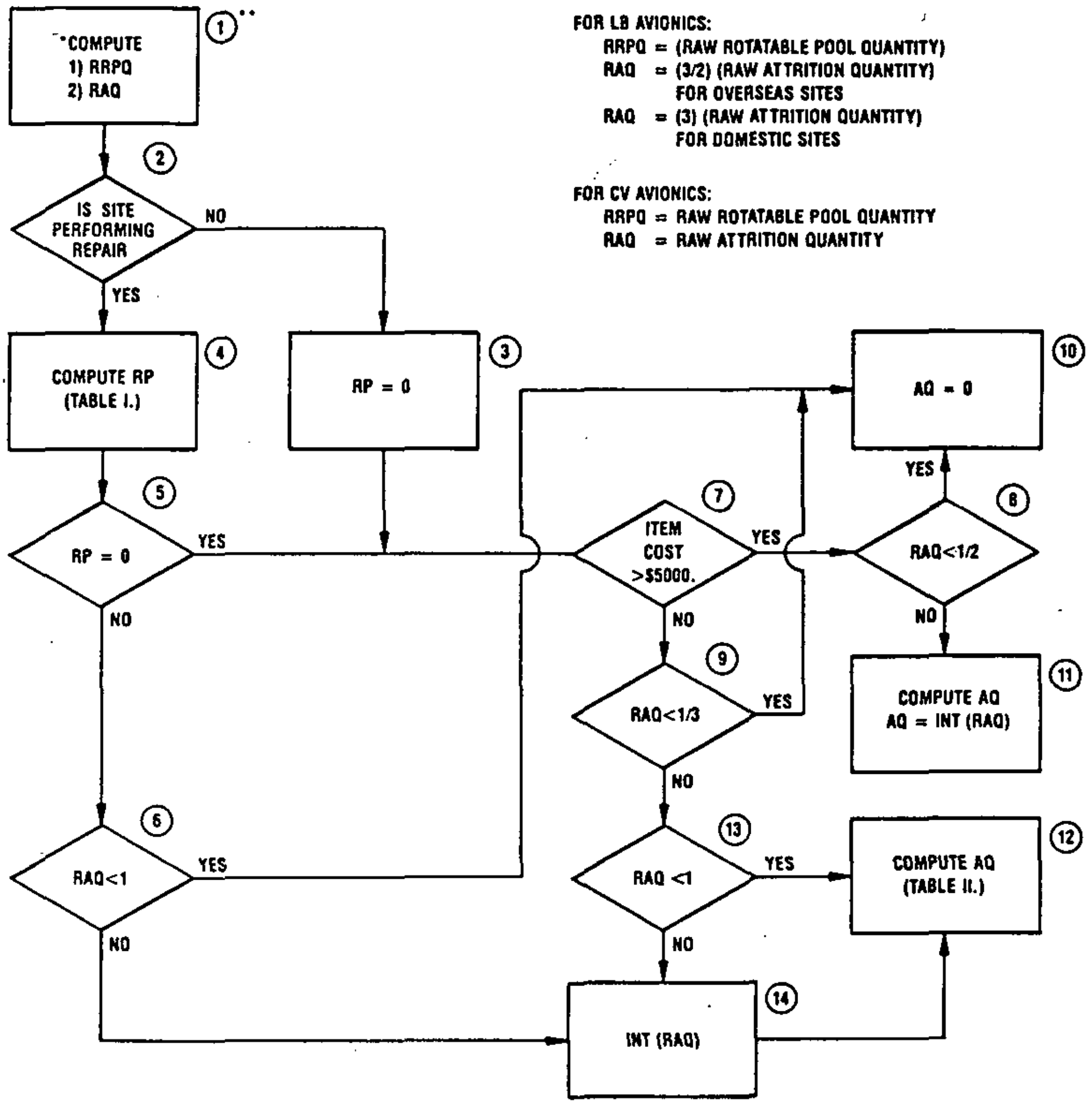
TABLE II. Integerization rules for computing attrition quantities (Continued).

Cost Range Criteria
Recommended Attrition Quantity per Site

Raw Attrition Quantity per Site (60.2.1.2.2.2)				
25	L $ .25 45-41	$ .26-$ 10.00 40-31	10.01- 100.00 30-21	G $100.01 25
30	L 2.50 50-41	2.51- 19.00 40-31	19.01- 100.00 30-21	G 100.01 30
35	L .60 75-51	.61- 9.00 50-41	9.01- 100.00 40-31	G 100.01 35
40	L 5.00 75-51	5.01- 100.00 50-41	G 100.01 49	
45	L 9.00 75-51	9.01- 100.00 50-41	G 100.01 45	
50	L 14.00 75-51	14.01- 100.00 50-41	G 100.01 50	
55	L .40 100-76	.41- 100.00 74-51	G 100.01 55	
60	L 1.50 100-76	1.51- 100.00 75-51	G 100.01 60	
65	L 5.00 100-76	5.01- 100.00 75-51	G 100.01 65	
70	L 7.50 100-76	7.51- 100.00 75-51	G 100.01 70	
75	L .20 100	.21- 12.00 100-76	12.01- 100.00 75-51	G 100.01 75
80	L .70 100	.71- 100.00 100-76	G 100.01 80	
85	L 2.50 100	2.51- 100.00 100-76	G 100.01 85	
90	L 4.25 100	4.26- 100.00 100-76	G 100.01 90	
95	L 7.00 100	7.01- 100.00 100-76	G 100.01 95	
Round raw quantities greater than 100 to nearest whole integer. Recommended attrition quantity is equal to integer.				

Example: Raw quantities between 25 and 100 are rounded to the nearest whole integer which is divisible by 5. For any rounded raw quantity the recommended attrition quantity is obtained through a linear interpolation of the applicable cost and quantity ranges (example p. 126). Whether the recommended quantity is stocked at a site is dependent on the criteria of figure 2.

TASK 103 (Continued)



*RP = ROTATABLE POOL QUANTITY PER SITE
AQ = ATTRITION QUANTITY PER SITE
**CIRCLED NUMBERS ARE DEFINED ON PAGE 129 BY THEIR RESPECTIVE NUMBER.

FIGURE 2. Rotatable pool and attrition quantity computations.

TASK 103 - Figure 2 (Continued)

Description of the Rotatable Pool and Attrition Quantity Computations

Figure 2 presents the criteria used in determining per site RP (Rotatable Pool) and AQ (Attrition Quantity) values. The flow diagram is based on range and quantity criteria derived by the Aviation Supply Office for computing allowance quantities.

A RRPQ (Raw Rotatable Pool Quantity) and a RAQ (Raw Attrition Quantity) are computed as in sections 10.3.1.2.2.1 and 10.3.1.2.2.2 (1) *. Raw or non-integerized quantities for the RP and AQ are calculated for each CV and LB operational site. A criterion for the existence of an RP at a site is whether the site is authorized to repair the item under analysis (2) . If the item is not repairable at the site the RP quantity is zero (3) . If the site can repair the item an RP is computed in accordance with the RRPQ integerization rules of Table I (4) . Various criteria may be used to calculate the AQ; the criteria used are dependent on the RP existence (5) . For items with a non-zero RP the AQ determination is based on an initial RAQ criterion of 1 (6); for items with a zero RP the AQ determination is based on an initial cost criterion of $5000 (7) . If the initial cost criterion is satisfied then a RAQ criterion of 1/2 is applied (8) , if not a RAQ criterion of 1/3 is applied (9) . Consequently there is no AQ (10) for items that: (1) have an RP but have an RAQ less than 1, (2) have no RP, cost more than $5000, and have an RAQ less than 1/2, (3) have no RP, cost less than $5000, and have an RAQ less than 1/3. AQs are computed for items that do not satisfy the above criterial sequence such that the AQ is equal to the RAQ rounded off to the nearest whole integer for items not meeting the 1/2 criterion (11) ; the AQs for the remaining items are computed according to the rules of Table II (12) which operate only on RAQs greater than 1/3. RAQs greater than 1, (6) and (13) , are rounded off to the nearest whole integer (14) before inclusion in Table II, RAQs less than 1 are not rounded off.

*Numbers refer to the blocks in Figure 2.

TASK 103 (Continued)

10.3.1.2.2.3 <u>System Stock Quantity Equation</u>. The system stock is a safety inventory quantity procured to satisfy demands due to anticipated losses during the procurement cycle and pipeline quantities to account for repair cycle times exceeding required days of stock. The system stock is stored at designated inventory control resupply points or depots.

$$\begin{pmatrix}\text{System}\\ \text{Stock}\\ \text{of an}\\ \text{Item}\end{pmatrix} = \text{INT}\left\{\left[\begin{pmatrix}\text{Procurement}\\ \text{Lead Time}\\ \text{in Years}\end{pmatrix} + \begin{pmatrix}\text{Safety}\\ \text{Level}\\ \text{in Years}\end{pmatrix}\right]\left[\sum_{d=1}^{i}\begin{pmatrix}\text{Annual Number}\\ \text{of Real Failures}\\ \text{Removed at}\\ \text{the } d^{th} \text{ IMA}\end{pmatrix}_d^{\dagger}\left[1.0 - \begin{pmatrix}\text{BCM Rate}\\ \text{of Item at}\\ \text{the IMA}\end{pmatrix}\right]\begin{pmatrix}\text{Fraction of Item}\\ \text{Failures Scrapped}\\ \text{at the IMA}\end{pmatrix}\right]\right.$$

$$\left. + \sum_{g=1}^{h}\left[\left[\begin{pmatrix}\text{Annual Number}\\ \text{of Real Failures}\\ \text{Removed at}\\ \text{the } g^{th} \text{ Depot}\end{pmatrix}_g^{\dagger} + \begin{pmatrix}\text{Annual Number}\\ \text{of Real Failures}\\ \text{Received by}\\ \text{the } g^{th} \text{ Depot}\end{pmatrix}_g^{\dagger}\right]\begin{pmatrix}\text{Fraction of Item}\\ \text{Failures Scrapped}\\ \text{at the Depot}\\ \text{Repair Facility}\end{pmatrix}\right]\right\}$$

$$+ \left[\begin{pmatrix}\text{Repair Cycle}\\ \text{Time from the}\\ \text{CV to Depot}\\ \text{in Years}\end{pmatrix} - \begin{pmatrix}\text{Required}\\ \text{Years}\\ \text{Stock at CV}\end{pmatrix}\right]^{*}\sum_{g=1}^{h}\begin{pmatrix}\text{Annual Number}\\ \text{of Items Sent}\\ \text{from All CV's}\\ \text{to the } g^{th} \text{ Depot}\end{pmatrix}_g^{\dagger}$$

$$+ \left[\begin{pmatrix}\text{Repair Cycle}\\ \text{Time from the}\\ \text{NAS to Depot}\\ \text{in Years}\end{pmatrix} - \begin{pmatrix}\text{Required}\\ \text{Years}\\ \text{Stock at NAS}\end{pmatrix}\right]^{*}\sum_{g=1}^{h}\begin{pmatrix}\text{Annual Number}\\ \text{of Items Sent}\\ \text{from All NAS's}\\ \text{to the } g^{th} \text{ Depot}\end{pmatrix}_g^{\dagger}$$

*Negative quantities are not allowed; if term is less than zero a zero quantity is computed. Yearly parameters for stockage and repair times are input as days and converted to years by the computer model.

10.3.1.2.2.4 <u>Total Repairable Inventory Quantity Equation</u>. The total repairable inventory quantity is the summation of the rotatable pool, attrition, and system stock quantities. Since the rotatable pool and attrition quantities are computed by site, the quantities must be totaled across all sites.

$$\begin{pmatrix}\text{Total}\\ \text{Repairable}\\ \text{Inventory}\\ \text{Quantity}\end{pmatrix}^{\dagger} = \sum_{k=1}^{i}\left[\begin{pmatrix}\text{Rotatable}\\ \text{Pool Quantity}\\ \text{at the } k^{th} \text{ CV}\\ \text{Site}\end{pmatrix}_k^{\dagger} + \begin{pmatrix}\text{Attrition}\\ \text{Quantity}\\ \text{at the } k^{th}\\ \text{CV Site}\end{pmatrix}_k^{\dagger}\right] + \sum_{p=1}^{q}\left[\begin{pmatrix}\text{Rotatable}\\ \text{Pool Quantity}\\ \text{at the } p^{th} \text{ LB}\\ \text{Site}\end{pmatrix}_p^{\dagger} + \begin{pmatrix}\text{Attrition}\\ \text{Quantity}\\ \text{at the } p^{th}\\ \text{LB Site}\end{pmatrix}_p^{\dagger}\right] + \begin{pmatrix}\text{System}\\ \text{Stock of}\\ \text{the Item}\end{pmatrix}^{\dagger}$$

q = total number of LB sites which includes NAS's.

TASK 103 (Continued)

10.3.1.2.2.4.1 Total Repairable Inventory Cost Equation.

$$\begin{pmatrix}\text{Total}\\ \text{Repairable}\\ \text{Inventory}\\ \text{Cost}\end{pmatrix}^{\dagger} = \left[\begin{pmatrix}\text{Unit}\\ \text{Cost of}\\ \text{Item}\end{pmatrix}\begin{pmatrix}\text{Total}\\ \text{Repairable}\\ \text{Inventory}\\ \text{Quantity}\end{pmatrix}^{\dagger}\right]$$

10.3.1.3 Repair Scrap Quantity Equation. The repair scrap quantity is the inventory procured throughout the life cycle to replenish the system stock quantity. Replenishment of the system stock is necessary to account for losses in the supply system caused by items being scrapped during the repair process. A repair scrap quantity is computed for each repair site.

10.3.1.3.1 The Annual Repair Scrap Quantity at a CV Site. This quantity accounts for the contribution to the total repair scrap quantity of losses occurring at each CV site.

$$\begin{pmatrix}\text{Annual Repair}\\ \text{Scrap Quantity}\\ \text{at the } k^{th} \text{ CV Site}\end{pmatrix}^{\dagger} = \left[\begin{pmatrix}\text{Annual Number}\\ \text{of Real Failures}\\ \text{Removed at the}\\ k^{th} \text{ CV Site}\end{pmatrix}^{\dagger}\left[1.0 - \begin{pmatrix}\text{BCM Rate}\\ \text{of Item at}\\ \text{the IMA}\end{pmatrix}\right]\begin{pmatrix}\text{Fraction of Item}\\ \text{Failures Scrapped}\\ \text{at the IMA}\end{pmatrix}\right]$$

10.3.1.3.2 The Annual Repair Scrap Quantity at a LB Site. This quantity accounts for the contribution to the total repair scrap quantity of losses occurring at each LB site.

$$\begin{pmatrix}\text{Annual Repair}\\ \text{Scrap Quantity}\\ \text{at the } p^{th}\\ \text{LB Site}\end{pmatrix}^{\dagger} = \begin{pmatrix}\text{Annual Number of}\\ \text{Real Failures Removed}\\ \text{at the NAS Located}\\ \text{at the } p^{th} \text{ LB Site}\end{pmatrix}^{\dagger}\left[1.0 - \begin{pmatrix}\text{BCM Rate}\\ \text{of Item at}\\ \text{the IMA}\end{pmatrix}\right]\begin{pmatrix}\text{Fraction of Item}\\ \text{Failures Scrapped}\\ \text{at the IMA}\end{pmatrix}$$

10.3.1.3.3 The Annual Repair Scrap Quantity at a Depot Site. This quantity accounts for the contribution to the total repair scrap quantity of losses occurring at each depot site.

$$\begin{pmatrix}\text{Annual Repair}\\ \text{Scrap Quantity}\\ \text{at the } g^{th}\\ \text{Depot Site}\end{pmatrix}^{\dagger} = \left[\begin{pmatrix}\text{Annual Number}\\ \text{of Real Failures}\\ \text{Removed at the}\\ g^{th} \text{ Depot Site}\end{pmatrix}^{\dagger} + \begin{pmatrix}\text{Annual Number}\\ \text{of Real Failures}\\ \text{Received by the}\\ g^{th} \text{ Depot Site}\end{pmatrix}^{\dagger}\right]\begin{pmatrix}\text{Fraction of Item}\\ \text{Failures Scrapped}\\ \text{at the Depot}\\ \text{Repair Facility}\end{pmatrix}$$

TASK 103 (Continued)

10.3.1.3.4 Repair Scrap Cost Equation.

$$\begin{pmatrix}\text{Repair}\\ \text{Scrap}\\ \text{Cost}\end{pmatrix}^t = \sum_{v=1}^{r}\left[\begin{pmatrix}\text{Annual Repair}\\ \text{Scrap Quantity}\\ \text{at the } v^{th} \text{ Site}\end{pmatrix}^t_v\right]\begin{pmatrix}\text{Unit}\\ \text{Cost of}\\ \text{Item}\end{pmatrix}\begin{pmatrix}\text{Normal}\\ \text{Discount}\\ \text{Factor}\end{pmatrix}$$

r = number of repair facilities to include IMA's and depots.

10.3.1.4 Repair Material Cost Equation. The Repair material cost accounts for the cost of parts required per repair action, excluding those which are included in the analysis. The total repair material cost is the summation of the costs at all sites.

10.3.1.4.1 Repair Material Cost at a CV Site.

$$\begin{pmatrix}\text{Repair Material}\\ \text{Cost at the}\\ k^{th} \text{ CV Site}\end{pmatrix}^t = \left[\begin{pmatrix}\text{Annual Number of}\\ \text{Repairs to an Item}\\ \text{at the } k^{th} \text{ CV Site}\end{pmatrix}^t\begin{pmatrix}\text{Unit}\\ \text{Cost of}\\ \text{Item}\end{pmatrix}\begin{pmatrix}\text{Repair}\\ \text{Material Rate}\\ \text{at the IMA}\end{pmatrix}\begin{pmatrix}\text{Normal}\\ \text{Discount}\\ \text{Factor}\end{pmatrix}\right]$$

10.3.1.4.2 Repair Material Cost at a LB Site.

$$\begin{pmatrix}\text{Repair Material}\\ \text{Cost at the}\\ p^{th} \text{ LB Site}\end{pmatrix}^t = \begin{pmatrix}\text{Annual Number of}\\ \text{Repairs to an Item}\\ \text{at the NAS Located}\\ \text{at the } p^{th} \text{ LB Site}\end{pmatrix}^t\begin{pmatrix}\text{Repair}\\ \text{Material Rate}\\ \text{at the IMA}\end{pmatrix}\begin{pmatrix}\text{Unit}\\ \text{Cost of}\\ \text{Item}\end{pmatrix}\begin{pmatrix}\text{Normal}\\ \text{Discount}\\ \text{Factor}\end{pmatrix}$$

10.3.1.4.3 Repair Material Cost at a Depot Site.

$$\begin{pmatrix}\text{Repair Material}\\ \text{Cost at the}\\ g^{th} \text{ Depot Site}\end{pmatrix}^t = \left[\begin{pmatrix}\text{Annual Number of}\\ \text{Repairs to an Item}\\ \text{at the } g^{th} \text{ Depot Site}\end{pmatrix}^t\begin{pmatrix}\text{Unit}\\ \text{Cost of}\\ \text{Item}\end{pmatrix}\begin{pmatrix}\text{Repair}\\ \text{Material Rate}\\ \text{at the Depot}\end{pmatrix}\begin{pmatrix}\text{Normal}\\ \text{Discount}\\ \text{Factor}\end{pmatrix}\right]$$

10.3.1.4.4 Total Repair Material Cost Equation.

$$\begin{pmatrix}\text{Repair}\\ \text{Material}\\ \text{Cost}\end{pmatrix}^t = \sum_{v=1}^{r}\left[\begin{pmatrix}\text{Repair}\\ \text{Material Cost}\\ \text{at the } v^{th} \text{ Site}\end{pmatrix}^t_v\right]$$

TASK 103 (Continued)

10.3.1.5 Transportation Costs. These are the costs of packaging, handling and transporting for purposes of repair or replenishment, item inventories to and from operational, repair, and resupply sites. The costs are functions of packaging and handling rates per cubic foot and transportation rates per pound from site to site, and are computed by site.

10.3.1.5.1 Transportation Cost Equation for the Discard Cases.

$$\begin{pmatrix}\text{Transportation}\\ \text{Cost}\\ \text{for Discard}\end{pmatrix}^{t} = \begin{pmatrix}\text{Normal}\\ \text{Discount}\\ \text{Factor}\end{pmatrix} \left\{ \sum_{v=1}^{r} \sum_{s=1}^{t} \left[\begin{pmatrix}\text{Annual Number}\\ \text{of Items for}\\ \text{Disposition at}\\ \text{the } v^{th} \text{ Site}\end{pmatrix}_{v}^{t} \left[\begin{pmatrix}\text{Transportation}\\ \text{Rate per Pound}\\ \text{from the } s^{th} \text{ Site}\\ \text{to the } v^{th} \text{ Site}\end{pmatrix}_{s,v} \begin{pmatrix}\text{Weight}\\ \text{of the}\\ \text{Item}\end{pmatrix} \begin{pmatrix}\text{Fraction of}\\ \text{the } v^{th} \text{ Site}\\ \text{Resupply}\\ \text{from the } s^{th} \text{ Site}\end{pmatrix}_{s,v} + \begin{pmatrix}\text{Packaging and}\\ \text{Handling Rate}\\ \text{per Cubic Foot}\end{pmatrix} \begin{pmatrix}\text{Inventory}\\ \text{Storage Space}\\ \text{per Item in}\\ \text{Cubic Feet}\end{pmatrix} \right] \right] \right\}$$

where,

$$\begin{pmatrix}\text{Annual Number}\\ \text{of Items for}\\ \text{Disposition}\\ \text{at the } p^{th} \text{ LB Site}\end{pmatrix}^{t} = \begin{pmatrix}\text{Annual Number of}\\ \text{Items for Disposition}\\ \text{at the NAS Located}\\ \text{at the } p^{th} \text{ LB Site}\end{pmatrix}^{t}$$

s = an index element denoting the s^{th} resupply depot.
t = number of resupply depots.

TASK 103 (Continued)

10.3.1.5.2 <u>Transportation Cost Equation for the Repair Cases.</u>

$$
\begin{pmatrix}\text{Transportation}\\ \text{Cost}\\ \text{for Repair}\end{pmatrix}^{\dagger} =
\begin{pmatrix}\text{Normal}\\ \text{Discount}\\ \text{Factor}\end{pmatrix}
\Bigg\{ +2 \sum_{d=1}^{j} \sum_{g=1}^{h} \left[\begin{pmatrix}\text{Annual Number of}\\ \text{Items Sent from}\\ \text{the } d^{th} \text{ IMA to}\\ \text{the } g^{th} \text{ Depot}\end{pmatrix}^{\dagger}_{g,d} \left[\begin{pmatrix}\text{Transportation}\\ \text{Rate per Pound}\\ \text{from the } d^{th} \text{ IMA}\\ \text{to the } g^{th} \text{ Depot}\end{pmatrix}_{g,d} \begin{pmatrix}\text{Weight}\\ \text{of the}\\ \text{Item}\end{pmatrix} + \begin{pmatrix}\text{Packaging and}\\ \text{Handling Rate}\\ \text{per Cubic Foot}\end{pmatrix} \begin{pmatrix}\text{Inventory}\\ \text{Storage Space}\\ \text{per Item in}\\ \text{Cubic Feet}\end{pmatrix} \right] \right]
$$

$$
+ \sum_{k=1}^{i} \sum_{s=1}^{t} \left[\begin{pmatrix}\text{Annual Repair}\\ \text{Scrap Quantity}\\ \text{at the } k^{th}\\ \text{CV Site}\end{pmatrix}^{\dagger}_{k} \left[\begin{pmatrix}\text{Transportation}\\ \text{Rate per Pound}\\ \text{from the } s^{th} \text{ Site}\\ \text{to the } k^{th} \text{ CV Site}\end{pmatrix}_{s,k} \begin{pmatrix}\text{Weight}\\ \text{of the}\\ \text{Item}\end{pmatrix} \begin{pmatrix}\text{Fraction of}\\ \text{the } k^{th} \text{ CV's}\\ \text{Resupply}\\ \text{from } s^{th} \text{ Site}\end{pmatrix}_{s,k} + \begin{pmatrix}\text{Packaging and}\\ \text{Handling Rate}\\ \text{per Cubic Foot}\end{pmatrix} \begin{pmatrix}\text{Inventory}\\ \text{Storage Space}\\ \text{per Item in}\\ \text{Cubic Feet}\end{pmatrix} \right] \right]
$$

$$
+ \sum_{p=1}^{q} \sum_{s=1}^{t} \left[\begin{pmatrix}\text{Annual Repair}\\ \text{Scrap Quantity}\\ \text{at the } p^{th}\\ \text{LB Site}\end{pmatrix}^{\dagger}_{p} \left[\begin{pmatrix}\text{Transportation}\\ \text{Rate per Pound}\\ \text{from the } s^{th} \text{ Site}\\ \text{to the } p^{th} \text{ LB Site}\end{pmatrix}_{s,p} \begin{pmatrix}\text{Weight}\\ \text{of the}\\ \text{Item}\end{pmatrix} \begin{pmatrix}\text{Fraction of}\\ \text{the } p^{th} \text{ LB's}\\ \text{Resupply}\\ \text{from } s^{th} \text{ Site}\end{pmatrix}_{s,p} + \begin{pmatrix}\text{Packaging and}\\ \text{Handling Rate}\\ \text{per Cubic Foot}\end{pmatrix} \begin{pmatrix}\text{Inventory}\\ \text{Storage Space}\\ \text{per Item in}\\ \text{Cubic Feet}\end{pmatrix} \right] \right]
$$

$$
+ \sum_{g=1}^{h} \sum_{s=1}^{t} \left[\begin{pmatrix}\text{Annual Repair}\\ \text{Scrap Quantity}\\ \text{at the } g^{th}\\ \text{Depot Site}\end{pmatrix}^{\dagger}_{g} \left[\begin{pmatrix}\text{Transportation}\\ \text{Rate per Pound}\\ \text{from the } s^{th} \text{ Site}\\ \text{to the } g^{th} \text{ Depot Site}\end{pmatrix}_{s,g} \begin{pmatrix}\text{Weight}\\ \text{of the}\\ \text{Item}\end{pmatrix} \begin{pmatrix}\text{Fraction of}\\ \text{the } g^{th} \text{ Depot's}\\ \text{Resupply}\\ \text{from } s^{th} \text{ Site}\end{pmatrix}_{s,g} + \begin{pmatrix}\text{Packaging and}\\ \text{Handling Rate}\\ \text{per Cubic Foot}\end{pmatrix} \begin{pmatrix}\text{Inventory}\\ \text{Storage Space}\\ \text{per Item in}\\ \text{Cubic Feet}\end{pmatrix} \right] \right] \Bigg\}
$$

10.3.2 <u>Support for Support Equipment Cost.</u> Two types of support equipment are considered in LOR decisions. First, the item may require PSSE (Peculiar Support for Support Equipment) for fault isolation or verification. The contractor would design a specific equipment to service the item. Second, the contractor may design an equipment that services a group of items, in which case the equipment is required if at least one member of the group is assigned to some level requiring the equipment.

TASK 103 (Continued)

10.3.2.1 <u>Peculiar Support for Support Equipment Cost Equations</u>. When performing an analysis at the item's indenture level, allocatable and/or non-allocatable costs may be incurred. For PSSE peculiar to an individual item, the cost is assigned entirely to the item as an allocatable cost. For PSSE designed for a group of items, the cost is assigned to the group of items as a non-allocatable cost. Within the following equations, the word item refers to an item that has PSSE specifically designed for it or to the items in a group that have PSSE designed for the group. In the PSSE cost equations that follow the total cost of one PSSE set is defined to include the initial unit cost and annually recurring support costs.

$$\left(\begin{array}{c}\text{Unit and}\\ \text{Support}\\ \text{Cost of}\\ \text{a PSSE}\end{array}\right)^{*} = \left(\begin{array}{c}\text{Unit Cost}\\ \text{of the}\\ \text{PSSE}\end{array}\right)\left[1.0 + \left[\frac{\left(\begin{array}{c}\text{Support of the Support for}\\ \text{Support Equipment}\\ \text{Rate for the}\\ \text{First Year}\end{array}\right)}{(1.0 + \text{Discount Rate})}\right] + \left(\begin{array}{c}\text{Support of the Support for}\\ \text{Support Equipment}\\ \text{Rate for the}\\ \text{Succeeding Years}\end{array}\right)\left(\begin{array}{c}\text{Reduced}\\ \text{Discount}\\ \text{Factor}\end{array}\right)\right]$$

*Applicable to repair and discard PSSE as required by the LOR case under consideration.

