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EXTENDED PARTS REQUIREMENTS AND COST MODEL (PARCOM)
FUNCTIONAL DESCRIPTIO. (U) ARMY CONCEPTS ANALYSIS
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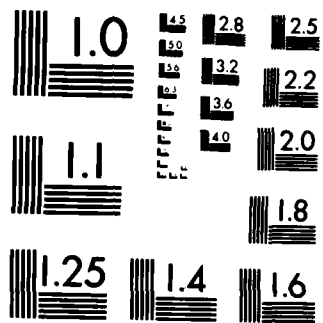
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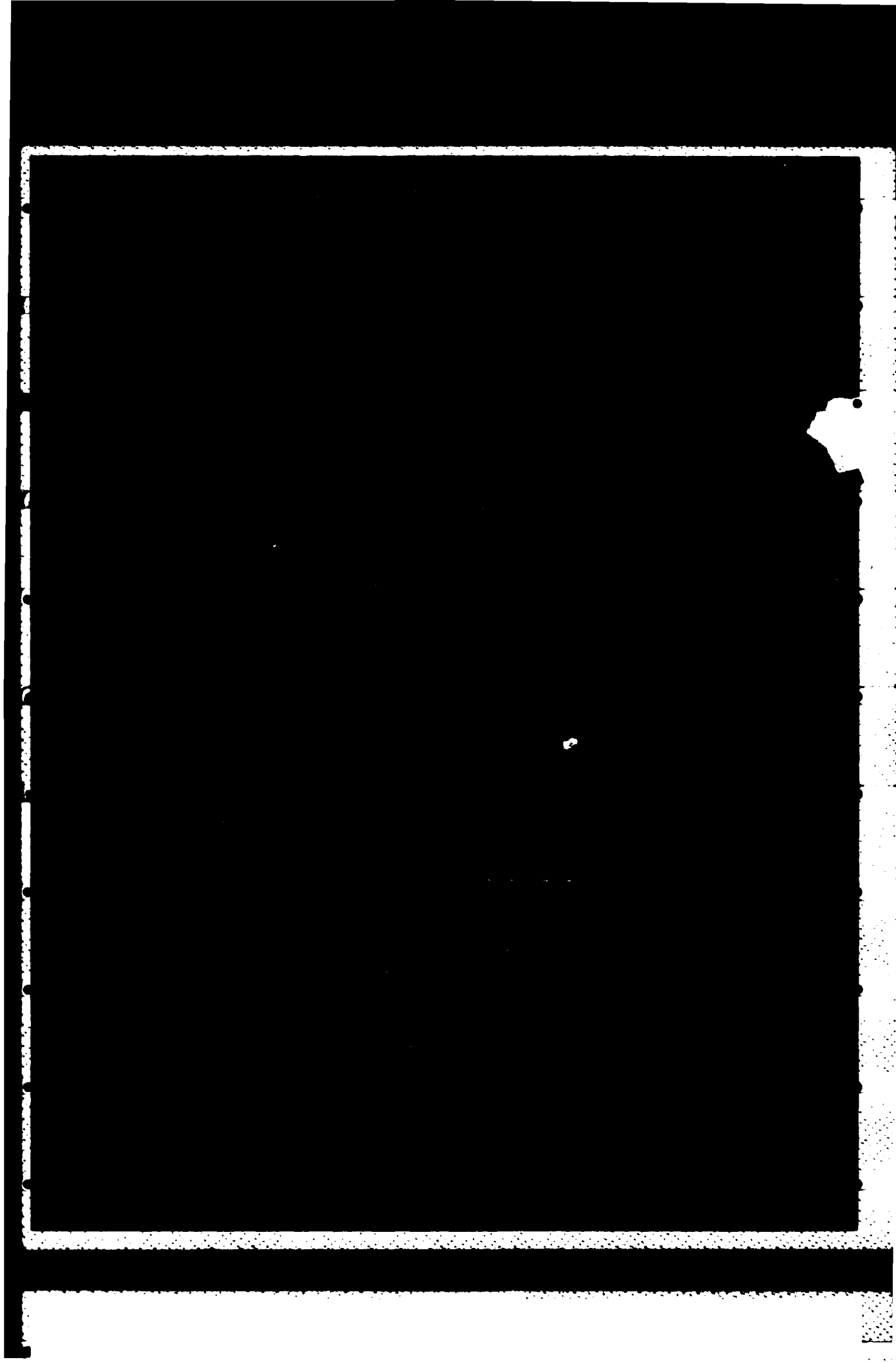
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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The basic Parts Requirements and Cost Model (basic PARCOM), developed at the US Army Concepts Analysis Agency, was redesigned to include partial substitution parts replacement policies and other features lacking in the basic PARCOM. The redesigned model is documented and denoted as Extended PARCOM. Extended PARCOM provides the Army with an analytical tool for quick reaction, gross estimation of wartime spare parts requirements and costs as they relate to flying hour and availability objectives and to part replacement policies. The model also assists in the identification of problem parts and possible causes of the		

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20. ABSTRACT Continued

problems. The Extended PARCOM Functional Description is structured to provide a user with detailed information on Extended PARCOM model logic and restrictions. Additional information on model application may be found in the Extended PARCOM User's Guide, published separately.

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**EXTENDED PARTS REQUIREMENTS
AND COST MODEL (PARCOM)
FUNCTIONAL DESCRIPTION
(Short title: Extended PARCOM
Functional Description)**

MARCH 1985

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EXTENDED PARTS REQUIREMENTS AND COST MODEL (PARCOM) FUNCTIONAL DESCRIPTION

(Short title: Extended PARCOM Functional Description)

CHAPTER 1

GENERAL DESCRIPTION

1-1. PURPOSE OF THE FUNCTIONAL DESCRIPTION. This functional description of the Extended Parts Requirements and Cost Model (PARCOM) provides:

- a. The structure of the model logic which will serve as a basis for mutual understanding between the user and the developer.
- b. Information on model restrictions, potential for extension, and user impacts.

1-2. PROJECT REFERENCES. The reader is directed to the reference list in Appendix B of this document.

1-3. TERMS AND ABBREVIATIONS. The reader is directed to the glossary at the end of this document.

1-4. BACKGROUND

a. **Model Origin.** The US Army Concepts Analysis Agency (CAA) developed the Parts Requirements and Cost Model (PARCOM) to generate cost-effective mixes of aircraft spare parts and to assess aircraft fleet performance under specified wartime scenario conditions. Development occurred during the course of the Aircraft Spare Stockage Methodology (Aircraft Spares) Study¹ conducted by CAA. That study, and PARCOM development, were in response to interest shown by the Deputy Chief of Staff for Logistics (DCSLOG) in developing a methodology (or methodologies) relating aircraft spare parts stockage levels to combat readiness and flying hour capability. The calculation of spare parts requirements and of the effects of budgeting changes had been a slow and cumbersome peacetime-oriented exercise. The principal criterion for spares stockage had been the achievement of acceptable stockout, or fill rate, levels. To more realistically predict wartime spare parts requirements, and to better justify budget requests for spare parts procurement, the Army needed a more responsive methodology based on wartime flying hour expectations and system readiness/availability requirements. At first, the Army used the Overview Model,^{1,2} but later PARCOM was developed to meet that need.

b. **Documentation.** Results reported in the Aircraft Spares Study were sufficiently encouraging to warrant a follow-on study designated the Overview/PARCOM Turnkey Project (OTPT).² Included in the objectives of OTPT were the following actions pertaining to PARCOM:

(1) Document PARCOM, as developed in the Aircraft Spares Study, and deliver it to the US Army Aviation Systems Command (AVSCOM). That documentation consisted of a User's Guide³ and a Functional Description.⁴

(2) Evaluate and report on the potential for extending the capability of the PARCOM methodology to include partial-substitution parts replacement policies and any other features deemed desirable but lacking in the version of the model developed for Aircraft Spares. The version of PARCOM developed in OPTP is denoted as Extended PARCOM, while the Aircraft Spares version is denoted as basic PARCOM. A technical paper⁵ was issued describing Extended PARCOM methodology. This report is a functional description of the new version of the model. An Extended PARCOM User's Guide⁶ has also been prepared.

1-5. STRUCTURE OF ARMY AIRCRAFT LOGISTICS

a. Governing Regulations. Policy and procedural guidance for the Army's inventory management efforts is largely contained in two regulations:

- AR 710-1, Centralized Inventory Management of the Army Supply System
- AR 710-2, Supply Policy Below the Wholesale Level

(1) AR 710-1 establishes responsibilities and procedures for centralized inventory management of Army materiel by the major subordinate commands (MSC) of the US Army Materiel Command (AMC).

(2) AR 710-2 prescribes supply procedures to be used at the retail level, including methods for determining authorized stockage lists and appropriate stockage levels.

b. Maintenance System Structure. Figure 1-1 illustrates the interaction of supply, maintenance, and industrial activities within the aircraft parts logistics system.

(1) **Parts Storage Locations.** Aircraft spare parts are stored with using units at the aviation unit maintenance (AVUM) and the aviation intermediate maintenance (AVIM) levels. Aircraft spare parts are stored in various CONUS depots for shipment to users upon requisition. Additionally, war reserve parts are stored in various CONUS depots or prepositioned in the appropriate theater.

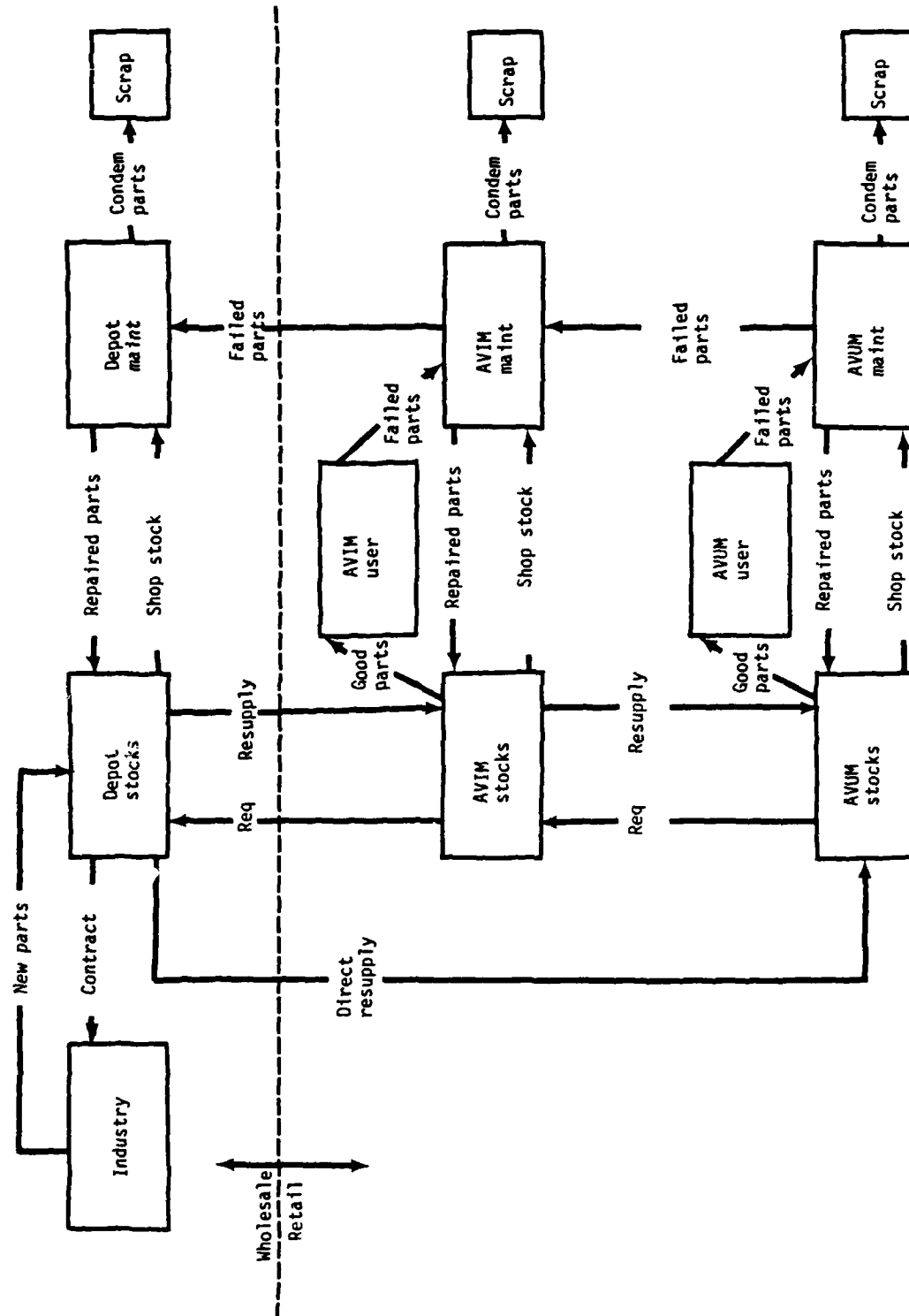


Figure 1-1. Aircraft Parts Logistics System

(2) Participating Organizations and Responsibilities. AVUM facilities are organic to the lower echelon aviation units which actually fly and maintain the Army's aircraft. These user units stock a prescribed load list (PLL) of repair parts at the AVUM level. PLLs are sized to sustain the unit's anticipated wartime flight operations for a specified number of days (usually 15). Stockage levels and reordering procedures are governed by AR 710-2. AVIM units develop their own authorized stockage lists (ASL) based on demands for parts received from supported AVUM units and from their own AVIM operations. AVIM ASLs are exclusive of subordinate unit PLLs. The development of ASLs is also governed by AR 710-2. Part types are selected for PLL and ASL stockage based upon a combination of experienced demand frequency and mission essentiality. The AVIM/AVUM (retail) parts requirements are supported by stocks maintained in supply depots (wholesale) in CONUS. Automated inventory management techniques are employed by AVSCOM to authorize and record fill of retail requisitions by the appropriate wholesale depot. Depot stocks are replenished through procurement of new parts or repair of returned unserviceables.

c. Areas of Consideration

(1) Peacetime versus Wartime. Peacetime requirements for spare parts are computed based upon experienced annual demand and projected peacetime usage. AVSCOM uses an automated system of data bases and models to forecast these requirements, and bases its computations on a supply availability goal. Wartime requirements are computed and funded separately from peacetime requirements, and address those parts required to sustain the force during the initial stages of war until lines of communication and supply can be established. The primary consideration for peacetime requirements is meeting supply availability goals, while that for war reserve requirements is meeting sustainability goals.

(2) Initial Provisioning versus Replenishment. Computation of the spare parts requirement for initial provisioning of new weapons systems is necessarily based on less concrete data than is that for replenishment parts for already fielded systems. No demand history has yet been developed, so engineering estimates of parts failure factors are used instead. In many cases, all the parts to be included in the new aircraft have not been fully identified, and their cost must be extrapolated from that of a list of major assemblies. AVSCOM has an automated capability to compute initial provisioning requirements based on these projected data. Over the first 2 years of a system's life, actual demand data is accumulated and given increasing weight in spare parts management decisions. After a system has been fielded for 2 years, its replenishment spare parts requirements are computed using actual demand data to the maximum extent possible.

(3) Retail versus Wholesale. The Army splits its inventory management into "retail" and "wholesale" activities. In the aviation logistics context, AVUM- and AVIM-level parts stockages are termed "retail," while those at the depot level are termed "wholesale." The methodologies used

to compute spare parts requirements for the retail and wholesale levels are entirely different and essentially unrelated. Retail stockage levels are computed and authorized based upon a combination of demand experience, combat essentiality, and mobility requirements. AR 710-2 establishes computational procedures used by retail parts managers to determine their stockage levels and appropriate reorder points. Wholesale parts requirements are computed based upon average monthly demand experienced at the wholesale level. Wholesale item managers have little visibility of retail spare parts postures or weapons system availabilities. Rather, wholesale parts are procured or repaired at rates calculated to achieve a chosen demand satisfaction percentage without backorders.

(4) Fill Rate versus System Availability Criteria. AVSCOM computes spare parts requirements with the objective of achieving a target fill rate. Its goal is to fill a selected percentage of all demands received without having to backorder parts. The item manager does not base his parts management decisions on weapons system availability, and in fact, has little or no visibility of this retail level criterion. The Department of Defense (DOD) has expressed its support for implementation of system availability-driven parts requirements computation methodologies in all the armed services. The primary difficulty for the Army is the collection of accurate data to drive such automated models.

d. Similarity of Aircraft and Other Spares Procurement. Each of the MSCs uses the Commodity Command Standard System (CCSS) to meet its inventory management responsibilities. The processes used are essentially the same for all types of spares.

1-6. EXTENDED PARCOM REPRESENTATION OF LOGISTICS ENVIRONMENT. The Extended PARCOM "world view" of the aircraft part logistics system is based on the representation in Figure 1-1. Extended PARCOM, however, has only two echelons of stock and repair.

a. Wholesale Level. This level consists of the "depot stocks" and "depot maintenance" blocks of Figure 1-1. Depot maintenance is represented in terms of depot repair times, depot condemnation rates, and order ship times (OST) between depot and retail level. Extended PARCOM treats initial wholesale stocks in four categories. Initial depot serviceables are shipped to theater according to a user-specified schedule. Initial depot unserviceables are repaired or condemned at depot; completed repairs are shipped to theater. Serviceable war reserve stocks are assumed in place in theater. Unserviceable war reserve stocks are treated as failed parts and are condemned or shipped to repair as appropriate.

b. Retail Level. This level is treated as one pool (or "bin") of spare parts stocks consisting of all stocks at AVIM and AVUM levels in Figure 1-1. Retail maintenance is treated as an aggregate process and is represented in terms of retail repair times, not repairable this station (NRTS) percentages, and retail condemnation rates. Essentially, "retail" represents pooled AVIM and AVUM functions. Deploying ASL/PLL stocks arrive in theater according to a user-specified schedule.

c. Distribution of Parts Over Time. Extended PARCOM distributes parts over intervals of 5 days rather than over individual days. All parts due to be received during a given 5-day interval are distributed uniformly throughout that interval. An exception is Day 1 of the scenario. All parts due in (or in place) on Day 1 are treated as received at the beginning of Day 1. The categories of parts treated are:

(1) Depot Serviceables. These consist of serviceable parts located at depot at the start of the scenario. For each part, the initial stock of depot serviceables is entered in the part data base input. The scenario input specifies a depot lag, L , and a depot distribution time, D , applicable to all parts, such that, for each part, the initial stock of depot serviceables is distributed (received at retail) uniformly between Day $(L + 1)$ and Day $(L + D)$.

(2) Depot Unserviceables. These consist of unserviceable parts located at depot at the start of the scenario. They are at various stages of the depot repair process and, after repair, are to be shipped to retail. Since a part may be in any state of its repair cycle, distribution of uncondemned depot unserviceables for each part is assumed uniform over an interval equal to the depot repair time (DRT) for the part, with the first receipt (at retail) after a lag equal to the order ship time (OST) for the part. For each part, the initial stock of depot unserviceables, the depot condemnation rate (DC), the OST, and the depot repair time are input in the part data base. Letting A = number of depot unserviceables, Extended PARCOM distributes $(1-DC) \times A$ repaired parts at retail between Day $(OST + 1)$ and Day $(OST + DRT)$.

(3) War Reserve Serviceables. These consist of serviceable parts in the war reserve located at retail. For each part, the amount of the serviceable war reserve is input in the parts data base. The entire stock is treated as available at retail from the scenario start (Day 1).

(4) War Reserve Unserviceables. These consist of unserviceable war reserve parts located at retail at the start of the scenario. Some of these will be condemned. Others will be sent to depot for repairs. Others are in various stages of repair at retail. The distribution of these parts is as follows:

(a) Items Repairable at Retail. For each part, let $NRTS$ = the NRTS fraction, BR = the retail repair time, BC = retail condemnation rate, and A = number of war reserve unserviceables. Then, Extended PARCOM simulates the receipt in theater, between Day 1 and Day BR , of $(1-NRTS) \times A \times (1-BC)$ parts repaired at retail. All of these factors are input in the parts data base.

(b) Items not Repairable at Retail. For each part, let $NRTS$ = the NRTS fraction, DRT = the depot repair time, DC = depot condemnation rate, OST = the order ship time, and A = number of war reserve unserviceables. Then, Extended PARCOM returns to the theater $(NRTS) \times A \times (1-DC)$ depot-repaired parts between $(2 \times OST + 1)$ and Day $(2 \times OST + DRT)$.