10.3.2.1.1 <u>Peculiar Support for Support Equipment Cost Equation for the Discard Cases</u>. Discard or verification PSSE may be used at the item level to check and test an item's failure.

$$\left(\begin{array}{c}\text{Item PSSE}\\ \text{Cost for}\\ \text{Discard}\end{array}\right)^{\dagger} = \left[\left(\begin{array}{c}\text{Unit and Support}\\ \text{Cost per Repair}\\ \text{PSSE at CV to}\\ \text{Verify Item}\\ \text{Failure}\end{array}\right)\left(\begin{array}{c}\text{Number of}^{*}\\ \text{Discard PSSE}\\ \text{Required}\\ \text{per CV}\end{array}\right)\left(\begin{array}{c}\text{Number}\\ \text{of}\\ \text{CV's}\end{array}\right)^{\dagger} + \left(\begin{array}{c}\text{Unit and Support}\\ \text{Cost per Discard}\\ \text{PSSE at NAS to}\\ \text{Verify Item}\\ \text{Failure}\end{array}\right)\left(\begin{array}{c}\text{Number of}^{*}\\ \text{Discard PSSE}\\ \text{Required}\\ \text{per NAS}\end{array}\right)\left(\begin{array}{c}\text{Number of}\\ \text{NAS}\end{array}\right)\right.$$

$$\left. + \left(\begin{array}{c}\text{Unit and Support}^{**}\\ \text{Cost per Discard}\\ \text{PSSE at Depot}\\ \text{to Verify Item}\\ \text{Failure}\end{array}\right)\left(\begin{array}{c}\text{Number of}^{*}\\ \text{Discard PSSE}\\ \text{Required}\\ \text{per Depot}\end{array}\right)^{**}\left(\begin{array}{c}\text{Number of}\\ \text{Depots}\end{array}\right)^{\dagger}\right]$$

*The term = 0 if the higher assembly is not repaired at the site, as applicable to the LOR case under consideration. The determination as to whether CV or NAS sites require support equipment is dependent upon where the higher assembly is repaired.

**The type of support equipment resources, full or back-up, at the Depot sites is dependent on the LOR case and workload at the sites. The determination of full or back-up resources is based on the criteria of Figures 3 and 4.

TASK 103 (Continued)

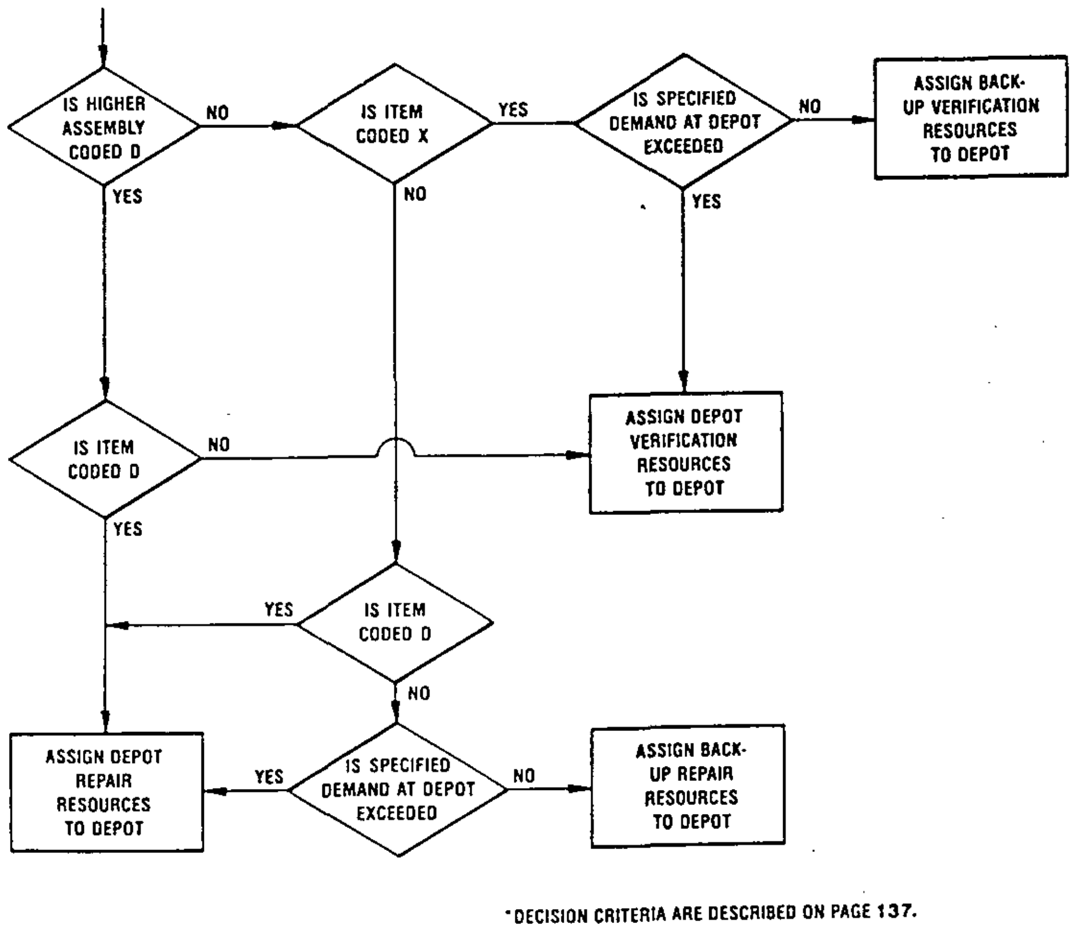


FIGURE 3. Criteria for full or back-up resources at depot sites.

TASK 103 - Figure 3 (continued)

Description of the Criteria for Full or Back-up Resources at a Depot Site

The LOR analytical techniques allow one or two types of support resources to be used at depot repair facilities. The mode of operation of a depot to support the item under analysis depends on the LOR code assignment of the item. A depot services repairables forwarded to it from other repair sites. Full depot resources are always provided for items which are coded depot repair, or for higher level assemblies coded depot repair; the resources determination for other items depends on the workload experienced at the depot. If the workload does not exceed a specified percentage then the depot operates under a limited mode and back-up depot resources are required. If the workload exceeds the specified percentage the depot operates under a full mode and full depot resources are provided. The decision criteria for the determination of full or back-up repair and verification resources at depot facilities as a function of the LOR code assignment are given in Figure 3.

TASK 103 (continued)

10.3.2.1.2 Peculiar Support for Support Equipment Cost Equation for the Repair Intermediate Cases. Repair PSSE at intermediate repair facilities can verify the item failure and fault isolate to the next lower assembly. The repair PSSE is more complex than its discard counterpart and the complexity is reflected in different costs for the required PSSE. The assignment of the PSSE cost as allocatable/non-allocatable and the resource type determination are the same as that for discard.

$$\begin{pmatrix}\text{Item PSSE}\\\text{Cost for}\\\text{Intermediate}\\\text{Repair}\end{pmatrix} = \left[\begin{pmatrix}\text{Unit and Support}\\\text{Cost per Repair}\\\text{PSSE at CV to}\\\text{Repair Item}\\\text{Failure}\end{pmatrix}\begin{pmatrix}\text{Number of}\\\text{Discard PSSE}\\\text{Required}\\\text{per CV}\end{pmatrix}\begin{pmatrix}\text{Number}\\\text{of}\\\text{CV's}\end{pmatrix}^{\dagger} + \begin{pmatrix}\text{Unit and Support}\\\text{Cost per Repair}\\\text{PSSE at NAS}\\\text{to Repair Item}\\\text{Failure}\end{pmatrix}\begin{pmatrix}\text{Number of}\\\text{Repair PSSE}\\\text{Required}\\\text{per NAS}\end{pmatrix}\begin{pmatrix}\text{Number of}\\\text{NAS's}\end{pmatrix}^{\dagger} + \begin{pmatrix}\text{Unit and Support}^{*}\\\text{Cost per Repair}\\\text{PSSE at Depot}\\\text{to Repair}\\\text{Item Failure}\end{pmatrix}\begin{pmatrix}\text{Number of}^{*}\\\text{Repair PSSE}\\\text{Required}\\\text{per Depot}\end{pmatrix}\begin{pmatrix}\text{Number of}\\\text{Depots}\end{pmatrix}^{\dagger}\right]$$

*The determination of full or back-up resources is based on the criteria of Figure 3.

10.3.2.1.3 Peculiar Support for Support Equipment Cost Equation for the Repair Depot Cases. For the repair depot cases, support equipment for fault verification may be required at the operational site if the higher assembly was repaired there. The assignment of the PSSE as allocatable/non-allocatable is the same as that for the discard and repair intermediate.

$$\begin{pmatrix}\text{Item PSSE}\\\text{Cost for}\\\text{Depot}\\\text{Repair}\end{pmatrix}^{\dagger} = \left[\begin{pmatrix}\text{Unit and Support}\\\text{Cost per Discard}\\\text{PSSE at CV to}\\\text{Verify Item}\\\text{Failure}\end{pmatrix}\begin{pmatrix}\text{Number of}^{*}\\\text{Discard PSSE}\\\text{Required}\\\text{per CV}\end{pmatrix}\begin{pmatrix}\text{Number}\\\text{of}\\\text{CV's}\end{pmatrix}^{\dagger} + \begin{pmatrix}\text{Unit and Support}\\\text{Cost per Discard}\\\text{PSSE at NAS to}\\\text{Verify Item}\\\text{Failure}\end{pmatrix}\begin{pmatrix}\text{Number of}^{*}\\\text{Discard PSSE}\\\text{Required}\\\text{per NAS}\end{pmatrix}\begin{pmatrix}\text{Number of}\\\text{NAS's}\end{pmatrix} + \begin{pmatrix}\text{Unit and Support}\\\text{Cost per Repair}\\\text{PSSE at Depot}\\\text{to Repair}\\\text{Item Failure}\end{pmatrix}\begin{pmatrix}\text{Number of}\\\text{Repair PSSE}\\\text{Required}\\\text{per Depot}\end{pmatrix}\begin{pmatrix}\text{Number of}\\\text{Depots}\end{pmatrix}^{\dagger}\right]$$

*The term = 0 if the higher assembly is not repaired at the site, as applicable to the LOR case under consideration.

TASK 103 (continued)

10.3.3 Space Cost. For each case, total space cost is the summation of three separate costs: cost of inventory storage space, cost of support equipment space, and cost of repair work space.

10.3.3.1 Inventory Storage Space Cost. This is the cost of inventory storage space associated with the discard inventory; attrition, rotatable pool, and system stock quantities.

10.3.3.1.1 Inventory Storage Space Cost Equation for the Discard Cases. For carrier based aircraft, the storage quantity is adjusted to account for the fact that failures occur only during the carrier's deployments. This adjustment is carried out through division by the carrier deployment factor.

$$\left(\begin{array}{c}\text{Cost of Inventory}\\ \text{Storage Space}\\ \text{for Discard}\end{array}\right)^{t} = \sum_{v=1}^{r}\left[\left(\begin{array}{c}\text{Inventory Reserved}\\ \text{for the Required}\\ \text{Days of Stock at}\\ \text{the } v^{th} \text{ Site}\end{array}\right)_{v}^{t}\left(\begin{array}{c}\text{Cost of Space per}\\ \text{Cubic Foot per Year}\\ \text{at the } v^{th} \text{ Site}\end{array}\right)_{v}\right]\left(\begin{array}{c}\text{Inventory}\\ \text{Storage Space}\\ \text{per Item in}\\ \text{Cubic Feet}\end{array}\right)\left(\begin{array}{c}\text{Normal}\\ \text{Discount}\\ \text{Factor}\end{array}\right)$$

where,

$$\left(\begin{array}{c}\text{Inventory Reserved}\\ \text{for the Required}\\ \text{Days of Stock at}\\ \text{the } v^{th} \text{ Site}\end{array}\right)^{t} = \text{INT}\left\{\frac{\left(\begin{array}{c}\text{Annual Inventory}\\ \text{Quantity for Discard}\\ \text{at the } v^{th} \text{ Site}\end{array}\right)^{t}\left(\begin{array}{c}\text{Required Days}\\ \text{of Stock at}\\ \text{the } v^{th} \text{ Site}\end{array}\right)}{\left(\begin{array}{c}\text{365 Days}\\ \text{per}\\ \text{Year}\end{array}\right)\left(\begin{array}{c}\text{Carrier}^{*}\\ \text{Deployment}\\ \text{Factor}\end{array}\right)}\right\}$$

*For LB sites no deployment factor is required.

10.3.3.1.2 Inventory Storage Space Cost Equation for the Repair Cases.

$$\left(\begin{array}{c}\text{Cost of Inventory}\\ \text{Storage Space}\\ \text{per Item}\\ \text{for Repair}\end{array}\right)^{t} = \left[\sum_{k=1}^{l}\left[\left(\begin{array}{c}\text{Rotatable}\\ \text{Pool Quantity}\\ \text{at the } k^{th}\\ \text{CV Site}\end{array}\right)_{k}^{t} + \left(\begin{array}{c}\text{Attrition}\\ \text{Quantity}\\ \text{at the } k^{th}\\ \text{CV Site}\end{array}\right)_{k}^{t}\right]\left(\begin{array}{c}\text{Cost of Space}\\ \text{per Cubic Foot}\\ \text{per Year for}\\ \text{CV Sites}\end{array}\right)\right.$$

$$+ \sum_{p=1}^{q}\left[\left(\begin{array}{c}\text{Rotatable}\\ \text{Pool Quantity}\\ \text{at the } p^{th}\\ \text{LB Site}\end{array}\right)_{p}^{t} + \left(\begin{array}{c}\text{Attrition}\\ \text{Quantity}\\ \text{at the } p^{th}\\ \text{LB Site}\end{array}\right)_{p}^{t}\right]\left(\begin{array}{c}\text{Cost of Space}\\ \text{per Cubic Foot}\\ \text{per Year for}\\ \text{LB Sites}\end{array}\right)$$

$$\left. + \left(\begin{array}{c}\text{System}\\ \text{Stock of}\\ \text{the Item}\end{array}\right)^{t}\left(\begin{array}{c}\text{Cost of Space}\\ \text{per Cubic Foot}\\ \text{per Year for}\\ \text{Depot Sites}\end{array}\right)\right]\left(\begin{array}{c}\text{Inventory Storage}\\ \text{Space per Item}\\ \text{in Cubic Feet}\end{array}\right)\left(\begin{array}{c}\text{Normal}\\ \text{Discount}\\ \text{Factor}\end{array}\right)$$

TASK 103 (continued)

10.3.3.2 Support for Support Equipment Space Cost.

10.3.3.2.1 Support for Support Equipment Space Cost Equation. This is the cost of PSSE space allocated to an item or a group of items. It is determined as a function of the number of required PSSE, the PSSE deck space and the cost of space at the facility. The deck space includes both the space occupied by the PSSE and the working space necessary to operate the equipment. The assignment of the space cost to an item or group of items and the determination of type of resource are the same as that for support equipment. Within the following equations, the word item refers to an item that has PSSE specifically designed for it or to the group of items that have PSSE designed for the group.

$$\left(\begin{matrix}\text{Cost of}\\\text{PSSE Space}\end{matrix}\right)^{\dagger} = \left[\left[\left(\begin{matrix}\text{Number of}\\\text{PSSE Required}\\\text{per CV Site}\end{matrix}\right)^{\dagger}\left(\begin{matrix}\text{Space}\\\text{Required}\\\text{per PSSE}\end{matrix}\right)\left(\begin{matrix}\text{Number of}\\\text{CV Sites}\end{matrix}\right)^{\dagger}\left(\begin{matrix}\text{Cost of Space}\\\text{per Square Foot}\\\text{per Year for}\\\text{CV Sites}\end{matrix}\right)\right]\right.$$

$$+\left[\left(\begin{matrix}\text{Number of}\\\text{PSSE Required}\\\text{per NAS}\end{matrix}\right)^{\dagger}\left(\begin{matrix}\text{Space}\\\text{Required}\\\text{per PSSE}\end{matrix}\right)\left(\begin{matrix}\text{Number of}\\\text{NAS's}\end{matrix}\right)^{\dagger}\left(\begin{matrix}\text{Cost of Space}\\\text{per Square Foot}\\\text{per Year for}\\\text{LB Sites}\end{matrix}\right)\right]$$

$$\left.+\left[\left(\begin{matrix}\text{Number of}\\\text{PSSE Required}\\\text{per Depot}\end{matrix}\right)^{\dagger}\left(\begin{matrix}\text{Space}\\\text{Required}\\\text{per PSSE}\end{matrix}\right)\left(\begin{matrix}\text{Number of}\\\text{Depots}\end{matrix}\right)^{\dagger}\left(\begin{matrix}\text{Cost of Space}\\\text{per Square Foot}\\\text{per Year for}\\\text{Depot Sites}\end{matrix}\right)\right]\right]\left(\begin{matrix}\text{Normal}\\\text{Discount}\\\text{Factor}\end{matrix}\right)$$

10.3.3.3 Repair Work Space Cost.

10.3.3.3.1 Repair Work Space Cost Equation. Repair work space is defined as that space dedicated solely for maintenance actions of an item or group of items exclusive of the support for support equipment space. The assignment of the space cost as allocatable/non-allocatable and determination of type of resource is the same as that for support for support equipment. The word item, within the following equations, refers to the item or the items in a group that uniquely have the space set aside for maintenance actions.

$$\left(\begin{matrix}\text{Repair Work}\\\text{Space Cost}\end{matrix}\right)^{\dagger} = \left[\left[\left(\begin{matrix}\text{Item Repair}\\\text{Work Space}\\\text{Required at}\\\text{the CV Site}\end{matrix}\right)^{\dagger}\left(\begin{matrix}\text{Number}\\\text{of}\\\text{CV Sites}\end{matrix}\right)^{\dagger}\left(\begin{matrix}\text{Cost of Space}\\\text{per Square Foot}\\\text{per Year for}\\\text{CV Sites}\end{matrix}\right)\right]\right.$$

$$+\left[\left(\begin{matrix}\text{Item Repair}\\\text{Work Space}\\\text{Required at}\\\text{the NAS}\end{matrix}\right)^{\dagger}\left(\begin{matrix}\text{Number of}\\\text{NAS's}\end{matrix}\right)\left(\begin{matrix}\text{Cost of Space}\\\text{per Square Foot}\\\text{per Year for}\\\text{LB Sites}\end{matrix}\right)\right]$$

$$\left.+\left[\left(\begin{matrix}\text{Item Repair}\\\text{Work Space}\\\text{Required at}\\\text{the Depot}\end{matrix}\right)^{\dagger}\left(\begin{matrix}\text{Number}\\\text{of}\\\text{Depots}\end{matrix}\right)\left(\begin{matrix}\text{Cost of Space}\\\text{per Square Foot}\\\text{per Year for}\\\text{Depot Sites}\end{matrix}\right)\right]\right]\left(\begin{matrix}\text{Normal}\\\text{Discount}\\\text{Factor}\end{matrix}\right)$$

TASK 103 (continued)

10.3.3.4 Total Space Cost Equation. The total space cost is the summation of the inventory, support equipment, and repair work space costs.

$$\begin{pmatrix}\text{Total}\\ \text{Space}\\ \text{Cost}\end{pmatrix}^{t} = \left[\begin{pmatrix}\text{Inventory}\\ \text{Storage}\\ \text{Space Cost}\end{pmatrix}^{t} + \begin{pmatrix}\text{Support}\\ \text{Equipment}\\ \text{Space Cost}\end{pmatrix}^{t} + \begin{pmatrix}\text{Repair}\\ \text{Work}\\ \text{Space Cost}\end{pmatrix}^{t}\right]$$

10.3.4 Labor Cost Equations. These express the labor costs incurred for discard and repair actions.

10.3.4.1 Labor Cost Equation for the Discard Cases.

$$\begin{pmatrix}\text{Cost of}\\ \text{Labor for}\\ \text{Discard}\end{pmatrix}^{t} = \Bigg[\sum_{k=1}^{l} \left[\begin{pmatrix}\text{Annual Number}\\ \text{of Real Failures}\\ \text{Removed at the}\\ k^{th}\text{ CV Site}\end{pmatrix}^{t}_{k} \begin{pmatrix}\text{Direct Maintenance}\\ \text{Man Hours at CV}\\ \text{per Discard Action}\end{pmatrix} \begin{pmatrix}\text{Labor Cost}\\ \text{per Hour}\\ \text{at the CV}\end{pmatrix}\right]$$

$$+ \sum_{m=1}^{n} \left[\begin{pmatrix}\text{Annual Number}\\ \text{of Real Failures}\\ \text{Removed at the}\\ m^{th}\text{ NAS Site}\end{pmatrix}^{t}_{m} \begin{pmatrix}\text{Direct Maintenance}\\ \text{Man Hours at NAS}\\ \text{per Discard Action}\end{pmatrix} \begin{pmatrix}\text{Labor Cost}\\ \text{per Hour}\\ \text{at the NAS}\end{pmatrix}\right]$$

$$+ \sum_{g=1}^{h} \left[\begin{pmatrix}\text{Annual Number}\\ \text{of Real Failures}\\ \text{Removed at the}\\ g^{th}\text{ Depot Site}\end{pmatrix}^{t}_{g} \begin{pmatrix}\text{Direct Maintenance}\\ \text{Man Hours at Depot}\\ \text{per Discard Action}\end{pmatrix} \begin{pmatrix}\text{Labor Cost}\\ \text{per Hour}\\ \text{at the Depot}\end{pmatrix}\right] \left[1.0 + \begin{pmatrix}\text{Fraction of}\\ \text{Items Falsely}\\ \text{Removed}\end{pmatrix}\right] \begin{pmatrix}\text{Normal}\\ \text{Discount}\\ \text{Factor}\end{pmatrix} \Bigg]$$

TASK 103 (continued)

10.3.4.2 Labor Cost Equation for the Repair Intermediate Cases.

$$\begin{pmatrix}\text{Cost of}\\\text{Labor for}\\\text{Intermediate}\\\text{Repair}\end{pmatrix}^{t} = \Bigg[\sum_{k=1}^{t}\begin{pmatrix}\text{Annual Number}\\\text{of Real Failures}\\\text{Removed at the}\\k^{th}\text{ CV Site}\end{pmatrix}_{k}^{t}\begin{pmatrix}\text{Labor Cost}\\\text{per Hour}\\\text{at the CV}\end{pmatrix}\Bigg\{\begin{pmatrix}\text{Fraction of}\\\text{Items Falsely}\\\text{Removed}\end{pmatrix}\begin{pmatrix}\text{Fraction of Item}\\\text{False Removals}\\\text{Detected as Such}\end{pmatrix}\begin{pmatrix}\text{Direct Maintenance}\\\text{Man Hours at CV}\\\text{per Discard Action}\end{pmatrix}$$

$$+\left[1.0+\begin{pmatrix}\text{Fraction of}\\\text{Items Falsely}\\\text{Removed}\end{pmatrix}\left[1.0-\begin{pmatrix}\text{Fraction of Item}\\\text{False Removals}\\\text{Detected as Such}\end{pmatrix}\right]\right]\begin{pmatrix}\text{Direct Maintenance}\\\text{Man Hours at CV}\\\text{per Repair Action}\end{pmatrix}\Bigg\}$$

$$+\sum_{m=1}^{n}\begin{pmatrix}\text{Annual Number}\\\text{of Real Failures}\\\text{Removed at the}\\m^{th}\text{ NAS Site}\end{pmatrix}_{m}^{t}\begin{pmatrix}\text{Labor Cost}\\\text{per Hour}\\\text{at the NAS}\end{pmatrix}\Bigg\{\begin{pmatrix}\text{Fraction of}\\\text{Items Falsely}\\\text{Removed}\end{pmatrix}\begin{pmatrix}\text{Fraction of Item}\\\text{False Removals}\\\text{Detected as Such}\end{pmatrix}\begin{pmatrix}\text{Direct Maintenance}\\\text{Man Hours at NAS}\\\text{per Discard Action}\end{pmatrix}$$

$$+\left[1.0+\begin{pmatrix}\text{Fraction of}\\\text{Items Falsely}\\\text{Removed}\end{pmatrix}\left[1.0-\begin{pmatrix}\text{Fraction of Item}\\\text{False Removals}\\\text{Detected as Such}\end{pmatrix}\right]\right]\begin{pmatrix}\text{Direct Maintenance}\\\text{Man Hours at NAS}\\\text{per Repair Action}\end{pmatrix}\Bigg\}$$

$$+\sum_{g=1}^{h}\begin{pmatrix}\text{Annual Number}\\\text{of Real Failures}\\\text{Removed at the}\\g^{th}\text{ Depot Site}\end{pmatrix}_{g}^{t}\begin{pmatrix}\text{Labor Cost}\\\text{per Hour}\\\text{at the Depot}\end{pmatrix}\Bigg\{\begin{pmatrix}\text{Fraction of}\\\text{Items Falsely}\\\text{Removed}\end{pmatrix}\begin{pmatrix}\text{Fraction of Item}\\\text{False Removals}\\\text{Detected as Such}\end{pmatrix}\begin{pmatrix}\text{Direct Maintenance}\\\text{Man Hours at Depot}\\\text{per Discard Action}\end{pmatrix}$$

$$+\left[1.0+\begin{pmatrix}\text{Fraction of}\\\text{Items Falsely}\\\text{Removed}\end{pmatrix}\left[1.0-\begin{pmatrix}\text{Fraction of Item}\\\text{False Removals}\\\text{Detected as Such}\end{pmatrix}\right]\right]\begin{pmatrix}\text{Direct Maintenance}\\\text{Man Hours at Depot}\\\text{per Repair Action}\end{pmatrix}\Bigg\}$$

$$+\sum_{g=1}^{h}\begin{pmatrix}\text{Annual Number}\\\text{of Items}\\\text{Received by the}\\g^{th}\text{ Depot Site}\end{pmatrix}_{g}^{t}\begin{pmatrix}\text{Direct Maintenance}\\\text{Man Hours at Depot}\\\text{per Repair Action}\end{pmatrix}\Bigg]\begin{pmatrix}\text{Normal}\\\text{Discount}\\\text{Factor}\end{pmatrix}$$

TASK 103 (continued)

10.3.4.3 Labor Cost Equation for the Repair Depot Cases. Two labor cost equations are presented: one each for the next higher assembly repaired at intermediate or depot level.

10.3.4.3.1 Labor Cost Equation for the Repair Depot Case if Higher Assembly is Coded Intermediate Repair.

$$
\begin{aligned}
\begin{pmatrix}\text{Cost of Labor for}\\ \text{Depot Repair if}\\ \text{Higher Assembly}\\ \text{is Intermediate}\\ \text{Repair}\end{pmatrix}^{t} = \Bigg[\Bigg\{ & \sum_{k=1}^{l} \begin{pmatrix}\text{Annual Number}\\ \text{of Real Failures}\\ \text{Removed at the}\\ k^{th}\text{ CV Site}\end{pmatrix}_{k}^{t} \begin{pmatrix}\text{Direct Maintenance}\\ \text{Man Hours at CV}\\ \text{per Discard Action}\end{pmatrix} \begin{pmatrix}\text{Labor Cost}\\ \text{per Hour}\\ \text{at the CV}\end{pmatrix} \\
& + \sum_{m=1}^{n} \begin{pmatrix}\text{Annual Number}\\ \text{of Real Failures}\\ \text{Removed at the}\\ m^{th}\text{ NAS Site}\end{pmatrix}_{m}^{t} \begin{pmatrix}\text{Direct Maintenance}\\ \text{Man Hours at NAS}\\ \text{per Discard Action}\end{pmatrix} \begin{pmatrix}\text{Labor Cost}\\ \text{per Hour}\\ \text{at the NAS}\end{pmatrix} \Bigg\} \left[1.0 + \begin{pmatrix}\text{Fraction of}\\ \text{Items Falsely}\\ \text{Removed}\end{pmatrix} \right] \\
& + \sum_{g=1}^{h} \begin{pmatrix}\text{Annual Number}\\ \text{of Real Failures}\\ \text{Removed at the}\\ g^{th}\text{ Depot Site}\end{pmatrix}_{g}^{t} \begin{pmatrix}\text{Labor Cost}\\ \text{per Hour}\\ \text{at the Depot}\end{pmatrix} \Bigg\{ \begin{pmatrix}\text{Fraction of}\\ \text{Items Falsely}\\ \text{Removed}\end{pmatrix} \begin{pmatrix}\text{Fraction of Item}\\ \text{False Removals}\\ \text{Detected as Such}\end{pmatrix} \begin{pmatrix}\text{Direct Maintenance}\\ \text{Man Hours at Depot}\\ \text{per Discard Action}\end{pmatrix} \\
& + \left[1.0 + \begin{pmatrix}\text{Fraction of}\\ \text{Items Falsely}\\ \text{Removed}\end{pmatrix} \right] \left[1.0 - \begin{pmatrix}\text{Fraction of Item}\\ \text{False Removals}\\ \text{Detected as Such}\end{pmatrix} \right] \begin{pmatrix}\text{Direct Maintenance}\\ \text{Man Hours at Depot}\\ \text{per Repair Action}\end{pmatrix} \Bigg\} \\
& + \sum_{g=1}^{h} \begin{pmatrix}\text{Annual Number}\\ \text{of Items Received}\\ \text{by the } g^{th}\text{ Depot}\\ \text{Site}\end{pmatrix}_{g}^{t} \begin{pmatrix}\text{Direct Maintenance}\\ \text{Man Hours at Depot}\\ \text{per Repair Action}\end{pmatrix} \begin{pmatrix}\text{Labor Cost}\\ \text{per Hour}\\ \text{at the Depot}\end{pmatrix} \Bigg] \begin{pmatrix}\text{Normal}\\ \text{Discount}\\ \text{Factor}\end{pmatrix}
\end{aligned}
$$

TASK 103 (continued)

10.3.4.3.2 Labor Cost Equation for the Repair Depot Case if Higher Assembly is Coded Depot Repair.

$$\begin{pmatrix}\text{Cost of Labor for}\\ \text{Depot Repair if}\\ \text{Higher Assembly}\\ \text{is Depot Repair}\end{pmatrix}^{\dagger} = \Bigg[\sum_{g=1}^{h} \begin{pmatrix}\text{Annual Number}\\ \text{of Real Failures}\\ \text{Removed at the}\\ g^{th}\text{ Depot Site}\end{pmatrix}^{\dagger}_{g} \begin{pmatrix}\text{Labor Cost}\\ \text{per Hour}\\ \text{at the Depot}\end{pmatrix} \Bigg\{ \begin{pmatrix}\text{Fraction of}\\ \text{Items Falsely}\\ \text{Removed}\end{pmatrix} \begin{pmatrix}\text{Fraction of Item}\\ \text{False Removals}\\ \text{Detected as Such}\end{pmatrix} \begin{pmatrix}\text{Direct Maintenance}\\ \text{Man Hours at Depot}\\ \text{per Discard Action}\end{pmatrix}$$

$$+ \Bigg[1.0 + \begin{pmatrix}\text{Fraction of}\\ \text{Items Falsely}\\ \text{Removed}\end{pmatrix} \Bigg[1.0 - \begin{pmatrix}\text{Fraction of Item}\\ \text{False Removals}\\ \text{Detected as Such}\end{pmatrix} \Bigg] \Bigg] \begin{pmatrix}\text{Direct Maintenance}\\ \text{Man Hours at Depot}\\ \text{per Repair Action}\end{pmatrix} \Bigg\} \Bigg] \begin{pmatrix}\text{Normal}\\ \text{Discount}\\ \text{Factor}\end{pmatrix}$$

10.3.5 Training Cost Equation.

$$\begin{pmatrix}\text{Cost of}\\ \text{Training}\end{pmatrix}^{\dagger} = \Bigg[\begin{pmatrix}\text{Total Number of}\\ \text{Squadron Men}\\ \text{Trained}\end{pmatrix}^{\dagger} \begin{pmatrix}\text{Training Cost}\\ \text{per}\\ \text{Squadron Man}\end{pmatrix}^{\dagger} + \begin{pmatrix}\text{Total Number of}\\ \text{CV Men}\\ \text{Trained}\end{pmatrix}^{\dagger} \begin{pmatrix}\text{Training Cost}\\ \text{per}\\ \text{CV Man}\end{pmatrix}^{\dagger}$$

$$+ \begin{pmatrix}\text{Total Number of}\\ \text{NAS Men}\\ \text{Trained}\end{pmatrix}^{\dagger} \begin{pmatrix}\text{Training Cost}\\ \text{per}\\ \text{NAS Man}\end{pmatrix}^{*} \Bigg] + \Bigg[1.0 + \begin{pmatrix}\text{Navy}\\ \text{Personnel}\\ \text{Attrition}\\ \text{Rate}\end{pmatrix} \Bigg] \begin{pmatrix}\text{Normal}\\ \text{Discount}\\ \text{Factor}\end{pmatrix}$$

$$+ \begin{pmatrix}\text{Total Number of}\\ \text{Depot Men}\\ \text{Trained}\end{pmatrix}^{\dagger} \begin{pmatrix}\text{Training Cost}\\ \text{per}\\ \text{Depot Man}\end{pmatrix}^{*} \Bigg[1.0 + \begin{pmatrix}\text{Depot}\\ \text{Personnel}\\ \text{Attrition}\\ \text{Rate}\end{pmatrix} \Bigg] \begin{pmatrix}\text{Normal}\\ \text{Discount}\\ \text{Factor}\end{pmatrix}$$

*Full or back-up resources based on the criteria of Figures 3 and 4.

10.3.5.1 Training Cost Equation for the Intermediate Repair Cases. For the intermediate repair case, a repair training cost is incurred for each operational site; for the depot repair facilities either full or back-up resources are required based on the criteria of Figure 3.

10.3.5.2 Training Cost Equation for the Depot Repair Cases. For the depot repair cases, repair training costs are incurred for the depot facilities and discard training costs are incurred for the sites other than the depots which repair the higher assembly.

10.3.5.3 Training Cost Equation for the Discard Cases. For the discard cases, discard training costs are incurred for the sites which repair the higher assembly. The depot sites are subject to the criteria of Figure 3.

TASK 103 (continued)

10.3.6 Documentation Cost Equation. A cost value is predetermined for the case under consideration. Documentation includes the following elements: the drawings and specifications which make up the avionic system technical manual; the LSA (Logistic Support Analysis) preparation; and support equipment requirement sheets, lists, software, etc. The determination of applicable costs is the same as that for training.

$$\left(\begin{array}{c}\text{Cost of}\\ \text{Documentation}\end{array}\right)^{t} = \left[\left(\begin{array}{c}\text{Documentation}\\ \text{Cost at IMA}\end{array}\right) + \left(\begin{array}{c}\text{Documentation}\\ \text{Cost at Depot}\end{array}\right)\right]$$

10.4 Combination of Cost Elements. The cost element equations are combined for each item for the alternative under consideration. The cost of an LOR alternative for an equipment is the summation of the costs associated with the items in the equipment. For an avionic equipment different alternatives may be recommended for the different items; the higher assembly, however, must always be assigned to the same case when evaluating all the next lower assemblies contained in it. When making individual recommendations for a group of items which have non-allocatable costs associated with them, redundant costing must be compensated for. If part of the group requires verification at a site and the remainder requires repair at the same site, the verification cost is deleted since it is assumed that the capability to verify is acquired with the capability to repair. Similarly, back-up costs at a site are ignored if full repair capability is collocated with it.

10.5 Table of Data Elements. Table III contains the various LOR data elements, the LSA interface, the associated units required and the data element sources as input to the LOR model for Naval Air Systems Command equipments.

TASK 103 (Continued)

TABLE III. Naval Air Systems Command LOR data elements.

Input Format	Data Elements	LSA	Unit Required	Data Source
I	Next Higher Assembly			
	WRA	Yes	System	Contractor
	SRA	Yes	WRA	Contractor
	SSRA	Yes	SRA	Contractor
L	Predicted MTBF:			
	WRA	Yes	Hours	Contractor
	SRA	Yes	Hours	Contractor
	SSRA	Yes	Hours	Contractor
I	Item Name		Number	Contractor
Y	Degradation Factor		Fraction	Navy
I	Part No.	Yes	P/N	Contractor
I	Nomenclature	Yes	Name	Contractor
I	Identical Items per System:			
	WRA	Yes	WRAs	Contractor
	SRA	Yes	SRAs	Contractor
	SSRA	Yes	SSRAs	Contractor
L	Cost per Item:			
	WRA	Yes	Dollars	Contractor
	SRA	Yes	Dollars	Contractor
	SSRA	Yes	Dollars	Contractor
L	Item Weight:			
	WRA	Yes	Pounds	Contractor
	SRA	Yes	Pounds	Contractor
	SSRA	Yes	Pounds	Contractor
L	Item Volume:			
	WRA	Yes	Ft^3	Contractor
	SRA	Yes	Ft^3	Contractor
	SSRA	Yes	Ft^3	Contractor
L	BCM Rate at IMA:			
	WRA		Fraction	Contractor
	SRA		Fraction	Contractor
	SSRA		Fraction	Contractor
S	Number of SE per Type:			
	CV		Aircraft/ Type/Site	Navy
	NAS		Aircraft/ Type/Site	Navy

TASK 103 (Continued)

TABLE III. Naval Air Systems Command LOR data elements (Continued).

Input Format	Data Elements	LSA	Unit Required	Data Source
S	SE Type Deployment Factor:			
	CV		Fraction	Navy
	NAS		Fraction	Navy
S	Number of SE Operational Sites:			
	CV		CVs	Navy
	NAS		NASs	Navy
	Depot		Depots	Navy
S	Number of Repair Facilities:			
	CV		CVs	Navy
	NAS		NASs	Navy
	Depot		Depots	Navy
Y/Z	RCT for Repair:			
	Intermediate Repair			
	(CV-CV)	Yes	Days	Navy
	(NAS-NAS)	Yes	Days	Navy
	Depot Repair			
	(CV-Depot)	Yes	Days	Navy
	(NAS-Depot)	Yes	Days	Navy
S	RDS at Intermediate Repair Facility:			
	CV		Days	Navy
	NAS		Days	Navy
Y	RDS for Discard:			
	CV		$\$/Ft^2/Site$	Navy
	NAS		$\$/Ft^2/Site$	Navy
			$\$/Ft^2/Site$	Navy
Z	Inventory Storage Cost			
	CV		$\$/Ft^3/Site$	Navy
	*LB		$\$/Ft^3/Site$	Navy
	Depot		$\$/Ft^3/Site$	Navy
Z	Labor Rate:			
	CV		Dollars/Hour	Navy
	*LB		Dollars/Hour	Navy
	Depot		Dollars/Hour	Navy

*LB accounts for NAS and PIMA sites if the value of the applicable data element is identical for the site types.

TASK 103 (Continued)

TABLE III. Naval Air Systems Command LOR data elements (Continued).

Input Format	Data Elements	LSA	Unit Required	Data Source
L	Repair Material Rate:			
	IMA		Fraction	Contractor
	Depot		Fraction	Contractor
Z	Item Repair Work Space:			
	CV		$/Ft²/Year	Navy
	NAS		$/Ft²/Year	Navy
	Depot		$/Ft²/Year	Navy
L	Scrap Rate at IMA:			
	WRA		Fraction	Contractor
	SRA		Fraction	Contractor
	SSRA		Fraction	Contractor
L	Scrap Rate at Depot:			
	WRA		Fraction	Contractor
	SRA		Fraction	Contractor
	SSRA		Fraction	Contractor
L	Item Operating Factor:			
	WRA	Yes	Fraction	Navy
	SRA	Yes	Fraction	Navy
	SSRA	Yes	Fraction	Navy
L	False Removal Rate:			
	WRA	Yes	Fraction	Contractor
	SRA	Yes	Fraction	Contractor
	SSRA	Yes	Fraction	Contractor
L	False Removal Detection Rate:			
	WRA	Yes	Fraction	Contractor
	SRA	Yes	Fraction	Contractor
	SSRA	Yes	Fraction	Contractor

TASK 103 (Continued)

TABLE III. Naval Air Systems Command LOR data elements (Continued).

Input Format	Data Elements	LSA	Unit Required	Data Source
T	Space Required for Verify PSE (Options Identical to Repair PSE)	Yes	Ft^2/PSE	Contractor
T	Additional Work Space		Ft^2	Contractor
T	Documentation Cost:			
	IMA		Dollars	Contractor
	Depot		Dollars	Contractor
M	Number of Men Trained:			
	CV		Men	Navy
	NAS		Men	Navy
	Depot		Men	Navy
M	Training Cost:			
	CV	Yes	$/Man	Navy/Contractor
	NAS	Yes	$/Man	Navy/Contractor
	Depot	Yes	$/Man	Navy/Contractor
M	Personnel Attrition Rate:			
	Naval		Fraction/Year	Navy
	Civilian		Fraction/Year	Navy
L	Number of New Items Entered in NSN System		NSNs	Contractor
Y	Item Entry Cost		Dollars/Items	Navy
Y	Item Retention Cost		Dollars/Items/Year	Navy
L	Field Supply Administration Cost		Dollars/Items/Site/Year	Navy
Y	Packaging and Handling Rate		$Dollars/Ft^3$	Navy
Y	Life Cycle		Years	Navy
Y	Procurement Lead Time		Weeks	Contractor
Y	Safety Level		Weeks	Navy
Y	Discount Rate		Fraction	Navy
T	SE Support Factor (first year)		Fraction/Year	Contractor
T	SE Support Factor (succeeding year)		Fraction/Year	Contractor

TASK 103 (Continued)

TABLE III. Naval Air Systems Command LOR data elements (Continued).

Input Format	Data Elements	LSA	Unit Required	Data Source
S	Hour Per Month:			
	CV	Yes	Hours/Month/ SE/Site	Navy
	NAS	Yes	Hours/Month/ SE/Site	Navy
	Depot	Yes	Hours/Month/ SE/Site	Navy
T	Direct Maintenance Man-Hours for Repair:			
	(WRA)			
	CV	Yes	Hours	Contractor
	NAS	Yes	Hours	Contractor
	Depot	Yes	Hours	Contractor
	(SRA)			
	CV	Yes	Hours	Contractor
	NAS	Yes	Hours	Contractor
	Depot	Yes	Hours	Contractor
	(SSRA)			
	CV	Yes	Hours	Contractor
	NAS	Yes	Hours	Contractor
	Depot	Yes	Hours	Contractor
T	Direct Maintenance Man-Hours for Verify (Options Identical to Man-Hours for Repair)	Yes	Hours	Contractor
S	Transportation Rate:			
	IMA-Depot		Dollars/Pound	Navy
	Resupply-CV		Dollars/Pound	Navy
	Resupply-NAS		Dollars/Pound	Navy
	Resupply-Depot		Dollars/Pound	Navy
T	Unit Cost of Verify/Repair PSE:			
	CV		Dollars/PSE	Contractor
	NAS		Dollars/PSE	Contractor
	Depot		Dollars/PSE	Contractor
T	Unit Cost of Verify PSE (Options Identical to Repair PSE)		Dollars/PSE	Contractor
T	Number of Verify/Repair PSE:			
	CV	Yes	PSE	Contractor
	NAS	Yes	PSE	Contractor
	Depot	Yes	PSE	Contractor
T	SE Development Cost		Dollars	Contractor
T	SE Manufacturing Hardware Cost		Dollars	Contractor
	CV			
	NAS			
	Depot			
T	Space Required for Repair PSE:			
	CV	Yes	Ft^2/PSE	Contractor
	NAS	Yes	Ft^2/PSE	Contractor
	Depot	Yes	Ft^2/PSE	Contractor

SECTION 200

LEVEL OF REPAIR
FOR
SPAWAR//NAVSEA COMMANDS

TASK 201

LOR Analytical Techniques for Space and Naval Warfare Systems Command/Naval Sea Systems Command Equipments

20. SCOPE

20.1 Purpose.

This task specifies the mathematical equations for performing LOR analyses for equipments under the cognizance of the Space and Naval Warfare Systems Command and the Naval Sea Systems Command. The equations determine the life cycle logistic support costs associated with the assembly hardware indenture level.

20.2 General. The LOR analysis recommendation for an item is based on the economic impact of four LOR alternatives: (1) Organizational Repair; (2) Intermediate Repair; (3) Depot Repair; and (4) Discard. The economic LOR analytical techniques are based upon six major cost categories: (1) inventory which includes level of investment, attrition, administration, and storage space; (2) personnel which includes training, and direct labor; (3) support equipment which includes acquisition, support, and space; (4) repair which includes material, scrap, and space; (5) documentation; and (6) transportation which includes packaging, and shipping. These Cost categories include fifteen cost equations.

In the process of determining life cycle costs, first, one of seven inventory policies must be specified by the user. The model will then select one of three reorder level distributions. This information is then combined with two types of parameters, discount factors (of which there are two), and flow rates (of which there are five).

The following pages will define the methodologies used with the discount factors, flow rates, reorder level distributions, inventory policies, and finally, the cost equations.

20.3 Required Parameters. These are parameters which are used within the various cost element equations.

20.3.1 Discount Factors. Two discount factors are required for use with individual cost equations. The first factor calculates the present value for future costs incurred at the end of each year for a number of years of the operating life span.

The standard formula for the present value of an annuity is used with the "peak program" cost computations. For "phase-in" methodology, where yearly expenditures will not be identical, the standard present value discounting equation should be used for each year of the life cycle. Results of present values can then be computed. Year n is defined as the number of the year in to the life span.

TASK 201 (Continued)

For peak program (do one)

$$\begin{pmatrix}\text{Discount}\\ \text{Factor 1}\\ \text{Year } n\end{pmatrix} = \frac{\left[1.0 - \left(\dfrac{1.0}{\left[1.0 + \begin{pmatrix}\text{Annual}\\ \text{Interest Rate}\end{pmatrix}\right]^{(\text{Life Span})}}\right)\right]}{\begin{pmatrix}\text{Annual}\\ \text{Interest Rate}\end{pmatrix}}$$

For phase-in (do for every calendar year of life span):

$$\begin{pmatrix}\text{Discount}\\ \text{Factor 1}\\ \text{Year } n\end{pmatrix} = \left[\frac{1.0}{\left[1.0 + \begin{pmatrix}\text{Annual}\\ \text{Interest Rate}\end{pmatrix}\right]^{(\text{Year } n \,-\, \text{Base Year} \,+\, 1)}}\right]$$

The second factor is the discount factor for future costs incurred at the end of each year starting with the second year and continuing through a number of years per life cycle. It is used for the phase-in methodology.

$$\begin{pmatrix}\text{Discount}\\ \text{Factor 2}\\ \text{Year } n\end{pmatrix} = \begin{pmatrix}\text{Discount}\\ \text{Factor 1}\\ \text{Year } (n-1)\end{pmatrix}$$

20.3.2 <u>Flow Rates</u>. There are five flow rates used in the cost equations. The flow rate is the movement of a repairable item through the maintenance cycle.

20.3.2.1 <u>Verification Rate</u>. The verification rate is the probability that a component failure will be detected at a given maintenance echelon for a given LOR case. Verification is the ability of a maintenance technician to fault isolate and determine that the item has failed. The actual repair may occur at the same echelon or at a higher echelon. Non-zero values for this rate at all three echelons are possible for some LOR cases; for other cases, values may be zero for one or more echelons.

$$\begin{pmatrix}\text{Verification}\\ \text{Rate}\end{pmatrix} = \left(1.0 + \begin{matrix}\text{False Removal Rate from}\\ \text{Next Higher Assembly (NHA)}\end{matrix}\right)$$

TASK 201 (Continued)

20.3.2.2 Repair Rate. The repair rate is the probability that the component, upon failure, undergoes repair at a given maintenance echelon for a given LOR case. This rate is defined for all three maintenance echelons but may be zero for one or more according to the LOR case. In particular, it will be zero for all three echelons for LOR cases in which the LOR assignment is discard for the item or any higher assembly.

$$\begin{pmatrix}\text{Repair}\\ \text{Rate}\end{pmatrix} = \left[\left(1.0 + \begin{pmatrix}\text{False Removal}\\ \text{Rate from NHA}\end{pmatrix}\left(1.0 - \begin{pmatrix}\text{False Removal Detection}\\ \text{Rate From NHA}\end{pmatrix}\right)\right)\left(1.0 - \begin{pmatrix}\text{BCM}\\ \text{Rate}\end{pmatrix}\right)\left(1.0 - \begin{pmatrix}\text{Unrepairable}\\ \text{Failure Rate}\end{pmatrix}\right)\right]$$

20.3.2.3 Scrap Rate. The scrap rate is the probability that a component failure will result in the item being scrapped or discarded at a given maintenance echelon for a given LOR case. The component is assumed to be permanently lost for further use. This rate is defined for all three maintenance echelons but may be zero for one or more echelon. For example, if the LOR case specifies discard for the item, then the scrap rate will be 1.0 for the echelon at which the item is first removed from its next higher assembly (which may be in the equipment) and zero at the other echelons.

$$\begin{pmatrix}\text{Scrap}\\ \text{Rate}\end{pmatrix} = \left[\left(1.0 + \begin{pmatrix}\text{False Removal}\\ \text{Rate from NHA}\end{pmatrix}\left(1.0 - \begin{pmatrix}\text{False Removal Detection}\\ \text{Rate From NHA}\end{pmatrix}\right)\right)\left(1.0 - \begin{pmatrix}\text{BCM}\\ \text{Rate}\end{pmatrix}\right)\begin{pmatrix}\text{Unrepairable}\\ \text{Failure Rate}\end{pmatrix}\right]$$

20.3.2.4 BCM-To-IMA Rate. The BCM to IMA rate is the probability that a component failure will be beyond capability of maintenance (BCM) at the organizational level and is sent to the intermediate maintenance activity (IMA) for repair. This rate is defined only for the organizational maintenance echelon and will be non-zero only for LOR cases that permit organizational level repair of the item.

$$\begin{pmatrix}\text{BCM to}\\ \text{IMA Rate}\end{pmatrix} = \left[\left(1.0 + \begin{pmatrix}\text{False Removal}\\ \text{Rate from NHA}\end{pmatrix}\left(1.0 - \begin{pmatrix}\text{False Removal Detection}\\ \text{Rate From NHA}\end{pmatrix}\right)\right)\begin{pmatrix}\text{BCM}\\ \text{Rate}\end{pmatrix}\begin{pmatrix}\text{\% of Failed Units}\\ \text{Sent to IMA}\end{pmatrix}\right]$$

20.3.2.5 BCM-To-Depot Rate. This probability assumes that a component failure will be beyond capability of maintenance at a lower-level maintenance echelon and is sent to the depot level for repair. This rate is defined only for the organizational and intermediate maintenance levels and will be non-zero only for LOR cases that permit repair at these levels.

$$\begin{pmatrix}\text{BCM to}\\ \text{Depot}\\ \text{Rate}\end{pmatrix} = \left[\left(1.0 + \begin{pmatrix}\text{False Removal}\\ \text{Rate from NHA}\end{pmatrix}\left(1.0 - \begin{pmatrix}\text{False Removal Detection}\\ \text{Rate From NHA}\end{pmatrix}\right)\right)\begin{pmatrix}\text{BCM}\\ \text{Rate}\end{pmatrix}\left(1.0 - \begin{pmatrix}\text{\% of Failed Units}\\ \text{Sent to IMA}\end{pmatrix}\right)\right]$$

TASK 201 (Continued)

20.4 Reorder Level. The Reorder Level used by a given inventory policy, is calculated for a given mean, variance, and risk factor. There are three types of standard distributions used to perform this calculation: the Poisson, the negative binomial, and the normal. The type of distribution used depends upon the mean and variance. The selection criteria and computation methodology for each of the three distributions are given below.

20.4.1 Poisson Distribution. This distribution is used whenever the mean is less than 20 and the variance is equal to the mean. The distribution is given by the following formula:

$$(\text{Reorder Level}) = P(x) = \left(\frac{(\text{Mean})^{(x)} (e)^{(-\text{Mean})}}{(x!)} \right)$$

In using this formula to obtain a reorder level, it is necessary to find the smallest value of x such that the sum of P(x) from that point on is less than the given risk factor. This value is found by a recursive procedure which relies on the fact that

$$P(x) = \frac{(\text{Mean})\, P(x-1)}{x}$$

$$\text{if } (e)^{(-\text{Mean})} \geq (1.0 - (\text{Risk}))$$

$$(\text{Reorder Level}) = 0$$

20.4.2 Negative Binomial. This distribution is used whenever the mean is less than 20 and the variance is greater than the mean. The distribution is given by the following formula:

$$(\text{Reorder Level}) = P(x) = \frac{((K + x - 1)!\,(Q - 1)^{x})}{((K - 1)!\, x!\, (Q)^{(K + x)})}$$

where

$$K = \frac{(\text{Mean})}{(Q - 1)}$$

$$Q = \frac{(\text{Variance})}{(\text{Mean})}$$

TASK 201 (Continued)

As in the case of the Poisson distribution, it is necessary to find the smallest value for x such that the sum of P(x) from that point on is less than the given risk factor. Again, this value is found by a recursive procedure based upon the following:

$$P(x) = \left(\frac{(K + x - 1)(Q - 1)}{(x)(Q)} \right) P(x-1)$$

If $Q^{-K} \geq (1.0 - \text{Risk})$
(Reorder Level) = 0

20.4.3 Normal Distribution. The normal probability distribution is used when the mean is 20 or more, or when the variance is less than the mean. For these parameter values, the normal is used to approximate the Poisson or negative binomial distributions so as to reduce the amount of computation involved. The reorder level is calculated by the following set of formulas (these formulas use a Hasting's approximation of the normal distribution):

Sign = +1
If Risk > .5 Replace Risk with (1.0 − Risk)
and let Sign = −1

$$Z = \sqrt{-\log_e (\text{Risk})^2}$$

$$T = (Z) \left[\frac{(2.515517 + .802853(Z) + .010328(Z^2))}{(1 + 1.432788(Z) + .189269(Z^2) + .0013908(Z^3))} \right]$$

$$(\text{Reorder Level}) = \left((\text{Mean}) + (\text{Sign})(T)\sqrt{(\text{Variance})} \right)$$

20.5 Inventory Policies. Alternative inventory policies are used to calculate stock levels for each item at each site for individual support programs. These policies represent rules and procedures used in various segments of the Navy inventory management system. The selection of inventory policies is as follows:

- FLSIP COSAL
- MODFLSIP COSAL
- MCO COSAL
- ASO Retail
- Wholesale Stockage (DODINST 4140.42)
- UICP Wholesale Follow-on
- Protection Level

TASK 201 (Continued)

The stock levels are used to calculate several kinds of inventory costs according to LOR case for use in determining least-cost LOR code assignments. Basic inventory theory begins with historical demand and demand averages as a primary element. The theory assumes a demand estimate is available.

$$\left(\begin{matrix}\text{Number of Replacements}\\\text{Per Year Per Site}\end{matrix}\right) = \left(\left(\begin{matrix}\text{Item}\\\text{Population}\end{matrix}\right)\left(\frac{\text{(8760 Hours Per Year)}}{\text{MTBF}}\right)\right)\left(\begin{matrix}\text{Equipment}\\\text{Population}\end{matrix}\right)$$

a. Demand is the number of items to be replaced at a particular level because of items requested by customers during a 90 day period.

$$\text{(Demand)} = \left(\begin{matrix}\text{Number of Replacements}\\\text{Per Year Per Site}\end{matrix}\right)\text{(Rate)}^{*}$$

One of the following factors is computed depending upon maintenance level:

$$^{*}\left(\begin{matrix}\text{Organizational}\\\text{Level Rate}\end{matrix}\right) = \left(\begin{matrix}\text{Verification}\\\text{Rate}\end{matrix}\right)$$

$$\text{or } ^{*}\left(\begin{matrix}\text{Intermediate}\\\text{Level Rate}\end{matrix}\right) = \left[\left(\begin{matrix}\text{Verification}\\\text{Rate}\end{matrix}\right) + \left(\begin{matrix}\text{Scrap Rate at}\\\textit{Organizational}\\\text{Level}\end{matrix}\right) + \left(\begin{matrix}\text{BCM to Depot Rate}\\\text{at Organizational}\end{matrix}\right)\right]$$

$$\text{or } ^{*}\left(\begin{matrix}\text{Depot Level}\\\text{Rate}\end{matrix}\right) = \left[\left(\begin{matrix}\text{Verification}\\\text{Rate}\end{matrix}\right) + \left(\begin{matrix}\text{Scrap Rate at}\\\text{Organizational}\\\text{Level}\end{matrix}\right) + \left(\begin{matrix}\text{Scrap Rate}\\\textit{at IMA Level}\end{matrix}\right)\right]$$

b. Discard is the number of items lost at a particular maintenance level and represents a number of replacements.

$$\text{(Discard)} = \left[\left(\begin{matrix}\text{Number of Replacements}\\\text{Per Year Per Site}\end{matrix}\right)\left(\left(\begin{matrix}\text{Scrap}\\\text{Rate}\end{matrix}\right) + \left(\begin{matrix}\text{BCM to}\\\text{IMA Rate}\end{matrix}\right) + \left(\begin{matrix}\text{BCM to}\\\text{Depot Rate}\end{matrix}\right)\right)\right]$$

c. DSF is the discard fraction of total demand lost to the system at the particular maintenance level.

$$\text{(DSF)} = \left[\frac{\text{(Discard)}}{\text{(Demand)}}\right]$$

TASK 201 (Continued)

d. DSS is the discard of total demand lost to the system at the particular level.

$$(DSS) = (Discard)\left(\frac{\begin{pmatrix}\text{Number of Equipments}\\ \text{per Site for Year } (n+2)\end{pmatrix}}{\begin{pmatrix}\text{Number of Equipments}\\ \text{per Site for Year } (n)\end{pmatrix}}\right)$$

20.5.1 FLSIP COSAL. (Fleet Logistic Support Improvement Program Coordinated Shipboard Allowance List). This formulation uses a demand cutoff of .25 per year (.0625 per quarter) for stockage of insurance items. For demand rates greater than 1, the COSAL level is based on the use of a probability distribution and provides a 10% or less risk of incurring stockouts (90% protection level). If the demand rate is greater than 10, an approximation based on the normal distribution is used with the stock level being calculated with the given formula. The Essentiality Code (EC) is a code to indicate the degree to which the failure of the part affects the ability of the end item to perform its intended operation.