(5) **ASL/PLL Deployments.** For each part, the Extended PARCOM parts data base inputs on Day 1 include total in-place ASL/PLL parts. In addition, total ASL/PLL parts deployed after Day 1 are input for successive 5-day intervals of the scenario.

d. **Users.** Users of spare parts are deployed aircraft. Extended PARCOM treats deployed aircraft only at retail level. These are augmented by scheduled deployments of additional aircraft (from a presumed rear area) during the course of a simulated "war." Currently, Extended PARCOM can treat only a homogeneous aircraft fleet of one type for a single force. Deployed aircraft are subject to attrition based on (input) attrition factors. Combat is not explicitly represented.

e. **Failure Generation.** The deployed aircraft fleet is assigned (via input) a flying hour program, broken into daily fleet flying hour requirements. Extended PARCOM finds a cost-effective mix of spare parts, which, over the course of the "war," will, on average, achieve the set flying program in addition to specified daily aircraft availability requirements. If spares procurement funds are constrained, Extended PARCOM seeks a cost-effective spares mix achieving as much of the flying program as possible. Input failure rates for spare parts are in terms of failures per flying hour. In general, achieved flying hours interact with part failure rates to produce gross part failures. Gross part failures interact with issues from initial spare inventory and the repair process at depot and at retail to produce a net demand for spare parts at user level. The net demand for spare parts at user level then determines the number of surviving aircraft that are mission capable or not mission capable supply (NMCS). As will be seen in the next chapter, Extended PARCOM simulates all interactions in expected value terms, i.e., in terms of the product of an average process rate and the number of items subjected to that process.

1-7. EXTENDED PARCOM PROBLEM SPECIFICATION. The basic purpose of Extended PARCOM is to generate cost-effective mixes of add-on spare parts needed to permit an aircraft fleet of specified type to achieve specified flying program and availability goals under various cost constraints and aircraft availability objectives for a user-specified part replacement policy. These are described below in summary fashion. Additional detail may be found in the Extended PARCOM User's Guide.

a. **Cost Constraints.** The two cost constraint modes are:

(1) **Unconstrained Funds** - where unlimited funds for procurement of additional required parts are assumed available.

(2) **Constrained Funds** - where a cost (funding) limit for add-on spares is set. If unable to meet the flying hour, and possibly, availability objectives with the limited funds, the model generates a "best" solution mix with the funds available, i.e., it seeks to maximize program flying hours achievable within the funding constraint.

b. Parts Replacement Policies. Whether or not a failed critical part degrades aircraft flying hour productivity depends on the parts replacement policy used. Basic PARCOM represented the effects on only two specific policies, full substitution and no substitution. These policies are special cases of the partial-substitution policy capability of Extended PARCOM.

(1) Full and No Substitution. Under a no-substitution policy, only a spare may replace a failed part. Under a full-substitution policy, a failed part may be replaced by either a spare or, if a spare is not readily available, by a serviceable part removed from an aircraft which is already NMC (not mission capable). A third parts replacement policy is "NMCS = 0," which has, as a goal, the replacement of all failed parts with spares. Basically, the "NMCS = 0" policy is just a no-substitution policy with an additional requirement that daily aircraft availability be 1.00. This variation is of interest since it represents the most expensive plausible policy. In a sense, all else being equal, a full-substitution policy is associated with the "cheapest" buy which fulfills the flying program, while the "NMCS = 0" policy is associated with the "most expensive" buy ("covering" all failures with spares).

(2) Partial Substitution. In Extended PARCOM, a partial-substitution parts replacement policy is defined by partitioning all part types into a full-sub set and a no-sub set. A part type is in only one set and remains in that set throughout the scenario. The full-substitution and no-substitution policies of the basic PARCOM are special cases of partial substitution in which all parts are either in the full-sub set or in the no-sub set. The analytic usefulness of the definition arises from the consequence that any NMCS aircraft will either be awaiting exactly one no-sub part or at least one full-sub part but will never be awaiting a mixture of full-sub and no-sub parts.

(a) All parts in the full-sub set operate with a full-substitution replacement policy relative to aircraft which are NMCS due to lack of a part from that set. That is, a failed full-sub part on an aircraft may be replaced either by a spare (if available) or by a serviceable part installed on an NMCS aircraft which is awaiting a full-sub part, if a spare is not available. However, no failed full-sub part can be replaced by any part installed on an NMCS aircraft awaiting a no-sub part.

(b) Parts in the no-sub set operate with a no-substitution replacement policy. That is, a failed no-sub part on an aircraft may only be replaced by a spare part. An NMCS aircraft lacking a no-sub part may neither receive a serviceable part from another NMCS aircraft nor provide a serviceable part to (fill a hole in) any other NMCS aircraft.

c. Flying Hour Objective. A flying hour objective is a requirement for the aircraft fleet to achieve a specified number of program flying hours on each day of the scenario. An input flying hour program designates the daily goals. The Extended PARCOM objective is to generate a parts mix which will achieve the specified flying program at least cost.

d. Aircraft Availability Objective. An aircraft availability objective is a requirement for a specific minimum aircraft availability on each day (different days may have different minimum required availabilities). In this context, aircraft availability = $1 - \text{NMCS}$, where NMCS = the fraction of surviving aircraft in "not mission capable supply" status. An aircraft is in an NMCS status if it is nonoperational because a spare part is needed but is not available to restore it to serviceability. Specification of availability objectives is in addition to the flying hour objective. Specification of a zero availability objective is equivalent to no availability objective at all.

1-8. SUMMARY OF EXTENDED PARCOM OUTPUT. The following are the basic types of print output produced by Extended PARCOM for requirements problems. Details may be found in the Extended PARCOM User's Guide.

a. Unconstrained Cost Cases

(1) Total Requirement. The least-cost parts mix and costs required to achieve the case objectives (flying program and availability) given a zero initial inventory.

(2) Residual Requirement. The least-cost add-on parts mix (to an input initial inventory) and costs required to achieve the case objectives.

(3) Cumulative Cost by Day. For each day N ($N=1, 2, \dots$, through end of "war"), the total and the add-on cost of the full parts requirement to meet the case objectives through day N only, i.e., it is the cost of the requirement for a truncated scenario of N days. Parts mix is not shown.

(4) Cumulative Requirement by Day. For selected parts, for each day N , the cumulative total and residual requirement needed (in the full parts scenario) to meet the case objectives through N days.

(5) Daily Aircraft Available. For each day of the full scenario, the fraction of surviving aircraft which are not NMCS, assuming that the computed solution parts mix is stocked in the theater war reserve.

(6) Daily Flying Hours per Aircraft per Day. For each day of the scenario, the average achieved flying hours per available aircraft per day, assuming that the computed solution parts mix is stocked in the theater war reserve.

b. Constrained Costs

(1) Total Requirement. Total "best" requirements mix, with zero initial inventory, that can be bought with a user-specified funding limit. The principal objective of a "best" mix is to maximize flying hour productivity with the constrained funds.

(2) Residual Requirement. Best add-on (to input initial inventory) requirements mix that can be bought with a user-specified funding limit.

(3) **Daily Aircraft Available.** For each day of the full scenario, the fraction of surviving aircraft which are **not** NMCS, assuming that the computed constrained cost solution parts mix is stocked in the theater war reserve.

(4) **Daily Flying Hour Fraction.** For each day of the full scenario, the fraction of the fleet flying program which can be achieved, assuming that the computed constrained cost solution parts mix is stocked in the theater war reserve.

(5) **Daily Flying Hours per Aircraft per Day.** For each day of the scenario, the average achieved flying hours per aircraft per day, assuming that the computed constrained cost solution parts mix is stocked in the theater war reserve.

1-9. TYPICAL PROBLEMS ADDRESSED. A single Extended PARCOM run can provide answers to several problems pertinent to a given scenario. From the user point of view, typical problem statements, given a specified aircraft deployment schedule, flying program, part replacement policy, and attrition scenario are:

a. What is the least cost add-on buy needed to achieve the flying program and an NMCS fraction not exceeding 0.15 on any day? What is the associated daily NMCS status?

b. With a budget limit of \$10,000,000, what spares should be added to current inventory, using a specified partial substitution policy, to increase to the extent possible the fraction of the flying program achieved? What is the associated daily NMCS status? What is the associated fraction of the flying program that is achievable?

CHAPTER 2

PARCOM LOGIC

2-1. PROCESSING SEQUENCE. Extended PARCOM is a series of expected value simulations of the spare part requirements generation process for cases defined by a combination of parameters noted in the previous chapter. The model determines a cost-effective solution spares mix for each case. In addition, the model computes the capability potential of the force when operated with each computed spares mix. The assessed capability potential is in terms of achievable aircraft availability and fraction of the flying hour program which can be accomplished. Figure 2-1 illustrates the general nature and sequence of Extended PARCOM processing. The basic model sequence, with logic diagrams as appropriate, is described in succeeding paragraphs.

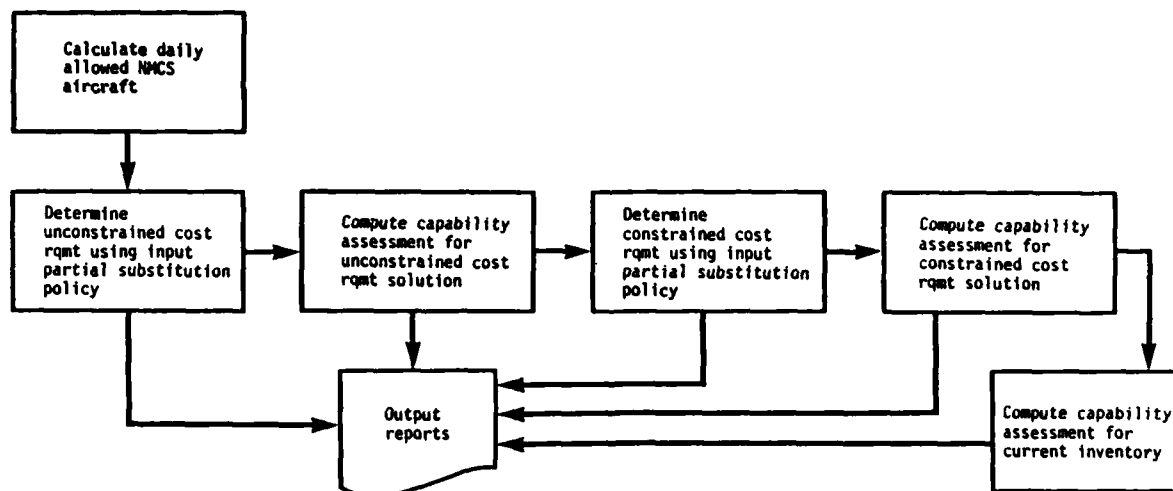


Figure 2-1. Extended PARCOM Processing Sequence

2-2. **ALGORITHM FOR CALCULATING ALLOWABLE NMCS AIRCRAFT.** To meet flying hour and availability goals, the maximum number of aircraft allowed to be down due to a lack of parts (allowable NMCS aircraft) is determined for each day. As shown in Figure 2-2, separate minimums are computed for aircraft required to meet the flying objective and those required to meet the availability objective (if any). The larger of the two minimums is subtracted from the number of surviving aircraft on each day to yield the "allowable NMCS aircraft" for that day. Within the subsequent processing algorithms, the "allowable NMCS aircraft" is converted to an "allowable stockout" for each part and replacement policy. The "allowable stockout" for a part on a day is just the maximum number of backorders (unfilled demands) for the part which will still allow accomplishment of the case objective (flying hour and availability) on that day, i.e., these are parts that are missing but which do not have to be bought.

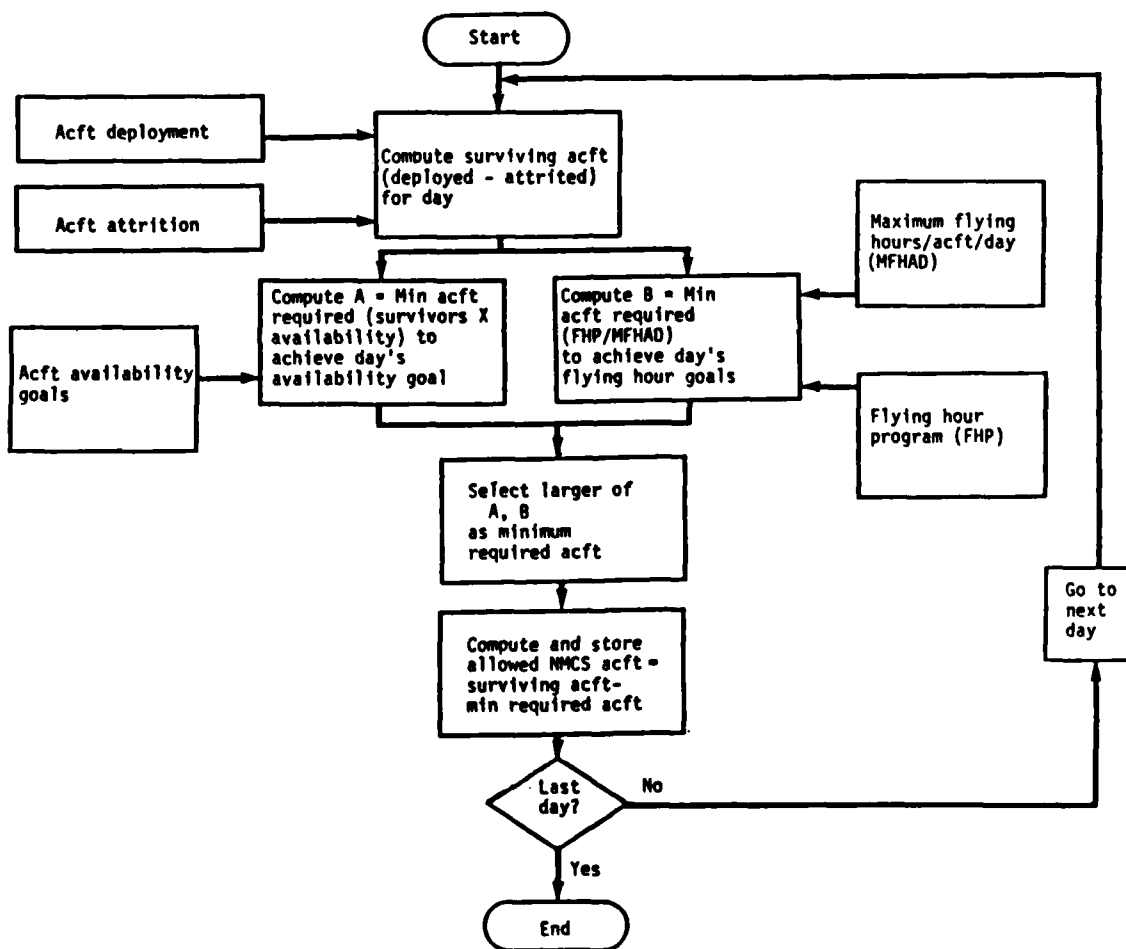


Figure 2-2. Extended PARCOM Computation Algorithm for Allowable NMCS Aircraft

2-3. UNCONSTRAINED COST REQUIREMENTS ALGORITHM IN BASIC PARCOM. Extended PARCOM uses the requirements algorithm of basic PARCOM as a step in its unconstrained cost calculation. Therefore, the logic of that predecessor program is detailed below. Recall that basic PARCOM only processed a full-substitution replacement policy and a no-substitution replacement policy. (The "NMCS = 0" policy is just a special case of no substitution.) The calculation of allowable NMCS aircraft (described previously) is the same for both versions of PARCOM.

a. Unconstrained Cost Full-Substitution Requirement. Figure 2-3 shows the basic PARCOM algorithm used to compute a requirements solution for three parts replacement policies with unconstrained costs. The difference between full-substitution and no-substitution calculations is in the way that allowed stockouts are calculated. Net demand is the same for each.

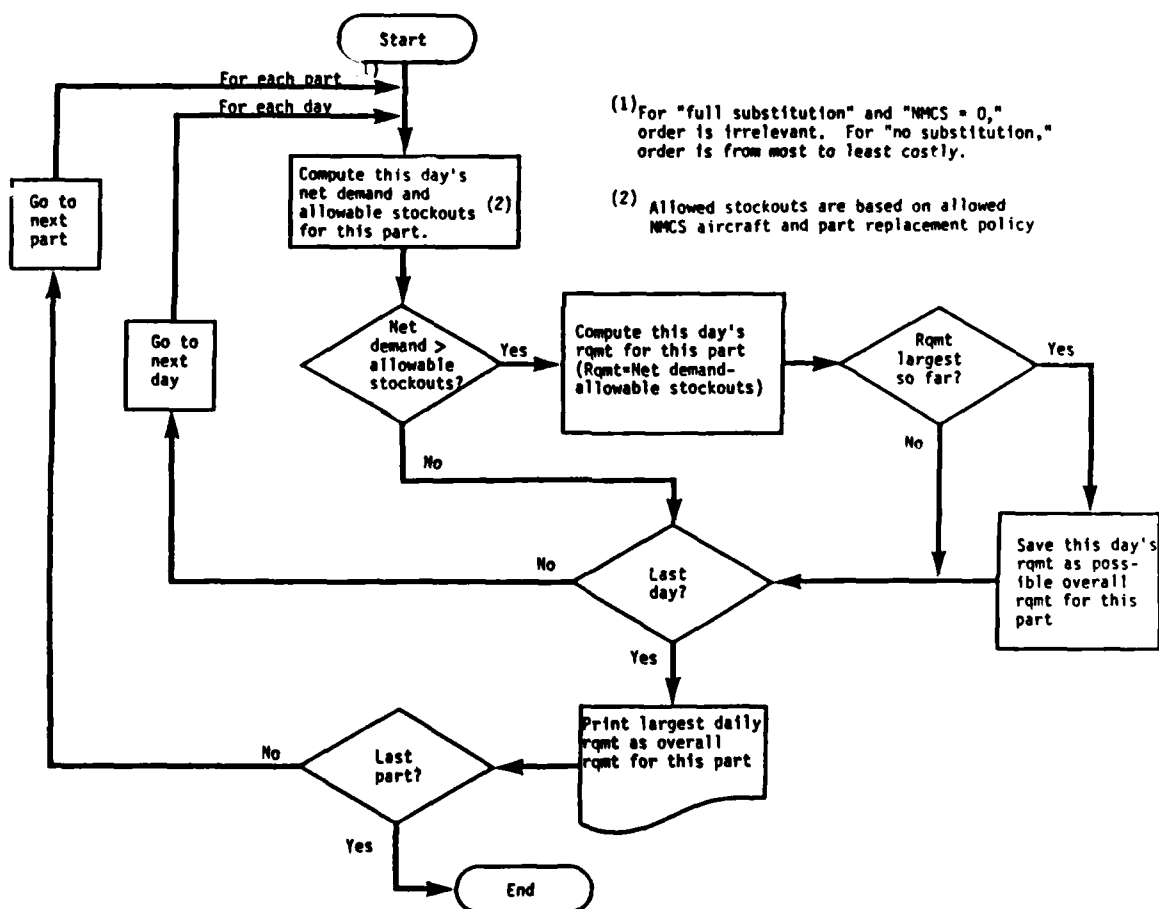


Figure 2-3. Basic PARCOM Requirements Computation Algorithm for Unconstrained Costs, "Full Substitution," "No Substitution," and "NMCS = 0"

(1) Net demand (for all three replacement policies) for a part at any point in time is the cumulative removals through that time minus the sum of cumulative returning repairs and issued inventory. Removals are generated as the product of failure rate, part QPA (quantity installed per aircraft), and programed fleet flying hours. Returning repairs are generated by having removed parts cycled through a "repair pipeline" and being returned to the theater spare pool. A positive net demand represents a shortage of a part.

(2) Under full substitution, the aircraft frames providing the sources of parts substituted for failed parts when spares unavailable are consolidated to the minimum possible number, i.e., there will be a maximum overlap of aircraft frames providing missing parts. Because of this overlap, the spare parts requirements for each part may be independently computed. For a full-substitution policy, the allowable stockout for a part on any day is the product of allowable NMCS aircraft for that day and the part QPA.