Assignments:

(Demand Rate) = ((.25) (Discard))

Variance = Demand Rate

Risk = 0.10

a. If (Demand Rate) < .0625
then (Stock Level) = 0

b. If .0625 ≤ (Demand Rate) < 1.0
then (Stock Level) = 1.0 if Essentiality Code = 1
or
(Stock Level) = 0 if Essentiality Code > 1

c. If 1.0 ≤ (Demand Rate) < 10

$$\text{then (Stock Level)} = \text{Maximum}^{*}\begin{cases} 2, \\ \text{or} \\ \text{Reorder}\end{cases}$$

d. If (Demand Rate) ≥ (10)

$$\text{then (Stock Level)} = \text{Maximum}^{*}\begin{cases} 2, \\ \text{or} \\ \left(\text{Demand Rate} + (1.28249)\sqrt{(\text{Demand Rate})}\right)\end{cases}$$

*Indicates a choice of either of the two options.

TASK 201 (Continued)

20.5.2 MOD FLSIP COSAL. This allowance is calculated in the same manner as FLSIP, except that, under MODFLSIP authorized allowances of insurance items vary depending on the level of importance of the mission an item supports and the item's demand rate. It uses the same logic for a demand rate greater than 1. The stock level for a demand rate less than 1 is determined using the Essentiality Code for the item.

Assignments:

(Demand Rate) = (.25) (Discard)
Variance = Demand Rate
Risk = 0.10

a. If (Demand Rate) < .025
then (Stock Level) = 0

b. If Essentiality Code = 1
and if .025 ≤ (Demand Rate) < .5
then (Stock Level) = 1
or
if .5 ≤ (Demand Rate) < 1.0
then (Stock Level) = 2

c. If Essentiality Code > 1
and if .025 ≤ (Demand Rate) < .0625
then (Stock Level) = 0
if .0625 ≤ (Demand Rate) < 1.0
then (Stock Level) = 1
if 1.0 ≤ (Demand Rate) < 10
then (Stock Level) = Maximum* { 2, or (Reorder) }

if (Demand Rate) ≥ 10
then (Stock Level) = Maximum* { 2, or Demand Rate + (1.28249) $\sqrt{\text{(Demand Rate)}}$ }

*Indicates a choice of either of the two options.

TASK 201 (Continued)

20.5.3 MCO COSAL (Maintenance Criticality Oriented). This formula derives the stock level using the Essentiality Code (EC) of an item. The EC determines a Mission Criticality Code (MCC) for an item, which is then used in the formula. The calculated value is rounded off to the nearest integer. The low limit, high limit, A, B, and C parameters are given as input factors for this policy, with values for the low limit and high limit being given by the EC.

Assignments:

(Demand Rate) = ((.25) (Discard))

Mission Criticality Code = 1 if Essentiality Code > 1

or

Mission Criticality Code = 4 if Essentiality Code = 1

$$\text{Risk} = \text{Maximum} \; {}^{*}\begin{cases} \text{Low Limit,} \\ \text{or} \\ \text{Minimum} \end{cases} \; {}^{*}\begin{cases} \text{High Limit,} \\ \text{or} \\ (A - (B\,(4 - \text{MCC})\,) - (C \log_e (\text{Unit Cost})\,)\,) \end{cases}$$

$$\text{then (Stock Level)} = \left(\text{(Demand Rate)} + \text{Risk}\left(\sqrt{\text{(Demand Level)}}\right) \right)$$

20.5.4 ASO Retail Policy (Aviation Supply Office). This model provides a fixed endurance level of support for the ship or station in accordance with the support period authorized by OPNAV.

Assignments:

(Daily Rate) = ((Demand)/365)

Mean = ((Daily Rate) (Repair Cycle) (1.0 − (OSF))

(Demand Rate) = ((Daily Rate) (ASO Factor) (OSF))

Variance = Mean

Risk = 0.10

Local Repair Cycle Allowance (Pool) = Reorder if Mean > 0

Local Repair Cycle Allowance (Pool) = 0 if Mean ≤ 0

a. If (Demand Rate) < .34
   the (Stock Level) = (Pool)

b. If (Unit Cost) < $5000
   and if .34 ≤ (Demand Rate) < 1.0
   then (Stock Level) = (1.0 + (Pool))

c. If (Unit Cost) ≥ $5000
   then if .34 ≤ (Demand Rate) ≤ .5
   then (Stock Level) = (Pool)
   or else if .5 < (Demand Rate) < 1.0
   then (Stock Level) = (1.0 + (Pool))

d. If (Demand Rate) ≥ 1.0
   then (Stock Level) = (Demand Rate) + (Pool)

*Indicates a choice of either of the two options.

TASK 201 (Continued)

20.5.5 Wholesale Stockage. The formulae used in the wholesale stockage concept, under DoD Instruction 4140.42, is based upon the observation that problem items often develop as a result of engineering deficiencies which were not anticipated but which were not improved even when the item was stocked. Therefore, the wholesale stockage criteria is used to determine when an item should be managed with or without stock. These criteria are used on all types of items and include variable holding costs (HC), variable procurement costs, implied shortage costs (as define in DOD Instruction 4140.39), and a probability of no-demand function.

$$\text{(Losses)} = \left(\frac{((\text{DSF})(\text{Production Lead Time}) + (1.0 - (\text{DSF}))(\text{Repair Cycle}))}{(365)} \right)$$

if DSS < 12.0

(Item Holding Cost) = (Holding Cost) (Unit Cost)

$$\text{Shortage Cost} = (.5)\ \text{Maximum} \begin{cases} \text{Item Holding Cost,} \\ \text{or} \\ \text{Shortage Cost} \end{cases}$$

DT = (DSS) DSF)

$$\left(\begin{matrix}\text{Frequency} \\ \text{of Procurement}\end{matrix}\right) = \text{Minimum} \begin{cases} \text{DSS} \\ \text{Minimum} \begin{cases} 4.0 \\ \text{Maximum} \begin{cases} 0.3 \\ \left(\dfrac{(.5)(\text{DSS})(\text{IHC})}{(\text{C'p}^*)} \right) \end{cases} \end{cases} \end{cases}$$

$$\text{(Index)} = \text{Minimum} \begin{cases} 12 \\ \text{DT} + 1 \end{cases}$$

$$\left(\begin{matrix}\text{Probability} \\ \text{of no demand}\end{matrix}\right) = \text{Ptable (Index) [The Probability of no demand in two years.]}$$

$$\text{Economic Order Quantity (EOQ)} = \left(\frac{(\text{DSS})}{(\text{Frequency of Procurement})} \right)$$

BUY = (EOQ) + ((DT) ((Losses) + (.25) (DSF)))

C'pA = C'p*

C'pB = C'p*

if (BUY) (Unit Cost) < (THRESH)

C'pA = Low

if (EOQ) (Unit Cost) < (THRESH)

C'pB = Low

*C'P is the administrative costs of procurement plus receipt cost for stocked items.

TASK 201 (Continued)

The difference in costs is the difference in stocked items minus non-stocked items.

$$\begin{pmatrix}\text{Difference}\\ \text{in Costs}\\ \text{(COSDIF)}\end{pmatrix} = \text{(Probability of no demand) ((}C^1pA\text{) + (2.0) (IHC) (BUY)) + ((1.0 − (Prob)) ((}C^1pB\text{) (Frequency of Procurement) + (.5) (IHC) ((DSS)/(Frequency of Procurement)) + (DT) ((IC) − (}C^2p\text{) − (Production Lead Times) (SC)/(365)) − (DSS (Unit Cost) Procurement Cycle))}$$

If COSDIF ≤ 0

Then

$$\text{(Stock Level)} = \text{Maximum}\begin{cases}1\\ \text{(((Demand) (Losses)) = ((.25) (DSF)))}\end{cases}$$

If COSDIF > 0

Then

(Stock Level) = 0

20.5.6 <u>UICP Wholesale Follow-on (Uniform Inventory Control Program)</u>. This policy is used by Navy inventory control points to manage supply system inventories. It is based on simplifying assumptions which may or may not accurately reflect the environment in which UICP operates. Such assumptions include a steady state environment, continuous demand, and a continual review of assets and requirements. Procurements are not constrained by funding or other factors.

a. Definitions:

Item Holding Cost (IHC) = ((Unit Cost) ((OBS) + (HC))) [HC is the holding cost rate of an item based on obsolesence, storage cost, and interest rate.]

Obsolesence (OBS) Rate = (4.0) / (OBS) [Obsolesence rate is the reciprocal of expected item life and is the cost, recognized in advance, of procuring material which is never sold.],

Order = (High Limit) + (Manufacturer's Setup Cost)

$$\text{Test} = \frac{\text{(80000000) (IHC)}}{\text{(Unit Cost)}\left(\text{((Lower Limit) + }\left(\begin{matrix}\text{Manufacturer's}\\ \text{Setup Cost}\end{matrix}\right)\right)}$$

$$\textit{Unit Shortage Cost} = \frac{\text{(IHC)}}{\left(\text{(2.0) (SC)}\right)}$$

(Demand Rate) = (Demand) 365

TASK 201 (Continued)

BDF = (91.25) (DSF) (Demand Rate) [BDF is the expected system losses per quarter during the year's operating period following procurement lead time.]

BCE = (Lead Time) (Demand Rate) (DSF) [BCE is the expected system losses during the procurement lead time.]

B022 = (91.25) (Demand Rate) [B022 is the expected quarterly demand based on a 365 day year.]

B023G = (1.0 − (DSF)) (Demand Rate) (Repair Cycle) [B023G is the number of items in depot repair at the end of the procurement lead time.]

SYSOQ = 1

$$\text{Mean} = \left(\text{BCE} + \text{B023G}\right)$$

Variance = Mean

b. If Mean $\leq$ .001
   (Stock Level) = 0

c. If BDF $\leq$ .001

$$(\text{Stock Level}) = .5 + \text{Maximum}\begin{cases} 0.0, \\ \text{or} \\ (\text{Mean}) + .5 \end{cases}$$

OCST = ORDER [OCST is the fixed order cost for procurement of an item.]
if B022 $\leq$ Test then
   OCST = ((Low) + (Manufacturers Setup Costs))

$$\text{Q1} = \text{Minimum}\begin{cases} \text{Maximum}\begin{cases} (\text{BDF}) + .5),\ \text{or} \\ \sqrt{\dfrac{(8.0)\ (\text{BDF})\ (\text{OCST})}{(\text{IHC})}} + .5 \end{cases} \\ \text{Minimum}\begin{cases} (\text{BDF})\ (\text{OBSOL}),\ \text{or} \\ \text{Maximum}\begin{cases} \dfrac{(25)}{(\text{Unit Cost})},\ \text{or} \\ (12)\ (\text{BDF}) \end{cases} \end{cases} \end{cases}$$

$$\text{OMEGA1} = \text{Minimum}\begin{cases} 99 \\ \dfrac{(\text{Unit Shortage Cost})\ (\text{Q1})}{(\text{BDF})} \end{cases}$$

$$\text{Risk} = \text{Minimum}\begin{cases} .4499 \\ \text{Maximum}\begin{cases} .01 \\ \left(\dfrac{(\text{OMEGA1})}{(\text{OMEGA1}) + 1.0}\right) \end{cases} \end{cases}$$

If Mean > 1.0

$$\text{Variance} = (1.31)\ (\text{Mean})^{(.72)}$$

TASK 201 (Continued)

$$(\text{Stock Level}) = \text{Maximum}\begin{cases} .001 \\ \text{Minimum}\begin{cases} (\text{Reorder}) \\ \left((\text{BDF})(\text{OBSOL}) + (\text{Mean})\right) - 1.0 \end{cases} \end{cases}$$

$$\text{SYSOQ} = \left[\text{Maximum}\begin{cases} \text{BDF} \\ \text{Minimum}\begin{cases} \text{Q1} \\ (\text{BDF})(\text{OBSOL}) - \text{Maximum}\begin{cases} 0.0 \\ (\text{Stock Level}) - (\text{Mean}) \end{cases} \end{cases} \end{cases}\right] + .5$$

20.5.7 Protection Policy. In this policy, the user specifies a level of protection for the items. This level of protection must then be met for all possible demand rates.

Assignments:

$$(\text{Mean}) = ((\text{Demand})\ (\text{DSF})\ (\text{Lead Time})) + \left(\frac{(1.0 - \text{DSF})\ (\text{Repair Cycle})}{(365)}\right)$$

$\text{Risk} = (1.0 - (\text{Protection Level}))$

a. if at Depot Level
then Variance = Mean

b. if not at Depot Level
then Variance = $(1.31)\ (\text{Mean})^{(.72)}$
(Stock Level) = (Reorder)

20.6 Cost Equations.

20.6.1 Inventory Costs.

20.6.1.1 Level of Investment. The following cost equation accounts for the level of investment needed to acquire new stock per location. The new stock per location is the current stock level for the preceding year subtracted from the required stock level of the given year. This cost element is calculated when the new stock per location is greater than zero. The stock levels are determined according to the inventory policy used.

$$\begin{pmatrix}\text{Inventory}\\\text{Level of}\\\text{Investment}\end{pmatrix} = \left[(\text{Unit Cost})\begin{pmatrix}\text{Number of}\\\text{Locations}\\\text{Per Site}\end{pmatrix}\begin{pmatrix}\text{New Stock}\\\text{Per}\\\text{Location}\end{pmatrix}\begin{pmatrix}\text{Discount}\\\text{Factor 2}\end{pmatrix}\begin{pmatrix}\text{Number of}\\\text{Operational}\\\text{Sites}\end{pmatrix}\right]$$

$$\begin{pmatrix}\text{New Stock}\\\text{Per}\\\text{Location}\end{pmatrix} = \left[\begin{pmatrix}\text{Required}\\\text{Stock}\\\text{Level}\end{pmatrix} - \begin{pmatrix}\text{Current}\\\text{Stock}\\\text{Level}\end{pmatrix}\right]$$

TASK 201 (Continued)

20.6.1.2 Discard Attrition. The following cost equation accounts for the recurring cost of inventory purchased throughout the life cycle necessary to resupply stock levels due to failed assemblies being scrapped. The failed assemblies are replaced in the equipment with new assemblies. This cost element is calculated when the level of repair option is discard.

$$\begin{pmatrix}\text{Inventory}\\\text{Discard}\\\text{Attrition}\end{pmatrix} = \left[\begin{pmatrix}\text{Number of}\\\text{Replacements}\\\text{per Life Cycle}\\\text{for all Sites}\end{pmatrix}\begin{pmatrix}\text{Unit Cost}\end{pmatrix}\begin{pmatrix}\text{Scrap}\\\text{Rate}\end{pmatrix}\begin{pmatrix}\text{Discount}\\\text{Factor 1}\end{pmatrix}\right]$$

The number of replacements per life cycle for all sites is calculated below. The operating factor represents the fraction of calendar time an equipment is operational at the location during any year.

$$\begin{pmatrix}\text{Number of}\\\text{Replacements}\\\text{per Life Cycle}\\\text{for all Sites}\end{pmatrix} = \frac{\begin{pmatrix}\text{Quantity of}\\\text{Identical}\\\text{Items Per Site}\end{pmatrix}\begin{pmatrix}\text{Number of}\\\text{Operating}\\\text{Sites}\end{pmatrix}\begin{pmatrix}\text{Life}\\\text{Span}\end{pmatrix}\begin{pmatrix}\text{Operating}\\\text{Factor}\end{pmatrix}\begin{pmatrix}\text{Annual}\\\text{Operating}\\\text{Requirements}\end{pmatrix}}{\begin{pmatrix}\text{Mean Time Between Failures}\end{pmatrix}}$$

$$\begin{pmatrix}\text{Quantity of}\\\text{Identical Items}\\\text{per Site}\end{pmatrix} = \left[\begin{pmatrix}\text{Quantity}\\\text{per End Item}\end{pmatrix}\begin{pmatrix}\text{Quantity}\\\text{per Location}\end{pmatrix}\begin{pmatrix}\text{Number of}\\\text{Locations}\\\text{per Site}\end{pmatrix}\right].$$

20.6.1.3 *Inventory Administration Cost.* Inventory administration cost represents the cost of entering the assembly into the supply system and retaining it throughout the life cycle. The LOR analytical technique treats inventory administration cost as proportional to the number of new items entered in the NSN (National Stock Number) system. Specifically, the cost is a function of three separate costs: item entry, item retention, and field supply administration. Item entry is a one-time cost per NSN incurred during the inventory procurement process so as to establish the new item in the NSN system. Item retention is a recurring cost per NSN incurred throughout the life cycle. It is a per-year cost due to updating of the NSN system. Field supply administration is a per site cost incurred for local management of the item.

TASK 201 (Continued)

20.6.1.3.1 Inventory Administration Cost Equation for the Discard Alternative. The administrative cost incurred for discard is the cost of local management, entry, and retention of the assembly in the NSN system. Specifically, within the various data elements, the word "item" refers to the assembly.

$$\begin{pmatrix}\text{Inventory}\\\text{Administration}\\\text{Cost for Discard}\end{pmatrix} = \left[\begin{pmatrix}\text{Entry and}\\\text{Retention}\\\text{Cost}\end{pmatrix} + \begin{pmatrix}\text{Inventory}\\\text{Administration}\\\text{Cost per Site}\end{pmatrix}\begin{pmatrix}\text{Life}\\\text{Span}\end{pmatrix}\begin{pmatrix}\text{Number of}\\\text{Operating}\\\text{Sites}\end{pmatrix}\begin{pmatrix}\text{Discount}\\\text{Factor 1}\end{pmatrix}\right]$$

20.6.1.3.2 Inventory Administration Cost Equation for the Repair Alternative. The administrative cost incurred for repair is the cost of local management, entry, and retention of the assembly and its unique components or piece parts in the NSN system. Specifically, within the data elements, the word "item" refers to the new piece parts. Inclusion of the discard equation accounts for the assembly itself. A common cost element equation is applicable for each of the repair alternatives.

$$\begin{pmatrix}\text{Inventory}\\\text{Administration}\\\text{Cost for Repair}\end{pmatrix} = \left[\left(\begin{pmatrix}\text{Entry and}\\\text{Retention}\\\text{Cost}\end{pmatrix} + \begin{pmatrix}\text{Inventory}\\\text{Administration}\\\text{Cost per Site}\end{pmatrix}\begin{pmatrix}\text{Life}\\\text{Span}\end{pmatrix}\begin{pmatrix}\text{Number of}\\\text{Operating}\\\text{Sites}\end{pmatrix}\begin{pmatrix}\text{Discount}\\\text{Factor 1}\end{pmatrix}\right)\begin{pmatrix}\text{Number of New}\\\text{Parts in NSN}\\\text{System per Assembly}\end{pmatrix} + \begin{pmatrix}\text{Inventory}\\\text{Administration}\\\text{Cost for Discard}\end{pmatrix}\right]$$

$$\begin{pmatrix}\text{Entry and}\\\text{Retention}\\\text{Cost}\end{pmatrix} = \left[\left(\begin{pmatrix}\text{Entry}\\\text{Cost per}\\\text{Item}\end{pmatrix}\begin{pmatrix}\text{Discount}\\\text{Factor 2}\end{pmatrix}\right) + \left(\begin{pmatrix}\text{Life}\\\text{Span}\end{pmatrix}\begin{pmatrix}\text{Retention}\\\text{Cost per Item}\\\text{per Year}\end{pmatrix}\begin{pmatrix}\text{Discount}\\\text{Factor 1}\end{pmatrix}\right)\right]$$

20.6.1.4 Inventory Storage Space Cost. A common cost equation is applicable for discard and each of the possible repair alternatives. The equation computes the cost of storage space for the required stock level.

$$\begin{pmatrix}\text{Inventory}\\\text{Storage Space}\\\text{Cost}\end{pmatrix} = \left[\begin{pmatrix}\text{Unit}\\\text{Size}\end{pmatrix}\begin{pmatrix}\text{Number of}\\\text{Locations}\\\text{per Site}\end{pmatrix}\begin{pmatrix}\text{Required}\\\text{Stock}\\\text{Level}\end{pmatrix}\begin{pmatrix}\text{Storage}\\\text{Cost per}\\\text{Cubic Foot}\end{pmatrix}\begin{pmatrix}\text{Discount}\\\text{Factor 1}\end{pmatrix}\begin{pmatrix}\text{Number of}\\\text{Operating}\\\text{Sites}\end{pmatrix}\right]$$

TASK 201 (Continued)

20.6.2 Personnel Costs.

20.6.2.1 Training Cost. The cost equations are common for discard and repair alternatives. The equation computes the cost of training men for a predicted number of man-hours required. The number of man-hours required is computed as a function of how many men are required for an action and how much time is needed to complete the action. If initial training has already been purchased, it is considered to be an expended cost and is not included in the training cost. Only the attrition training cost is calculated for such a case.

$$\left(\begin{array}{c}\text{Training}\\\text{Cost}\end{array}\right) = \left[\left(\begin{array}{c}\text{Number of}\\\text{Man-Hours}\\\text{Required}\end{array}\right)\left(\begin{array}{c}\text{Amortized}\\\text{Training Cost}\\\text{per Person}\end{array}\right)\left(\begin{array}{c}\text{Discount}\\\text{Factor 1}\end{array}\right)\right]$$

$$\left(\begin{array}{c}\text{Amortized}\\\text{Training Cost}\\\text{per Person}\end{array}\right) = \left[\frac{\left(\begin{array}{c}\text{Training Cost}\\\text{per Person}\end{array}\right)}{\left(\begin{array}{c}\text{Available}\\\text{Man-Hours}\\\text{per Year}\end{array}\right)\left(\begin{array}{c}\text{Life}\\\text{Span}\end{array}\right)}\right]$$

$$\left(\begin{array}{c}\text{Training}\\\text{Time}\end{array}\right) = \left[\left(\begin{array}{c}\text{Number of}\\\text{Replacements per}\\\text{Life Cycle}\\\text{for All Sites}\end{array}\right)\left(\left(\begin{array}{c}\text{Number of}\\\text{Persons Required}\\\text{for Repair}\end{array}\right)\left(\begin{array}{c}\text{Task}\\\text{Time}\end{array}\right)\left(\begin{array}{c}\text{Repair}\\\text{Rate}\end{array}\right)\right)^{*}\right]$$

$$^{*}\left(\left(\begin{array}{c}\text{Number of}\\\text{Persons Required}\\\text{for Verification}\end{array}\right)\left(\begin{array}{c}\text{Task}\\\text{Duration for}\\\text{Verification}\end{array}\right)\left(\left(\begin{array}{c}\text{Verification}\\\text{Rate}\end{array}\right) - \left(\begin{array}{c}\text{Repair}\\\text{Rate}\end{array}\right)\right)\right)$$ is substituted for the discard alternative

20.6.2.2 Direct Labor Cost. The cost equations are common for discard and repair alternatives. The equation computes the cost of labor charged directly for the action taken.

$$\left(\begin{array}{c}\text{Direct}\\\text{Labor}\\\text{Cost}\end{array}\right) = \left[\left(\begin{array}{c}\text{Number of}\\\text{Man-Hours}\\\text{Required}\end{array}\right)\left(\begin{array}{c}\text{Recurring}\\\text{Hourly}\\\text{Cost}\end{array}\right)\left(\begin{array}{c}\text{Discount}\\\text{Factor 1}\end{array}\right)\right]$$

or**

$$\left(\begin{array}{c}\text{Direct}\\\text{Labor}\\\text{Cost}\end{array}\right) = \left[\left(\begin{array}{c}\text{Number of}\\\text{Replacements per}\\\text{Life Cycle}\\\text{for All Sites}\end{array}\right)\left(\begin{array}{c}\text{Unit}\\\text{Cost}\end{array}\right)\left(\left(\begin{array}{c}\text{Repair}\\\text{Rate}\end{array}\right)\left(\begin{array}{c}\text{Personnel}\\\text{Repair}\\\text{Rate}\end{array}\right)\right)^{*}\left(\begin{array}{c}\text{Discount}\\\text{Factor 1}\end{array}\right)\right]$$

$$^{*}\left[\left(\left(\begin{array}{c}\text{Verification}\\\text{Rate}\end{array}\right) - \begin{array}{c}\text{Repair}\\\text{Rate}\end{array}\right)\left(\begin{array}{c}\text{Personnel}\\\text{Verification}\\\text{Rate}\end{array}\right)\right]$$ is substituted for the discard alternative

**Two modes of calculating the cost equations are available. The mode is dependent upon the input data provided.

TASK 201 (Continued)

20.6.3 Support Equipment Cost.

20.6.3.1 Support Equipment Acquisition Cost. This element represents the cost for acquisition of support equipment associated with the electronic system in question. Already available support equipment is considered an expended cost and does not enter the computations.

$$\left(\text{Support Equipment Acquisition Cost}\right) = \left[\left(\text{Number of Support Equipment Hours Required}\right)\left(\text{Amortized Support Equipment Cost}\right)\left(\text{Discount Factor 1}\right)\left(1.0 - \left(\text{Support Equipment Fraction}\right)\right)\right]$$

$$\left(\text{Amortized Support Equipment Cost}\right) = \left[\frac{\left(\text{Initial Cost per Support Equipment}\right)}{\left(\text{Available Support Equipment Hours Per Year}\right)\left(\text{Life Span}\right)}\right]$$

$$\left(\text{Number of Support Equipment Hours Required}\right) = \left[\left(\text{Number of Replacements per Life Cycle for All Sites}\right)\left(\left(\text{Number of Support Equipment Required for Repair}\right)\left(\text{Task Time}\right)\left(\text{Repair Rate}\right)\right)^{*}\right]$$

$$^{*}\left(\text{Number of Support Equipment Required for Verification}\right)\left(\text{Task Duration for Verification}\right)\left(\left(\text{Verification Rate}\right) - \left(\text{Repair Rate}\right)\right)$$ is substituted for the discard alternative

$$\left(\text{Support Equipment Fraction}\right) = \left[\frac{\left(\text{Area Per Support Equipment}\right)\left(\text{Area Cost per Year}\right)\left(\text{Discount Factor 1}\right)}{\left(\text{Support Equipment Procurement Costs}\right)\left(\text{Support Equipment Attrition}\right) + \left(\text{Area per Support Equipment}\right)\left(\text{Area Cost per Year}\right)\left(\text{Discount Factor 1}\right)}\right]$$

or**

$$\left(\text{Support Equipment Acquisition Cost}\right) = \left[\left(\text{Number of Replacements per Life Cycle for All Sites}\right)\left(\text{Unit Cost}\right)\left(\text{Support Equipment Cost Rate}\right)\left(\text{Repair Rate}\right)^{*}\left(\text{Discount Factor 1}\right)\right]$$

$$^{*}\left(\left(\text{Verification Rate}\right) - \left(\text{Repair Rate}\right)\right)$$ is substituted for the discard alternative

**Two modes of calculating the cost equations are available, the mode is dependent upon the input data provided.

TASK 201 (Continued)

20.6.3.2 Support Equipment Support Cost. The common cost equation is applicable for discard and each of the repair alternatives. This equation accounts for the recurring cost for support of support equipment.

$$\begin{pmatrix}\text{Support}\\ \text{Equipment}\\ \text{Support Cost}\end{pmatrix} = \left[\begin{pmatrix}\text{Number of}\\ \text{Support Equipment}\\ \text{Hours Required}\end{pmatrix}\begin{pmatrix}\text{Recurring}\\ \text{Hourly}\\ \text{Cost}\end{pmatrix}\begin{pmatrix}\text{Discount}\\ \text{Factor 1}\end{pmatrix}\right]$$

20.6.3.3 Support Equipment Area Cost. The cost equations are common for discard and each of the repair alternatives. This is the repair work area cost calculated for a predicted number of hours that work area is required for the type of action taken.

$$\begin{pmatrix}\text{Support}\\ \text{Equipment}\\ \text{Area Cost}\end{pmatrix} = \left[\begin{pmatrix}\text{Number of}\\ \text{Support Equipment}\\ \text{Hours Required}\end{pmatrix}\begin{pmatrix}\text{Amortized}\\ \text{Support}\\ \text{Equipment Cost}\end{pmatrix}\begin{pmatrix}\text{Support}\\ \text{Equipment}\\ \text{Fraction}\end{pmatrix}\begin{pmatrix}\text{Discount}\\ \text{Factor 1}\end{pmatrix}\right]$$

20.6.4 Repair Costs.

20.6.4.1 Repair Material Cost. The repair material cost is the cost of materials (wire, piece parts, etc.) utilized to repair the assemblies which have failed. The repair material cost rate is a percentage of the assembly cost associated with the amount of repair material. Each repair alternative uses the same equation. For the discard alternative, the repair material cost is zero since no repair parts are required.

$$\begin{pmatrix}\text{Repair}\\ \text{Material}\\ \text{Cost}\end{pmatrix} = \left[\begin{pmatrix}\text{Number of}\\ \text{Replacements per}\\ \text{Life Cycle}\\ \text{for All Sites}\end{pmatrix}\begin{pmatrix}\text{Unit}\\ \text{Cost}\end{pmatrix}\begin{pmatrix}\text{Repair}\\ \text{Material}\\ \text{Cost Rate}\end{pmatrix}\begin{pmatrix}\text{Repair}\\ \text{Rate}\end{pmatrix}\begin{pmatrix}\text{Discount}\\ \text{Factor 1}\end{pmatrix}\right]$$

20.6.4.2 Repair Scrap Cost. A common cost equation is applicable for each of the repair alternatives. The repair scrap cost accounts for the recurring cost of inventory purchased throughout the life cycle necessary to resupply stock levels due to failed assemblies being sent to a higher level of repair for restoration. The failed assemblies are replaced in the equipment with new assemblies. This cost element is not calculated when the level of repair option is discard.

$$\begin{pmatrix}\text{Repair}\\ \text{Scrap}\\ \text{Cost}\end{pmatrix} = \left[\begin{pmatrix}\text{Number of}\\ \text{Replacements per}\\ \text{Life Cycle}\\ \text{for All Sites}\end{pmatrix}\begin{pmatrix}\text{Unit}\\ \text{Cost}\end{pmatrix}\begin{pmatrix}\text{Scrap}\\ \text{Rate}\end{pmatrix}\begin{pmatrix}\text{Discount}\\ \text{Factor 1}\end{pmatrix}\right]$$

TASK 201 (Continued)

20.6.4.3 Repair Area Cost. This is the repair work area cost calculated for a predicted number of hours that the work area is required for the type of action taken.

$$\begin{pmatrix}\text{Repair}\\\text{Area}\\\text{Cost}\end{pmatrix} = \left[\begin{pmatrix}\text{Number of}\\\text{Repair Work Area}\\\text{Hours Required}\end{pmatrix}\left(\begin{pmatrix}\text{Amortized}\\\text{Repair Work}\\\text{Area Cost}\end{pmatrix} + \begin{pmatrix}\text{Recurring}\\\text{Hourly}\\\text{Cost}\end{pmatrix}\right)\begin{pmatrix}\text{Discount}\\\text{Factor 1}\end{pmatrix}\right]$$

$$\begin{pmatrix}\text{Amortized}\\\text{Repair Work}\\\text{Area Cost}\end{pmatrix} = \left[\frac{\begin{pmatrix}\text{Cost for}\\\text{Repair Work Area}\end{pmatrix}}{\begin{pmatrix}\text{Available}\\\text{Repair Work Area}\\\text{Hours per Year}\end{pmatrix}\begin{pmatrix}\text{Life}\\\text{Span}\end{pmatrix}}\right]$$

$$\begin{pmatrix}\text{Number of}\\\text{Repair Work}\\\text{Area Hours}\\\text{Required}\end{pmatrix} = \left[\begin{pmatrix}\text{Number of}\\\text{Replacements per}\\\text{Life Cycle}\\\text{for All Sites}\end{pmatrix}\left(\begin{pmatrix}\text{Number of}\\\text{Repair Work}\\\text{Areas Required}\\\text{for Repair}\end{pmatrix}\begin{pmatrix}\text{Task}\\\text{Time}\end{pmatrix}\begin{pmatrix}\text{Repair}\\\text{Rate}\end{pmatrix}\right)^{*}\right.$$

$$\left.{}^{*}\left(\begin{pmatrix}\text{Number of}\\\text{Repair Work}\\\text{Areas Required}\\\text{for Verification}\end{pmatrix}\begin{pmatrix}\text{Task Time}\\\text{for}\\\text{Verification}\end{pmatrix}\left(\begin{pmatrix}\text{Verification}\\\text{Rate}\end{pmatrix} - \begin{pmatrix}\text{Repair}\\\text{Rate}\end{pmatrix}\right)\right)\right]$$

is substituted for the discard alternative

20.6.5 Documentation Costs. A common cost equation is applicable for discard and repair alternatives. Documentation includes the following elements: the drawings and specifications which make up the electronic system technical manual; the logistic support analysis preparation; and various support equipment requirements sheets, lists, etc.

$$\begin{pmatrix}\text{Documentation}\\\text{Cost}\end{pmatrix} = \left[\begin{pmatrix}\text{Documentation}\\\text{Hours}\\\text{Required}\end{pmatrix}\left(\begin{pmatrix}\text{Amortized}\\\text{Documentation}\\\text{Cost}\end{pmatrix} + \begin{pmatrix}\text{Recurring}\\\text{Hourly}\\\text{Cost}\end{pmatrix}\right)\begin{pmatrix}\text{Discount}\\\text{Factor 1}\end{pmatrix}\right]$$

$$\begin{pmatrix}\text{Amortized}\\\text{Documentation}\\\text{Cost}\end{pmatrix} = \left[\frac{\begin{pmatrix}\text{Initial Cost for}\\\text{Documentation}\end{pmatrix}}{\begin{pmatrix}\text{Available}\\\text{Documentation}\\\text{Hours per Year}\end{pmatrix}\begin{pmatrix}\text{Life}\\\text{Span}\end{pmatrix}}\right]$$

$$\begin{pmatrix}\text{Documentation}\\\text{Hours}\\\text{Required}\end{pmatrix} = \left[\begin{pmatrix}\text{Number of}\\\text{Replacements per}\\\text{Life Cycle}\\\text{for All Sites}\end{pmatrix}\left(\begin{pmatrix}\text{Pages of}\\\text{Documentation}\\\text{Required for}\\\text{Repair}\end{pmatrix}\begin{pmatrix}\text{Task}\\\text{Time}\end{pmatrix}\begin{pmatrix}\text{Repair}\\\text{Rate}\end{pmatrix}\right)^{*}\right]$$

TASK 201 (Continued)

$$^{*}\left(\left(\begin{matrix}\text{Page of}\\ \text{Documentation}\\ \text{Required for}\\ \text{Verification}\end{matrix}\right)\left(\begin{matrix}\text{Task Time}\\ \text{for}\\ \text{Verification}\end{matrix}\right)\left(\left(\begin{matrix}\text{Verification}\\ \text{Rate}\end{matrix}\right)-\left(\begin{matrix}\text{Repair}\\ \text{Rate}\end{matrix}\right)\right)\right)\ \text{is substituted for the discard alternative}$$

or**

$$\left(\begin{matrix}\text{Documentation}\\ \text{Cost}\end{matrix}\right)=\left[\left(\begin{matrix}\text{Number of}\\ \text{Replacements per}\\ \text{Life Cycle}\\ \text{for All Sites}\end{matrix}\right)\left(\begin{matrix}\text{Unit}\\ \text{Cost}\end{matrix}\right)\left(\begin{matrix}\text{Documentation}\\ \text{Cost Rate}\end{matrix}\right)\left(\begin{matrix}\text{Repair}\\ \text{Rate}\end{matrix}\right)^{*}\left(\begin{matrix}\text{Discount}\\ \text{Factor 1}\end{matrix}\right)\right]$$

$$^{*}\left(\left(\begin{matrix}\text{Verification}\\ \text{Rate}\end{matrix}\right)-\left(\begin{matrix}\text{Repair}\\ \text{Rate}\end{matrix}\right)\right)\ \textit{is substituted for the discard alternative}$$

**Two modes of calculating the cost equations are available, the mode is dependent upon the input data provided.

20.6.6 Transportation Costs.

20.6.6.1 Packaging Cost. This element includes the costs incurred during the life cycle accounting for packaging of assemblies which must be sent to another maintenance site for further action or are replacements for those which have been lost to the supply system.

$$\left(\begin{matrix}\text{Packaging}\\ \text{Cost}\end{matrix}\right)=\left[\left(\begin{matrix}\text{Number of}\\ \text{Replacements per}\\ \text{Life Cycle for}\\ \text{All Sites}\end{matrix}\right)\left(\begin{matrix}\text{Unit}\\ \text{Size}\end{matrix}\right)\left(\begin{matrix}\text{Cost of}\\ \text{Packaging}\end{matrix}\right)\left(\begin{matrix}\text{Scrap}\\ \text{Rate}\end{matrix}\right)^{*}\left(\begin{matrix}\text{Discount}\\ \text{Factor 1}\end{matrix}\right)\right]$$

20.6.6.2 Shipping Cost. This element includes the costs incurred during the life cycle accounting for transportation of assemblies which must be sent to another maintenance site for further action or are replacements for those which have been lost to the supply system.

$$\left(\begin{matrix}\text{Shipping}\\ \text{Cost}\end{matrix}\right)=\left[\left(\begin{matrix}\text{Number of}\\ \text{Replacements per}\\ \text{Life Cycle}\\ \text{for All Sites}\end{matrix}\right)\left(\begin{matrix}\text{Unit}\\ \text{Weight}\end{matrix}\right)\left(\begin{matrix}\text{Cost per lb.}\\ \text{for Shipping}\end{matrix}\right)\left(\begin{matrix}\text{Scrap}\\ \text{Rate}\end{matrix}\right)^{*}\left(\begin{matrix}\text{Discount}\\ \text{Factor 1}\end{matrix}\right)\right]$$

$$^{*}\left(\begin{matrix}\text{BCM}\\ \text{to IMA}\\ \text{Rate}\end{matrix}\right)\ \text{is substituted for items sent to the Intermediate Level (refer to flow rates under required parameters)}$$

$$^{*}\left(\begin{matrix}\text{BCM}\\ \text{to Depot}\\ \text{Rate}\end{matrix}\right)\ \text{is substituted for items sent to the Depot Level (refer to flow rates under required parameters)}$$

TASK 201 (Continued)

20.7 Integer Considerations. Quantities involving a number of assemblies are rounded to an integer by the following method. First the quantities are computed as specified in the preceding formulas. After calculating these quantities for all of the assemblies in the system, each quantity is summed for all the assemblies. These total quantities are then operated on in two ways. First, these total quantities, for each level of repair are compared to a minimum of one per site. If they are less than one per site, they are set equal to one per site. If the total quantities are greater than this minimum, the quantities are rounded to the next higher integer. After these totals are adjusted, they are reapportioned over all the assemblies in the same ratio as they were originally calculated.

20.8 LOR Results. For each of the repair categories and discard, the computed values of the various cost equations are summed to determine the most cost effective level of repair.

20.9 Table of Data Elements. Table I contains the various LOR data elements, the LSA interface, the associated units required, and the data element sources as input to the LOR model for SPAWAR/NAVSEA equipments. Definitions for LSA related data elements are found in MIL-STD-1388-2A, Appendix F.

TASK 201 (Continued)

TABLE I. Level of repair model data elements.

Input Format	Data Element Number	Data Element Name	LSA	Units	Data Sources
A	1	Run Identification		None	Navy
A	2	Date of Last Change		Yr/Mo/Da	Navy/Contractor
A	3	Base Year		Year	Navy
A	4	Life Span	Yes	Years	Navy
I,J	5	Reference Symbol		None	Contractor
I,J	6	Reference Number		None	Contractor
I	7	Item Indenture		None	Contractor
I	8	Part Number/Nomenclature	Yes	None	Contractor
I	9	No. of New Items		None	Contractor
I	10	Unit Weight	Yes	lbs.	Contractor
I	11	Unit Size	Yes	Cu.ft.	Contractor
I	12	Number Per Next Higher Assembly	Yes	Unit	Contractor
I	13	Unit Cost	Yes	$/Assembly	Contractor
I	14	Source, Maintenance & Recoverability (SM&R) Codes	Yes	None	Navy/Contractor
I	15	Mean Time Between Failures (MTBF)	Yes	Hours	Contractor
I	16	Mean Time to Repair (MTTR)	Yes	Hours	Contractor
I	17	Military Essentiality Code (MEC)	Yes	None	Contractor
I	18	Override Code		Unit	Navy
I	19	Override Amount		Unit	Navy
J	20	Item Operating Factor	Yes	Hr/Yr	Navy/Contractor
J	21	Order and Shipping Time (O&ST) - Organizational		Days	Navy
J	22	O&ST - Intermediate Maint Activity		Days	Navy
J	23	Procurement Lead Time		Days	Navy/Contractor
J	24	Repair Cycle - Organization		Days	Navy
J	25	Repair Cycle - IMA		Days	Navy
J	26	Repair Cycle - Depot		Days	Contractor
J	27	Personnel Cost Rate - Verification		Fraction	Navy
J	28	Personnel Cost Rate - Repair		Fraction	Navy
J	29	Material Cost Rate		Fraction	Navy/Contractor
J	30	Support Equipment Cost Rate		Fraction	Navy
J	31	Documentation Cost Rate		Fraction	Navy
J	32	IMA Percentage		Fraction	Navy
J	33	BCM Rate - Organization		Fraction	Navy
J	34	BCM Rate - IMA		Fraction	Navy
J	35	Scrap Rate - Organization		Fraction	Navy
J	36	Scrap Rate - IMA	Yes	Fraction	Navy
J	37	Scrap Rate - Depot	Yes	Fraction	Navy
J	38	False Removal Rate - Organizational		Fraction	Navy
J	39	False Removal Rate - IMA		Fraction	Navy
J	40	False Removal Rate - Depot		Fraction	Navy
J	41	False Removal Detection Rate - Organization		Fraction	Navy
J	42	False Removal Detection Rate - IMA		Fraction	Navy
J	43	False Removal Detection Rate- Depot		Fraction	Navy

TASK 201 (Continued)

TABLE I. Level of repair model data elements (Continued).

Input Format	Data Element Number	Data Element Name	LSA	Units	Data Sources
L	44	Site Name		None	Navy
L	45	Location Indenture		None	Navy
L	46	Location Echelon Code		None	Navy
L	47	Lead Time	None	Days	Navy
L	48	Repair Cycle	Yes	Days	Navy(Ship/ Shore
L	49	No. of Locations	Yes	Unit	Navy(Ship/ Shore
L	50	No. of Equipments		Unit	Navy
L	51	Stockage Policy		None	
L	52	Availability Target (Protection Level)		Percentage	Navy
L	53	No. of Shifts		Unit	Navy
L	54	Site Operating Factor		Fraction	Navy
L	55	Zone		None	Navy(Transportation Cost)
L	56	Delivery Schedule (three deliveries)		No. per yr/mo	Navy
R	57	Resource Type	Yes	None	Contractor
R,T	58	Resource Identification	Yes	None	Contractor
R	59	Resource Description	Yes	None	Contractor
R	60	Facilities/Support Space	Yes	Sq. Ft.	Contractor
R	61	Hourly Cost - Recurring		$/Hr.	Contractor
R	62	Hourly Cost - Amortized		$/Hr.	Contractor
R	63	Procurement/Training Cost		Follows	Contractor
R	64	Procurement Sunk Cost		Dollars	Contractor
R	65	Attrition/Support Rate - First Year		Fraction	Navy
R	66	Attrition/Support Rate - Subsequent Years		Fraction	Navy
R	67	Development Cost		Dollars	Contractor
R	68	Development Sunk Cost		None	Contractor
R	69	Hours Available Per Shift		Hr/Yr	Contractor
R	70	Availability Fraction		Fraction	Contractor
T	71	Item Number		None	Contractor
T	72	Task Echelon		None	Contractor
T	73	Task Type		None	Contractor
T	74	Task Duration		Hours	Contractor
T	75	Resource Identification for Task (6)		None	Contractor
T	76	No. Required (6)		Unit	Contractor

SECTION 300

LEVEL OF REPAIR FOR MARINE CORPS

TASK 301

Level of Repair Analytical Techniques for
Marine Corps Equipment

30. SCOPE

30.1 Purpose. This task provides the mathematical equations for performing level of repair (LOR) analyses of electronic, electrical, mechanical, and ordnance equipment under Marine Corps cognizance. Selected application of these equations permits computation of logistic support costs at designated indenture levels of the equipment being analyzed.

30.2 General. Military maintenance functions are normally performed at three levels: organizational, intermediate, and depot. For Marine Corps operations however, a five-echelon hierarchy usually exists within these three maintenance levels as follows:

Organizational Maintenance - 1st and 2nd Echelons
Intermediate Maintenance - 3rd and 4th Echelons
Depot Maintenance - 5th Echelon

30.2.1 LOR Composition. Within this hierarchy the LOR analytical techniques determine the lowest life cycle cost alternative for maintaining a failed hardware item, i.e., should it be discarded (washed out) or repaired, and at what maintenance level should the work be performed. Life cycle maintenance costs are produced for three designated equipment indentures. In decreasing order of complexity these indentures are unit, assembly and, lowest replacement item (LRI). Within each indenture level the LOR analysis technique allocates costs to 6 major categories covering a total of 12 cost elements:

Cost Category	Cost Element
Inventory	Item Entry and Retention Cost
	Inventory Cost
	Repair Material Cost
	Packaging and Transportation Cost
Support	Support Equipment Cost
	Support of Support Equipment Cost
Space	Inventory Storage Space Cost
	Support Equipment Space Cost
	Repair Work Space Cost
Labor	Labor Cost
Training	Training Cost
Documentation	Documentation Cost

TASK 301 (Continued)

Summing the costs for each cost element thus provides the total cost of the LOR alternative being analyzed.

30.2.2 Maintenance Definitions. Maintenance is divided into two classes: discard and repair. Discard maintenance is a policy where a failed item is discarded (washed out) and replaced with a new item from stock. The discard maintenance policy may be designed for execution at any maintenance level. Repair maintenance is a more comprehensive procedure. It generally consists of maintaining a failed item by isolating and removing a defective lower level component and installing a new one in its place. For example, a failed unit could be repaired by installing a new assembly. A defective LRI could be repaired by isolating and replacing a faulty piece part within the LRI. Repairs are attempted and/or performed initially at a designated maintenance level. For those failures that cannot be corrected there, the discrepant item is generally sent to higher level maintenance echelons for additional troubleshooting and repair. Under certain conditions a maintenance echelon may be authorized to discard a failed item if it is beyond economical or practical repair.

30.2.3 Required Parameters. There are three parameters derived from input data that are used in most cost element equations, namely, annual number of item failures, item daily demand rate (number of item failures per day), and discount factor.

30.2.3.1 Annual Number of Item Failures. The annual number of item failures represents the expected frequency of repair actions. It is the key initiator of all maintenance events. For purposes of this standard, all item removals are defined as failures, i.e., there are no false removals.

$$\begin{pmatrix}\text{Annual} \\ \text{Number} \\ \text{of Item}^{*} \\ \text{Failures}\end{pmatrix} = \frac{\begin{pmatrix}\text{Number of} \\ \text{Operating} \\ \text{End} \\ \text{Items}\end{pmatrix}\begin{pmatrix}\text{Number of} \\ \text{Operating} \\ \text{Hours}^{**} \\ \text{Per End} \\ \text{Item Per Year}\end{pmatrix}}{(\text{MTBF}^{***})}$$

*Item can be a unit, assembly, or LRI.

**Operating hours may be replaced by miles traveled, rounds fired, or cycles as appropriate to type of equipment being analyzed.

***Mean time between failure (MTBF) can be based on operating hours, mileage, rounds fired, cycles, or whatever term is appropriate to use in describing failure (or repair) frequency.

30.2.3.2 Daily Demand Rate. The daily demand rate is the average number of item failures occurring daily at the operational sites. For the discard alternative it represents the number of spares consumed each day. For the repair alternative the daily demand rate describes the number of daily maintenance events for a given repairable item.

TASK 301 (Continued)

$$\begin{pmatrix}\text{Daily}\\ \text{Demand}\\ \text{Rate}\end{pmatrix} = \left[\frac{\text{(Annual Number of Item Failures)}}{\text{(365 Days Per Year)}}\right]$$

30.2.3.3 Discount Factor. The discount factor employs a finite discount rate (other than zero) and a stated period of time to determine the present value of future money. It is used to determine the amount of money that would have to be placed in an interest-bearing account now in order to pay for future costs incurred during the equipment life cycle. It is assumed that these expenditures will occur as equal annual payments made at the beginning of each year of the life cycle.

$$\begin{pmatrix}\text{Discount}^{*}\\ \text{Factor}\end{pmatrix} = \left[\frac{(1.0 + \text{Discount Rate})^{\begin{pmatrix}\text{Number of}\\ \text{Years in}\\ \text{Life Cycle}\end{pmatrix}} - 1.0}{(\text{Discount Rate})\,(1.0 + \text{Discount Rate})^{\left[\begin{pmatrix}\text{Number of}\\ \text{Years in}\\ \text{Life Cycle}\end{pmatrix} - 1.0\right]}}\right]$$

*This term breaks down mathematically if the discount rate is zero. If zero discount rate is used, set discount factor equal to the life cycle.

30.3 Cost Category and Cost Element Equations. The following paragraphs provide descriptions and mathematical equations for the cost categories and/or cost elements which form the basis for the LOR analysis technique. Separate equations are given for the discard and repair maintenance alternatives. In addition, two forms of repair alternative equations are shown. The first form addresses equipment repair where a single level maintenance policy exists, e.g., organizational level repair of a failed item and organizational level discard of the item if it cannot be fixed. The second repair alternative, multiple level repair, treats situations where more than one maintenance level is involved, e.g., organizational level repair followed by depot repair of those items which are beyond the maintenance capability of the organizational level. If the item subsequently cannot be repaired at the depot, it is washed out.

30.3.1 Inventory Costs. Inventory costs are the sum of the expenses associated with inventory administration, i.e., item entry and retention in the supply system, inventory stock, repair material, packaging for shipment, and transportation.

TASK 301 (Continued)

30.3.1.1 Item Entry and Retention Cost. This cost is the sum of two cost segments: item entry cost and item retention cost. Item entry cost is a one-time cost incurred in establishing a new item and assigning it a national stock number (NSN) in the supply system. Item retention cost is the annual administrative expense of keeping the item in the supply system.

30.3.1.1.1 Item Entry and Retention Cost Equation. The item entry and retention cost equations for the discard and repair alternatives are identical. However, the number of new NSN required in the supply system may vary depending on the maintenance alternative. Generally, if an item is discarded at failure, only the NSN covering that item would be necessary. If the item is capable of being repaired, those parts unique to it and not currently residing in the supply system inventory will require NSN assignments. Multiple use NSNs, i.e., those NSNs used in two or more different items are not considered to be unique NSNs.

$$\begin{pmatrix}\text{Item Entry}\\\text{and}\\\text{Retention}\\\text{Cost}\end{pmatrix} = \left[\begin{pmatrix}\text{Item}\\\text{Entry}\\\text{Cost}\end{pmatrix} + \begin{pmatrix}\text{Annual}\\\text{Item}\\\text{Retention}\\\text{Cost}\end{pmatrix}\begin{pmatrix}\text{Discount}\\\text{Factor}\end{pmatrix}\right]\begin{pmatrix}\text{Number of}\\\text{New NSN}\end{pmatrix}$$

30.3.1.2 Inventory Stock Cost. This cost element accounts for the cost of spares required for maintenance during the equipment life cycle.

30.3.1.2.1 Inventory Stock Cost for the Discard Alternative. For the discard alternative, inventory stock cost consists of the cost of spare items needed to remain self-sufficient for a stated period, and the cost of system stock required during the item's life cycle to replace items discarded at failure. The item spares quantity is the number of spares required to meet an input target probability against stock-out (PASO) for the specified Required Days of Stock (RDS) using the Poisson probability distribution. This is, enough items are spared so that the probability of exhausting the available stock during the RDS is lower than a particular threshold given as 1-PASO.

30.3.1.2.2 Inventory Stock Cost Equation for the Discard Alternative.

$$\begin{pmatrix}\text{Inventory}\\\text{Stock}\\\text{Cost}\end{pmatrix} = \left[\begin{pmatrix}\text{Item Spares}\\\text{Quantity at a}^{\text{th}}\\\text{Maintenance}\\\text{Level}\end{pmatrix} + \begin{pmatrix}\text{Annual System}\\\text{Stock Quantity at}\\\text{a}^{\text{th}}\text{ Maintenance}\\\text{Level}\end{pmatrix}\begin{pmatrix}\text{Discount}\\\text{Factor}\end{pmatrix}\right]\begin{pmatrix}\text{Cost}\\\text{per}\\\text{Item}\end{pmatrix}$$

where,

$$\begin{pmatrix}\text{Item Spares}\\\text{Quantity at a}^{\text{th}}\\\text{Maintenance}\\\text{Level}\end{pmatrix} = \text{N, where N is smallest integer such that}$$

TASK 301 (Continued)

$$\begin{pmatrix}\text{Probability}\\ \text{Against}\\ \text{Stock-Out}\\ \text{with N}\\ \text{Spares}\end{pmatrix} = \sum_{i=0}^{N} \frac{\lambda^i}{i!} e^{-\lambda} \geq \begin{pmatrix}\text{Target}\\ \text{Probability}\\ \text{Against}\\ \text{Stock-Out}\end{pmatrix}$$

where

$$\lambda = \begin{pmatrix}\text{Daily}\\ \text{Demand}\\ \text{Rate}\end{pmatrix} \begin{pmatrix}\text{Required Days of Stock}\\ \text{at } a^{th} \text{ Maintenance Level}\end{pmatrix}$$

and

$$\begin{pmatrix}\text{Annual}\\ \text{System Stock}\\ \text{at } a^{th}\\ \text{Maintenance}\\ \text{Level}\end{pmatrix} = \begin{pmatrix}\text{Daily}\\ \text{Demand}\\ \text{Rate}\end{pmatrix} \begin{pmatrix}\text{365 Days}\\ \text{Per Year}\end{pmatrix}$$

30.3.1.2.3 Inventory Stock Cost for the Repair Alternative. For the repair alternative the inventory stock cost is composed of the cost of the maintenance float (rotatable pool), spares, and system stock. The maintenance float and spares quantities are located at a particular maintenance level. In order to achieve a specified level of confidence against having an item stock-out, a confidence quantity will be maintained at this particular level. This confidence quantity will be the number of spares required to meet an input target probability against stock-out using the Poisson distribution. It will be sufficient to cover both the maintenance float and item spares quantities.

30.3.1.2.3.1 The maintenance float is a rotating inventory of items stocked at a maintenance echelon to provide onsite replacements of failed items. The maintenance float quantity is a function of the percentage of failed items which can be repaired at the maintenance echelon and the repair cycle time (RCT) required to effect maintenance. When a failed item cannot be repaired immediately, a replacement item is taken from the maintenance float and used to return the discrepant equipment to service. When the failed item is repaired, it joins the float. When an item is subject to multiple level repair a maintenance float at successively higher maintenance echelons may be required if maintenance pipeline delays are excessive. These delays occur when the RCT at the next higher maintenance echelon exceeds the RDS at the lower maintenance echelon.

30.3.1.2.3.2 The spares quantity is an inventory used to replace failed items which cannot be repaired onsite. These items are either sent to a higher maintenance echelon for repair, i.e., beyond capability of maintenance (BCM), or discarded. BCM items occur when: (a) the site is not authorized to repair

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the item, (b) the site is restricted to a discrete but not complete set of repair actions and must send the item to a higher maintenance echelon for additional repairs, and/or (c) the site is not authorized to discard the failed item and must send it to another maintenance echelon for final disposition or condemnation. Items are discarded when they are not economically repairable and the site is authorized to condemn and dispose of them. This action is usually performed at the highest maintenance level where complete repair of the item is authorized. BCM and discard items both affect spares quantity because they are local inventory losses which must be recovered in order for the site to remain self-sufficient for the specified period.

30.3.1.2.3.3 System stock is that quantity of items procured during the life cycle to replace BCM (wash out) losses.

30.3.1.2.4 Inventory Stock Cost Equation for Single Level Repair Alternative.

$$\left(\begin{array}{c}\text{Inventory}\\ \text{Stock}\\ \text{Cost}\end{array}\right) = \left(\begin{array}{c}\text{Confidence}\\ \text{Quantity}\\ \text{at } a^{th}\\ \text{Maintenance}\\ \text{Level}\end{array}\right)\left(\begin{array}{c}\text{Cost}\\ \text{Per}\\ \text{Item}\end{array}\right) + \left(\begin{array}{c}\text{Annual System}\\ \text{Stock Quantity}\\ \text{at } a^{th}\\ \text{Maintenance}\\ \text{Level}\end{array}\right)\left(\begin{array}{c}\text{Cost}\\ \text{Per}\\ \text{Item}\end{array}\right)\left(\begin{array}{c}\text{Discount}\\ \text{Factor}\end{array}\right)$$

where,

$$\left(\begin{array}{c}\text{Confidence}\\ \text{Quantity}\\ \text{at } a^{th}\\ \text{Maintenance}\\ \text{Level}\end{array}\right) = N\text{, where } N \text{ is the smallest integer such that}$$

$$\left(\begin{array}{c}\text{Probability}\\ \text{Against}\\ \text{Stock-Out}\\ \text{with } N\\ \text{Spares}\end{array}\right) = \sum_{i=0}^{N} \frac{\lambda^i}{i!} e^{-\lambda} \geq \left(\begin{array}{c}\text{Target}\\ \text{Probability}\\ \text{Against}\\ \text{Stock-Out}\end{array}\right)$$

$$\text{where } \lambda = \left(\begin{array}{c}\text{Item}\\ \text{Daily}\\ \text{Demand}\\ \text{Rate}\end{array}\right)\left[1.0 - \left(\begin{array}{c}\text{Item BCM}\\ \text{Rate at } a^{th}\\ \text{Maintenance}\\ \text{Level}\end{array}\right)\right]\left(\begin{array}{c}\text{Repair Cycle}\\ \text{Time in Days at}\\ a^{th}\text{ Maintenance}\\ \text{Level}\end{array}\right) + \left(\begin{array}{c}\text{Item}\\ \text{Daily}\\ \text{Demand}\\ \text{Rate}\end{array}\right)\left(\begin{array}{c}\text{Item BCM}\\ \text{Rate at } a^{th}\\ \text{Maintenance}\\ \text{Level}\end{array}\right)\left(\begin{array}{c}\text{Required Days}\\ \text{of Stock at } a^{th}\\ \text{Maintenance}\\ \text{Level}\end{array}\right)$$

and

$$\left(\begin{array}{c}\text{Annual}\\ \text{System Stock}\\ \text{Quantity at } a^{th}\\ \text{Maintenance}\\ \text{Level}\end{array}\right) = \left(\begin{array}{c}\text{Item}\\ \text{Daily}\\ \text{Demand}\\ \text{Rate}\end{array}\right)\left(\begin{array}{c}\text{Item BCM}\\ \text{Rate at } a^{th}\\ \text{Maintenance}\\ \text{Level}\end{array}\right)\left(\begin{array}{c}\text{365 Days}\\ \text{Per Year}\end{array}\right)$$

and, a = an index denoting the first maintenance level in the alternative being evaluated.