(3) As indicated by Figure 2-3, the minimum spare requirement for a part needed to achieve the case objective on any day is the net demand for that part minus the allowable stockout. The overall spare requirement for a part is the largest of the daily minimum spare requirements for that part. It is a least-cost solution because it is the smallest purchase of that part which will permit the case objective to be met on all days.

b. Unconstrained Cost "NMCS = 0" Requirement. The "NMCS = 0" policy corresponds to the case in which 100 percent aircraft availability is required every day. In such a case, allowed NMCS aircraft and allowable stockout both must be zero every day. The "NMCS = 0" case could be considered a special case of full substitution with a 100 percent aircraft availability objective (the no-substitution case with that objective would yield the same answer, because substitution policy is irrelevant when no stockouts are allowed). The spares required by the solution to the "NMCS = 0" case also can be interpreted as the total expected net demand for a part during the war. It is a least-cost solution because any amount less than that required to meet the expected demand will create an NMCS aircraft, i.e., will not meet the case objective.

c. Unconstrained Cost No-Substitution Requirement

(1) Under no substitution, the stockouts generated by parts removals in excess of on-hand spares must each be associated with separate aircraft frames. Every missing part results in an inoperable (NMCS) aircraft. It is most cost effective, therefore, to assign the allowed stockout (allowed number of NMCS aircraft) to the most expensive parts. For example, if 50 aircraft are allowed to be NMCS and a shortage exists of 50 expensive parts and 50 cheap ones, the 50 cheap ones need to be bought. If 75 expensive parts and 50 cheap ones are short, there will be no choice but to buy 25 expensive ones (leaving 50 unbought) and 50 cheap ones, in order to best meet the case objective.

(2) The algorithm of Figure 2-3 also applies to the no-substitution and "NMCS = 0" requirements. Under no substitution, an allowed stockout equates to an allowed NMCS aircraft; and the total allowed stockout, over all parts, equals the total allowed NMCS aircraft for that day. However, allowed stockout calculations for individual parts are interdependent, i.e., the calculations for the first part affect those of the second, etc. The interdependence occurs because there is no overlap/consolidation of stockout effects (as was the case for full substitution). During the no-substitution calculations, basic PARCOM determines allowed stockout and net demand in decreasing order of part unit cost, i.e., for the most expensive parts first. The aspects of algorithm operation affected by differences in substitution policy are summarized in Table 2-1.

**Table 2-1. Differences in Application of Basic PARCOM
Unconstrained Cost Requirements Algorithm by Policy**

Policy	Algorithm procedure/calculation	
	Allowable stockout	Order of processing
Full-sub	Allowed NMCS acft x QPA	Irrelevant
No-sub	Allowed NMCS acft	By decreasing part cost
NMCS = 0	0	Irrelevant

2-4. UNCONSTRAINED COST REQUIREMENTS ALGORITHM IN EXTENDED PARCOM

a. Partial-substitution Concept Definition. Prior to describing the requirements calculation algorithms, it is important to describe the specific representation of a partial-substitution replacement policy in Extended PARCOM. A partial-substitution parts replacement policy is defined by a user-specified partitioning of all part types into a full-sub set and a no-sub set. A part type is in only one set and remains in that set throughout the scenario. These sets are defined as follows:

(1) All parts in the full-sub set operate with a full-substitution replacement policy relative to aircraft which are NMCS due to lack of a part from that set. That is, a failed full-sub part on an aircraft may be replaced either by a spare (if available) or by a serviceable part installed on an NMCS aircraft which is awaiting a full-sub part, if a spare is not available. However, no failed full-sub part can be replaced by any part installed on an NMCS aircraft awaiting a no-sub part.

(2) Parts in the no-sub set operate with a no-substitution replacement policy. That is, a failed no-sub part on an aircraft may only be replaced by a spare part. An NMCS aircraft lacking a no-sub part may neither receive a serviceable part from another NMCS aircraft, nor may it provide a serviceable part to (fill a "hole") in any other NMCS aircraft.

b. Selection of Full-sub Parts. Before requirements processing begins in Extended PARCOM, a full-sub and a no-sub part set, applicable over all scenario days, must be defined. One option allows the user to specify those part types which comprise the full-sub set. By default, all non-specified parts are presumed to be in the no-sub set. However, the model has another option, allowing the user to specify four screening limits--L1, L2, L3, and L4. With these limits, the model selects a part type for the full-sub set if at least one of the following apply:

- The (input) depot repair cycle time for the part exceeds L1 days, and the not repairable this station (NRTS) fraction exceeds zero.
- The (input) NRTS fraction for the part exceeds L2.
- The (input) retail repair time for the part exceeds L3.
- The (input) failure rate for the part exceeds L4.

c. Partial-substitution Algorithm Logic. Figure 2-4 shows the sequence of processing in Extended PARCOM for unconstrained cost requirements. The sequence of operations is:

(1) Partition all part types into a full-sub set and a no-sub set as defined in paragraph 2-4a.

(2) Calculate the allowable NMCS aircraft for each day.

(3) For each day:

(a) Generate all possible nonnegative integer combinations (AF, AN) (for full-sub and no-sub, respectively) such that $AF + AN = \text{allowable NMCS aircraft for that day}$.

(b) For each integer combination (AF, AN), compute a basic PARCOM full-sub solution **over only the full-sub part set** for the scenario through that day, assuming AF allowed NMCS aircraft (awaiting full-sub parts) for that day. Also compute a basic PARCOM no-sub solution **over only the no-sub part set** for the scenario through that day, assuming AN allowed NMCS aircraft (awaiting no-sub parts) for that day. Calculate the total solution cost for the combination (AF, AN) as the sum of the costs for the full-sub and no-sub solutions described above.

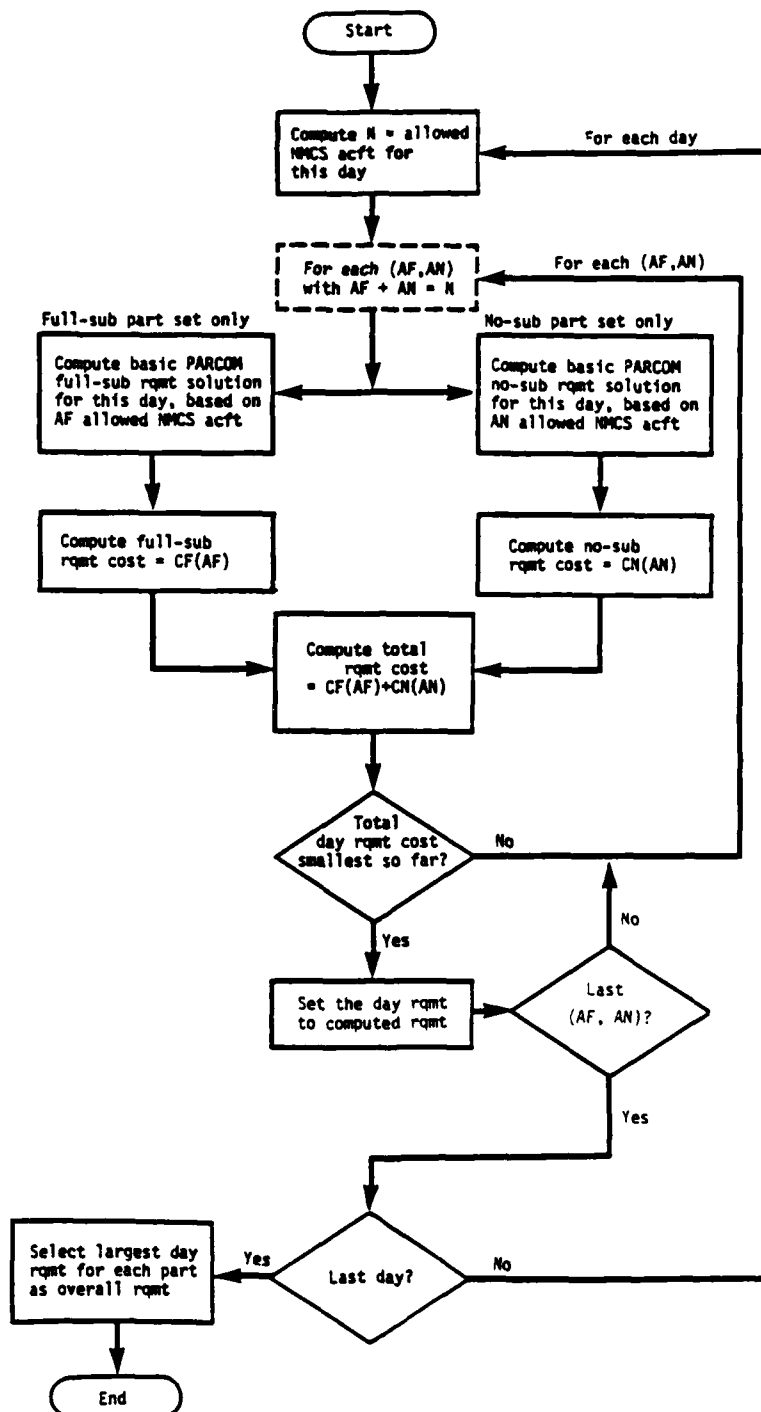


Figure 2-4. Extended PARCOM Requirements Computation Algorithm for Unconstrained Cost, Partial Substitution

(c) Select the solution for the combination (AF, AN) yielding the minimum total solution cost. This solution determines the requirements for each part on that day and is called the day requirement. The combination (AF, AN) used in the selected solution then becomes the allowed stockout used during cumulative (from Day 1) calculations on all succeeding scenario days.

(4) After all days are processed, select the largest (over all scenario days) of the computed day requirements for each part as the overall requirement. The logic for computing a basic PARCOM solution is described in paragraph 2-3. The above algorithm tends toward a least-cost solution mix (assuming unconstrained funds) for the partial-substitution replacement policy defined by the full-sub/no-sub partition of the part data base.

2-5. CONSTRAINED COST REQUIREMENTS ALGORITHM IN BASIC PARCOM. While the unconstrained cost solution is the one that best meets the flying program, a full requirements buy may not be affordable if funds are limited. With constrained costs, a user wishes to apply limited funds to buy a cost-effective slice of the full requirements. Basic PARCOM only treated the constrained cost case for a no-substitution policy. Neither full substitution nor partial substitution were addressed. Extended PARCOM incorporates a method for deriving cost-effective constrained cost requirements under partial substitution. For a no-substitution policy, the Extended PARCOM constrained cost algorithm yields the same solution as the basic PARCOM constrained cost algorithm. Since the Extended PARCOM algorithm uses the constrained cost algorithm of basic PARCOM at one stage of its computation, foundation logic from that predecessor model is presented first. In basic PARCOM after the unconstrained cost no-substitution requirements are computed, they become the basis for the constrained cost solution. A cost limit on spares is input along with the other scenario and objective data. A constrained cost parts mix can be constructed by the simulated purchase, in order of increasing part unit cost, of the part requirements for the unconstrained cost solution until the available funds are exhausted. That would entail the procurement, within the fund limit, of the largest possible number of affordable parts from the unconstrained cost solution. However, another characteristic of such a constrained cost parts mix is that it is the mix which has the fewest unbought (hence, unstocked) items from the unconstrained cost solution. The basic PARCOM algorithm, shown in Figure 2-5, arrives at its solution by calculating unbought items. Initially, it "spends" the full cost of the unconstrained cost requirements mix, assuming it to be the constrained cost solution. Basic PARCOM subsequently selects the fewest number of items to remove from that solution until the remaining parts mix is priced at the input cost limit. Because the programed algorithm solves by "unbuying" items rather than "buying" them, parts are processed in decreasing order of part unit cost. Notice that under a policy of no substitution, each unbought item (regardless of part type) creates an NMCS aircraft. Therefore, our constrained cost solution mix minimizes the instances of NMCS created by the constrained funds. The solution tends, heuristically, toward the achievement of maximum cumulative flying hours.

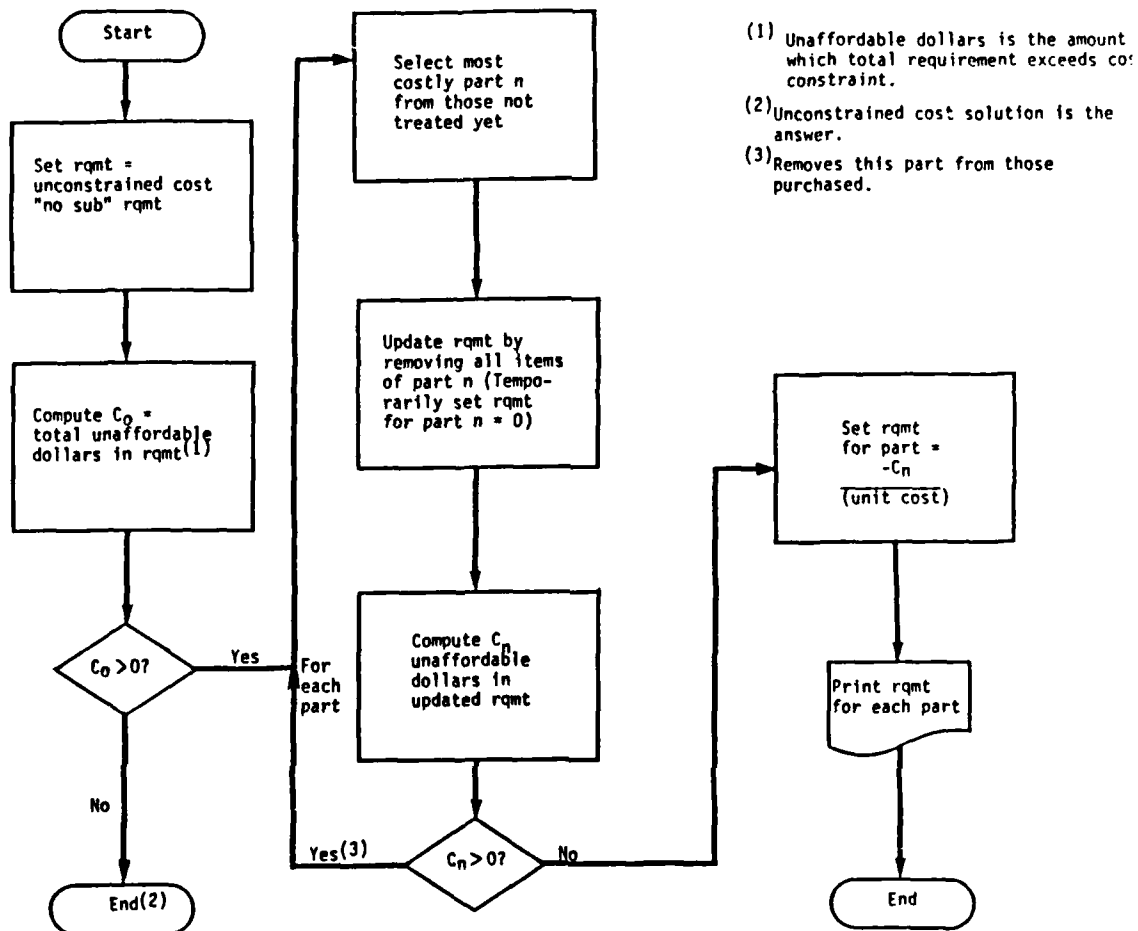


Figure 2-5. Basic PARCOM Requirements Computation Algorithm for Constrained Cost with No Substitution

2-6. CONSTRAINED COST REQUIREMENTS ALGORITHMS IN EXTENDED PARCOM. Figure 2-6 shows the logic for constrained cost calculations in Extended PARCOM. Since no single algorithm yielding optimum results for all cases was found, the Extended PARCOM logic employs two separate algorithms represented by the branches labeled "algorithm 1" and "algorithm 2" in the figure. These algorithms compute separate trial solutions. Each computed solution is assessed in terms of the fleet program flying hour productivity which it contributes. The trial solution yielding the larger flying hour productivity is selected as the final solution. The component algorithms of Figure 2-6 are explained below.

a. Constrained Cost Algorithm 1 Solution. The previously computed unconstrained cost requirements solution is partitioned into the set of requirements for no-sub parts and the set of requirements for full-sub parts. In Figure 2-6, these are denoted as "no-sub part set only" and "full-sub part set only." The "no-sub part set only" is taken as the unconstrained cost no-sub requirement which the basic PARCOM no-substitution constrained cost algorithm (Figure 2-5) operates on, using the input-specified cost limit (LIM in Figure 2-6), to yield a cost effective solution mix of no-sub parts. From this procedure, there are two possible outcomes: either the entire cost limit is spent, or only a portion of the cost limit is spent. Each outcome yields a different algorithm 1 solution as follows:

(1) In the first outcome, the basic PARCOM solution mix cost, C , equals the cost limit. That mix of no-sub parts is then taken as the algorithm 1 solution.

(2) In the second case, the cost of the basic PARCOM solution mix will be less than the cost limit. That solution mix is then assumed bought, and its associated cost, C , is assumed spent. The unspent portion, FLIM, of the cost limit is then calculated. Computation of the algorithm 1 solution then continues by using the FLIM dollars to buy the most cost-effective portion of the "full-sub part set only," as follows:

(a) One product of the Extended PARCOM unconstrained cost solution is a list showing, for each day, the cumulative total cost of all full-sub parts in the unconstrained cost requirement for the scenario truncated at that day. Algorithm 1 determines D , the last day for which the associated cumulative requirement cost of full-sub parts is less than or equal to the unspent funds, FLIM.

(b) Next, algorithm 1 generates an Extended PARCOM unconstrained cost solution for the scenario truncated at that day. The full-sub parts required in that solution are denoted in Figure 2-6 as the "constrained cost requirements solution for full substitution." These full-sub parts are combined with the no-sub solution mix previously bought to form the full algorithm 1 solution for the second case.

b. Constrained Cost Algorithm 2 Solution. Figure 2-7 shows the logic of algorithm 2. One product of the Extended PARCOM unconstrained cost solution is a list showing, for each scenario day, the cumulative cost of all parts (full-sub and no-sub) that would be required under unconstrained cost if the war was truncated at that day. The algorithm determines D , the last day on that list, for which the associated cost is less than or equal to the input cost limit. Next, the algorithm operates Extended PARCOM in the unconstrained cost mode for a scenario of length D . The resulting (unconstrained cost) solution is taken as the algorithm 2 solution.

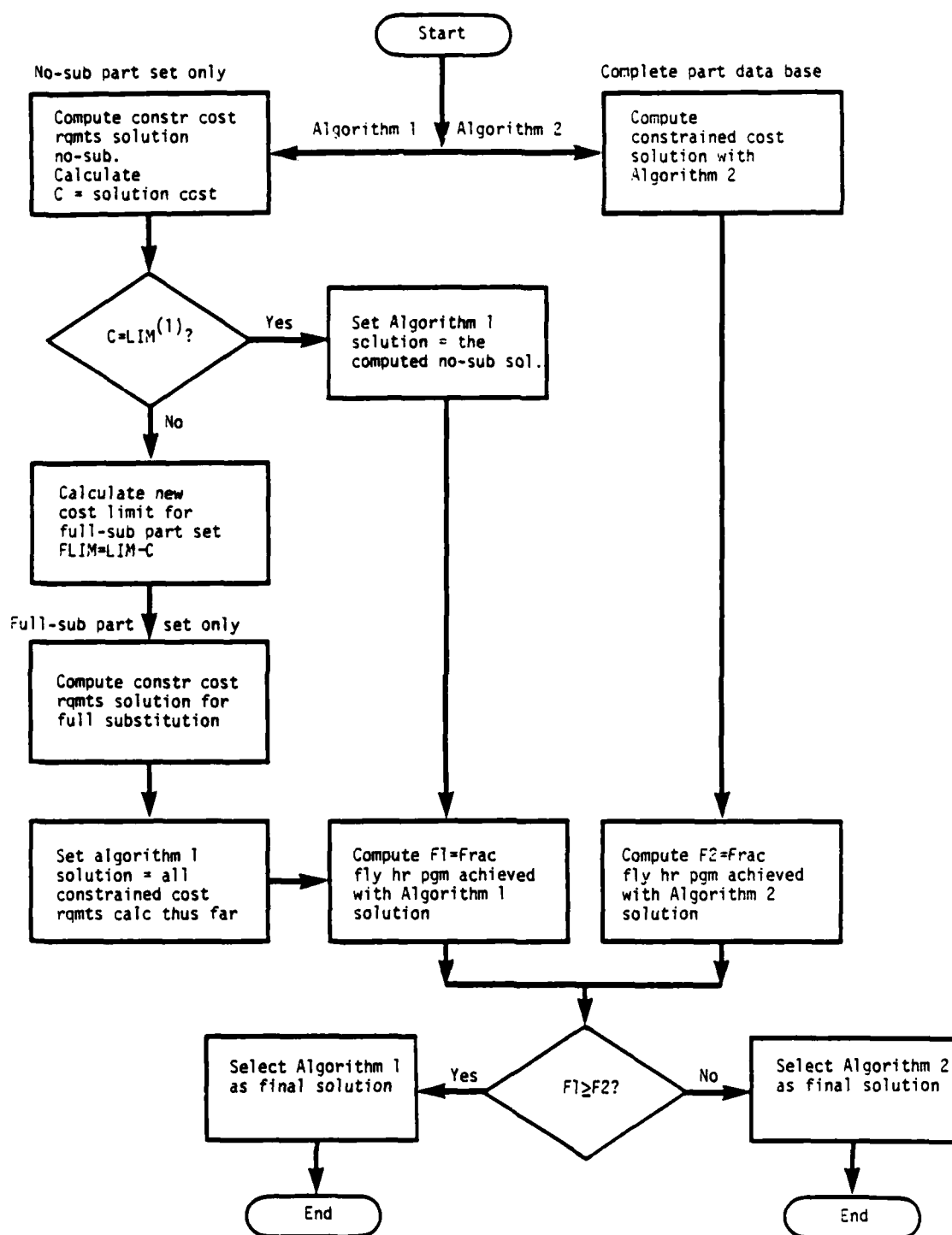


Figure 2-6. Extended PARCOM Requirements Computation Algorithm for Constrained Cost with Partial Substitution

- (1) CCOST(N) = cumulative
unconstrained \$ rqmt cost thru day N
- (2) LIM = cost constraint for
spares buy

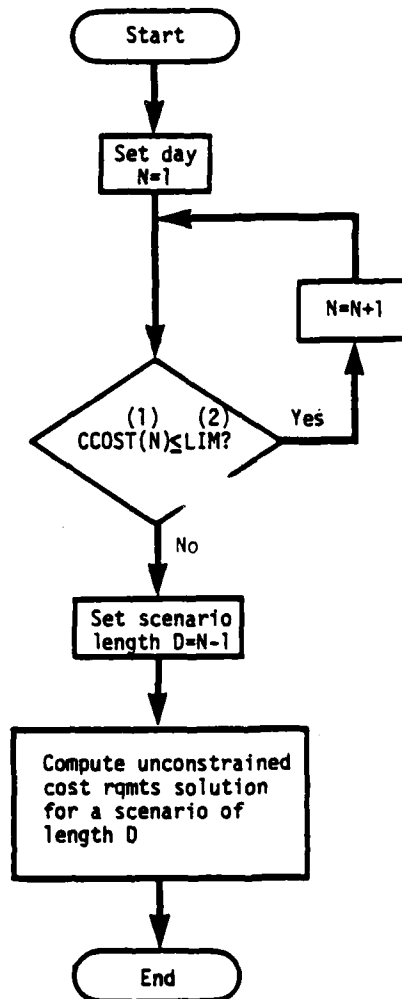


Figure 2-7. Extended PARCOM Constrained Cost Algorithm 2

c. **Solution Selection.** The preferred solution mix, of those generated by the two algorithms, is the one which yields the maximum program flying hour productivity in the scenario. The model, therefore, does two separate current inventory capability assessments based on each algorithm solution being bought and stocked. The add-on solution requirement is assumed to be added to the theater war reserve. The final constrained cost solution is the one for which the associated capability assessment yields the larger value for average fraction of total flying hour program achieved (F1 or F2 in Figure 2-6).

2-7. CAPABILITY ASSESSMENT OF UNCONSTRAINED COST SOLUTIONS. Figure 2-8 illustrates the Extended PARCOM computation algorithm for capability assessment of the unconstrained cost requirements solutions. After an unconstrained cost solution mix is computed, Extended PARCOM generates a record of daily and average fleet operational capability achievable by stocking each computed requirement in the war reserve, i.e., the new initial inventory is assumed to be the sum of the computed requirement and the original initial inventory. For each computed unconstrained cost requirements mix, the model generates a record of achieved daily and average aircraft availability and achieved flying hours per available aircraft per day. The achieved program flying hours are simply the desired program flying hours, by the definition of an unconstrained cost solution. Within the algorithm, each day's calculations consist of a full-sub assessment phase and a no-sub assessment phase, followed by a consolidated computation. Each full-sub phase treats only NMCS aircraft created by stockouts of full-sub parts. For a full-substitution policy, a single NMCS aircraft may have demands for several different parts. In this case, the total number of NMCS aircraft created is the largest value, over all full-sub parts, of the quotient of net demand divided by QPA for each full-sub part type. The no-sub phase treats only NMCS aircraft created by stockouts of no-sub parts. For a no-substitution policy, each net demand creates a single NMCS aircraft. In this case, the total number of NMCS aircraft created is the sum of net demand over all no-sub parts. At the end of daily processing, the consolidated total NMCS aircraft for the day is calculated as the sum of the NMCS aircraft results from the two phases. Under our definition of partial substitution, each NMCS aircraft is down due to either at least one needed full-sub part or to a single needed no-sub part, but not to a needed combination of the two types. Therefore, the order of performing the phases is irrelevant. For each day, the number of NMCS aircraft is subtracted from the number of surviving aircraft to yield available aircraft. Availability is then the ratio of available to surviving aircraft. Flying hours per available aircraft is just the daily program flying hours divided by the number of available aircraft for the day.

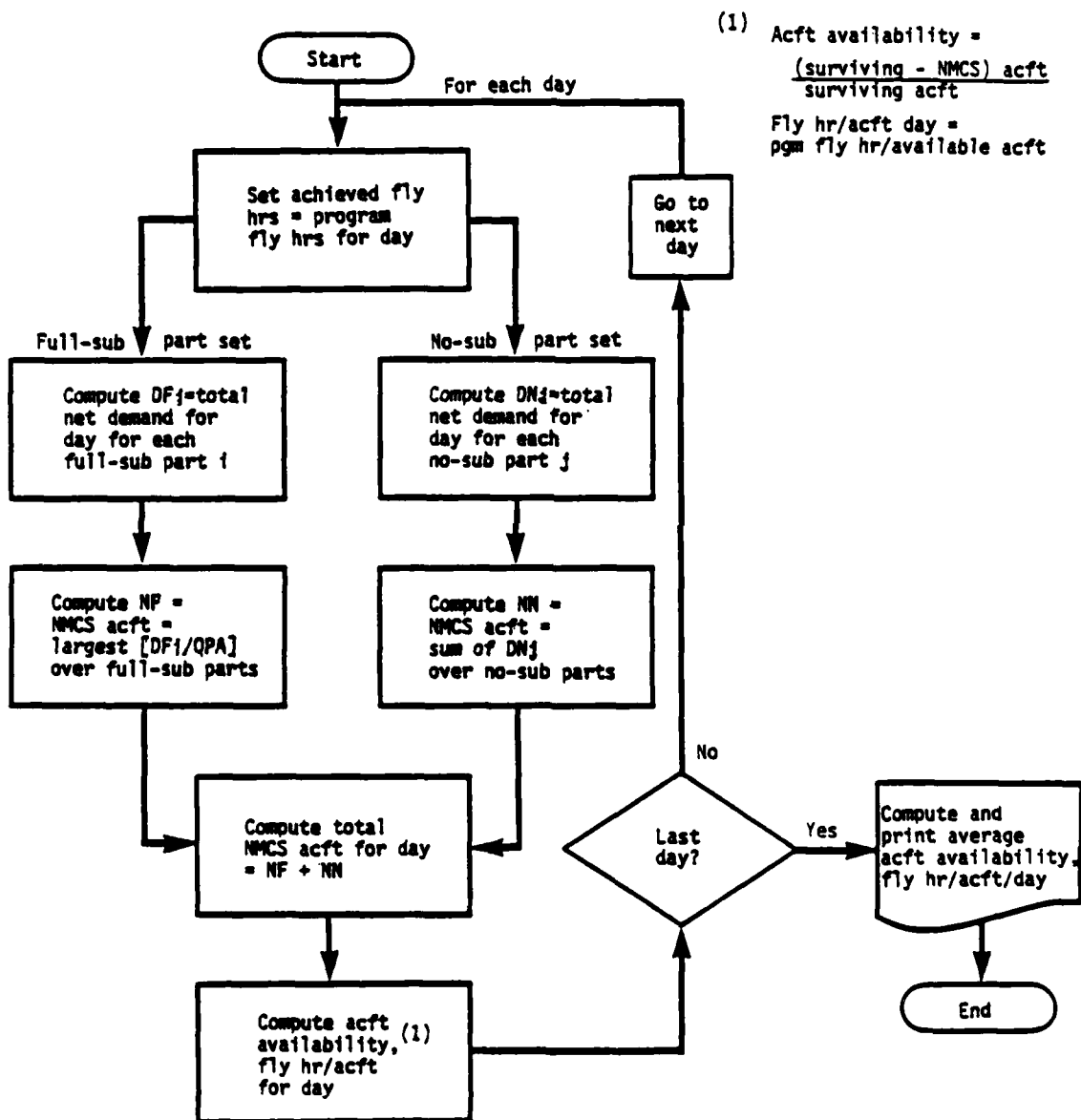


Figure 2-8. Extended PARCOM Computation Algorithm for Unconstrained Cost Capability Assessment

2-8. CAPABILITY ASSESSMENT OF CONSTRAINED COST SOLUTION MIXES. Extended PARCOM also generates the daily fleet availability and flying hour capability achieved with a constrained cost solution mix or with current inventory. Computation logic is shown in Figure 2-9. By current inventory is meant any user-specified inventory (with an add-on cost constraint of zero). This is in contrast to the "required inventory" as assessed above. The basic logic of assessment of current inventory in Extended PARCOM is the same as in the basic PARCOM. With unconstrained cost, net demand was based on the entire planned flying hour program being flown. For a constrained cost or current inventory mix, some unknown (at first) number of hours will be flown. That number must initially be estimated; and an iterative approach, as shown in Figure 2-9, applied to determine NMCS aircraft, availability, and achievable program flying hours. For each day, therefore, a starting estimate of flying hours flown is made. The starting (first day's) estimate is the desired program flying hours. Then, net demand, as based on the estimated flying hours, is computed, followed by computation of implied NMCS aircraft (generated by the estimated flying hours), achievable flying hours (based on aircraft available if implied NMCS aircraft are really NMCS), and flying hours per available aircraft. The achievable flying hours are compared with the estimated flying hours flown. If, based on input thresholds, they are close enough, the iterations stop. Iterations also stop after an input-specified number of them have been performed. If iterations continue, the calculations are repeated based on a new starting estimate of flying hours equal to the average of the estimated and the achieved flying hours. After iterations for a day are completed, the available aircraft for the day and their flying hour potential are calculated based on the last calculation of NMCS aircraft and on the maximum flying hour potential per aircraft per day (an input). Processing for the next day uses a starting estimate of flying hours equal to the program flying hours for that day or the flying hour potential of the surviving non-NMCS aircraft on that day, whichever is smaller.

2-9. EXAMPLE. The algorithm logic described in the previous paragraphs can be better understood through use of a manual example. The tables to follow portray a stylized but useful hypothetical example which utilizes only "back-of-the envelope" calculations. The tables all apply to one case and are presented in the same sequence as the model algorithms described in the previous paragraph.

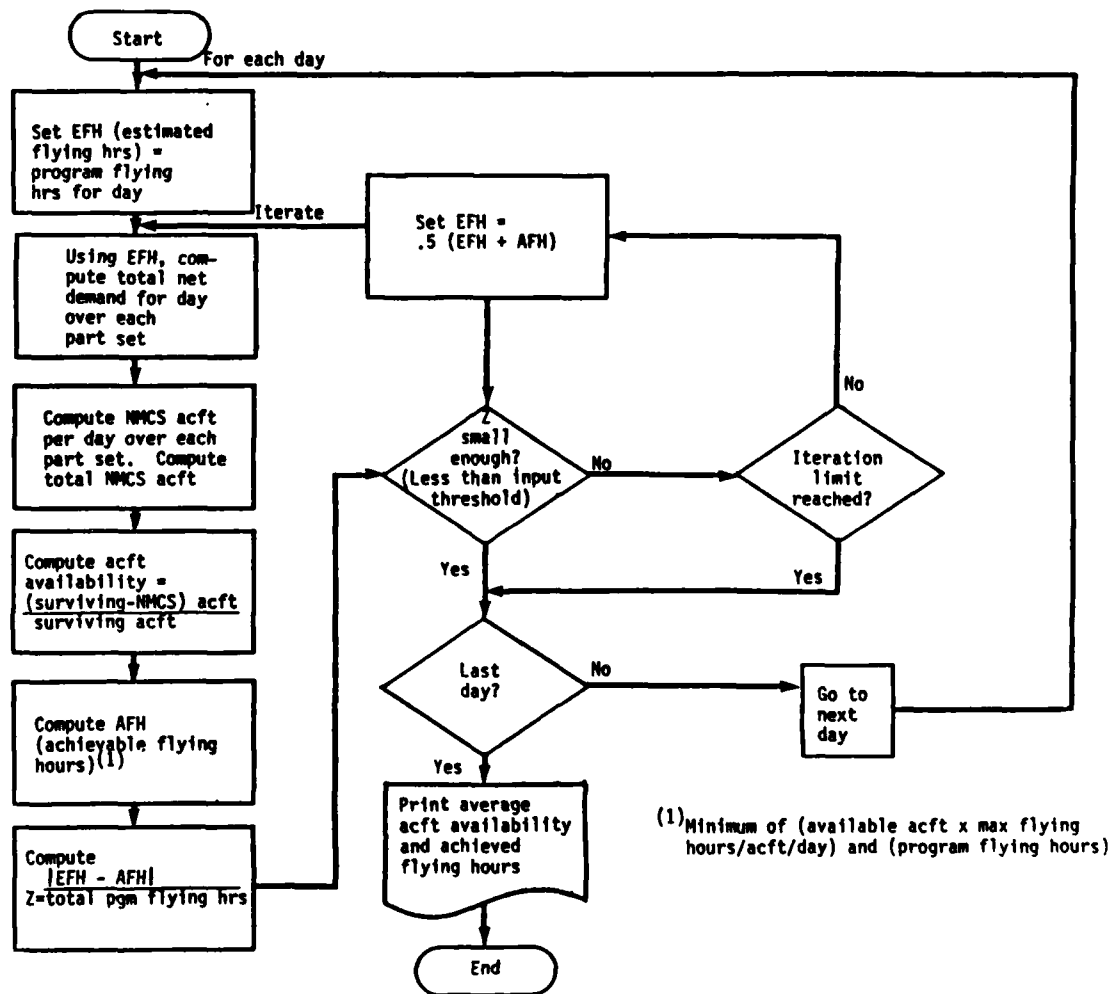


Figure 2-9. Extended PARCOM Computation Algorithm for Constrained Cost/Current Inventory Capability Assessment

a. **Parts Data Base.** Tables 2-2 through 2-4 show a parts data base for four part types. Recall that failure rate is in terms of failures per flying hour, and QPA = number of parts installed per operational aircraft. The last column of Table 2-4 is the computed repair cycle calculated from the other data in that row; e.g., for Part 1 the repair cycle = 2 x OST + depot repair time = 3 days. The repair cycle for a part is defined as the average time between failure of a part and its (repaired) return to the retail spare pool. Only the repair cycle entry will be used in succeeding calculations because it includes the effects of the other data in Table 2-4.

Table 2-2. Part Characteristic Data

Part	Failure rate (per fly hour)	QPA	Unit cost (\$)	Substitution class
1	.08	1	40	Full-sub
2	.02	1	50	Full-sub
3	.06	1	400	No-sub
4	.02	1	30	No-sub

Table 2-3. Initial Stock Distribution Data

Part	In-place Day 1	Addition to initial stock				Total initial stock
		Day 2	Day 3	Day 4	Day 5	
1	90	40	40	40	40	250
2	6	1	1	1	1	10
3	220	10	10	10	10	260
4	30	0	0	0	0	30

Table 2-4. Part Repair Time Data

Part	OST (days)	Depot repair time (days)	Retail repair time (days)	NRTS (fraction)	Depot condemned (fraction)	Retail condemned (fraction)	Repair cycle (days)
1	1	1	0	1.00	0	0	3
2	0	0	3	.00	0	0	3
3	1	2	0	1.00	0	0	4
4	0	0	2	.00	0	0	2

b. Definition of Policy. As noted in Table 2-2, Part 1 and Part 2 are designated for the full-sub set while Part 3 and Part 4 comprise the no-sub part set.

c. Scenario Data Base. Table 2-5 shows the scenario data for the case. A 5-day "war" is shown. The aircraft status (deployed, lost) entries are for the start of the associated day of the war. Thus, for example, 50 aircraft are newly deployed at the start of day 2. By "cumulative aircraft deployed" is meant all aircraft deployed in theater from the start of the war through the given day. No aircraft are assumed withdrawn once deployed. Computed "cumulative aircraft surviving" entries are defined by the difference between "cumulative aircraft deployed" and "cumulative aircraft lost." Since, for simplicity, our example shows a zero aircraft attrition rate, surviving aircraft are equal to deployed aircraft. The "program flying hours" column gives the flying hour objective in terms of required program flying hours for the fleet on each day. The last column gives the availability objective in terms of an input-specified daily minimum (fleet) aircraft availability required each day. The input-specified "maximum flying hours per aircraft per day" is also noted at the bottom of Table 2-5.

Table 2-5. Scenario Data

Day	Cumulative aircraft deployed	Cumulative aircraft lost	Cumulative aircraft surviving	Program flying hours	Minimum aircraft availability
1	150	0	150	500	.10
2	200	0	200	1,000	.09
3	200	0	200	1,000	.09
4	200	0	200	1,500	.09
5	200	0	200	1,500	.09

Maximum flying hours per aircraft per day = 10.

Cost limit for constrained cost case = \$2,300.

Desired convergence (constrained cost) = 0.

Maximum iterations (constrained cost) = 2.

d. Calculation of Daily Allowable NMCS Aircraft. Table 2-6 shows results of the calculation of allowable NMCS aircraft for each day. Each result in the rightmost column is the surviving aircraft minus the larger of:

(1) The minimum aircraft required to achieve the daily flying hour objective, for each day, computed as "program flying hours" divided by "maximum flying hours per aircraft per day."

(2) The minimum aircraft required to achieve the daily availability objective, for each day, computed as the product of "surviving aircraft" and "minimum aircraft availability." Component calculations for the first day, using the data of Table 2-5, are shown.

Table 2-6. Calculation of Allowable NMCS Aircraft

Day	Minimum aircraft required		Allowable NMCS acft
	Flying hour objective	Availability objective	
1	$500/10 = 50$	$150 \cdot .10 = 15$	$150 - 50 = 100$
2	100	18	100
3	100	18	100
4	150	18	50
5	150	18	50

e. Unconstrained Cost Residual Requirement. The full set of algorithmic calculations is too complex to represent. The Extended PARCOM algorithm consists of calculation and cost comparison of a large number of basic PARCOM full-substitution and no-substitution solutions using the full-sub and the no-sub part sets, respectively. However, two of these solutions for one value of AF and the consequent values of AN (see Figure 2-4) which serve as the base of the Extended PARCOM solution are illustrated below.

(1) The full-sub solution with zero allowed stockouts ($AF = 0$) is illustrated in Tables 2-7 and 2-8 for those parts in the full-sub set. Each "cumulative net demand" entry is just the "cumulative failures" minus the sum of the "cumulative returning repairs" and the cumulative initial stock distributed (from Table 2-3). "Cumulative failures" is based on the program hours being flown and is computed by accumulating (over days) the product of failure rate, QPA, and program flying hours for each day (as taken from Tables 2-2 and 2-5). The "cumulative returning repairs" entries are the "cumulative failures" entries lagged by 3 days (the repair cycle from Table 2-4). Any condemnations (our case has none) would have to be deducted from the lagged failures. If R is the length of the repair cycle for a part (see Table 2-4), Extended PARCOM treats all noncondemned failures occurring by the start of day n as being returned to the retail spare pool at the start of day $n + R$. If a part has both a depot repair cycle and a retail repair cycle, Extended PARCOM would partition repairs over the two cycles. In our simplified example, Part 1 has only a depot repair cycle of 3 days while Part 2 has only a retail repair cycle of 3 days. The "day requirement" is calculated as the larger of zero and (cumulative net demand minus allowable stockouts). Since this case has a zero allowed stockout, the day requirement is equal to the cumulative net demand. The overall requirement for each part is determined as the largest value (over days) of the "day requirement" entries. It is circled in each table. Component calculations are based on the data of Tables 2-2 through 2-6 and are shown for the first day and, partly, for the last day. Because allowed stockouts = 0 for this case, the solution shown is also an "NMCS = 0" solution in basic PARCOM.