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30.3.1.2.5 Inventory Stock Cost Equation for the Multiple Level Repair Alternative.

$$\begin{pmatrix}\text{Inventory}\\ \text{Stock}\\ \text{Cost}\end{pmatrix} = \left[\begin{pmatrix}\text{Confidence}\\ \text{Quantity at}\\ a^{th}\text{ Maintenance}\\ \text{Level}\end{pmatrix} + \begin{pmatrix}\text{Confidence}\\ \text{Quantity at}\\ b^{th}\text{ Maintenance}\\ \text{Level}\end{pmatrix} + \ldots + \begin{pmatrix}\text{Confidence}\\ \text{Quantity at}\\ n^{th}\text{ Maintenance}\\ \text{Level}\end{pmatrix}\right]\begin{pmatrix}\text{Cost}\\ \text{Per}\\ \text{Item}\end{pmatrix} + \begin{pmatrix}\text{Annual System}\\ \text{Stock Quantity at}\\ n^{th}\text{ Maintenance}\\ \text{Level}\end{pmatrix}\begin{pmatrix}\text{Cost}\\ \text{Per}\\ \text{Item}\end{pmatrix}\begin{pmatrix}\text{Discount}\\ \text{Factor}\end{pmatrix}$$

where,

$$\begin{pmatrix}\text{Confidence}\\ \text{Quantity at}\\ a^{th}\text{ Maintenance}\\ \text{Level}\end{pmatrix} = N_a,\text{ where } N_a \text{ is the smallest integer such that}$$

$$\begin{pmatrix}\text{Probability}\\ \text{Against}\\ \text{Stock-Out}\\ \text{with } N_a\\ \text{Spares}\end{pmatrix} = \sum_{i=0}^{N_a} \frac{\lambda_a^{i}}{i!} e^{-\lambda_a} \geq \begin{pmatrix}\text{Target}\\ \text{Probability}\\ \text{Against}\\ \text{Stock-Out}\end{pmatrix}$$

$$\text{where } \lambda_a = \begin{pmatrix}\text{Item}\\ \text{Daily}\\ \text{Demand}\\ \text{Rate}\end{pmatrix}\left[1.0 - \begin{pmatrix}\text{Item BCM}\\ \text{Rate at } a^{th}\\ \text{Maintenance}\\ \text{Level}\end{pmatrix}\right]\begin{pmatrix}\text{Repair Cycle}\\ \text{Time in Days at}\\ a^{th}\text{ Maintenance}\\ \text{Level}\end{pmatrix} + \begin{pmatrix}\text{Item}\\ \text{Daily}\\ \text{Demand}\\ \text{Rate}\end{pmatrix}\begin{pmatrix}\text{Item BCM}\\ \text{Rate at } a^{th}\\ \text{Maintenance}\\ \text{Level}\end{pmatrix}\begin{pmatrix}\text{Required Days}\\ \text{of Stock at } a^{th}\\ \text{Maintenance}\\ \text{Level}\end{pmatrix}$$

$$\begin{pmatrix}\text{Confidence}\\ \text{Quantity at}\\ b^{th}\text{ Maintenance}\\ \text{Level}\end{pmatrix} = N_b,\text{ where } N_b \text{ is the smallest integer such that}$$

$$\begin{pmatrix}\text{Probability}\\ \text{Against}\\ \text{Stock-Out}\\ \text{with } N_b\\ \text{Spares}\end{pmatrix} = \sum_{i=0}^{N_b} \frac{\lambda_b^{i}}{i!} e^{-\lambda_b} \geq \begin{pmatrix}\text{Target}\\ \text{Probability}\\ \text{Against}\\ \text{Stock-Out}\end{pmatrix}$$

$$\text{where } \lambda_b = \begin{pmatrix}\text{Item}\\ \text{Daily}\\ \text{Demand}\\ \text{Rate}\end{pmatrix}\begin{pmatrix}\text{Item BCM}\\ \text{Rate at } a^{th}\\ \text{Maintenance}\\ \text{Level}\end{pmatrix}\left[1.0 - \begin{pmatrix}\text{Item BCM}\\ \text{Rate at } b^{th}\\ \text{Maintenance}\\ \text{Level}\end{pmatrix}\right]\left[\begin{pmatrix}\text{Repair Cycle}\\ \text{Time in Days at}\\ b^{th}\text{ Maintenance}\\ \text{Level}\end{pmatrix} - \begin{pmatrix}\text{Required Days}\\ \text{of Stock at } a^{th}\\ \text{Maintenance}\\ \text{Level}\end{pmatrix}\right]$$

$$+ \begin{pmatrix}\text{Item}\\ \text{Daily}\\ \text{Demand}\\ \text{Rate}\end{pmatrix}\begin{pmatrix}\text{Item BCM}\\ \text{Rate at } a^{th}\\ \text{Maintenance}\\ \text{Level}\end{pmatrix}\begin{pmatrix}\text{Item BCM}\\ \text{Rate at } b^{th}\\ \text{Maintenance}\\ \text{Level}\end{pmatrix}\begin{pmatrix}\text{Required Days}\\ \text{of Stock at}\\ b^{th}\text{ Maintenance}\\ \text{Level}\end{pmatrix}$$

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$$\left(\begin{array}{c}\text{Confidence}\\ \text{Quantity at}\\ n^{th}\text{ Maintenance}\\ \text{Level}\end{array}\right) = N_n,\ \text{where } N_n \text{ is the smallest integer such that}$$

$$\left(\begin{array}{c}\text{Probability}\\ \text{Against}\\ \text{Stock-Out}\\ \text{with } N_n\\ \text{Spares}\end{array}\right) = \sum_{i=0}^{N_n} \frac{\lambda_n^i}{i!} e^{-\lambda_n} \geq \left(\begin{array}{c}\text{Target}\\ \text{Probability}\\ \text{Against}\\ \text{Stock-Out}\end{array}\right)$$

$$\text{where } \lambda_n = \left(\begin{array}{c}\text{Item}\\ \text{Daily}\\ \text{Demand}\\ \text{Rate}\end{array}\right) \left(\begin{array}{c}\text{Item BCM}\\ \text{Rate at } a^{th}\\ \text{Maintenance}\\ \text{Level}\end{array}\right) \left(\begin{array}{c}\text{Item BCM}\\ \text{Rate at } b^{th}\\ \text{Maintenance}\\ \text{Level}\end{array}\right) \cdots \left(\begin{array}{c}\text{Item BCM}\\ \text{Rate at } (n-1)^{th}\\ \text{Maintenance}\\ \text{Level}\end{array}\right) \left[1.0 - \left(\begin{array}{c}\text{Item BCM}\\ \text{Rate at } n^{th}\\ \text{Maintenance}\\ \text{Level}\end{array}\right)\right]$$

$$\left[\left(\begin{array}{c}\text{Repair Cycle}\\ \text{Time in Days at}\\ b^{th}\text{ Maintenance}\\ \text{Level}\end{array}\right) - \left(\begin{array}{c}\text{Required Days}\\ \text{of Stock at } a^{th}\\ \text{Maintenance}\\ \text{Level}\end{array}\right)\right] + \left(\begin{array}{c}\text{Item}\\ \text{Daily}\\ \text{Demand}\\ \text{Rate}\end{array}\right) \left(\begin{array}{c}\text{Item BCM}\\ \text{Rate at } a^{th}\\ \text{Maintenance}\\ \text{Level}\end{array}\right) \left(\begin{array}{c}\text{Item BCM}\\ \text{Rate at } b^{th}\\ \text{Maintenance}\\ \text{Level}\end{array}\right) \cdots \left(\begin{array}{c}\text{Item BCM}\\ \text{Rate at } n^{th}\\ \text{Maintenance}\\ \text{Level}\end{array}\right)$$

and

$$\left(\begin{array}{c}\text{Annual}\\ \text{System Stock}\\ \text{Quantity at } n^{th}\\ \text{Maintenance}\\ \text{Level}\end{array}\right) = \left(\begin{array}{c}\text{Item}\\ \text{Daily}\\ \text{Demand}\\ \text{Rate}\end{array}\right) \left(\begin{array}{c}\text{Item BCM}\\ \text{Rate at } a^{th}\\ \text{Maintenance}\\ \text{Level}\end{array}\right) \left(\begin{array}{c}\text{Item BCM}\\ \text{Rate at } b^{th}\\ \text{Maintenance}\\ \text{Level}\end{array}\right) \cdots \left(\begin{array}{c}\text{Item BCM}\\ \text{Rate at } n^{th}\\ \text{Maintenance}\\ \text{Level}\end{array}\right) \left(\begin{array}{c}\text{365 Days}\\ \text{Per Year}\end{array}\right)$$

and

b = an index denoting the second maintenance level.

n = an index denoting the highest maintenance level.

$n-1$ = an index denoting the maintenance level immediately preceding the highest maintenance level.

NOTES:

1. For the purpose of this standard, integerization quantity criteria for Annual System Stock, i.e., rounding to the next higher integer, are not applicable.
2. Negative quantities are not allowed. If term is less than zero, use zero.
3. BCM rate at highest maintenance level is a discard (washout) rate.

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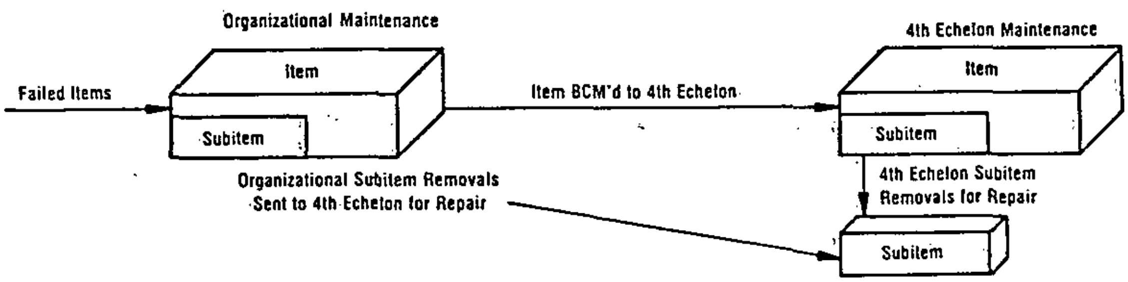
30.3.1.2.6 Inventory Stock Cost for the Multiple Level Subitem Repair Alternative. A slightly different procedure is required for determining inventory stock quantities when a repairable item contains repairable subitems. For example, a repairable item at the unit level of complexity may contain subitems, i.e., assemblies, which are also repairable. Further, these subitems may be repaired at the maintenance level where they are removed and replaced or they may require repair at one of more higher level maintenance echelons.

30.3.1.2.6.1 Consider the maintenance sequence of a repairable item containing repairable subitems as diagrammed and described below. Item repair is permitted at the organizational and 4th echelon maintenance levels but subitem repair can be effected only at the 4th echelon.



Defective subitems removed at the organizational level must be sent to the 4th echelon for repair. Also, same items which are beyond the capability of organizational level maintenance are sent to the 4th echelon for additional repair and they can contain failed subitems which are 4th echelon-repairable. Therefore, the total number of 4th echelon subitem repairs is a function of the number of subitems sent from the organizational level to the 4th echelon for directed repair and the number of subitem failures detected in items repaired at the 4th echelon.

30.3.1.2.6.2 This situation is replicated as more maintenance levels are employed. (Also, this sequence of events can be extended to include sub-subitems, i.e., LRI's, contained in subitems.) When such an indentured structure equipment is subjected to an LOR analysis, the following equations should be used, as necessary, to determine inventory stock cost and maintenance float, spares, and system stock quantities.

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30.3.1.2.7 Inventory Stock Cost Equation for the Multiple Level Subitem Repair Alternative.

$$\begin{pmatrix}\text{Subitem}\\\text{Inventory}\\\text{Stock}\\\text{Cost}\end{pmatrix} = \left[\begin{pmatrix}\text{Subitem}\\\text{Confidence}\\\text{Quantity at a}^{\text{th}}\\\text{Maintenance}\\\text{Level}\end{pmatrix} + \begin{pmatrix}\text{Subitem}\\\text{Confidence}\\\text{Quantity at b}^{\text{th}}\\\text{Maintenance}\\\text{Level}\end{pmatrix} + \ldots + \begin{pmatrix}\text{Subitem}\\\text{Confidence}\\\text{Quantity at n}^{\text{th}}\\\text{Maintenance}\\\text{Level}\end{pmatrix}\right]\begin{pmatrix}\text{Cost}\\\text{Per}\\\text{Item}\end{pmatrix} +$$

$$\begin{pmatrix}\text{Annual Subitem}\\\text{System Stock}\\\text{Quantity at n}^{\text{th}}\\\text{Maintenance}\\\text{Level}\end{pmatrix}\begin{pmatrix}\text{Cost}\\\text{Per}\\\text{Item}\end{pmatrix}\begin{pmatrix}\text{Discount}\\\text{Factor}\end{pmatrix}$$

where,

$$\begin{pmatrix}\text{Subitem}\\\text{Confidence}\\\text{Quantity at a}^{\text{th}}\\\text{Maintenance}\\\text{Level}\end{pmatrix} = N_a\text{, where } N_a \text{ is the smallest integer such that}$$

$$\begin{pmatrix}\text{Probability}\\\text{Against}\\\text{Stock-Out}\\\text{with } N_a\\\text{Spares}\end{pmatrix} = \sum_{i=0}^{N_a} \frac{\lambda_a^i}{i!} e^{-\lambda_a} \geq \begin{pmatrix}\text{Target}\\\text{Probability}\\\text{Against}\\\text{Stock-Out}\end{pmatrix}$$

$$\text{where } \lambda_a = \begin{pmatrix}\text{Subitem}\\\text{Failures}\\\text{Detected at a}^{\text{th}}\\\text{Maintenance}\\\text{Level}\end{pmatrix}\left[1.0 - \begin{pmatrix}\text{Subitem}\\\text{BCM Rate}\\\text{at a}^{\text{th}}\\\text{Maintenance}\\\text{Level}\end{pmatrix}\right]\begin{pmatrix}\text{Repair}\\\text{Time in Days}\\\text{at a}^{\text{th}}\\\text{Maintenance}\\\text{Level}\end{pmatrix} +$$

$$\begin{pmatrix}\text{Item}\\\text{Daily}\\\text{Demand}\\\text{Rate}\end{pmatrix}\left[1.0 - \begin{pmatrix}\text{Item}\\\text{BCM Rate}\\\text{at a}^{\text{th}}\\\text{Maintenance}\\\text{Level}\end{pmatrix}\right]\begin{pmatrix}\frac{\text{Item MTBF}}{\text{Subitem MTBF}}\end{pmatrix}\begin{pmatrix}\text{Subitem}\\\text{BCM Rate}\\\text{at a}^{\text{th}}\\\text{Maintenance}\\\text{Level}\end{pmatrix}\begin{pmatrix}\text{Required}\\\text{Days of Stock}\\\text{at a}^{\text{th}}\\\text{Maintenance}\\\text{Level}\end{pmatrix}$$

and,

$$\begin{pmatrix}\text{Subitem}\\\text{Failures}\\\text{Detected at a}^{\text{th}}\\\text{Maintenance}\\\text{Level}\end{pmatrix} = \begin{pmatrix}\text{Item}\\\text{Daily}\\\text{Demand}\\\text{Rate}\end{pmatrix}\left[1.0 - \begin{pmatrix}\text{Item}\\\text{BCM Rate}\\\text{at a}^{\text{th}}\\\text{Maintenance}\\\text{Level}\end{pmatrix}\right]\begin{pmatrix}\frac{\text{Item MTBF}}{\text{Subitem MTBF}}\end{pmatrix}$$

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$$\begin{pmatrix}\text{Subitem}\\ \text{Confidence}\\ \text{Quantity at } b^{th}\\ \text{Maintenance}\\ \text{Level}\end{pmatrix} = N_b\text{, where } N_b \text{ is the smallest integer such that}$$

$$\begin{pmatrix}\text{Probability}\\ \text{Against}\\ \text{Stock-Out}\\ \text{with } N_b\\ \text{Spares}\end{pmatrix} = \sum_{i=0}^{N_b} \frac{\lambda_b^i}{i!} e^{-\lambda_b} \geq \begin{pmatrix}\text{Target}\\ \text{Probability}\\ \text{Against}\\ \text{Stock-Out}\end{pmatrix}$$

$$\text{where } \lambda_b = \left[\begin{pmatrix}\text{Subitem}\\ \text{Failures}\\ \text{Sent From } a^{th} \text{ to}\\ b^{th} \text{ Maintenance Level}\\ \text{Level}\end{pmatrix} + \begin{pmatrix}\text{Subitem}\\ \text{Failures}\\ \text{Detected at } b^{th}\\ \text{Maintenance}\\ \text{Level}\end{pmatrix}\right]\left[1.0 - \begin{pmatrix}\text{Subitem}\\ \text{BCM Rate}\\ \text{at } n^{th}\\ \text{Maintenance}\\ \text{Level}\end{pmatrix}\right]\left[\begin{pmatrix}\text{Repair Cycle}\\ \text{Time in Days}\\ \text{at } b^{th}\\ \text{Maintenance}\\ \text{Level}\end{pmatrix} - \begin{pmatrix}\text{Required}\\ \text{Days of Stock}\\ \text{at } a^{th}\\ \text{Mainenance}\\ \text{Level}\end{pmatrix}\right]$$

$$+ \left\{\begin{pmatrix}\text{Item}\\ \text{Daily}\\ \text{Demand}\\ \text{Rate}\end{pmatrix}\left[1.0 - \begin{pmatrix}\text{Item}\\ \text{BCM Rate}\\ \text{at } a^{th}\\ \text{Maintenance}\\ \text{Level}\end{pmatrix}\right]\begin{pmatrix}\frac{\text{Item MTBF}}{\text{Subitem MTBF}}\end{pmatrix}\begin{pmatrix}\text{Subitem}\\ \text{BCM Rate}\\ \text{at } a^{th}\\ \text{Maintenance}\\ \text{Level}\end{pmatrix}\right.$$

$$\left. + \begin{pmatrix}\text{Item}\\ \text{Daily}\\ \text{Demand}\\ \text{Rate}\end{pmatrix}\begin{pmatrix}\text{Item}\\ \text{BCM Rate}\\ \text{at } a^{th}\\ \text{Maintenance}\\ \text{Level}\end{pmatrix}\left[1.0 - \begin{pmatrix}\text{Item}\\ \text{BCM Rate}\\ \text{at } b^{th}\\ \text{Maintenance}\\ \text{Level}\end{pmatrix}\right]\begin{pmatrix}\frac{\text{Item MTBF}}{\text{Subitem MTBF}}\end{pmatrix}\right\}$$

$$\begin{pmatrix}\text{Subitem}\\ \text{BCM Rate}\\ \text{at } b^{th}\\ \text{Maintenance}\\ \text{Level}\end{pmatrix}\begin{pmatrix}\text{Required}\\ \text{Days of Stock}\\ \text{at } b^{th}\\ \text{Maintenance}\\ \text{Level}\end{pmatrix}$$

and,

$$\begin{pmatrix}\text{Subitem}\\ \text{Failures}\\ \text{Sent From } a^{th} \text{ to}\\ b^{th} \text{ Maintenance}\\ \text{Level}\end{pmatrix} = \begin{pmatrix}\text{Item}\\ \text{Daily}\\ \text{Demand}\\ \text{Rate}\end{pmatrix}\left[1.0 - \begin{pmatrix}\text{Item}\\ \text{BCM Rate}\\ \text{at } a^{th}\\ \text{Maintenance}\\ \text{Level}\end{pmatrix}\right]\begin{pmatrix}\frac{\text{Item MTBF}}{\text{Subitem MTBF}}\end{pmatrix}\begin{pmatrix}\text{Subitem}\\ \text{BCM Rate}\\ \text{at } a^{th}\\ \text{Maintenance}\\ \text{Level}\end{pmatrix}$$

$$\begin{pmatrix}\text{Subitem}\\ \text{Failures}\\ \text{Detected at}\\ b^{th} \text{ Maintenance}\\ \text{Level}\end{pmatrix} = \begin{pmatrix}\text{Item}\\ \text{Daily}\\ \text{Demand}\\ \text{Rate}\end{pmatrix}\begin{pmatrix}\text{Item}\\ \text{BCM Rate}\\ \text{at } a^{th}\\ \text{Maintenance}\\ \text{Level}\end{pmatrix}\left[1.0 \begin{pmatrix}\text{Item}\\ \text{BCM Rate}\\ \text{at } b^{th}\\ \text{Maintenance}\\ \text{Level}\end{pmatrix}\right]\begin{pmatrix}\frac{\text{Item MTBF}}{\text{Subitem MTBF}}\end{pmatrix}$$

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$$\begin{pmatrix}\text{Subitem}\\ \text{Confidence}\\ \text{Quantity at } n^{th}\\ \text{Maintenance}\\ \text{Level}\end{pmatrix} = N_n, \text{ where } N_n \text{ is the smallest integer such that}$$

$$\begin{pmatrix}\text{Probability}\\ \text{Against}\\ \text{Stock-Out}\\ \text{with } N_n\\ \text{Spares}\end{pmatrix} = \sum_{i=0}^{N_n} \frac{\lambda_n^i}{i!} e^{-\lambda_n} \geq \begin{pmatrix}\text{Target}\\ \text{Probability}\\ \text{Against}\\ \text{Stock-Out}\end{pmatrix}$$

$$\text{where } \lambda_n = \left[\begin{pmatrix}\text{Subitem}\\ \text{Failures Sent}\\ \text{From } (n-1)^{th} \text{ to}\\ n^{th} \text{ Maintenance}\\ \text{Level}\end{pmatrix} + \begin{pmatrix}\text{Subitem}\\ \text{Failures}\\ \text{Detected at}\\ n^{th} \text{ Maintenance}\\ \text{Level}\end{pmatrix}\right]\left[1.0 - \begin{pmatrix}\text{Subitem}\\ \text{BCM Rate}\\ \text{at } b^{th}\\ \text{Maintenance}\\ \text{Level}\end{pmatrix}\right]\left[\begin{pmatrix}\text{Repair Cycle}\\ \text{Time in Days}\\ \text{at } n^{th}\\ \text{Maintenance}\\ \text{Level}\end{pmatrix} - \begin{pmatrix}\text{Required}\\ \text{Days of Stock}\\ \text{at } (n-1)^{th}\\ \text{Maintenance}\\ \text{Level}\end{pmatrix}\right]$$

$$+ \left[\left\{\left\{\begin{pmatrix}\text{Item}\\ \text{Daily}\\ \text{Demand}\\ \text{Rate}\end{pmatrix}\left[1.0 - \begin{pmatrix}\text{Item}\\ \text{BCM Rate}\\ \text{at } a^{th}\\ \text{Maintenance}\\ \text{Level}\end{pmatrix}\right]\begin{pmatrix}\dfrac{\text{Item MTBF}}{\text{Subitem MTBF}}\end{pmatrix}\begin{pmatrix}\text{Subitem}\\ \text{BCM Rate}\\ \text{at } a^{th}\\ \text{Maintenance}\\ \text{Level}\end{pmatrix}\right.\right.\right.$$

$$\left.+ \begin{pmatrix}\text{Item}\\ \text{Daily}\\ \text{Demand}\\ \text{Rate}\end{pmatrix}\begin{pmatrix}\text{Item}\\ \text{BCM Rate}\\ \text{at } a^{th}\\ \text{Maintenance}\\ \text{Level}\end{pmatrix}\left[1.0 - \begin{pmatrix}\text{Item}\\ \text{BCM Rate}\\ \text{at } b^{th}\\ \text{Maintenance}\\ \text{Level}\end{pmatrix}\right]\begin{pmatrix}\dfrac{\text{Item MTBF}}{\text{Subitem MTBF}}\end{pmatrix}\right\}\begin{pmatrix}\text{Subitem}\\ \text{BCM Rate}\\ \text{at } n^{th}\\ \text{Maintenance}\\ \text{Level}\end{pmatrix} + \ldots + \Bigg\}$$

$$\left.+ \begin{pmatrix}\text{Item}\\ \text{Daily}\\ \text{Demand}\\ \text{Rate}\end{pmatrix}\begin{pmatrix}\text{Item}\\ \text{BCM Rate}\\ \text{at } a^{th}\\ \text{Maintenance}\\ \text{Level}\end{pmatrix}\begin{pmatrix}\text{Item}\\ \text{BCM Rate}\\ \text{at } b^{th}\\ \text{Maintenance}\\ \text{Level}\end{pmatrix}\ldots\begin{pmatrix}\text{Item}\\ \text{BCM Rate}\\ \text{at } (n-1)^{th}\\ \text{Maintenance}\\ \text{Level}\end{pmatrix}\left[1.0 - \begin{pmatrix}\text{Item}\\ \text{BCM Rate}\\ \text{at } n^{th}\\ \text{Maintenance}\\ \text{Level}\end{pmatrix}\right]\begin{pmatrix}\dfrac{\text{Item MTBF}}{\text{Subitem MTBF}}\end{pmatrix}\right]$$

$$\begin{pmatrix}\text{Subitem}\\ \text{BCM Rate}\\ \text{at } n^{th}\\ \text{Maintenance}\\ \text{Level}\end{pmatrix}\begin{pmatrix}\text{Required}\\ \text{Days of Stock}\\ \text{at } n^{th}\\ \text{Maintenance}\\ \text{Level}\end{pmatrix}$$

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$$\left(\begin{matrix}\text{Subitem Failures}\\ \text{Sent From } (n-1)^{th} \text{ to}\\ n^{th} \text{ Maintenance}\\ \text{Level}\end{matrix}\right) = \left\{\left\{\left[\left(\begin{matrix}\text{Item}\\ \text{Daily}\\ \text{Demand}\\ \text{Rate}\end{matrix}\right)\left[1.0 - \left(\begin{matrix}\text{Item BCM}\\ \text{Rate at } a^{th}\\ \text{Maintenance}\\ \text{Level}\end{matrix}\right)\right]\left(\frac{\text{Item MTBF}}{\text{Subitem MTBF}}\right)\left(\begin{matrix}\text{Subitem}\\ \text{BCM Rate at}\\ a^{th} \text{ Maintenance}\\ \text{Level}\end{matrix}\right)\right.\right.\right.$$

$$\left.\left.+\left(\begin{matrix}\text{Item}\\ \text{Daily}\\ \text{Demand}\\ \text{Rate}\end{matrix}\right)\left(\begin{matrix}\text{Item BCM}\\ \text{Rate at } a^{th}\\ \text{Maintenance}\\ \text{Level}\end{matrix}\right)\left[1.0 - \left(\begin{matrix}\text{Item BCM}\\ \text{Rate at } b^{th}\\ \text{Maintenance}\\ \text{Level}\end{matrix}\right)\right]\left(\frac{\text{Item MTBF}}{\text{Subitem MTBF}}\right)\right]\left(\begin{matrix}\text{Subitem}\\ \text{BCM Rate at}\\ b^{th} \text{ Maintenance}\\ \text{Level}\end{matrix}\right)\right\} + \ldots + \right\}$$

$$\left(\begin{matrix}\text{Subitem}\\ \text{Failures}\\ \text{Detected at } n^{th}\\ \text{Maintenance}\\ \text{Level}\end{matrix}\right) = \left(\begin{matrix}\text{Item}\\ \text{Daily}\\ \text{Demand}\\ \text{Rate}\end{matrix}\right)\left(\begin{matrix}\text{Item BCM}\\ \text{Rate at } a^{th}\\ \text{Maintenance}\\ \text{Level}\end{matrix}\right)\left(\begin{matrix}\text{Item BCM}\\ \text{Rate at } b^{th}\\ \text{Maintenance}\\ \text{Level}\end{matrix}\right)\cdots\left(\begin{matrix}\text{Item BCM}\\ \text{Rate at } (n-1)^{th}\\ \text{Maintenance}\\ \text{Level}\end{matrix}\right)\left[1.0 - \left(\begin{matrix}\text{Item BCM}\\ \text{Rate at } n^{th}\\ \text{Maintenance}\\ \text{Level}\end{matrix}\right)\right]\left(\frac{\text{Item MTBF}}{\text{Subitem MTBF}}\right)$$

$$\left(\begin{matrix}\text{Annual Subitem}\\ \text{System Stock}\\ \text{Quantity at } n^{th}\\ \text{Maintenance}\\ \text{Level}\end{matrix}\right) = \left(\begin{matrix}\text{Subitem}\\ \text{Daily}\\ \text{Demand}\\ \text{Rate}\end{matrix}\right)\left(\begin{matrix}\text{Subitem}\\ \text{BCM Rate at}\\ a^{th} \text{ Maintenance}\\ \text{Level}\end{matrix}\right)\left(\begin{matrix}\text{Subitem}\\ \text{BCM Rate at}\\ b^{th} \text{ Maintenance}\\ \text{Level}\end{matrix}\right)\cdots\left(\begin{matrix}\text{Subitem}\\ \text{BCM Rate at}\\ n^{th} \text{ Maintenance}\\ \text{Level}\end{matrix}\right)\left(\begin{matrix}\text{365 Days}\\ \text{Per Year}\end{matrix}\right)$$

30.3.1.3 Repair Material Cost. Repair material cost accounts for the parts and/or supplies required to fix a failed hardware item. A repair material cost factor (the ratio of the average yearly cost of repair material per failure to the item's unit cost) is used to predict costs in this LOR category.