Table 2-7. Unconstrained Cost Residual Requirement with Full-Substitution, Allowed Stockouts = 0 (Part 1)

Day	Cumulative failures	Cumulative returning repairs	Cumulative initial stk distributed	Cumulative net demand (= day rqmt)
1	.08*500=40	0	90	max (0,40-90) = 0
2	120	0	130	0
3	200	0	170	30
4	320	40	210	70
5	440	120	250	440-370 = 70

Table 2-8. Unconstrained Cost Residual Requirement with
Full Substitution, Allowed Stockouts = 0 (Part 2)

Day	Cumulative failures	Cumulative returning repairs	Cumulative initial stk distributed	Cumulative net demand (= day rqmt)
1	.02*500=10	0	6	max (0, 10-6) = 4
2	10	0	7	23
3	50	0	8	42
4	80	10	9	61
5	110	30	10	110-40 = 70

(2) The no-sub solution from basic PARCOM is shown in Tables 2-9 and 2-10 for those parts in the no-sub set. The tables are presented in the required sequence of computations, i.e., the more expensive no-sub part (Part 3) is processed first. The "cumulative net demand" is computed in the same way as for Part 1 and Part 2 above. The day requirement is just the cumulative net demand (the shortage on that day) minus the allowable stockout (the allowed shortage) for that day (but not less than zero). Under no substitution, daily allowed stockout is equal to daily allowable NMCS aircraft (computed in Table 2-6). The overall Part 3 requirement is the circled largest day requirement. The Part 3 requirement is treated as "purchased" during further processing (for other no-sub part requirements). Table 2-10 shows the calculation of the next no-sub part requirement which must be for the next most expensive no-sub part (i.e., Part 4 in our example). The purchase of the Part 3 requirement augments the initial inventory for that part. Therefore, the old cumulative net demand for Part 3 in Table 2-9 is reduced by the purchased requirement for that part to generate the new cumulative net demand for that part. Since the computed requirement was zero, the new cumulative net demand for Part 3 equals the old cumulative net demand in this example. The new cumulative net demand for Part 3 is also the number of stockouts which must be allocated to that part. For a no-substitution policy, the total allowed stockout consists of the summed stockouts over all parts treated. For each day, the cumulative net demand for Part 3 acts as a "lock" or "claimant" on the same number of stockouts in the original allowable stockout. Requirements for Part 4 can only be based on the unallocated allowable stockout, tabulated in Table 2-10, which is the original allowed stockout minus all "claimant" stockouts (net demands) from parts already processed (from Part 3 in this example). Since the Part 4 requirement is not yet "purchased" (it is being computed), the cumulative net demand entries for Part 4 in Table 2-10 are computed in the same manner as in Tables 2-7 and 2-8, using the initial stock distribution of Table 2-3. The day requirement in Table 2-10 is calculated as the cumulative net demand for Part 4 minus the unallocated allowable stockout.

As before, the overall requirement (circled) is the largest of the day requirements. The Part 4 requirement would be assumed purchased, and the process would be continued with less expensive no-sub parts (if any). Each successive calculation would use an unallocated allowable stockout equal to the original allowable stockout reduced by the sum total of allocated stockouts reflected in purchases of parts already processed.

Table 2-9. Unconstrained Cost Residual Requirement with No Substitution (Part 3)

Day	Cum failures	Cum return repairs	Cum init stock	Cum net demand	Allowed stockout	Day rqmt
1	30	0	220	0	100	0
2	90	0	230	0	100	0
3	150	0	240	0	100	0
4	240	0	250	0	50	0
5	330	30	260	40	50	0

Table 2-10. Unconstrained Cost Residual Requirement with No Substitution (Part 4)

Day	Part 3 (new cum net demand)	Cumulative net demand (Part 4)	Unallocated allowable stockouts	Day rqmt
1	0	0	$100-0 = 100$	0
2	0	0	$100-0 = 100$	0
3	0	10	$100-0 = 100$	0
4	0	20	$50-0 = 50$	0
5	$40-0 = 40$	30	$50-40 = 10$	$30-10 = 20$

(3) After the above solutions are computed, they become the basis for the partial-substitution algorithm calculations for Day 5 shown in Table 2-11. The following comments apply:

(a) To simplify computations, the only combinations (AF, AN) shown are multiples of 10. Since, from Table 2-6, total allowed NMCS aircraft on Day 5 from all parts must equal 50, the sum of AF and AN in Table 2-11 must be 50.

(b) For $AF = 0$ on Day 5, the solution for the full-sub part set is 70 for Part 1 and 70 for Part 2 (Tables 2-7 and 2-8, respectively). These are also the requirements for these parts under an "NMCS = 0" policy in basic PARCOM.

(c) For values of AF greater than 0, solutions for the full-sub parts set are obtained by subtracting $AF \times QPA$ ($= AF$ since $QPA = 1$ in this example) units from each part requirement in the " $AF = 0$ " solution (since each reduction of parts stock by its QPA units creates QPA backorders which, in turn, correspond to one NMCS aircraft).

(d) The no-sub solution for AN (allowed NMCS aircraft for the no-sub set) = 50 on Day 5 is computed in Tables 2-9 and 2-10. For AN less than 50, a no-sub solution is obtained, as seen in Table 2-11, by adding $(50 - AN)$ units to the computed stock requirement for the cheapest item(s) in the " $AN = 50$ " solution in the following manner. Units are added first to the computed requirement for the cheapest part, up to the level of cumulative net demand for that part, after which further units are added to the computed requirement for the next cheapest part, in the same manner. Using this technique, each increase of one unit eliminates a backorder and corresponds to one less NMCS aircraft.

(e) The minimum combined (total) solution cost (\$6,300) is marked in Table 2-11. The combined parts requirement for the associated (AF, AN) combination is the day requirement for Day 5. If (as assumed in this example) Day 5 has the largest day requirement, then that day requirement is also the overall minimum cost solution for our partial-substitution example.

Table 2-11. Unconstrained Cost Residual Requirement Calculations for Day 5

Combined solution	AF	Full-sub solution pt 1/pt 2 \$40/\$50	Cost (\$)	AN	No-sub solution pt 3/pt 4 \$400/\$30	Cost (\$)	Combined solution cost (\$)
1	0	70/70	6,300	50	0/20	600	6,900
2	10	60/60	5,400	40	0/30	900	6,300
3	20	50/50	4,500	40	10/30	4,900	9,400
4	30	40/40	3,600	20	20/30	8,900	12,500
5	40	30/30	2,700	10	30/30	12,900	15,600
6	50	20/20	1,800	0	40/30	16,900	18,700

Minimum cost solution = Pt 1 Pt 2 Pt 3 Pt 4

60 60 0 30
(assuming Day 5 has max day requirement).

f. **Capability Assessment of the Unconstrained Cost Solution.** Tables 2-12a and b shows the Extended PARCOM capability assessment calculation of the effects of stocking the requirements computed in Table 2-11. Each day's calculations entail a full-sub assessment phase and a no-sub assessment phase, operating on the full-sub part set (Parts 1 and 2) and the no-sub part set (Parts 3 and 4), respectively. During the full-sub phase, NMCS aircraft from failed full-sub parts is determined as the larger of the (cumulative net demand/QPA) entries over Parts 1 and 2, where cumulative net demand is based on initial inventory as augmented by the computed requirement from Table 2-11. Therefore, the entries for Parts 1 and 2 consist of the cumulative net demand entries from Tables 2-7 and 2-8 reduced by the value of the computed requirements. During the no-sub phase, NMCS aircraft from failed no-sub parts are determined as the sum of the cumulative net demand entries for Parts 3 and 4, where cumulative net demand is based on initial inventory as augmented by the computed requirements. Under the assumed definition of partial substitution, each NMCS aircraft is "down" due to either at least one needed full-sub part or a single needed no-sub part, but not to a needed combination of the two types. Therefore, the order of performing the phases is irrelevant. On each day, after the two NMCS aircraft calculation phases are completed, the

sum of the two results yields the total NMCS aircraft for the day (Table 2-12b). This value divided by surviving aircraft on that day determines the fraction NMCS. Subtracting this fraction NMCS from 1.00 yields aircraft availability for the day. Flying hours per (available) aircraft per day are calculated by dividing the program flying hours for each day (see Table 2-5) by the number of available aircraft on that day. Average availability is constructed by weighting daily availabilities by the daily surviving aircraft. Average flying hours per (available) aircraft per day are weighted by the available aircraft on each day.

Table 2-12a. Capability Assessment for Unconstrained Cost Residual Requirement^a

Day	Phase ^b	Cum net demand/QPA Part 1	Cum net demand/QPA Part 2	Cum net demand Part 3	Cum net demand Part 4	NMCS aircraft
1	FS	0	0	--	--	0
	NS	--	--	0	0	0
2	FS	0	0	--	--	0
	NS	--	--	0	0	0
3	FS	0	0	--	--	0
	NS	--	--	0	0	0
4	FS	70-60=10	61-60=1	--	--	10
	NS	--	--	0	0	0
5	FS	70-60=10	0	--	--	10
	NS	--	--	40	0	40

^aResidual requirement (60,60,0,30) is added to initial war reserve stock.

^bFS = Full-sub phase (processes full-sub part set)
NS = No-sub phase (processes no-sub part set)

**Table 2-12b. Capability Assessment for Unconstrained
Cost Residual Requirement**

Day	Total NMCS aircraft	Surviving aircraft	Aircraft availability	Program flying hours/acft/day
1	0	150	1.00	3.3
2	0	200	1.00	5.0
3	0	200	1.00	5.0
4	10+0=10	200	190/200=.95	7.9
5	10+40=50	200	.75	10.0
Average availability = .94				
Average flying hours/aircraft/day = 6.2				

g. Capability Assessment of Current Inventory/Constrained Cost Case.
 Since the same algorithm applies to capability assessment of current inventory and of a constrained cost solution, only assessment of current inventory will be detailed here. Tables 2-13a, b, and c show the calculations for this case. As before, calculation of daily NMCS aircraft is done in two phases. Now, however, each phase of each day employs a series of iterative calculations, as explained in paragraph 2-8, beginning with an "estimated flying hours flown" and, based on that estimate, calculating an "achieved flying hours" value. Iterations continue until estimated and achieved flying hours are close together or until a specified number of iterations have been performed. Some essential explanatory comments follow the tables.

Table 2-13a. Capability Assessment of Current Inventory

Day	Iteration	Phase	Est fly hrs	Cum net dmd/QPA Part 1	Cum net dmd/QPA Part 2	Cum net demand Part 3	Cum net demand Part 4	NMCS acft
1	1	FS	500	0	4	--	--	4
	1	NS	500	--	--	0	0	0
2	1	FS	1,000	0	23	--	--	23
	1	NS	1,000	0	--	0	0	0
3	1	FS	1,000	0	42	--	--	42
	1	NS	1,000	--	--	0	10	10
4	1	FS	1,500	70	61	--	--	70
	1	NS	1,500	--	--	0	20	20
	2	FS	1,300	54	57	--	--	57
	2	NS	1,300	--	--	0	16	16
5	1	FS	1,270	36	61	--	--	61
	1	NS	1,270	--	--	14	21	35
	2	FS	1,165	27	59	--	--	59
	2	NS	1,165	--	--	8	19	27

Table 2-13b. Capability Assessment of Current Inventory

Day	Iteration	Total NMCS aircraft	Avail aircraft	Achieved flying hrs	(EFH-AFH)/ (average day FHP) ^a
1	1	4	146	500	0
2	1	23	177	1,000	0
3	1	52	148	1,000	0
4	1	90	110	1,100	.36
	2	73	127	1,270	.03
5	1	96	104	1,040	.21
	2	86	114	1,140	.02

^aAverage flying hour program (FHP) = 1,100 flying hrs/day.

Table 2-13c. Capability Assessment of Current Inventory

Day	Surviving ^a aircraft	Aircraft avail	Fraction flying program achieved	Program flying hrs/acft/day
1	150	.97	1.00	3.4
2	200	.88	1.00	5.6
3	200	.74	1.00	6.8
4	200	.63	.85	10.0
5	200	.57	.76	10.0

^aFrom the scenario data (Table 2-5).

(1) Estimated flying hours on the first iteration of each day are equal to the daily program hours (Table 2-5) or the flying hour potential of surviving non-NMCS aircraft, whichever is smaller. Surviving non-NMCS aircraft are the difference between cumulative aircraft surviving (Table 2-5) and the total NMCS aircraft computed on the last iteration of the preceding page. The associated flying hour potential is the product of this difference and the maximum flying hours/aircraft/day from Table 2-5.

(2) The cumulative net demand entries in Table 2-13a are calculated based on the estimated flying hours of each day and iteration. Thus, as long as estimated flying hours equal the flying program these values are identical to the cumulative net demand entries of Tables 2-7 through 2-10 (which are based on the program hours). This applies through Day 3 in the example. Entries for subsequent days can be determined by subtracting (failure rate x cumulative flying hour deficit) from the appropriate entry in Tables 2-7 through 2-10. For example, on iteration 2 of Day 4, the estimate is 1,300 program hours, representing a deficit of 200 hours from the daily program. Thus, the associated cumulative net demand entry for Part 1 is $200 \times .08 = 16$ less than the cumulative demand entry (70) of Table 2-7. Similarly, the Part 2 entry is $200 \times .02 = 4$ less than the Day 4 net demand entry (61) of Table 2-8. On Day 5, iteration 2, the cumulative flying hour deficit is the sum of the deficits from the last iterations for Days 4 and 5, viz $(1,500 - 1,300) + (1,500 - 1,165) = 535$ hours. The above adjustment technique is a short-cut which yields the same answer as direct calculation.

(3) The "NMCS aircraft" column of Table 2-13a is just the larger of the "cum net demand/QPA" values for the full-sub set and phase, and is the sum of the "cum net demand" entries for the no-sub set and phase.

(4) "Total NMCS aircraft" in Table 2-13b is just the sum of the NMCS aircraft from each phase.

(5) Available aircraft are computed as (surviving aircraft - total NMCS aircraft), where surviving aircraft is from the scenario data (Table 2-5).

(6) Achieved daily flying hours is just the smaller of (avail acft x 10) and the daily flying program. Recall that maximum flying hours/acft/day = 10.

(7) Program flying hours/acft/day is, from Table 2-13c, the quotient of the achieved flying hours and the available aircraft.

(8) The $(EFH - AFH) / (\text{avg daily FHP})$ column of Table 2-13b is a "closeness measure." EFH denotes estimated flying hours while AFH denotes achieved flying hours. Their difference is divided by the average program flying hours per day for the scenario. If this is small enough, iterations terminate. Since Table 2-5 specified "desired convergence = 0," estimated flying hours must equal achieved flying hours in order for iterations to terminate due to closeness. When EFH does not equal AFH, daily iterations continue up to the maximum iteration limit (2) specified in Table 2-5. If iterations continue, the average of estimated and achieved flying hours for this iteration becomes the estimated flying hours for the next iteration. Thus, $(1,500 + 1,100) / 2 = 1,300$ hours is the estimated flying hours for iteration 2 of Day 4.

(9) Daily aircraft availability in Table 2-13c is calculated as the ratio of computed available aircraft (from the last daily iteration of the previous section of the table (2-13b) and surviving aircraft. Daily fraction flying program achieved is the achieved daily flying hours (from the last iteration) divided by the program hours.

h. Constrained Cost Residual Requirement Solution. Two algorithms are applied, and the better solution (in terms of flying hour productivity) is chosen. The starting base for each algorithm is the unconstrained cost solution (Table 2-11). From Table 2-5, the residual cost limit is \$2,300. The complete calculations for the example case are too complex to represent here; however, the following steps illustrate algorithm application:

(1) Algorithm 1 (para 2-6a) first applies the constrained cost algorithm of basic PARCOM (para 2-5) to the no-sub parts in the unconstrained cost solution using the input cost limit (\$2,300). Any money "left over" is applied to buy a cost-effective slice of the full-sub parts in the unconstrained cost solution. Since the cost limit exceeds the price of the no-sub part set in the example unconstrained cost solution ($\$900 = 0 \times 400 + 30 \times 30$), the basic PARCOM no-sub solution is the entire no-sub solution set, and \$1,400 is left over to buy full-sub parts. To obtain a cost-

effective slice from this, Table 2-14 is used. The "full-sub parts" column shows, for each day, the cost of the full-sub parts in the total unconstrained cost requirements solution for the scenario truncated at that day. Extended PARCOM internally operates with this table. Such a "dollar vs day" table shows the full-sub portion of total requirements cost through each day. From the table, the day with associated full-sub parts cost closest to (but no more than) the money left over (\$1,400) is Day 4, with a full-sub cost of \$1,350. Extended PARCOM then generates a standard unconstrained cost solution (as in Table 2-11) for the example with a 4-day scenario. The full-sub parts in that solution are extracted and merged with the no-sub parts found earlier. The resulting merged solution is shown in Table 2-15. Extended PARCOM then applies the capability assessment algorithm for current inventory/constrained cost to generate the fleet capability assessment resulting from adding the algorithm 1 solution to current inventory. The resulting average fraction flying program achieved (.947) is noted for later use.

(2) Algorithm 2 (Figure 2-7) is similar to the second phase of algorithm 1 except that it operates on all parts. Table 2-14 shows the residual requirement costs (all parts) through each day. Day 4 is the day for which the associated cost (\$1,950) is closest to (but does not exceed) the input cost limit (\$2,300). Extended PARCOM then generates a standard unconstrained cost solution for the example with a 4-day scenario. That solution (shown in Table 2-16) is the algorithm 2 solution. A capability assessment is again done, but with the algorithm 2 requirement added to current inventory. The resulting average fraction flying program achieved is .946 of the required program.

Table 2-14. Residual Requirement Costs Through Given Day

Day	Full-substitution parts (\$)	No-substitution parts (\$)	All parts (\$)
1	0	0	0
2	0	0	0
3	0	0	0
4	1,350	600	1,950
5	5,400	900	6,300

Table 2-15. Algorithm 1 Constrained Cost Solution

Full substitution		No substitution	
Part	Requirement	Part	Requirement
1	20	3	0
2	11	4	30

Table 2-16. Algorithm 2 Constrained Cost Solution

Full substitution		No substitution	
Part	Requirement	Part	Requirement
1	20	3	0
2	11	4	20

(3) The solution yielding the higher average fraction flying program achieved is then selected as the overall solution. For the example, the algorithm 1 solution is chosen as the final solution. The already-computed algorithm 1 capability assessment then applies.

(4) Note that the solutions generally only approximate the input cost limit. The approximation is necessary because the full-sub part requirements are determined by incrementing over whole (i.e., nonfractional) days of flying program sustainability. For very small problems, such as in the example, the approximation may be poor in dollar terms. However, the solution cost is usually closer to the cost limit in large problems. In all cases, the difference between the solution cost and the cost limit must be less than a single extra day of flying program sustainability.

CHAPTER 3

OPERATIONAL CONSIDERATIONS AND CAVEATS

3-1. CASE OBJECTIVES. The user can specify a flying hour objective in conjunction with an aircraft availability objective. For each of these, one of two subobjectives is selected. The associated case types are noted below.

a. Maximizing Cumulative Flying Hours Achieved. This flying hour objective is always operating when running a constrained cost case. It entails the direct determination of the parts mix which will yield the greatest number of achieved flying hours for a specified cost limit. The flying hours achieved will be less than the desired flying hour program if the cost limit is less than the cost of the unconstrained cost solution mix.

b. Maximizing Consecutive Daily Program Flying Hours Achieved. This flying hour objective is relevant only to constrained cost cases since, for unconstrained cost cases, achieved flying hours = program flying hours. Obtaining a solution with this objective is a two-stage process. First, the user runs Extended PARCOM in an unconstrained cost mode for the full wartime period. The output list from that run shows, for each day, the cumulative cost of the add-on parts that would have been required if the war had been truncated at that day. D, the last day on that list for which the associated cost is less than or equal to the cost limit of the constrained cost case, is then the maximum number of consecutive days of 100 percent flying program sustainability with "cost limit" spares dollars. Next, to get the solution mix associated with D, Extended PARCOM is rerun, in the unconstrained cost mode, with a truncated war of D days length.

c. Minimum Specified Daily Aircraft Availability. This objective is in addition to any flying hour objective and is operative in all cases. The availability objective may increase the demand for available aircraft beyond those required to achieve the flying program. The input availability constraints are, as described previously, used to calculate daily allowed NMCS aircraft, which, in turn, are used in all case calculations.

d. No Specified Aircraft Availability. Extended PARCOM must always read in values for minimum daily aircraft availability objectives. However, entering blank or zero equates to not specifying an availability objective.