30.3.1.3.1 Repair Material Cost for the Discard Alternative. Material cost is zero for the discard alternative because repair parts and/or supplies are not required.

30.3.1.3.2 Repair Material Cost Equation for the Single Level Repair Alternative.

$$\left(\begin{matrix}\text{Item Repair}\\ \text{Material}\\ \text{Cost}\end{matrix}\right) = \left(\begin{matrix}\text{Annual}\\ \text{Number of}\\ \text{Item}\\ \text{Failures}\end{matrix}\right)\left[1.0 - \left(\begin{matrix}\text{Item BCM}\\ \text{Rate at } a^{th}\\ \text{Maintenance}\\ \text{Level}\end{matrix}\right)\right]\left(\begin{matrix}\text{Cost}\\ \text{Per}\\ \text{Item}\end{matrix}\right)\left(\begin{matrix}\text{Item Repair}\\ \text{Material}\\ \text{Cost Factor}\end{matrix}\right)\left(\begin{matrix}\text{Discount}\\ \text{Factor}\end{matrix}\right)$$

30.3.1.3.3 Repair Material Cost Equation for the Multiple Level Repair Alternative.

$$\left(\begin{matrix}\text{Item Repair}\\ \text{Material Cost}\end{matrix}\right) = \left[\left(\begin{matrix}\text{Item Repair}\\ \text{Material Cost at}\\ a^{th} \text{ Maintenance}\\ \text{Level}\end{matrix}\right) + \left(\begin{matrix}\text{Item Repair}\\ \text{Material Cost at}\\ b^{th} \text{ Maintenance}\\ \text{Level}\end{matrix}\right) + \ldots + \left(\begin{matrix}\text{Item Repair}\\ \text{Material Cost at}\\ n^{th} \text{ Maintenance}\\ \text{Level}\end{matrix}\right)\right]\left(\begin{matrix}\text{Discount}\\ \text{Factor}\end{matrix}\right)$$

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where,

$$\begin{pmatrix}\text{Item Repair}\\ \text{Material Cost at}\\ a^{th}\text{ Maintenance}\\ \text{Level}\end{pmatrix} = \begin{pmatrix}\text{Annual}\\ \text{Number of}\\ \text{Item}\\ \text{Failures}\end{pmatrix} \left[1.0 - \begin{pmatrix}\text{Item BCM}\\ \text{Rate at } a^{th}\\ \text{Maintenance}\\ \text{Level}\end{pmatrix}\right] \begin{pmatrix}\text{Cost}\\ \text{Per}\\ \text{Item}\end{pmatrix} \begin{pmatrix}\text{Item Repair}\\ \text{Material Cost}\\ \text{Factor}\end{pmatrix}$$

$$\begin{pmatrix}\text{Item Repair}\\ \text{Material Cost at}\\ b^{th}\text{ Maintenance}\\ \text{Level}\end{pmatrix} = \begin{pmatrix}\text{Annual}\\ \text{Number of}\\ \text{Item}\\ \text{Failures}\end{pmatrix} \begin{pmatrix}\text{Item BCM}\\ \text{Rate at } a^{th}\\ \text{Maintenance}\\ \text{Level}\end{pmatrix} \left[1.0 - \begin{pmatrix}\text{Item BCM}\\ \text{Rate at } b^{th}\\ \text{Maintenance}\\ \text{Level}\end{pmatrix}\right] \begin{pmatrix}\text{Cost}\\ \text{Per}\\ \text{Item}\end{pmatrix} \begin{pmatrix}\text{Item Repair}\\ \text{Material}\\ \text{Cost Factor}\end{pmatrix}$$

$$\begin{pmatrix}\text{Item Repair}\\ \text{Material Cost at}\\ n^{th}\text{ Maintenance}\\ \text{Level}\end{pmatrix} = \begin{pmatrix}\text{Annual}\\ \text{Number of}\\ \text{Item}\\ \text{Failures}\end{pmatrix} \begin{pmatrix}\text{Item BCM}\\ \text{Rate at } a^{th}\\ \text{Maintenance}\\ \text{Level}\end{pmatrix} \begin{pmatrix}\text{Item BCM}\\ \text{Rate at } b^{th}\\ \text{Maintenance}\\ \text{Level}\end{pmatrix} \cdots \left[1.0 - \begin{pmatrix}\text{Item BCM}\\ \text{Rate at } n^{th}\\ \text{Maintenance}\\ \text{Level}\end{pmatrix}\right] \begin{pmatrix}\text{Cost}\\ \text{Per}\\ \text{Item}\end{pmatrix} \begin{pmatrix}\text{Item Repair}\\ \text{Material Cost}\\ \text{Factor}\end{pmatrix}$$

*This is a washout rate when applied to a single level repair alternative.

30.3.1.4 Transportation Cost. Costs in this category cover the expenses incurred in packaging and shipping inventory items between the maintenance echelons for the purposes of supply or repair. These costs are functions of the type of commodity item, its size and weight, and the cost of transporting it.

30.3.1.4.1 Transportation Cost for the Discard Alternative. This cost is the one-way cost of shipping a new item from a supply point to the maintenance echelon which requisitioned the item as a replacement for the discarded item.

30.3.1.4.2 Transportation Cost Equation for the Discard Alternative.

$$\begin{pmatrix}\text{Transportation}\\ \text{Cost}\end{pmatrix} = \begin{pmatrix}\text{Annual}\\ \text{Number of}\\ \text{Item}\\ \text{Failures}\end{pmatrix} \left[\begin{pmatrix}\text{Item}\\ \text{Packaging}\\ \text{Cost}\end{pmatrix} + \begin{pmatrix}\text{Item}\\ \text{Transportation Cost}\\ \text{From Supply Point to}\\ a^{th}\text{ Maintenance}\\ \text{Level}\end{pmatrix}\right] \begin{pmatrix}\text{Discount}\\ \text{Factor}\end{pmatrix}$$

30.3.1.4.3 Transportation Cost for the Single Level Repair Alternative. This cost is the sum of two similar but unique cost factors. The first involves the packaging cost and the round-trip cost of transporting a failed item between the failure site and the maintenance echelon responsible for its repair. In some cases the cost of transporting the item is negligible because the failure site and the maintenance activity are colocated or the proximity

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of these facilities precludes significant cost accrual. The second factor is the cost of packaging and transporting an item from a supply point to the maintenance echelon. This supply item is a replacement for the one drawn from the echelon's spares stock to replace an item washed out during maintenance. This form of discard occurs when (a) the item is beyond the repair capability of the maintenance echelon, and (b) the echelon is authorized to discard the item when it is beyond economical and/or practical repair.

30.3.1.4.4 <u>Transportation Cost Equation for the Single Level Repair Alternative.</u>

$$\begin{pmatrix}\text{Transportation}\\\text{Cost}\end{pmatrix} = \left[\begin{pmatrix}\text{Annual}\\\text{Number of}\\\text{Item}\\\text{Failures}\end{pmatrix}\left\{\left[\begin{pmatrix}\text{Item}\\\text{Packaging}\\\text{Cost}\end{pmatrix} + \begin{pmatrix}\text{Item Transportation}\\\text{Cost, Failure Site}\\\text{to a}^{\text{th}}\text{ Maintenance}\\\text{Level}\end{pmatrix}\right](2)\begin{pmatrix}\text{Collocation}\\\text{Factor}\end{pmatrix}\right\} + \begin{pmatrix}\text{Annual}\\\text{Number of}\\\text{Item}\\\text{Failures}\end{pmatrix}\begin{pmatrix}\text{Item BCM}\\\text{Rate at a}^{\text{th}}\\\text{Maintenance}\\\text{Level}\end{pmatrix}\left[\begin{pmatrix}\text{Item}\\\text{Packaging}\\\text{Cost}\end{pmatrix} + \begin{pmatrix}\text{Item Transportation}\\\text{Cost, Supply Point}\\\text{to a}^{\text{th}}\text{ Maintenance}\\\text{Level}\end{pmatrix}\right]\right]\begin{pmatrix}\text{Discount}\\\text{Factor}\end{pmatrix}$$

and

Collocation Factor = zero when maintenance levels are collocated and 1.0 when maintenance levels are not collocated.

30.3.1.4.5 <u>Transportation Cost for the Multiple Level Repair Alternative.</u> For this repair alternative the cost includes packaging and transporting the failed item from its point of failure to and from the maintenance echelon initially responsible for its repair. It also includes subsequent costs for transporting items beyond that echelon's maintenance capability to higher level maintenance activities. In those situations where one or more maintenance echelons are colocated, transportation costs may be negligible. A separate transportation cost factor is provided for the case where a replacement for a failed item is obtained from a designated supply point other than a depot.

30.3.1.4.6 <u>Transportation Cost Equation for the Multiple Level Repair Alternative.</u>

$$\begin{pmatrix}\text{Transportation}\\\text{Cost}\end{pmatrix} = \left[\begin{pmatrix}\text{Annual}\\\text{Number of}\\\text{Item}\\\text{Failures}\end{pmatrix}\left[\begin{pmatrix}\text{Item}\\\text{Packaging}\\\text{Cost}\end{pmatrix} + \begin{pmatrix}\text{Item Transportation}\\\text{Cost, Failure Site}\\\text{to a}^{\text{th}}\text{ Maintenance}\\\text{Level}\end{pmatrix}\right](2)\begin{pmatrix}\text{Collocation}\\\text{Factor}\end{pmatrix}\right.$$

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$$+\begin{pmatrix}\text{Annual}\\ \text{Number of}\\ \text{Item}\\ \text{Failures}\end{pmatrix}\begin{pmatrix}\text{Item BCM}\\ \text{Rate at a}^{\text{th}}\\ \text{Maintenance}\\ \text{Level}\end{pmatrix}\left[\begin{pmatrix}\text{Item}\\ \text{Packaging}\\ \text{Cost}\end{pmatrix}+\begin{pmatrix}\text{Item Transportation}\\ \text{Cost, a}^{\text{th}}\text{ Maintenance}\\ \text{Level to b}^{\text{th}}\\ \text{Maintenance Level}\end{pmatrix}\right](2)\begin{pmatrix}\text{Collocation}\\ \text{Factor}\end{pmatrix}$$

$$+\begin{pmatrix}\text{Annual}\\ \text{Number of}\\ \text{Item}\\ \text{Failures}\end{pmatrix}\begin{pmatrix}\text{Item BCM}\\ \text{Rate at a}^{\text{th}}\\ \text{Maintenance}\\ \text{Level}\end{pmatrix}\begin{pmatrix}\text{Item BCM}\\ \text{Rate at b}^{\text{th}}\\ \text{Maintenance}\\ \text{Level}\end{pmatrix}\left[\begin{pmatrix}\text{Item}\\ \text{Packaging}\\ \text{Cost}\end{pmatrix}+\begin{pmatrix}\text{Item Transportation}\\ \text{Cost, b}^{\text{th}}\text{ Maintenance}\\ \text{Level to n}^{\text{th}}\\ \text{Maintenance Level}\end{pmatrix}\right](2)\begin{pmatrix}\text{Collocation}\\ \text{Factor}\end{pmatrix}$$

$$+\ldots+\begin{pmatrix}\text{Annual}\\ \text{Number of}\\ \text{Item}\\ \text{Failures}\end{pmatrix}\begin{pmatrix}\text{Item BCM}\\ \text{Rate at a}^{\text{th}}\\ \text{Maintenance}\\ \text{Level}\end{pmatrix}\begin{pmatrix}\text{Item BCM}\\ \text{Rate at b}^{\text{th}}\\ \text{Maintenance}\\ \text{Level}\end{pmatrix}\cdots\begin{pmatrix}\text{Item BCM}\\ \text{Rate at n}^{\text{th}}\\ \text{Maintenance}\\ \text{Level}\end{pmatrix}$$

$$\left[\left[\begin{pmatrix}\text{Item}\\ \text{Packaging}\\ \text{Cost}\end{pmatrix}+\begin{pmatrix}\text{Item Transportation}\\ \text{Cost, Supply Point}\\ \text{to n}^{\text{th}}\text{ Maintenance}\\ \text{Level}\end{pmatrix}\right]\begin{pmatrix}\text{Supply}\\ \text{Point}\\ \text{Factor}\end{pmatrix}\right]\begin{pmatrix}\text{Discount}\\ \text{Factor}\end{pmatrix}$$

and

Supply Point Factor = zero when item supply point and depot are the same and one when item supply point is not the depot.

30.3.2 Support Cost. This cost category is composed of two cost elements: support equipment cost and support equipment support cost. The first cost element accounts for the acquisition cost of the support equipment. The second element covers the long-term expenses accrued in supporting and/or maintaining support equipment during the life cycle of the prime equipment.

30.3.2.1 Support Equipment Cost. Two types of support equipment, peculiar support equipment (PSE) and common support equipment (CSE), are included in an LOR analysis. Both PSE and CSE can be employed for discard and repair actions. For discard, support equipment may be required to confirm a failure or to demilitarize the item.

30.3.2.1.1 PSE and CSE Application. PSE is unique to and generally designed for use with a specific equipment or equipment family. CSE is designed for a wide range of applications and usually exists in the normal support equipment inventory. However, a new equipment entering the operational environment may require either CSE not in the inventory at specific maintenance echelons or additional CSE at a repair site because of the increase in maintenance

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activity generated by the new equipment. For the purposes of this LOR, CSE cost is intended to cover the acquisition of additional CSE for these situations. The development cost of CSE is a sunk cost. However, the development cost of PSE is included in the overall cost of support equipment as a separate cost element.

30.3.2.1.2 PSE and CSE Cost Allocation. PSE and CSE costs are allocatable costs. PSE and CSE cost allocation factors are used in apportioning support equipment costs among only those items which require the support equipment. The allocation technique is based on the ratio of the item's failure rate to the total failure rate of all items in the equipment which share the support equipment. A discount factor is not applied to support equipment cost since it is a one-time purchase, but the cost of supporting support equipment during the life cycle is adjusted with the discount factor.

30.3.2.1.3 Support Equipment Cost Equation for the Discard Alternative.

$$\left(\begin{array}{c}\text{Support}\\\text{Equipment}\\\text{Cost}\end{array}\right) = \sum_{i=1}^{n}\left[\left(\begin{array}{c}i^{th}\text{ PSE}\\\text{Development}\\\text{Cost}\end{array}\right) + \left(\begin{array}{c}\text{Number of }i^{th}\\\text{PSE at }a^{th}\\\text{Maintenance}\\\text{Level}\end{array}\right)\left(\begin{array}{c}i^{th}\\\text{PSE}\\\text{Unit Cost}\end{array}\right)\right]\left(\begin{array}{c}\text{PSE Cost}\\\text{Allocation}\\\text{Factor}\end{array}\right)$$

$$+ \sum_{i=1}^{n}\left(\begin{array}{c}\text{Number of }i^{th}\\\text{Additional}\\\text{CSE at }a^{th}\\\text{Maintenance}\\\text{Level}\end{array}\right)\left(\begin{array}{c}i^{th}\text{ Additional}\\\text{CSE Unit}\\\text{Cost}\end{array}\right)\left(\begin{array}{c}\text{CSE Cost}\\\text{Allocation}\\\text{Factor}\end{array}\right)$$

30.3.2.1.4 Support Equipment Cost Equation for the Single Level Repair Alternative.

$$\left(\begin{array}{c}\text{Support}\\\text{Equipment}\\\text{Cost}\end{array}\right) = \sum_{i=1}^{n}\left[\left(\begin{array}{c}i^{th}\text{ PSE}\\\text{Development}\\\text{Cost}\end{array}\right) + \left(\begin{array}{c}\text{Number of }i^{th}\\\text{PSE at }a^{th}\\\text{Maintenance}\\\text{Level}\end{array}\right)\left(\begin{array}{c}i^{th}\text{ PSE}\\\text{Unit Cost}\end{array}\right)\right]\left(\begin{array}{c}\text{PSE Cost}\\\text{Allocation}\\\text{Factor}\end{array}\right)$$

$$+ \sum_{i=1}^{n}\left(\begin{array}{c}\text{Number of }i^{th}\\\text{Additional}\\\text{CSE at }a^{th}\\\text{Maintenance}\\\text{Level}\end{array}\right)\left(\begin{array}{c}i^{th}\text{ Additional}\\\text{CSE Unit}\\\text{Cost}\end{array}\right)\left(\begin{array}{c}\text{CSE Cost}\\\text{Allocation}\\\text{Factor}\end{array}\right)$$

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30.3.2.1.5 Support Equipment Cost Equation for the Multiple Level Repair Alternative.

$$\left(\text{Support Equipment Cost}\right) = \sum_{i=1}^{n} \left[\left(\text{i}^{\text{th}}\text{ PSE Development Cost}\right) + \left(\text{Number of i}^{\text{th}}\text{ PSE at a}^{\text{th}}\text{ Maintenance Level}\right)\left(\text{PSE Cost Allocation Factor}\right) + \left(\text{Number of i}^{\text{th}}\text{ PSE at b}^{\text{th}}\text{ Maintenance Level}\right)\left(\text{PSE Cost Allocation Factor}\right) + \ldots + \left(\text{Number of i}^{\text{th}}\text{ PSE at n}^{\text{th}}\text{ Maintenance Level}\right)\left(\text{PSE Cost Allocation Factor}\right) \right] \left(\text{i}^{\text{th}}\text{ PSE Unit Cost}\right)$$

$$+ \sum_{i=1}^{n} \left[\left(\text{Number of i}^{\text{th}}\text{ Additional CSE at a}^{\text{th}}\text{ Maintenance Level}\right)\left(\text{CSE Cost Allocation Factor}\right) + \left(\text{Number of i}^{\text{th}}\text{ Additional CSE at b}^{\text{th}}\text{ Maintenance Level}\right)\left(\text{CSE Cost Allocation Factor}\right) + \ldots + \left(\text{Number of i}^{\text{th}}\text{ Additional CSE at a}^{\text{th}}\text{ Maintenance Level}\right)\left(\text{CSE Cost Allocation Factor}\right) \right] \left(\text{i}^{\text{th}}\text{ Additional CSE Unit Cost}\right)$$

30.3.2.2 Support Equipment Support Cost. It is necessary to include the cost of maintaining support equipment during the life cycle of the equipment it supports. A support equipment support factor is used in predicting this cost. This factor is the ratio of the average annual support equipment maintenance cost to total cost of the support equipment.

30.3.2.2.1 Support Equipment Support Cost Equation for the Discard Alternative.

$$\left(\text{Support Equipment Support Cost}\right) = \left[\sum_{i=1}^{n} \left(\text{Number of i}^{\text{th}}\text{ PSE at a}^{\text{th}}\text{ Maintenance Level}\right)\left(\text{i}^{\text{th}}\text{ PSE Unit Cost}\right)\left(\text{PSE Cost Allocation Factor}\right) + \sum_{i=1}^{n} \left(\text{Number of i}^{\text{th}}\text{ Additional CSE at a}^{\text{th}}\text{ Maintenance Level}\right)\left(\text{i}^{\text{th}}\text{ Additional CSE Unit Cost}\right)\left(\text{CSE Cost Allocation Factor}\right) \right] \left(\text{Support Equipment Support Factor}\right)\left(\text{Discount Factor}\right)$$

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30.3.2.2.2 Support Equipment Support Cost Equation for the Single Level Repair Alternative.

$$\begin{pmatrix}\text{Support Equipment}\\ \text{Support Cost}\end{pmatrix} = \left[\sum_{i=1}^{n} \begin{pmatrix}\text{Number of } i^{th}\\ \text{PSE at } a^{th}\\ \text{Maintenance}\\ \text{Level}\end{pmatrix} \begin{pmatrix} i^{th}\text{ PSE}\\ \text{Unit}\\ \text{Cost}\end{pmatrix} \begin{pmatrix}\text{PSE Cost}\\ \text{Allocation}\\ \text{Factor}\end{pmatrix} + \sum_{i=1}^{n} \begin{pmatrix}\text{Number of}\\ \text{Additional}\\ \text{CSE at } a^{th}\\ \text{Maintenance}\\ \text{Level}\end{pmatrix} \begin{pmatrix} i^{th}\text{ Additional}\\ \text{CSE Unit}\\ \text{Cost}\end{pmatrix} \begin{pmatrix}\text{CSE Cost}\\ \text{Allocation}\\ \text{Factor}\end{pmatrix} \right] \begin{pmatrix}\text{Support Equipment}\\ \text{Support Factor}\end{pmatrix} \begin{pmatrix}\text{Discount}\\ \text{Factor}\end{pmatrix}$$

30.3.2.2.3 Support Equipment Support Cost Equation for the Multiple Level Repair Alternative.

$$\begin{pmatrix}\text{Support Equipment}\\ \text{Support Cost}\end{pmatrix} = \left[\sum_{i=1}^{n} \left[\begin{pmatrix}\text{Number of } i^{th}\\ \text{PSE at } a^{th}\\ \text{Maintenance}\\ \text{Level}\end{pmatrix} \begin{pmatrix}\text{PSE Cost}\\ \text{Allocation}\\ \text{Factor}\end{pmatrix} + \begin{pmatrix}\text{Number of } i^{th}\\ \text{PSE at } b^{th}\\ \text{Maintenance}\\ \text{Level}\end{pmatrix} \begin{pmatrix}\text{PSE Cost}\\ \text{Allocation}\\ \text{Factor}\end{pmatrix} + \ldots + \begin{pmatrix}\text{Number of } i^{th}\\ \text{PSE at } n^{th}\\ \text{Maintenance}\\ \text{Level}\end{pmatrix} \begin{pmatrix}\text{PSE Cost}\\ \text{Allocation}\\ \text{Factor}\end{pmatrix} \right] \begin{pmatrix} i^{th}\text{ PSE}\\ \text{Unit Cost}\end{pmatrix} + \sum_{i=1}^{n} \left[\begin{pmatrix}\text{Number of}\\ \text{Additional}\\ \text{CSE at } a^{th}\\ \text{Maintenance Level}\end{pmatrix} \begin{pmatrix}\text{CSE Cost}\\ \text{Allocation}\\ \text{Factor}\end{pmatrix} + \begin{pmatrix}\text{Number of}\\ \text{Additional}\\ \text{CSE at } b^{th}\\ \text{Maintenance Level}\end{pmatrix} \begin{pmatrix}\text{CSE Cost}\\ \text{Allocation}\\ \text{Factor}\end{pmatrix} + \ldots + \begin{pmatrix}\text{Number of}\\ \text{Additional}\\ \text{CSE at } n^{th}\\ \text{Maintenance Level}\end{pmatrix} \begin{pmatrix}\text{CSE Cost}\\ \text{Allocation}\\ \text{Factor}\end{pmatrix} \right] \begin{pmatrix} i^{th}\\ \text{Additional}\\ \text{CSE Unit}\\ \text{Cost}\end{pmatrix} \right] \begin{pmatrix}\text{Support Equipment}\\ \text{Support Factor}\end{pmatrix} \begin{pmatrix}\text{Discount}\\ \text{Factor}\end{pmatrix}$$

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30.3.3 Space Cost. The total space cost is the sum of three costs: inventory storage space cost, support equipment space cost, and repair work space cost.

30.3.3.1 Inventory Storage Space Cost. For the discard alternative this is the cost of storing the spares quantities and system stock on hand. For the repair alternative this is the cost of storing the maintenance float, spares quantities, and system stock on hand. It is assumed that on the average, one half of the annual system stock is on hand at any one time.

30.3.3.1.1 Inventory Storage Space Cost Equation for the Discard Alternative.

$$\begin{pmatrix}\text{Inventory}\\ \text{Storage}\\ \text{Space Cost}\end{pmatrix} = \left[\begin{pmatrix}\text{Item Spares}\\ \text{Quantity at}\\ a^{th}\text{ Maintenance}\\ \text{Level}\end{pmatrix} + \frac{\begin{pmatrix}\text{Annual}\\ \text{System Stock}\\ \text{Quantity at}\\ a^{th}\text{ Maintenance}\\ \text{Level}\end{pmatrix}}{(2)}\right] \begin{pmatrix}\text{Inventory}\\ \text{Storage}\\ \text{Space in}\\ \text{Cubic Feet}\\ \text{Per Item}\end{pmatrix} \begin{pmatrix}\text{Inventory}\\ \text{Storage}\\ \text{Space Cost}\\ \text{Per Cubic Foot}\\ \text{Per Month}\end{pmatrix} \begin{pmatrix}\text{12 Months}\\ \text{Per Year}\end{pmatrix} \begin{pmatrix}\text{Discount}\\ \text{Factor}\end{pmatrix}$$

30.3.3.1.2 Inventory Storage Space Cost Equation for the Single Level Repair Alternative.

$$\begin{pmatrix}\text{Inventory}\\ \text{Storage}\\ \text{Spare Cost}\end{pmatrix} = \left[\begin{pmatrix}\text{Item}\\ \text{Maintenance}\\ \text{Float}\\ \text{Quantity at } a^{th}\\ \text{Maintenance Level}\end{pmatrix} + \begin{pmatrix}\text{Item Spares}\\ \text{Quantity at}\\ a^{th}\text{ Maintenance}\\ \text{Level}\end{pmatrix} + \frac{\begin{pmatrix}\text{Annual}\\ \text{System Stock}\\ \text{Quantity at}\\ a^{th}\text{ Maintenance}\\ \text{Level}\end{pmatrix}}{(2)}\right] \begin{pmatrix}\text{Inventory}\\ \text{Storage}\\ \text{Space in}\\ \text{Cubic Feet}\\ \text{Per Item}\end{pmatrix}$$

$$\begin{pmatrix}\text{Inventory}\\ \text{Storage Space}\\ \text{Cost Per}\\ \text{Cubic Foot}\\ \text{Per Month}\end{pmatrix} \begin{pmatrix}\text{12 Months}\\ \text{Per Year}\end{pmatrix} \begin{pmatrix}\text{Discount}\\ \text{Factor}\end{pmatrix}$$

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30.3.3.1.3 Inventory Storage Space Cost Equation for the Multiple Level Repair Alternative.

$$\begin{pmatrix}\text{Inventory}\\\text{Storage}\\\text{Space Cost}\end{pmatrix} = \left[\begin{pmatrix}\text{Item}\\\text{Maintenance}\\\text{Float}\\\text{Quantity at a}^{th}\\\text{Maintenance Level}\end{pmatrix} + \begin{pmatrix}\text{Item Spares}\\\text{Quantity at}\\\text{a}^{th}\text{ Maintenance}\\\text{Level}\end{pmatrix} + \begin{pmatrix}\text{Item}\\\text{Maintenance}\\\text{Float}\\\text{Quantity at b}^{th}\\\text{Maintenance Level}\end{pmatrix} + \begin{pmatrix}\text{Item Spares}\\\text{Quantity at}\\\text{b}^{th}\text{ Maintenance}\\\text{Level}\end{pmatrix} + \ldots + \begin{pmatrix}\text{Item}\\\text{Maintenance}\\\text{Float}\\\text{Quantity at n}^{th}\\\text{Maintenance Level}\end{pmatrix}\right.$$

$$\left. + \begin{pmatrix}\text{Item Spares}\\\text{Quantity at}\\\text{n}^{th}\text{ Maintenance}\\\text{Level}\end{pmatrix} + \frac{\begin{pmatrix}\text{Annual}\\\text{System Stock}\\\text{Quantity at}\\\text{n}^{th}\text{ Maintenance}\\\text{Level}\end{pmatrix}}{(2)}\right] \begin{pmatrix}\text{Inventory}\\\text{Storage}\\\text{Space in}\\\text{Cubic Feet}\\\text{Per Item}\end{pmatrix} \begin{pmatrix}\text{Inventory}\\\text{Storage Space}\\\text{Cost Per}\\\text{Cubic Foot}\\\text{Per Month}\end{pmatrix} \begin{pmatrix}\text{12 Months}\\\text{Per Year}\end{pmatrix} \begin{pmatrix}\text{Discount}\\\text{Factor}\end{pmatrix}$$

30.3.3.2 Support Equipment Space Cost. This cost element accounts for the cost of peculiar support equipment (PSE) and additional common support equipment (CSE) floor space for discard and/or repair alternatives. PSE and CSE cost allocation factors are applied to prorate the cost of support equipment space among those items which require its use during maintenance.