3-2. CAPABILITY ASSESSMENT. Normally, Extended PARCOM capability assessments are performed after add-on requirements are determined for both unconstrained and constrained cost cases. In the unconstrained cost cases, flying hour and availability goals are fully met, so the assessed achievements are simply the same as the goals. However, average availability over the course of the war, which cannot be input as a goal, is also determined. For constrained cost cases, days of sustainability, fraction of daily and total flying hour program achieved, and daily and average aircraft availabilities are determined. At times, however, it is also desirable to be able to assess the degree to which an aircraft fleet, with its current or some other starting inventory (and no add-ons), can meet specified flying or availability goals. This can be done in Extended PARCOM for a variety of user-specified partial-substitution replacement policies. An assessment under the policy specified for requirements cases is always generated. However, the user may define a number of other partial-substitution policies for which individual current inventory capability assessments are desired from a single model "run." The partial-substitution policies are specified in terms of the partition of the parts data base into full-sub and no-sub part sets.

3-3. IMPACT OF PARTS DISTRIBUTION OVER TIME. The distribution of parts over time, as opposed to front loading of stocks, has no effect on Extended PARCOM results if all initial assets reach retail before they are required (as replacements). An ideally efficient stockage and transportation system will achieve this. Parts distribution over time may effect an increase in requirements, relative to front loading, if initial assets are sufficiently delayed so that they do not arrive in retail before all retail stocks are drawn down. In effect, such delayed assets may have their usefulness negated because they are in the wrong place at the wrong time. Similarly, the effect of such delays on capability assessment of current inventory may be a decrease in the period over which the flying program can be continuously sustained.

3-4. CAVEATS AND LIMITATIONS. The principal caveats and limitations on use of the Extended PARCOM Model, as applied in the study, are discussed below. Program modification and/or restructuring is required to extend model capabilities beyond the cited limits.

a. Number of Part Types Processed. The Extended PARCOM Model version demonstrated at the US Army Concepts Analysis Agency (CAA) can process at most 300 different part types. Simple (but memory consuming) modifications to the structure of the program can significantly increase this capacity.

b. Restrictive Partial-Substitution Policy Definition. Extended PARCOM only treats one concept of partial substitution. Other concepts may not be adaptable to the model methodology. The deterministic (as opposed to stochastic) nature of the model limits the range of processes which can be "added on."

c. Only Two Centralized Supply Levels. Extended PARCOM shares the Overview Model "world view" of a retail level and a wholesale level. With full substitution, each level has full cross-leveling (lateral transferability) of parts.

d. No Indenture Levels. Part types in the Extended PARCOM (and Overview) data base are nonoverlapping modular units, i.e., no part is a subcomponent of another listed part type. Use of indentured data is not processable in Extended PARCOM.

e. No Direct Maintenance Modeling. As with Overview, Extended PARCOM treats maintenance only indirectly, by incorporation into the repair time or by using an aircraft deployment/attrition data base, which is adjusted for aircraft down ("lost") due to maintenance constraints. Such adjustments could be based on results of a separate high-resolution simulation model which previously processed a "slice" of the scenario.

f. No Stochastic Results. All Extended PARCOM results are "expected value." Neither input nor results have variable probabilistic aspects (e.g., confidence levels). Safety levels would have to be treated separately as an add-on to Extended PARCOM quantities. However, use of expected values is meaningful for comparisons and parametric evaluations. Methodology for incorporating stochastic considerations into Extended PARCOM would be complex. Conversion of the model into a stochastic simulation could entail high risk for an uncertain payoff.

CHAPTER 4

POTENTIAL PROGRAM MODIFICATION

4-1. MODULE FUNCTIONS. Figure 4-1 shows the main and subprogram modules of Extended PARCOM. The subprograms consist of seven subroutines and one function. A summary of operational purpose is given below for each module. Details of module operations can be read in the commented FORTRAN code for Extended PARCOM presented in Appendix A.

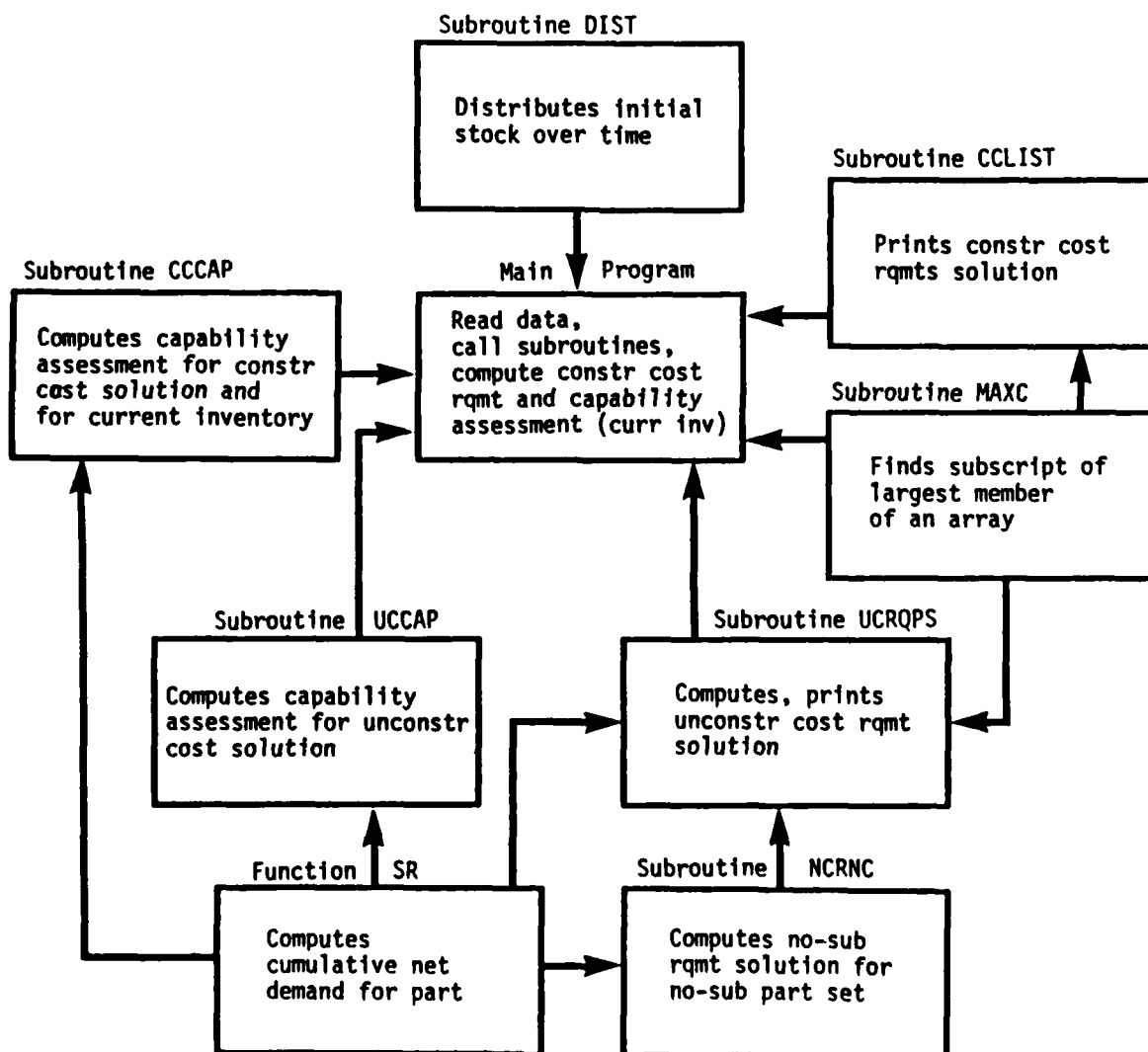


Figure 4-1. Extended PARCOM Subprogram Modules

a. Main Program. The Extended PARCOM main program:

- (1) Reads in all part and scenario data.
- (2) Prints summaries of the part and scenario data input.
- (3) Calls subroutine MAXC to order the part data base by part unit cost.
- (4) Calls subroutine DIST to distribute initial stock over time.
- (5) Calls subroutine UCRQPS to compute requirements and costs for the unconstrained cost case.
- (6) Calls subroutine UCCAP to compute capability assessment of the unconstrained cost solution mix.
- (7) Computes requirements and costs for the constrained cost case.
- (8) Calls subroutine CCLIST to print the constrained cost solution.
- (9) Calls subroutine CCCAP to compute capability assessment for the constrained cost solution.
- (10) Calls subroutine CCCAP to compute capability assessment of current inventory with various user-specified partial-substitution policies.

b. Subroutine UCRQPS. Subroutine UCRQPS is called only by the main program. It computes and prints the least-cost requirements mix of spare parts needed to achieve the case objective, given unconstrained funds. In addition to computing the unconstrained cost requirement, the subroutine operation is a part of the constrained cost requirements algorithm in the main program. Subroutine UCRQPS calls:

- (1) Subroutine NCRNC which computes unconstrained cost no-sub requirements solutions over only the no-sub part set. These solutions are used by the partial-substitution requirements algorithm.
- (2) Function SR which is used to compute cumulative net demand for each part.
- (3) Subroutine MAXC which is used to order computed requirements either in order of part unit cost or in order of amount of requirement.

c. Subroutine UCCAP. Subroutine UCCAP is called by the main program and calls function SR. It computes fleet capability (average availability, average program flying hours/aircraft/day) based on the unconstrained cost solution being stocked in the war reserve.

d. Subroutine CCCAP. Subroutine CCCAP is called by the main program and calls function SR. It computes fleet capability assessment based on the constrained cost solution being stocked in the war reserve. It is also called by the main program to compute capability assessments of current inventory for a series of user-specified partial-substitution policies.

e. Subroutine CCLIST. Subroutine CCLIST is called by the main program to print the constrained cost requirements solution. It calls subroutine MAXC for use in ordering the requirements list.

f. Subroutine DIST. Subroutine DIST is called by the main program and calls no external routines. It distributes the initial spares stock of a part type over a user-specified series of 5-day intervals.

g. Subroutine MAXC. Subroutine MAXC is called by the main program, by subroutine UCRQPS, and by subroutine CCLIST. It calls no external routines. This subroutine finds the largest member of a subscripted array. It is useful in rank-ordering a list according to the numeric value of a list attribute.

h. Subroutine NCRNC. Subroutine NCRNC is called by subroutine UCRQPS and calls function SR. It calculates a basic PARCOM unconstrained cost requirements solution for a no-substitution replacement policy. Its operation is an element of the Extended PARCOM partial-substitution requirements algorithm.

i. Function SR. Function SR is called by subroutine UCRQPS, by subroutine NCRNC, by subroutine UCCAP, and by subroutine CCCAP. No external routines are called. This function calculates the cumulative net demand through a specified day for a specified part based on a specified flying program. A zero initial inventory is assumed in this calculation.

4-2. ARRAY STORAGE. Definitions and sizes of Extended PARCOM array variables are given in the comments of the program code displayed in Appendix A. The types of arrays are local, as defined by DIMENSION statements, common, as defined by unlabeled COMMON, and character, as defined by CHARACTER declarations. Character variables occupy four words per entry in Extended PARCOM while other arrays require only one word per entry. During execution on the Sperry 1100/82 computer, Extended PARCOM occupies 47,000 words of memory.

4-3. EXTENSION OF DAY LIMIT. In the Extended PARCOM version delivered by CAA, 17 single-subscript arrays and 2 double-subscript arrays are defined in terms of the maximum number of days in the scenario. The current limit is 120 days. Those arrays of size 120 may be increased in size (through user reprogramming) to the scenario length desired insofar as computer memory permits. The arrays associated with the day limit, their dimensions, and the routines defining them are listed in Table 4-1.

Table 4-1. Extended PARCOM Arrays with a Day Limit Dimension

Array	Routine	Array	Routine	Array	Routine
AC(120)	COMMON	DCOST1(120)	COMMON	FHR(120)	COMMON
ALLOW1(120)	COMMON	DCOSTF(120)	COMMON	IFHC(120)	COMMON
ALLOWB(120)	COMMON	FHA(120)	COMMON	RNC(120)	COMMON
ALR(120)	Main	FHNC(120)	CCCAP	SM(120,100)	COMMON
ASURV(120)	COMMON	FHNZ(120)	CCCAP	SUMB(120)	COMMON
AVM(120)	COMMON	FHPAPD(3,120)	COMMON	SUMBZ(120)	NCRNC
				SUMP(120)	NCRNC

4-4. EXTENSION OF TOTAL PARTS LIMIT. In the Extended PARCOM version delivered by CAA, 37 single-subscript arrays and 1 double-subscript array are defined in terms of the maximum number of parts to be processed. The current limit is 300 parts. Those arrays of size 300 may be increased in size (through user reprogramming) to any limit permitted by computer memory. The arrays associated with the parts limit and the routines defining them are shown in Table 4-2.

4-5. CAVEATS. If the day and/or parts limits are increased, the processing time required for Extended PARCOM requirements run execution increases by at least the product of the two limit multipliers, i.e., doubling the day limit and the part limit will at least quadruple processing time. The reader should note that capability assessments without requirements calculations (a user option) are much faster than executions with requirements calculations.

Table 4-2. Extended PARCOM Arrays with a Parts Limit Dimension

Array	Routine	Array	Routine	Array	Routine
ADESC(300)	COMMON	DCY(300)	COMMON	PTDEP(300,24)	COMMON
AMSN(300)	COMMON	DF(300)	COMMON	QPA(300)	COMMON
BC(300)	Main	DMD(300)	COMMON	RNCS(300)	COMMON
BCY(300)	COMMON	DMDT(300)	CCCAP	SRMAX1(300)	COMMON
BF(300)	COMMON	DOD(300)	COMMON	STK(300)	COMMON
CDMDA(300)	COMMON	DSER(300)	Main	TRNCS(300)	COMMON
CF(300)	COMMON	DUNSER(300)	Main	TSTK(300)	COMMON
CLASS(300)	Main	FR(300)	Main	RMIN(300)	UCRQPS
CNCS(300)	COMMON	IFS(300)	COMMON	WRES(300)	Main
COST(300)	COMMON	INS(300)	COMMON	WRESU(300)	Main
CRNCS(300)	COMMON	IRC(300)	COMMON	XRNCS(300)	Main
DAY1D(300)	Main	IRO(300)	COMMON	ZNRT(300)	Main
DC(300)	Main	OST(300)	Main		

APPENDIX A
EXTENDED PARCOM PROGRAM SOURCE CODE

MAIN PROGRAM	pages A-3 thru A-20
SUBROUTINE CCCAP	pages A-21 thru A-25
SUBROUTINE CCLIST	pages A-27 thru A-29
SUBROUTINE DIST	pages A-31 and A-32
SUBROUTINE MAXC	page A-33
SUBROUTINE NCRNCT	pages A-35 thru A-37
SUBROUTINE UCCAP	pages A-39 thru A-42
SUBROUTINE UCRQPS	pages A-43 thru A-48
FUNCTION SR	pages A-49 and A-50

CAA-D-85-3

(NOT USED)

MAIN PROGRAM

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1  NAME: PARCOM-X          TYPE: MAIN PROGRAM
2
3  WRITTEN BY: WALTER BAUMAN/AUTOVON -295-1662
4  AT: US ARMY CAA/8120 WOODMONT AVE, BETHESDA, MD 20814
5
6  PURPOSE: THE PARCOM-X (PARTS REQUIREMENTS AND COST MODEL-EXTENDED) IS USED
7  TO GENERATE COST EFFECTIVE MIXES OF SPARE PARTS REQUIRED TO ACHIEVE A
8  FLYING PROGRAM/AVAILABILITY OBJECTIVE UNDER A USER-SPECIFIED
9  -PART REPLACEMENT POLICY (EITHER FULL, PARTIAL OR NO SUBSTITUTION)
10 - (PURCHASE) COST CONSTRAINT
11
12 IN ADDITION, THE PROGRAM ALLOWS THE CAPABILITY ASSESSMENT OF AN AIRCRAFT
13 FLEET BASED ON A USER-SPECIFIED SPARES INVENTORY APPLIED UNDER A
14 VARIETY OF USER-SPECIFIED PARTS REPLACEMENT POLICIES
15
16 ARGUMENTS: NOT APPLICABLE
17
18 CALLED BY: NOT APPLICABLE
19
20 CALLS
21 -SUBROUTINE MAXC: SELECTS LARGEST SUBSCRIPT OF AN ARRAY. USED TO
22                   ORDER PART TYPES IN DECREASING ORDER OF UNIT COST.
23 -SUBROUTINE CCCAP: PERFORMS A FLEET CAPABILITY ASSESSMENT BASED ON
24                   A SPARES STOCK EQUAL TO THE CONSTRAINED COST SOLUTION
25                   AND/OR CURRENT INVENTORY
26 -SUBROUTINE CLIST: PRINTS SELECTED CONSTRAINED COST SOLUTIONS
27 -SUBROUTINE DIST: DISTRIBUTES PARTS TO THEATER OVER 5-DAY INTERVALS
28 -SUBROUTINE UCROPS: COMPUTES A COST-EFFECTIVE REQUIREMENTS MIX BASED
29                   ON THE UNCONSTRAINED COST SOLUTION BEING STOCKED
30 -SUBROUTINE UCCAP: COMPUTES FLEET CAPABILITY ASSESSMENT BASED
31                   ON THE UNCONSTRAINED COST SOLUTION BEING STOCKED
32
33 FILES USED : INPUT - UNIT 10 (PARTS DATA)
34               - UNIT 11 (SCENARIO DATA)
35               OUTPUT - UNIT 6 (PRINT)
36
37 LOCAL ARRAYS
38
39 NAME      DIMENSION  TYPE      DESCRIPTION
40
41 ALR(I)    120 REAL    NR ACFT LOST (ATTRITION) ON DAY I
42
43 AM(I)     61 REAL    AC AVAILABILITY CONSTRAINT FOR I-TH
44                   "DAY INTERVAL", I.E. MINIMUM REQUIRED ACFT
45                   AVAILABILITY IN I-TH "DAY INTERVAL"
46
47 AMSN(I,J) 300 CHAR   IDENTIFICATION NR(SN) OF SPARE PART J
48
49 BC(I,J)   300 REAL   BASE (RETAIL) CONDEMNATION RATE OF PART J
50                   (= FRACTION FAILURES "JUNKED" AT RETAIL LEVEL)
51
52 CLASS(I,J) 300 REAL  IDENTIFYING LABEL FOR PART SET WHICH PART J
53                   BELONGS TO (EITHER FULL-SUB OR NO-SUB)
54
55 DAYID(I,J) 300 REAL  AMOUNT OF ASL/PLL STOCK FOR PART J WHICH
56                   IS IN-PLACE ON DAY I
57
58 DC(I,J)   300 REAL   DEPOT CONDEMNATION RATE OF PART J
59                   (= FRACTION FAILURES "JUNKED" AT DEPOT LEVEL)
60
61 DSER(I,J) 300 REAL   AMOUNT OF SERVICEABLE INITIAL DEPOT STOCK
62                   FOR PART J
63
64 DUNSER(I,J) 300 REAL  AMOUNT OF UNSERVICEABLE INITIAL DEPOT STOCK
65                   FOR PART J
66
67 FRI(I,J)   300 REAL   FAILURE (REPLACEMENT) RATE FOR PART J
68                   EXPRESSED AS EXPECTED NR OF FAILURES
69                   PER FLYING HOUR FLOWN.
70
71 IDAY(I)    61 FIXED   ARRAY WHICH TEMPORARILY STORES INPUT DATA ON
72                   DAYS BEGINNING "DAY INTERVALS" (IDAY(I) TO
73                   IDAY(I+1)) IN WHICH VARIOUS INPUT DATA
74                   TAKE EFFECT
75
76 NAC(I)     61 FIXED   NR OF AC DEPLOYED AT START OF I-TH TIME
77                   INTERVAL (IDAY(I) TO IDAY(I+1))
78
79 NFM(I)     61 FIXED   FLYING NR REQMT DURING I-TH TIME
80                   INTERVAL (IDAY(I) TO IDAY(I+1))
81

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83	OST(J)	300	REAL	ORDER/SHIP TIME (DAYS) FOR PART J (=INPUT-SPECIFIED OST + ADDOST)
84				
85	PT(K)	24	REAL	AMOUNT OF PART J DEPLOYED AFTER DAY 1 AND BETWEEN DAY 5+K-4 AND DAY 5+K
86				
87	JRES(J)	300	REAL	AMOUNT OF SERVICEABLE INITIAL WAR RESERVE FOR PART J
88				
89	URESU(J)	300	REAL	AMOUNT OF UNSERVICEABLE INITIAL WAR RESERVE FOR PART J
90				
91	XRNCS(IJ)	300	REAL	ARRAY FOR TEMPORARILY STORING THE CONSTRAINED COST SOLUTION REQMT COMPUTED BY THE CONSTR COST ALGORITHM 1 FOR PART J.
92				
93	ZLOSS(I)	61	REAL	NUMBER OF DAILY AC LOSSES BY ATTRITION DURING I-TH TIME INTERVAL (IDAY(I) TO IDAY(I+1))
94				
95	ZNRT(IJ)	300	REAL	NRTS (NOT REPAIRABLE THIS STATION) FRACTION FOR PART J. THIS IS THE FRACTION OF FAILURES WHICH ARE SENT TO DEPOT FOR REPAIR.
96				
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164	CCCCCCCCCCCC	COMDA(J)	300	REAL	ARRAY USED TO STORE THE CUMULATIVE NET DEMAND (BASED ON INITIAL STK=0) FOR PART J ON THE SCENARIO DAY BEING PROCESSED
165					
166					
167					
168					
169	CCCCCCCCCCCC	CF(J)	300	REAL	A COEFFICIENT USED IN CALCULATION OF NET DEMANDS(SR(I,J,...)) FOR PART J. IT=FR(J)*OPA(J)
170					
171					
172					
173	CCCCCCCCCCCC	CL	1	REAL	THE COST LIMIT (AS SPECIFIED BY INPUT) USED IN THE CONSTRAINED COST REQMTS CASE.
174					
175	CCCCCCCCCCCC	CMINT	1	REAL	TOTAL COST OF THE REQMT FOR THE UNCONSTRAINED COST CASE
176					
177					
178					
179	CCCCCCCCCCCC	CNCS(J)	300	REAL	TOTAL COST OF REQMT FOR PART J USING THE SPECIFIED PART REPLACEMENT POLICY.
180					
181					
182	CCCCCCCCCCCC	COST(J)	300	REAL	COST OF A SINGLE ITEM OF PART J. THIS IS ALSO DENOTED AS "PART UNIT COST".
183					
184					
185	CCCCCCCCCCCC	CRNCS(J)	300	REAL	THE UNCONSTRAINED COST SOLUTION REQMT FOR PART J AT ANY STAGE OF THE PARTIAL SUB REQUIREMENT CALCULATION ALGORITHM.
186					
187					
188	CCCCCCCCCCCC	DCOST1(I)	120	REAL	THE TOTAL CUMULATIVE REQMTS COST THRU DAY I FOR THE FULL SUB PARTS ONLY. I.E. THIS IS THE PORTION OF THE "CUM REQMTS COST THRU DAY N" ENTRY WHICH IS ASSOCIATED WITH THE FULL SUB PART SET.
189					
190					
191					
192					
193	CCCCCCCCCCCC	DCOSTF(I)	120	REAL	CUMULATIVE COST OF THE FULL REQUIREMENT (ALL PARTS) THRU DAY I USING THE SPECIFIED PART REPLACEMENT POLICY WITH UNCONSTRAINED COST.
194					
195					
196					
197					
198					
199	CCCCCCCCCCCC	DCY(J)	300	REAL	DEPOT RECYCLE TIME FOR PART TYPE J. THIS IS TIME BETWEEN REMOVAL AND RETURN FROM DEPOT REPAIR. THIS = DEPOT REPAIR TIME + 2*ORDER SHIP TIME.
200					
201					
202					
203					
204	CCCCCCCCCCCC	DF(J)	300	REAL	A COEFFICIENT USED IN CALCULATION OF NET DEMANDS(SR(I,J,...)) FOR PART J. IT= (1-DC(J))*ZNR(J)*CF(J)
205					
206					
207					
208					
209	CCCCCCCCCCCC	DMD(J)	300	REAL	WORKING VARIABLE USED IN CALCULATION OF NET DEMANDS(SR(I,J,...)) FOR PART J ON DAY I DURING CAPABILITY ASSESSMENT.
210					
211					
212					
213					
214					
215					
216	CCCCCCCCCCCC	DOD(J)	300	REAL	ARRAY STORING THE ATTRIBUTE TO BE SORTED ON IN SUBROUTINE MAXC. IN MAIN PGM, THIS WAS PART UNIT COST FOR PART J. IN SUBROUTINES CLIST & UCROPS, THIS WAS THE AMOUNT OF THE SOLUTION REQMT FOR PART J.
217					
218					
219					
220					
221					
222	CCCCCCCCCCCC	FHA(I)	120	REAL	DURING UNCONSTR COST REQMT CALCULATIONS(ROUTINE UCROPS) AND DURING UNCONSTR COST CAPABILITY ASSESSMENTS(ROUTINE UCCAP) THIS IS THE FLEET FLYING PROGRAM FLYING HOURS REQUIRED ON DAY I.
223					
224					
225					
226					
227					
228					
229					
230					
231					
232					
233					
234					
235	CCCCCCCCCCCC	FHM		REAL	MAXIMUM FLYING HRS PER ACFT PER DAY(INPUT)
236					
237	CCCCCCCCCCCC	FHPAPD(K,I)	3,120	REAL	FHPAPD(1,I)=FLYING HRS PER AVAILABLE ACFT PER FOR DAY I UNDER THE SPECIFIED REPLACEMENT POLICY BASED ON STOCKING (CURRENT INV + THE UNCONSTRAINED COST SOLUTION)
238					
239					
240					
241					
242					
243					
244					
245					

FHPAPD(3,I)=FLYING HRS PER AVAILABLE ACFT PER FOR DAY I UNDER THE SPECIFIED REPLACEMENT POLICY STOCKING EITHER CURRENT INVENTORY OR

			(CURR INV + THE CONSTRAINED COST SOLUTION)
0000	FM(I)	120 REAL	DURING THE CONST COST CAPABILITY ASSESSMENT
0000			THIS IS FLEET PROGRAM FLYING HOURS REQUIRED
0000			ON DAY I ACCORDING TO THE INPUT FLYING HR PGM
0000	FR(J)	300 REAL	FAILURE (REPLACEMENT) RATE FOR PART J
0000			EXPRESSED AS EXPECTED NR OF FAILURES
0000			PER FLYING HOUR FLOWN.
0000	ICOST	1 FIXED	INDICATOR WHICH TELLS SUBROUTINE UCROPS WHETHER
0000			TO PRINT THE PARTS REQMTS LIST (I=00 I=00N*1).
0000			REQMTS LIST IS NOT PRINTED DURING CONSTRAINED
0000			COST REQMT CALCULATIONS.
0000	IDCC(IND)	2 FIXED	STORES, FOR EITHER TOTAL (IND=1) OR RESIDUAL
0000			(IND=2), THE LATEST DAY FROM THE * CUM COST
0000			REQMT THRU DAY N* TABLE (FROM THE UNCONST
0000			COST CASE) FOR WHICH ASSOCIATED CUM COST
0000			IS LESS THAN OR = THE INPUT-SPECIFIED COST
0000			LIMIT USED IN THE CONSTRAINED COST CASE.
0000	IFHC(I)	120 FIXED	INDICATOR TELLING WHICH CONSTRAINT, FLY HR PGM
0000			(IFHC(I)=J) OR ACFT AVAILABILITY (IFHC(I)=1),
0000			DETERMINES REQUIRED DAILY FLEET AVAILABILITY
0000			FOR DAY I
0000	IFS(J)	300 FIXED	ARRAY STORING THE PARCOM PART NUMBERS OF THE
0000			PARTS IN THE FULL-SUB PART SET.
0000	INSEL	FIXED	NUMBER OF PART TYPES FOR WHICH INDIV ITEM
0000			*CUMULATIVE (UNCONST COST) SOLUTION REQMTS
0000			THRU DAY N* ARE DESIRED. (SEE SM(I,J) &
0000			2PT(J) BELOW)
0000	INC(J)	300 FIXED	ARRAY STORING THE PARCOM PART NUMBERS OF THE
0000			PARTS IN THE NO-SUB PART SET.
0000	INT	1 FIXED	THE INTERVAL AT WHICH THE PARTIAL SUB
0000			COMPUTATION ALGORITHM (ROUTINE UCROPS)
0000			INCREMENT VALUES FOR *ALLOWABLE NMCS *ACFT*
0000			AT EACH STAGE OF CALCULATION OF SEPARATE REQMT
0000			SOLUTIONS FOR THE FULL-SUB SET AND THE NO-SUB
0000			SET. ALWAYS SET=1 FOR RELIABLE RESULTS. ITS
0000			VALUE IS SET =1 IN THE PROGRAM CODE.
0000	IPT(J)	5 FIXED	ARRAY STORING INTERNAL PART NRS (SUBSCRIPTS)
0000			FOR PARTS FOR WHICH A CUMULATIVE DAY BY DAY
0000			REQUIREMENT HISTORY IS TO BE PRINTED
0000	IPC(J)	300 FIXED	ARRAY CONTAINING PART NUMBERS ORDERED ACC TO
0000			DECREASING PART UNIT COST FOR ASSOCIATED PART
0000	IPU(J)	300 FIXED	ARRAY CONTAINING PART NUMBERS ORDERED ACC TO
0000			DECREASING SOLUTION REQMT AMOUNT FOR ASSOCIATED
0000			PART
0000	NP	1 FIXED	NR OF PART TYPES PROCESSED IN RUN. (THIS
0000			EXCLUDES PART TYPES WITH ESSENTIALITY CODE
0000			*LF*. IESS OR WITH A ZERO FAILURE RATE)
0000	NP1	1 FIXED	TOTAL NUMBER OF *PART NUMBERS* IN THE FULL-SUB
0000			PART SET
0000	NP2	1 FIXED	TOTAL NUMBER OF *PART NUMBERS* IN THE NO-SUB
0000			PART SET
0000	NK	1 FIXED	LENGTH(DAYS) OF SCENARIO
0000	PTLEP(J,K)	700,24 REAL	TOTAL AMOUNT OF INITIAL STOCK FOR PART J
0000			RECEIVED AT THEATER (EXCLUDING IN-PLACE STOCK)
0000			BETWEEN DAY S*K-4 AND DAY S*K
0000	QPA(J)	300 REAL	THE *QUANTITY PER APPLICATION* FOR PART J.
0000			*I.E. THE STANDARD NUMBER OF ITEMS OF PART J
0000			INSTALLED ON EACH OPERATIONAL ACFT
0000	RNC(I)	120 REAL	AC AVAILABILITY IMPLIED BY STOCKAGE OF
0000			(COMPUTED REQMT + CURRENT INVENTORY) OR BY
0000			STOCKAGE OF ONLY THE CURRENT INVENTORY
0000	RNCS(J)	300 REAL	DURING REQMT CALCULATIONS IN MAIN PROGRAM &

328				IN SUBROUTINES NCRNC, UCROPS AND UCCAP, THIS IS
329				THE REQMT FOR PART J WITH UNCONSTRAINED COST.
330				DURING CONSTR COST CAPABILITY ASSESSMENT
331				(SUBROUTINE CCCAP) THIS IS THE REQMT FOR PART J
332				+ ISSUED INITIAL STOCK (TSK(J))
333				
334	SM(I,J)	120,100	REAL	THE CUMULATIVE (UNCONSTR COST) SOLUTION REQMT
335				THRU DAY I FOR PART IPT(J)
336				
337	SRMAX1(J)	300	REAL	A WORKING VARIABLE USED IN THE CALCULATION OF
338				THE UNCONSTR COST REQMT FOR A PART J IN THE
339				FULL-SUB SET. IT IS THE RUNNING MAXIMUM (OVER
340				TIME) OF THE NET DEMAND (INCLUDING INITIAL STK)
341				FOR PART J THRU THE DAY BEING PROCESSED
342				
343	STK(J)	300	REAL	INITIAL SERVICEABLE STOCK OF PART J. IT IS THE
344				SERVICEABLE WAR RESERVE + (IN-PLACE ASL/PLL
345				ON DAY 1)
346				
347	SUMB(I)	120	REAL	TOTAL STOCKOUTS OVER ALL PARTS IN THE NO-SUB
348				PART SET, AS CALCULATED DAY I DURING
349				CAPABILITY ASSESSMENT
350				
351	TRNCSIJ)	300	REAL	ARRAY USED TO STORE THE UNCONSTR COST SOLUTION
352				REQMT WHILE THE NO-SUB CONSTR COST ALGORITHM
353				IS BEING APPLIED TO THE NO-SUB PART SET DURING
354				PROCESSING FOR THE CONSTR COST ALGORITHM
355				
356	TSTK(J)	300	REAL	THE CUMULATIVE STOCK DEPLOYED FOR PART J ON
357				THE DAY BEING PROCESSED
358				
359	TSUMB	1	REAL	THE TOTAL NET STOCKOUT FROM ALL NO-SUB PARTS
360				PROCESSED AT ANY STAGE OF THE NO-SUB REQMTS
361				CALCULATION PORTION OF THE PARTIAL SUB REQMT
362				ALGORITHM
363				
364				
365				NOTEWORTHY SINGLE-SUBSCRIPT NAMES
366				
367	NAME		TYPE	DESCRIPTION
368				
369				
370				
371	ADDOST		REAL	CONSTANT ADDED TO INPUT VALUE OF OST
372				(ORDER/SHIP TIME AS READ FROM OVERVIEW INPUT)
373				TO YIELD THE OST USED IN PARCOM. THE OST
374				IS THE SAME FOR ALL PART TYPES. IN PARCOM
375				THE OST = ONE-WAY TRAVEL TIME BETWEEN
376				AND DEPOT.
377				
378	ADSC		REAL	16 CHARACTER DESCRIPTION OF PART J
379				
380	AX		REAL	AVERAGE DAILY MINIMUM REQUIRED ACFT AVAIL
381				
382	BREPL		REAL	PARTIAL SUB POLICY SCREENING LIMIT (INPUT).
383				IF THE BASE (RETAIL) REPAIR TIME (BCY(J))
384				FOR PART J EXCEEDS BREPL, THEN PART J IS PUT
385				IN THE FULL-SUB PART SET. IF NOT, IT'S IN THE
386				NO-SUB PART SET.
387				
388	BRR		REAL	NR OF RETURNING REPAIRS ARRIVING FROM RETAIL
389				REPAIR ON A SPECIFIED DAY
390	CL		REAL	THE COST LIMIT USED IN THE CONSTRAINED COST
391				CASES
392				
393	CL1		REAL	THE AMOUNT (%) OF THE UNCONSTR COST REQMTS
394				FROM THE NO-SUB PART SET WHICH ARE 'BOUGHT'
395				IN THE TRIAL SOLUTION FROM CONSTR COST
396				ALGORITHM 1
397				
398	CL2		REAL	THE AMOUNT (%) OF THE UNCONSTR COST REQMTS
399				FROM THE FULL-SUB PART SET WHICH ARE 'BOUGHT'
400				IN THE TRIAL SOLUTION FROM CONSTR COST
401				ALGORITHM 2
402				
403	CLNCR		REAL	THE COST LIMIT USED IN THE RESIDUAL (INIT
404				STK='CURRENT INVENTORY') REQMTS CASE
405				
406	CLNCT		REAL	THE COST LIMIT USED IN THE TOTAL (INIT
407				STK=0) REQMTS CASE
408				
409	CONVF		REAL	THE CONVERGENCE THRESHOLD (INPUT) USED IN THE

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410      C      CAPABILITY ASSESSMENT WITH CONSTRAINED COST OR
411      C      WITH 'CURRENT INVENTORY'
412
413      DAMT      REAL      THE AMOUNT OF INITIAL STOCK TO BE DISTRIBUTED
414      C      C      IN THEATER OVER A SPECIFIED (PARTS DEPLOYMENT)
415      C      C      TIME PERIOD (SEE IFDAY,ILDAY)
416
417      DDIS      REAL      LENGTH(DAYS) OF TIME PERIOD DURING WHICH
418      C      C      INITIAL DEPOT SERVICEABLES ARE RECEIVED
419      C      C      AT THEATER
420
421      DLAG      REAL      DELAY(DAYS AFTER DAY 1) BEFORE
422      C      C      INITIAL DEPOT SERVICEABLES ARE RECEIVED
423      C      C      AT THEATER
424
425      FNC      REAL      FRACTION OF FLEET FLYING HR PROGRAM (FULL WAR)
426      C      C      WHICH CAN BE ACHIEVED WITH THE CONSTR COST
427      C      C      SOLUTION INVENTORY OR WITH 'CURRENT INVENTORY'
428
429      FRLIM      REAL      PARTIAL SUB POLICY SCREENING LIMIT (INPUT).
430      C      C      IF THE FAILURE RATE (FRIJ) FOR PART J
431      C      C      EXCEEDS FRLIM, THEN PART J IS PUT IN THE
432      C      C      FULL-SUB PART SET. IF NOT, IT'S IN THE NO-SUB
433      C      C      PART SET.
434
435      IFDAY      FIXED     FIRST DAY OF RECEIPT(IN THEATER) OF INITIAL
436      C      C      STOCKS DISTRIBUTED (DEPLOYED) BY SUBROUTINE
437      C      C      DIST
438
439      IG      FIXED     INDICATOR TO SUBROUTINE CCLIST OF WHETHER CONSTR
440      C      C      COST ALGORITHM 1(IG=1) OR CONSTR COST ALGORITHM
441      C      C      2 WAS USED TO DETERMINE THE FINAL CONSTR COST
442      C      C      SOLUTION
443
444      ILDAY      FIXED     LAST DAY OF RECEIPT(IN THEATER) OF INITIAL
445      C      C      STOCKS DISTRIBUTED (DEPLOYED) BY SUBROUTINE
446      C      C      DIST
447
448      IND      FIXED     INDICATOR OF WHETHER TOTAL (INIT STK=0) OR
449      C      C      RESIDUAL (INIT STK='CURRENT INVENTORY') REQMTS
450      C      C      ARE BEING PROCESSED. IND=1 INDICATES TOTAL
451      C      C      REQMTS. IND=2 INDICATES RESIDUAL REQMTS.
452
453      IOPT1      FIXED     RUN OPTION(INPUT). IF IOPT1 .LE. 0, THEN ONLY
454      C      C      'CURRENT INVENTORY' CAPABILITY ASSESSMENT CASES
455      C      C      WILL BE DONE (I.E. NO REQMTS CALC). IF IOPT1
456      C      C      IS .GT. 0, BOTH CURR INV CAP ASSESS AND REQMTS
457      C      C      CASES WILL BE DONE.
458
459      IOPT2      FIXED     RUN OPTION(INPUT). IF IOPT2 .LE. 0, THEN THE
460      C      C      FULL-SUB PART SET USED IN THE
461      C      C      'CURRENT INVENTORY' CAPABILITY ASSESSMENT CASES
462      C      C      WILL NOT BE PRINTED. IF IOPT2 .GT. 0 THEY WILL .
463
464      IOPT3      FIXED     RUN OPTION(INPUT). IF IOPT3 .LE. 0, THEN THE
465      C      C      NO - SUB PART SET USED IN THE 'CURR INV'
466      C      C      CAPABILITY ASSESSMENT CASES WON'T BE PRINTED.
467      C      C      IF IOPT3 .GT. 0 THEY WILL BE PRINTED.
468
469      IOPT4      FIXED     RUN OPTION(INPUT). IF IOPT4 .LE. 0, THEN THE
470      C      C      UNCONSTR COST SOLUTION REQMTS LIST WILL NOT
471      C      C      BE PRINTED (BUT WILL BE COMPUTED INTERNALLY).
472      C      C      IF IOPT4 .GT. 0 THE LIST WILL BE PRINTED.
473
474      IOPT5      FIXED     RUN OPTION(INPUT). IF IOPT5 .LE. 0, THEN THE
475      C      C      'CUMULATIVE(UNCONSTR COST) REQMTS COSTS THRU
476      C      C      DAY N' LIST WILL NOT BE PRINTED. IF IOPT5 .GT. 0
477      C      C      THE LIST WILL BE PRINTED.
478
479      IORD      FIXED     RUN OPTION(INPUT). IF IORD .LE. 0, THEN THE
480      C      C      SOLUTION REQMTS LISTS WILL BE ORDERED ACCORDING
481      C      C      TO DECREASING UNIT COST OF PART. IF OPT3 .GT. 0
482      C      C      THE REQMTS LISTS ARE ORDERED BY (DECREASING)
483      C      C      AMOUNT OF SOLUTION REQMT.
484
485      IP      FIXED     INDICATOR TELLING THE CONSTR COST CAPABILITY
486      C      C      ASSESSMENT ROUTINE (CCCAP) WHETHER TO PRINT THE
487      C      C      AMOUNT OF SOLUTION REQMT. THIS IS SET BY THE
488      C      C      MAIN PROGRAM.
489
490      IPRT      FIXED     RUN OPTION(INPUT). IF IPRT .LE. 0, THEN THE
491      C      C      SCENARIO INPUT DATA SUMMARY WILL NOT BE PRINTED