30.3.3.2.1 Support Equipment Space Cost Equation for the Discard Alternative.

$$\begin{pmatrix}\text{Support Equipment}\\\text{Space Cost}\end{pmatrix} = \left[\sum_{i=1}^{n} \begin{pmatrix}\text{Number of i}^{th}\\\text{PSE at a}^{th}\\\text{Maintenance}\\\text{Level}\end{pmatrix} \begin{pmatrix}\text{i}^{th}\text{ PSE}\\\text{Space in}\\\text{Square Feet}\\\text{Per PSE}\end{pmatrix} \begin{pmatrix}\text{i}^{th}\text{ PSE Space}\\\text{Cost in Dollars}\\\text{Per Square}\\\text{Foot Per}\\\text{Month}\end{pmatrix} \begin{pmatrix}\text{PSE Cost}\\\text{Allocation}\\\text{Factor}\end{pmatrix}\right.$$

$$\left. + \sum_{i=1}^{n} \begin{pmatrix}\text{Number of i}^{th}\\\text{Additional}\\\text{CSE at a}^{th}\\\text{Maintenance}\\\text{Level}\end{pmatrix} \begin{pmatrix}\text{i}^{th}\text{ Additional}\\\text{CSE Space in}\\\text{Square Feet}\\\text{Per CSE}\end{pmatrix} \begin{pmatrix}\text{i}^{th}\text{ Additional}\\\text{CSE Space}\\\text{Cost in Dollars}\\\text{Per Square Foot}\\\text{Per Month}\end{pmatrix} \begin{pmatrix}\text{CSE Cost}\\\text{Allocation}\\\text{Factor}\end{pmatrix}\right] \begin{pmatrix}\text{12 Months}\\\text{Per Year}\end{pmatrix} \begin{pmatrix}\text{Discount}\\\text{Factor}\end{pmatrix}$$

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30.3.3.2.2 Support Equipment Space Cost Equation for the Multiple Level Repair Alternative.

$$\left(\text{Support Equipment Space Cost}\right) = \Bigg[\sum_{i=1}^{n}\left[\left(\text{Number of } i^{th} \text{ PSE at } a^{th} \text{ Maintenance Level}\right)\left(\text{PSE Cost Allocation Factor}\right) + \left(\text{Number of } i^{th} \text{ PSE at } b^{th} \text{ Maintenance Level}\right)\left(\text{PSE Cost Allocation Factor}\right) + \dots + \left(\text{Number of } i^{th} \text{ PSE at } n^{th} \text{ Maintenance Level}\right)\left(\text{PSE Cost Allocation Factor}\right)\right]\left(i^{th} \text{ PSE Space in Square Feet Per PSE}\right)\left(i^{th} \text{ PSE Space Cost in Dollars Per Square Foot Per Month}\right)$$

$$+ \sum_{i=1}^{n}\left[\left(\text{Number of } i^{th} \text{ Additional CSE at } a^{th} \text{ Maintenance Level}\right)\left(\text{CSE Cost Allocation Factor}\right) + \left(\text{Number of } i^{th} \text{ Additional CSE at } b^{th} \text{ Maintenance Level}\right)\left(\text{CSE Cost Allocation Factor}\right) + \dots + \left(\text{Number of } i^{th} \text{ Additional CSE at } n^{th} \text{ Maintenance Level}\right)\left(\text{CSE Cost Allocation Factor}\right)\right]\left(i^{th} \text{ Additional CSE Space in Square Feet Per CSE}\right)\left(i^{th} \text{ Additional CSE Space Cost in Dollars Per Square Foot Per Month}\right)\Bigg]\left(\text{12 Months Per Year}\right)\left(\text{Discount Factor}\right)$$

30.3.3.2.3 Support Equipment Space Cost Equation for the Single Level Repair Alternative.

$$\left(\text{Support Equipment Space Cost}\right) = \Bigg[\sum_{i=1}^{n}\left(\text{Number of } i^{th} \text{ PSE at } a^{th} \text{ Maintenance Level}\right)\left(i^{th} \text{ PSE Space in Square Feet Per PSE}\right)\left(i^{th} \text{ PSE Space Cost in Dollars Per Square Foot Per Month}\right)\left(\text{PSE Cost Allocation Factor}\right)$$

$$+ \sum_{i=1}^{n}\left(\text{Number of } i^{th} \text{ Additional CSE at } a^{th} \text{ Maintenance Level}\right)\left(i^{th} \text{ Additional CSE Space in Square Feet Per CSE}\right)\left(i^{th} \text{ Additional CSE Space Cost in Dollars Per Square Foot Per Month}\right)\left(\text{CSE Cost Allocation Factor}\right)\Bigg]\left(\text{12 Months Per Year}\right)\left(\text{Discount Factor}\right)$$

TASK 301 (Continued)

30.3.3.3 Repair Work Space Cost. Repair work space cost covers the cost of floor space (excluding support equipment space) required for the repair of failed items. This cost is apportioned across all items which are repaired in this work space. For the discard alternative repair work space is nonexistent; any space required for discard is considered to be included in support equipment space cost.

$$\begin{pmatrix}\text{Repair Work}\\ \text{Space Cost}\end{pmatrix} = \begin{pmatrix}\text{Total Repair}\\ \text{Work Space}\\ \text{in Square Feet}\\ \text{at } a^{th} \text{ Maintenance}\\ \text{Level}\end{pmatrix} \begin{pmatrix}\text{Repair Work}\\ \text{Space Apportionment}\\ \text{Factor at } a^{th}\\ \text{Maintenance}\\ \text{Level}\end{pmatrix} \begin{pmatrix}\text{Repair Work}\\ \text{Space Cost}\\ \text{In Dollars}\\ \text{Per Square Foot}\\ \text{Per Month}\end{pmatrix} \begin{pmatrix}\text{12 Months}\\ \text{Per Year}\end{pmatrix} \begin{pmatrix}\text{Discount}\\ \text{Factor}\end{pmatrix}$$

where,

$$\begin{pmatrix}\text{Repair Work}\\ \text{Space Apportionment}\\ \text{Factor at } a^{th}\\ \text{Maintenance}\\ \text{Level}\end{pmatrix} = \frac{\begin{pmatrix}\text{Number of Item Repairs}\\ \text{at } a^{th} \text{ Maintenance Level}\end{pmatrix}}{\sum_{i=1}^{n} \begin{pmatrix}\text{Number of } i^{th} \text{ Item Repairs}\\ \text{at } a^{th} \text{ Maintenace Level}\end{pmatrix}}$$

30.3.3.3.1 Repair Work Space Cost Equation for the Multiple Level Repair Alternative.

$$\begin{pmatrix}\text{Repair Work}\\ \text{Space Cost}\end{pmatrix} = \Bigg[\begin{pmatrix}\text{Total}\\ \text{Repair Work}\\ \text{Space in Square Feet}\\ \text{at } a^{th} \text{ Maintenance}\\ \text{Level}\end{pmatrix} \begin{pmatrix}\text{Repair Work}\\ \text{Space Apportionment}\\ \text{Factor at } a^{th}\\ \text{Maintenance}\\ \text{Level}\end{pmatrix} \begin{pmatrix}\text{Repair Work}\\ \text{Space Cost}\\ \text{in Dollars}\\ \text{Per Square Foot}\\ \text{Per Month}\end{pmatrix} + \begin{pmatrix}\text{Repair Work}\\ \text{Space in}\\ \text{Square Feet}\\ \text{at } b^{th} \text{ Maintenance}\\ \text{Level}\end{pmatrix} \begin{pmatrix}\text{Repair Work}\\ \text{Space Apportionment}\\ \text{Factor at } b^{th}\\ \text{Maintenance}\\ \text{Level}\end{pmatrix}$$

$$\begin{pmatrix}\text{Repair Work}\\ \text{Space Cost In}\\ \text{Dollars Per}\\ \text{Square Foot}\\ \text{Per Month}\end{pmatrix} + \ldots + \begin{pmatrix}\text{Total Repair}\\ \text{Work Space in}\\ \text{Square Feet at}\\ n^{th} \text{ Maintenance}\\ \text{Level}\end{pmatrix} \begin{pmatrix}\text{Repair Work}\\ \text{Apportionment}\\ \text{Factor at } n^{th}\\ \text{Maintenance}\\ \text{Level}\end{pmatrix} \begin{pmatrix}\text{Repair Work}\\ \text{Space Cost In}\\ \text{Dollars Per}\\ \text{Square Foot}\\ \text{Per Month}\end{pmatrix} \Bigg]$$

$$\begin{pmatrix}\text{12 Months}\\ \text{Per Year}\end{pmatrix} \begin{pmatrix}\text{Discount}\\ \text{Factor}\end{pmatrix}$$

where,

$$\begin{pmatrix}\text{Repair Work}\\ \text{Space Apportionment}\\ \text{Factor at } b^{th}\\ \text{Maintenance}\\ \text{Level}\end{pmatrix} = \frac{\begin{pmatrix}\text{Number of Item Repairs}\\ \text{at } b^{th} \text{ Maintenance Level}\end{pmatrix}}{\sum_{i=1}^{n} \begin{pmatrix}\text{Number of } i^{th} \text{ Item Repairs}\\ \text{at } b^{th} \text{ Maintenace Level}\end{pmatrix}} \qquad \begin{pmatrix}\text{Repair Work}\\ \text{Space Apportionment}\\ \text{Factor at } n^{th}\\ \text{Maintenance}\\ \text{Level}\end{pmatrix} = \frac{\begin{pmatrix}\text{Number of Item Repairs}\\ \text{at } n^{th} \text{ Maintenance Level}\end{pmatrix}}{\sum_{i=1}^{n} \begin{pmatrix}\text{Number of } i^{th} \text{ Item Repairs}\\ \text{at } n^{th} \text{ Maintenance Level}\end{pmatrix}}$$

TASK 301 (Continued)

30.3.4 Labor Cost. This category encompasses labor expenditures associated with both discard and repair actions. It accounts for the time in manhours spent by each labor category (military occupational specialty, MOS) involved in the maintenance event and the labor cost in these labor categories.

30.3.4.1 Labor Cost Equation for the Discard Alternative.

$$\begin{pmatrix}\text{Labor}\\\text{Cost}\end{pmatrix} = \begin{pmatrix}\text{Annual Number}\\\text{of Item}\\\text{Failures}\end{pmatrix} \left[\sum_{i=1}^{n} \begin{pmatrix}\text{Number of Maintenance}\\\text{Manhours for}\\\text{Discard, } i^{th} \text{ Skill}\\\text{Level MOS at } a^{th}\\\text{Maintenance Level}\end{pmatrix} \begin{pmatrix}i^{th} \text{ Skill}\\\text{Level MOS}\\\text{Labor Rate}\end{pmatrix}\right] \begin{pmatrix}\text{Discount}\\\text{Factor}\end{pmatrix}$$

30.3.4.2 Labor Cost Equation for the Single Level Repair Alternative.

$$\begin{pmatrix}\text{Labor}\\\text{Cost}\end{pmatrix} = \begin{pmatrix}\text{Annual Number}\\\text{of Item}\\\text{Failures}\end{pmatrix} \left[\sum_{i=1}^{n} \begin{pmatrix}\text{Number of Maintenance}\\\text{Manhours for}\\\text{Repair, } i^{th} \text{ Skill}\\\text{Level MOS at } a^{th}\\\text{Maintenance Level}\end{pmatrix} \begin{pmatrix}i^{th} \text{ Skill}\\\text{Level MOS}\\\text{Labor Rate}\end{pmatrix}\right] \begin{pmatrix}\text{Discount}\\\text{Factor}\end{pmatrix}$$

30.3.4.3 Labor Cost Equation for the Multiple Level Repair Alternative.

$$\begin{pmatrix}\text{Labor}\\\text{Cost}\end{pmatrix} = \left\{ \begin{pmatrix}\text{Annual Number}\\\text{of Item}\\\text{Failures}\end{pmatrix} \left[\sum_{i=1}^{n} \begin{pmatrix}\text{Number of Maintenance}\\\text{Man-Hours for}\\\text{Repair, } i^{th} \text{ Skill}\\\text{Level MOS at } a^{th}\\\text{Maintenance Level}\end{pmatrix} \begin{pmatrix}i^{th} \text{ Skill}\\\text{Level MOS}\\\text{Labor Rate}\end{pmatrix}\right] + \begin{pmatrix}\text{Annual Number}\\\text{of Item}\\\text{Failures}\end{pmatrix} \begin{pmatrix}\text{BCM Rate at}\\a^{th} \text{ Maintenance}\\\text{Level}\end{pmatrix} \right.$$

$$\left[\sum_{i=1}^{n} \begin{pmatrix}\text{Number of Maintenance}\\\text{Man-Hours for}\\\text{Repair, } i^{th} \text{ Skill}\\\text{Level MOS at } b^{th}\\\text{Maintenance Level}\end{pmatrix} \begin{pmatrix}i^{th} \text{ Skill}\\\text{Level MOS}\\\text{Labor Rate}\end{pmatrix}\right] + \ldots + \begin{pmatrix}\text{Annual Number}\\\text{of Item}\\\text{Failures}\end{pmatrix} \begin{pmatrix}\text{BCM Rate at}\\a^{th} \text{ Maintenance}\\\text{Level}\end{pmatrix} \begin{pmatrix}\text{BCM Rate at}\\b^{th} \text{ Maintenance}\\\text{Level}\end{pmatrix}$$

$$\left. \ldots \begin{pmatrix}\text{BCM Rate at}\\(n-1)^{th} \text{ Maintenance}\\\text{Level}\end{pmatrix} \left[\sum_{i=1}^{n} \begin{pmatrix}\text{Number of Maintenance}\\\text{Man-Hours for}\\\text{Repair, } i^{th} \text{ Skill}\\\text{Level MOS at } n^{th}\\\text{Maintenance Level}\end{pmatrix} \begin{pmatrix}i^{th} \text{ Skill}\\\text{Level MOS}\\\text{Labor Rate}\end{pmatrix}\right] \right\} \begin{pmatrix}\text{Discount}\\\text{Factor}\end{pmatrix}$$

TASK 301 (Continued)

30.3.5 Training Cost. This category includes the life cycle cost of training personnel required to maintain the equipment and replacing previously trained personnel lost through attrition.

30.3.5.1 Training Cost Equation for the Discard Alternative.

$$\begin{pmatrix}\text{Training}\\ \text{Cost}\end{pmatrix} = \left[\sum_{i=1}^{n} \begin{pmatrix}\text{Number of } i^{th}\\ \text{Skill Level}\\ \text{MOS at } a^{th}\\ \text{Maintenance}\\ \text{Level}\end{pmatrix}\begin{pmatrix}\text{Cost of}\\ \text{Discard Training}\\ i^{th}\text{ Skill}\\ \text{Level MOS}\end{pmatrix}\right]\left[1+\begin{pmatrix}\text{Skill Level}\\ \text{Attrition}\\ \text{Rate}\end{pmatrix}\begin{pmatrix}\text{Discount}\\ \text{Factor}\end{pmatrix}\right]$$

30.3.5.2 Training Cost Equation for the Single Level Repair Alternative.

$$\begin{pmatrix}\text{Training}\\ \text{Cost}\end{pmatrix} = \left[\sum_{i=1}^{n} \begin{pmatrix}\text{Number of } i^{th}\\ \text{Skill Level}\\ \text{MOS at } a^{th}\\ \text{Maintenance}\\ \text{Level}\end{pmatrix}\begin{pmatrix}\text{Cost of}\\ \text{Repair Training}\\ i^{th}\text{ Skill}\\ \text{Level MOS}\end{pmatrix}\right]\left[1+\begin{pmatrix}\text{Skill Level}\\ \text{Attrition}\\ \text{Rate}\end{pmatrix}\begin{pmatrix}\text{Discount}\\ \text{Factor}\end{pmatrix}\right]$$

30.3.5.3 Training Cost Equation for the Multiple Level Repair Alternative.

$$\begin{pmatrix}\text{Training}\\ \text{Cost}\end{pmatrix} = \left[\sum_{i=1}^{n} \begin{pmatrix}\text{Number of } i^{th}\\ \text{Skill Level}\\ \text{MOS at } a^{th}\\ \text{Maintenance}\\ \text{Level}\end{pmatrix}\begin{pmatrix}\text{Cost of Repair}\\ \text{Training } i^{th}\text{ Skill}\\ \text{Level MOS}\end{pmatrix} + \sum_{i=1}^{n} \begin{pmatrix}\text{Number of } i^{th}\\ \text{Skill Level}\\ \text{MOS at } b^{th}\\ \text{Maintenance}\\ \text{Level}\end{pmatrix}\begin{pmatrix}\text{Cost of Repair}\\ \text{Training } i^{th}\\ \text{Skill}\\ \text{Level MOS}\end{pmatrix}\right.$$

$$\left. + \dots + \sum_{i=1}^{n} \begin{pmatrix}\text{Number of } i^{th}\\ \text{Skill Level}\\ \text{MOS at } n^{th}\\ \text{Maintenance}\\ \text{Level}\end{pmatrix}\begin{pmatrix}\text{Cost of}\\ \text{Repair Training}\\ i^{th}\text{ Skill}\\ \text{Level MOS}\end{pmatrix}\right]\left[1+\begin{pmatrix}\text{Skill Level}\\ \text{Attrition}\\ \text{Rate}\end{pmatrix}\begin{pmatrix}\text{Discount}\\ \text{Factor}\end{pmatrix}\right]$$

30.3.6 Documentation Cost. This cost element covers the expenses associated with PSE technical manuals. It assumes that the major factor affecting technical documentation is its development cost. Production cost of technical manuals is considered negligible. Documentation cost is allocated among those equipment items which share the use of these manuals. Documentation development cost for CSE is a sunk cost. Additional CSE documentation costs are negligible. A common documentation cost equation is applicable to both discard and repair maintenance alternatives.

TASK 301 (Continued)

30.3.6.1 Documentation Cost Equation for the Discard and Repair Alternatives.

$$\begin{pmatrix} \text{Documentation} \\ \text{Cost} \end{pmatrix} = \sum_{i=1}^{n} \begin{pmatrix} i^{th}\ \text{PSE} \\ \text{Technical} \\ \text{Manual} \\ \text{Development} \\ \text{Cost} \end{pmatrix} \begin{pmatrix} \text{PSE Cost} \\ \text{Allocation} \\ \text{Factor} \end{pmatrix}$$

TASK 301 (Continued)

30.4 LOR Alternatives. A total of 19 different LOR alternatives exists in the Marine Corps maintenance hierarchy. These alternatives are shown in Table I where, for example, maintenance alternative 11 describes a sequence of events beginning with repair of a failed item at the Organizational level. If repair is unsuccessful, i.e., BCM at this level, the item is sent to the 4th echelon for further maintenance. If the 4th echelon cannot fix the faulty item it is shipped to the depot. At the depot the item is either repaired or washed out. Table I also identifies the washout point for each maintenance alternative. The washout point is the lowest maintenance level authorized to condemn or dispose an unserviceable item. An item may become unserviceable because it is BCM or it is not economically feasible to repair. In either case the item is washed out.

30.5 Combination of Cost Elements. The total life cycle LOR cost is the sum of the cost elements for the maintenance alternative being evaluated. The LOR discard alternative requires the inclusion of 10 cost elements. (Repair material cost and repair work space cost are not included in the LOR discard alternative.) The LOR repair alternative, however, encompasses all 12 cost elements.

30.5.1 Total Life Cycle LOR Cost for the Discard Alternative.

$$\left(\begin{array}{c}\text{Total Life}\\\text{Cycle Level}\\\text{of Repair Cost}\\\text{for the Discard}\\\text{Alternative}\end{array}\right) = \left(\begin{array}{c}\text{Item Entry}\\\text{and Retention}\\\text{Cost}\end{array}\right) + \left(\begin{array}{c}\text{Inventory}\\\text{Stock Cost}\end{array}\right) + \left(\begin{array}{c}\text{Transportation}\\\text{Cost}\end{array}\right) + \left(\begin{array}{c}\text{Support}\\\text{Equipment}\\\text{Cost}\end{array}\right) + \left(\begin{array}{c}\text{Support}\\\text{Equipment}\\\text{Support Cost}\end{array}\right)$$

$$+ \left(\begin{array}{c}\text{Inventory}\\\text{Storage}\\\text{Space Cost}\end{array}\right) + \left(\begin{array}{c}\text{Support}\\\text{Equipment}\\\text{Space Cost}\end{array}\right) + \left(\begin{array}{c}\text{Labor}\\\text{Cost}\end{array}\right) + \left(\begin{array}{c}\text{Training}\\\text{Cost}\end{array}\right) + \left(\begin{array}{c}\text{Documentation}\\\text{Cost}\end{array}\right)$$

30.5.2 *Total Life Cycle Cost for the Repair Alternative.*

$$\left(\begin{array}{c}\text{Total Life}\\\text{Cycle Level}\\\text{of Repair Cost}\\\text{for the Repair}\\\text{Alternative}\end{array}\right) = \left(\begin{array}{c}\text{Item Entry}\\\text{and Retention}\\\text{Cost}\end{array}\right) + \left(\begin{array}{c}\text{Inventory}\\\text{Stock Cost}\end{array}\right) + \left(\begin{array}{c}\text{Repair}\\\text{Material Cost}\end{array}\right) + \left(\begin{array}{c}\text{Transportation}\\\text{Cost}\end{array}\right) + \left(\begin{array}{c}\text{Support}\\\text{Equipment}\\\text{Cost}\end{array}\right) + \left(\begin{array}{c}\text{Support}\\\text{Equipment}\\\text{Support Cost}\end{array}\right)$$

$$+ \left(\begin{array}{c}\text{Inventory}\\\text{Storage}\\\text{Space Cost}\end{array}\right) + \left(\begin{array}{c}\text{Support}\\\text{Equipment}\\\text{Space Cost}\end{array}\right) + \left(\begin{array}{c}\text{Repair Work}\\\text{Space Cost}\end{array}\right) + \left(\begin{array}{c}\text{Labor}\\\text{Cost}\end{array}\right) + \left(\begin{array}{c}\text{Training}\\\text{Cost}\end{array}\right) + \left(\begin{array}{c}\text{Documentation}\\\text{Cost}\end{array}\right)$$

TASK 301 (Continued)

30.6 Table of Data Elements. Table II provides a list of the data elements required to perform an LOR analysis. Also identified in the table is Logistic Support Analysis (LSA) compatibility and data element units and sources.

30.7 LOR Computer Programs. Computer programs have been developed by the Marine Corps for machine processing LOR data and performing LOR calculations. These programs provide the capability, (a) to perform LOR analyses for any or all of the 19 LOR alternatives and, (b) to find the optimum (least cost) LOR solution for a given set of input data. An additional program feature is a sensitivity analysis routine which permits varying any input parameter over a range of values to assess its impact on the LOR alternative.

TASK 301 (Continued)

TABLE I. LOR maintenance alternatives.

Alternative Number	Discard	Repair				
		Lowest Repair Level	Next Higher Repair Level	Next Higher Repair Level	Next Higher Repair Level	Washout Point
1	0*					
2	3*					
3	4*					
4	D*					
5		0				0
6		0	3			3
7		0	3	4		4
8		0	3	4	D	D
9		0	3	D		D
10		0	4			4
11		0	4	D		D
12		0	D			D
13		3				3
14		3	4			4
15		3	4	D		D
16		3	D			D
17		4				4
18		4	D			D
19		D				D

*0 - Organizational Level, 1st and 2nd Echelons Combined
3 - Intermediate Level, 3rd Echelon
4 - Intermediate Level, 4th Echelon
D - Depot, 5th Echelon

TASK 301 (Continued)

Table II. Marine Corps LOR data elements.

Data Element	Data Element	LSA Output	Units Required	Data Source
1	Number of Operating End Items	Yes	Number	MC
2	Number of Operating Hours Per End Item Per Year	Yes	Number	MC
3	Mean Time Between Failure	Yes	Hours	Contractor
4	Number of Identical Items Per End Item	Yes	Number	Contractor
5	Number of Years in Life Cycle	Yes	Years	MC
6	Discount Rate		Fraction	MC
7	Item Entry Cost		Dollars	MC
8	Annual Item Retention Cost		Dollars	MC
9	Number of Unique New NSNs		Number	Contractor
10	Cost Per Item	Yes	Dollars	Contractor
11	Item BCM Rate			
	Organizational Level		Fraction	Contractor
	3rd Echelon		Fraction	Contractor
	4th Echelon		Fraction	Contractor
	Depot		Fraction	Contractor
12	RCT	Yes		
	Organizational Level		Days	MC
	3rd Echelon		Days	MC
	4th Echelon		Days	MC
	Depot		Days	MC
13	RDS			
	Organizational Level		Days	MC
	3rd Echelon		Days	MC
	4th Echelon		Days	MC
	Depot		Days	MC
14	Target Probability Against Stock-Out		Fraction	MC

TASK 301 (Continued)

Table II. Marine Corps LOR data elements (Continued).

Data Element	Data Element	LSA Output	Units Required	Data Source
15	Item Repair Material Cost Factor	Yes	Fraction	Contractor
16	Item Packaging Cost		Dollars	MC
17	Item Transportation Cost			
	Organizational Level to 3rd Echelon		Dollars	MC
	Organizational Level to 4th Echelon		Dollars	MC
	Organizational Level to Depot		Dollars	MC
	3rd Echelon to 4th Echelon		Dollars	MC
	3rd Echelon to Depot		Dollars	MC
	4th Echelon to Depot		Dollars	MC
	Supply Point to Organizational Level		Dollars	MC
	Supply Point to 3rd Echelon		Dollars	MC
	Supply Point to 4th Echelon		Dollars	MC
	Supply Point to Depot		Dollars	MC
18	Colocation Factor		1 or 0	MC
19	Supply Point Factor		1 or 0	MC
20	PSE Cost Allocation Factor		Fraction	Contractor
21	CSE Cost Allocation Factor		Fraction	Contractor
22	i^{th} PSE Development Cost	Yes	Dollars	Contractor
23A	Number of i^{th} PSE			
	Organizational Level	Yes	Number	Contractor
	3rd Echelon	Yes	Number	Contractor
	4th Echelon	Yes	Number	Contractor
	Depot	Yes	Number	Contractor
23B	Number of i^{th} CSE			
	Organizational Level	Yes	Number	Contractor
	3rd Echelon	Yes	Number	Contractor
	4th Echelon	Yes	Number	Contractor
	Depot	Yes	Number	Contractor
24A	i^{th} PSE Unit Cost	Yes	Dollars	Contractor

TASK 301 (Continued)

Table II. Marine Corps LOR data elements (Continued).

Data Element	Data Element	LSA Output	Units Required	Data Source
24B	i^{th} CSE Unit Cost	Yes	Dollars	Contractor
25	Support Equipment Support Factor	Yes	Fraction	MC
26	Inventory Storage Space	Yes	Cubic Feet	Contractor
27	Inventory Storage Space Cost		Dollars Per Cubic Foot Per Month	MC
28A	i^{th} PSE Space	Yes	Square Feet	Contractor
28B	i^{th} CSE Space	Yes	Square Feet	Contractor
29A	i^{th} PSE Space Cost		Dollars Per Square Foot Per Month	MC
29B	i^{th} CSE Space Cost		Dollars Per Square Foot Per Month	MC
30	Repair Work Space			
	Organizational Level		Square Feet	Contractor
	3rd Echelon		Square Feet	Contractor
	4th Echelon		Square Feet	Contractor
	Depot		Square Feet	Contractor
31	Repair Work Space Cost		Dollars Per Square Foot Per Month	MC
32	Number of Maintenance Manhours for Discard, i^{th} Skill Level MOS			
	Organizational Level	Yes	Hours	Contractor
	3rd Echelon	Yes	Hours	Contractor
	4th Echelon	Yes	Hours	Contractor
	Depot	Yes	Hours	Contractor

TASK 301 (Continued)

Table II. Marine Corps LOR data elements (Continued).

Data Element	Data Element	LSA Output	Units Required	Data Source
33	i^{th} Skill Level MOS Labor Rate		Dollars Per Hour	MC
34	Number of Maintenance Manhours for Repair, i^{th} Skill Level MOS			
	Organizational Level	Yes	Hours	Contractor
	3rd Echelon	Yes	Hours	Contractor
	4th Echelon	Yes	Hours	Contractor
	Depot	Yes	Hours	Contractor
35	Number of i^{th} Skill Level MOS			
	Organizational Level	Yes	Number	Contractor
	3rd Echelon	Yes	Number	Contractor
	4th Echelon	Yes	Number	Contractor
	Depot	Yes	Number	Contractor
36	Cost of Discard Training, i^{th} Skill Level MOS		Dollars	MC
37	Skill Level Attrition Rate		Fraction	MC
38	Cost of Repair Training, i^{th} Skill Level MOS		Dollars	MC
39	i^{th} PSE Technical Manual Development Cost		Dollars	Contractor

Custodian:

Navy - AS

Review Activities:

Navy - AS, EC, SE

Preparing Activity:

Navy - AS

Project Number:

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