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492      IF IPRT .GT. 0, IT WILL BE PRINTED
493
494      IPRT1      FIXED      RUN OPTION(INPUT). IF IPRT1 .LE. 0, THEN THE
495                        FULL-SUB & NO-SUB PART SETS USED IN REQMTS CASES
496                        WILL NOT BE PRINTED, NOR WILL THE PART DATA
497                        LIST SUMMARIES AFTER THE FIRST ONE. OTHERWISE
498                        THESE WILL BE PRINTED.
499
500      ISEL      FIXED      RUN OPTION(INPUT) TELLING WHETHER ONLY TOTAL
501                        (INIT STM=0) REQMTS (ISEL=0), ONLY RESIDUAL
502                        (INIT STM=CURR INV) REQMTS (ISEL=1), OR BOTH
503                        TOTAL AND RESIDUAL REQMTS (ISEL=2) ARE TO BE
504                        PROCESSED IN THIS RUN.
505
506      IW      FIXED      TEMPORARILY STORES NW (THE NR DAYS IN THE WAR)
507                        WHILE THE CONSTRAINED COST ALGORITHMS OPERATE.
508
509      KNTC      FIXED      THE PARTIAL-SUB POLICY BEING PROCESSED. KNTC=1
510                        IS THE POLICY USED IN REQMTS CALCULATIONS AND
511                        IN THE 1ST 'CURRENT INVENTORY' CAPABILITY
512                        ASSESSMENT. KNTC=2,3... ARE ADDITIONAL POLICIES
513                        (INPUT) USED ONLY IN CAPABILITY ASSESSMENTS
514                        OF CURRENT INVENTORY
515
516      LIMIT      FIXED      THE MAXIMUM NUMBER OF ITERATIONS (PER DAY)
517                        WHICH THE CONSTRAINED COST CAPABILITY
518                        ASSESSMENT ALGORITHM (SUBROUTINE CCCAP)
519                        WILL PERFORM BEFORE IT TERMINATES
520
521      NFS      FIXED      AN INPUT INDICATOR TELLING HOW THE FULL-SUB
522                        SET USED IN REQMTS CALCULATIONS IS DEFINED.
523                        IF NFS .LT. 0, THE FULL-SUB SET IS DEFINED
524                        BY FOUR SCREENING LIMITS (BREPL,ZDCY,FRLIM,
525                        ZNRTL) INPUT ON NEXT CARD. IF NFS .EQ. 0,
526                        NO PARTS ARE TO BE IN THE FULL-SUB SET (I.E.
527                        THIS IS A NO-SUB CASE). IF NFS .GT. 0, THEN
528                        THE NFS(NUMBER OF) PART NUMBERS DESIGNATED
529                        ON THE NEXT CARD(S) ARE IN THE FULL-SUB SET.
530
531      NPTFS      FIXED      (INPUT) NUMBER OF FULL-SUB PARTS FOR EACH
532                        PARTIAL-SUB POLICY USED ONLY FOR CAPABILITY
533                        ASSESSMENT OF CURRENT INVENTORY. IF INPUT
534                        VALUE OF NPTFS .GT. 0, THEN NPTNS (SEE BELOW)
535                        IS IGNORED.
536
537      NPTNS      FIXED      (INPUT) NUMBER OF NO-SUB PARTS FOR EACH
538                        PARTIAL-SUB POLICY USED ONLY FOR CAPABILITY
539                        ASSESSMENT OF CURRENT INVENTORY. NPTNS IS
540                        USED ONLY IF THE VALUE OF NPTFS IS 0.
541
542      TTFH      REAL      TOTAL FLYING HOURS IN THE FULL SCENARIO
543                        FLYING PROGRAM
544
545      ZCOST      REAL      TOTAL VALUE OF 'CURRENT INVENTORY', BASED ON
546                        PART UNIT COST
547
548      ZDCY      REAL      PARTIAL SUB POLICY SCREENING LIMIT (INPUT).
549                        IF THE DEPOT REPAIR CYCLE (DCY(J))
550                        FOR PART J EXCEEDS ZDCY, THEN PART J IS PUT
551                        IN THE FULL-SUB PART SET. IF NOT, IT'S IN THE
552                        NO-SUB PART SET.
553
554      ZNRTL      REAL      PARTIAL SUB POLICY SCREENING LIMIT (INPUT).
555                        IF THE MNTS (ZNRTL(J)) FOR PART J EXCEEDS
556                        ZNRTL, THEN PART J IS PUT IN THE FULL-SUB
557                        PART SET. IF NOT, IT'S IN THE NO-SUB PART SET.
558
559
560
561      DIMENSION
562      * ALR(120), AM(161), BC(300), DAY10(300),
563      * DC(300), OSER(300), DUNSER(300), FRI(300),
564      * IDAY(161), NAC(161), NFH(161), OST(300),
565      * PT(24), WRES(300), WRESU(300), XRNCS(300),
566      * ZLOSS(161), ZNRT(300)
567      * COMMON
568      * AC(120), ACL, ADESC(330), ALLOW1(120),
569      * ALLOWB(120), AMSN(330), ASURV(120), AVAVG(6),
570      * AVH(120), BCY(300), BF(300), CASE,
571      * COMCA(300), CF(300), CL, CMINT,
572      * CNCS(300), COST(300), CRNCS(300), DCOST(300),
573      * DCOSTF(120), DCY(300), DF(300), DMD(300),
574      * DOD(300), FHA(120), FHM, FHPAPD(3,120),

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574      *   FHR(120),      ICOST,      IDCC(2),      IFHC(120),
575      *   IFS(300),      IMSEL,      INS(300),      INT,
576      *   IPT(100),      IRC(300),      IRO(300),      ISMORT,
577      *   NP,      NP1,      NP2,      NW,
578      *   PTOEP(300,24), OPA(300),      RNC(120),      RNC(300),
579      *   SM(120,100),      SRMAX(300),      STK(300),      SUMB(120),
580      *   TRNCS(300),      TSTK(300),      TSUMB
581      *   CHARACTER*16
582      *   ADESC,      ADSC,      AMSN,      CASE,
583      *   CLASS(300),      Z1
584      ISHORT=0
585      IFCC=1
586      DO 100 I=1,2
587      100 IDCC(I)=0
588      DO 200 I=1,61
589      IDAY(I)=0
590      AVN(I)=0
591      NAC(I)=0
592      NFW(I)=0
593      ZLOSS(I)=0
594      200 AM(I)=0
595      DO 300 I=1,300
596      IFS(I)=0
597      300 INS(I)=0
598      ZZ=0
599      KNTC=1
600
601      C READ OST OFFSET, DESIRED CONVERGENCE, MAX ESSENTIALITY PROCESSED,
602      C DEPOT LAG TIME, AND DEPOT DISTRIBUTION PERIOD
603      C
604      READ (11,9000) ADDOST,CONVF,IESS,DLAG,DDIS
605      NP=0
606      NP1=0
607
608      C READ INDICATOR(NFS) OF HOW PARTIAL-SUB POLICY IS DEFINED
609      C
610      READ (11,9100) NFS
611
612      C IF NFS .LT.0 READ PARTIAL SUB SCREENING LIMITS ON DEPOT REPAIR CYCLE,
613      C NRTS,BASE(RETAIL) REPAIR CYCLE AND FAILURE RATE
614      C
615      IF (NFS.LT.0) READ (11,9200) ZDCY,ZNRTL,BREPL,FPLIM
616
617      C IF NFS .GT. 0, READ IN THE PART NUMBERS WHICH DEFINE THE FULL-SUB
618      C PART SET
619      C
620      IF (NFS.LE.0) GO TO 400
621      READ (11,9100) (IFS(J),J=1,NFS)
622      400 READ (11,9300) CASE
623      READ (10,9400)
624      I=0
625
626      C STMTS 500 TO 800 READ AND PROCESS THE PART DATA BASE INPUT, EACH PART
627      C HAS 12 RECORDS. THE READ ORDER IS: READ PART CHARACTERISTICS .
628      C SKIP A RECORD . READ INITIAL DEPOT STOCKS(SERV & UNSERV), INITIAL WAR
629      C RESERVES (SERV & UNSERV) AND IN-PLACE ASL/PLL. SKIP A RECORD.
630      C READ QUANTITY PER APPLICATION . READ PART DESCRIPTION. READ ASL/PLL
631      C DEPLOYED AFTER DAY 1. SKIP 3 RECORDS.
632      C
633      500 READ (10,9500,END=1300) Z1,Z2,Z3,Z4,Z5,Z6,Z7,Z8,Z9,IES
634      READ (10,9600,END=1300) DSRV,OUNS,WRS,WRU,DAY1
635      READ (10,9700,END=1300) IQPA
636      READ (10,9800,END=1300) ADSC
637      READ (10,9900,END=1300) IPT(K),K=1,24
638      READ (10,9400,END=1300)
639
640      C DO NOT PROCESS PARTS WITH A AN ESSENTIALITY .GT. IESS
641      C
642      IF (IES.GT.IESS) GO TO 700
643      ZT=Z3*ADDOST
644      ZXD=Z2*ZT*Z7
645      Z2C=Z2/100
646      Z4F=Z4/1000000
647      Z5N=Z5/100
648      Z100=IQPA
649      Z8B=Z8/100
650      Z9D=Z9/100
651      IF (MOD(NP+1,50).NE.0) GO TO 630
652      WRITE (6,10000) CASE
653      WRITE (6,10100)
654      WRITE (6,10200)
655      WRITE (6,10300)

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656 C DO NOT PROCSS PARTS WITH A FAILURE RATE =0.
657 C
658 600 IF (Z4,GE.,.0000001) GO TO 800
659 700 WRITE (6,10400) Z1,ADSC,Z2C,Z3,Z4F,Z5N,Z6,ZXD,Z7,Z8B,Z9D,Z10Q,IES
660 I=I+1
661 GO TO 500
662 800 NP=NP+1
663
664 C COMPUTE INITIAL STOCK IN THEATER AS SERVICEABLE WAR RESERVE *
665 C IN-PLACE ASL/PLL
666 C
667 STK(INP)=WRS*DAY1
668 BCY(INP)=Z6
669 DCY(INP)=0.
670 IF (Z5N,GT,0.) DCY(INP)=ZXD
671 ZNRT(INP)=Z5N
672 CLASS(INP)= " NO SUB"
673
674 C IF NFS .LT. 0, LABEL THE FULL-SUB PARTS ACCORDING TO THEIR EXCEEDING
675 C AT LEAST ONE OF THE SCREENING LIMITS
676 C
677 IF (NFS,GE,0) GO TO 900
678 CLASS(INP)="FULL SUB"
679 IF (BCY(INP).LE,BREPL.AND,DCY(INP).LE,ZDCY.AND,Z4F.LE,FRLIM.AND,ZNRT
680 *(NP).LE,ZNRTL) CLASS(INP)=" NO SUB"
681 GO TO 1100
682 900 IF (NFS,EQ,0) GO TO 1100
683 DO 1000 L=1,NFS
684 IF (IFS(L),NE,NP) GO TO 1000
685 CLASS(INP)="FULL SUB"
686 GO TO 1100
687 1000 CONTINUE
688 1100 WRITE (6,10500) NP,Z1,ADSC,Z2C,Z3,Z4F,Z5N,Z6,ZXD,Z7,Z8B,Z9D,Z10Q,I
689 *ES,CLASS(INP),STK(INP)
690 OST(INP)=Z1
691 AMSN(INP)=Z1
692 COST(INP)=Z2C
693 FR(INP)=Z4F
694 BC(INP)=Z8B
695 DC(INP)=Z9D
696 QPA(INP)=Z10Q
697 ADESC(INP)=ADSC
698 OSER(INP)=OSRV
699 DUNSER(INP)=DUNS
700 WRES(INP)=WRS
701 WRESU(INP)=WRU
702 DAY1D(INP)=DAY1
703 DO 1200 L=1,Z4
704 PTDEP(INP,L)=PT(L)
705 1200 IF (NFS,GE,0.OR,CLASS(INP).EQ," NO SUB") GO TO 500
706 C IF NFS .LT. 0, STORE THE PART NUMBERS OF THE FULL-SUB PART SET
707 C PREVIOUSLY LABELED
708 C
709 NP1=NP+1
710 IFS(NP1)=NP
711 GO TO 500
712 1300 II=NP+1
713 IF (NFS,GE,0) NP1=NFS
714 WRITE (6,10600) II,NP
715
716 C READ COST LIMIT(TOTAL RQMTS),COST LIMIT(ADD-ON RQMTS) AND ITERATION
717 C LIMIT
718 C
719 READ (11,10700) CLNCR,CLNCT,LIMIT
720 C
721 C READ MAX FH/ACFT/DAY,NR DAYS IN WAR,TYPE RQMTS TO CALCULATE,DESIRED
722 C ORDER OF RQMTS OUTPUT AND VARIOUS PRINT OPTIONS
723 C
724 READ (11,10800) FHM,NW,ISFL,IORD,IOPT1,IOPT2,IOPT3,IOPT4,IOPT5,IPR
725 *T,IPRT1
726 INT=1
727 IF (NP1,EQ,0.OR,IPRT1.LE,0) GO TO 1500
728 C PRINT THE LIST OF FULL-SUB PARTS USED IN THE RQMTS CASES
729 C
730 DO 1400 I=1,NP1
731 II=IFS(II)
732 IF (MOD(II-1,50).NE,0) GO TO 1400
733 WRITE (6,10900) CASE
734 WRITE (6,10900) KNIC
735

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738      WRITE (6,10200)
739      WRITE (6,10300)
740      1400 WRITE (6,11000) II,AMSN(II),ADESC(II),COST(II),FR(II),ZNRT(II),BCY
741      + (II),DCY(II),BC(II),DC(II),STK(II)
742      1500 NP2=0
743      C
744      C DEFINE THE NO-SUB PART SET (INS(J)) AS ALL PARTS NOT DESIGNATED FOR
745      C THE FULL-SUB PART SET
746      C
747      DO 1800 K=1,NP
748      IF (NP1.EQ.0) GO TO 1700
749      DO 1600 I=1,NP1
750      IF (IFS(I).EQ.K) GO TO 1800
751      1600 CONTINUE
752      NP2=NP2+1
753      INS(NP2)=K
754      1800 CONTINUE
755      IF (NP2.EQ.0.OR.IPRT1.LE.0) GO TO 2000
756      C
757      C PRINT THE LIST OF NO-SUB PARTS USED IN THE REQMTS CASES
758      C
759      DO 1900 I=1,NP2
760      II=INS(I)
761      IF (MOD(I-1,50).NE.0) GO TO 1900
762      WRITE (6,10000) CASE
763      WRITE (6,11100) KNTC
764      WRITE (6,10200)
765      WRITE (6,10300)
766      1900 WRITE (6,11200) II,AMSN(II),ADESC(II),COST(II),FR(II),ZNRT(II),BCY
767      + (II),DCY(II),BC(II),DC(II),STK(II)
768      C
769      C READ IN THE CUMULATIVE NUMBER OF ACFT DEPLOYED (FOR EACH DAY INTERVAL)
770      C
771      2000 READ (11,9100) NACDEP
772      READ (11,9100) (IDAY(I),I=1,NACDEP)
773      READ (11,9100) (NAC(I),I=1,NACDEP)
774      DO 2200 I=1,NACDEP
775      K1=IDAY(I)
776      K2=IDAY(I+1)-1
777      IF (I.EQ.NACDEP) K2=NW
778      DO 2100 J=K1,K2
779      AC(J)=NAC(I)
780      2200 CONTINUE
781      C
782      C READ IN THE PROGRAM FLYING HOURS (FOR EACH DAY INTERVAL)
783      C
784      READ (11,9100) NFHDAY
785      READ (11,9100) (IDAY(I),I=1,NFHDAY)
786      READ (11,9100) (NFH(I),I=1,NFHDAY)
787      DO 2400 I=1,NFHDAY
788      K1=IDAY(I)
789      K2=IDAY(I+1)-1
790      IF (I.EQ.NFHDAY) K2=NW
791      DO 2300 J=K1,K2
792      FHA(J)=NFH(I)
793      2300 FHR(J)=NFH(I)
794      2400 CONTINUE
795      C
796      C READ IN THE NUMBER OF ACFT LOST (ATTRITION) IN EACH DAY INTERVAL
797      C
798      READ (11,9100) NLDAY
799      READ (11,9100) (IDAY(I),I=1,NLDAY)
800      READ (11,11300) (ZLOSS(I),I=1,NLDAY)
801      DO 2600 I=1,NLDAY
802      K1=IDAY(I)
803      K2=IDAY(I+1)-1
804      IF (I.EQ.NLDAY) K2=NW
805      DO 2500 J=K1,K2
806      ALR(J)=ZLOSS(I)
807      2500 CONTINUE
808      C
809      C READ THE DESIRED MINIMUM ACFT AVAILABILITY OBJECTIVE FOR EACH DAY INTERVAL
810      C
811      READ (11,9100) NMDAY
812      READ (11,9100) (IDAY(I),I=1,NMDAY)
813      READ (11,11400) (AM(I),I=1,NMDAY)
814      DO 2800 I=1,NMDAY
815      K1=IDAY(I)
816      K2=IDAY(I+1)-1
817      IF (I.EQ.NMDAY) K2=NW
818      DO 2700 J=K1,K2
819      AVH(J)=AM(I)

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820 2800 CONTINUE
821 C
822 C READ (UP TO 100) PART NUMBERS OF PARTS SELECTED TO HAVE * CUMUL
823 C REQMT THRU DAY N* OUTPUT FOR EACH DAY N OF THE SCENARIO
824 C
825 READ (11,9100) IMSEL
826 READ (11,9100) (IPT(K),K=1,IMSEL)
827 IF (IPT(1).LE.0) GO TO 3300
828 ZCOST=0.
829 C
830 C THRU STMT 3500,PROCESS ALL PART DEPLOYMENTS
831 C
832 DO 3000 K=1,NP
833 SUM=0.
834 C
835 C FOR EACH PART,CALCULATE TOTAL ASL/PLL DEPLOYMENTS(SUM),TOTAL
836 C NON-CONDEMNED PARTS (SUMT) AND VALUE OF ENTIRE CURRENT INVENTORY.
837 C PRINT SUMMARY PART DEPLOYMENTS FOR EACH PART (IN ORDER OF INPUT)
838 C
839 DO 2900 I=1,24
840 SUM=SUM+PTDEP(K,I)
841 SUMT=SUM+DSER(K)*DUNSER(K)*(1.-DC(K))+WRES(K)+DAYID(K)+(1.-ZNRTI
842 * K)*WRESU(K)*(1.-BC(K))+ZNRT(K)*WRESU(K)*(1.-DC(K))
843 ZCOST=ZCOST+SUMT*COST(K)
844 IF (MOD(K-1,51).NE.0) GO TO 3000
845 WRITE (6,10000) CASE
846 WRITE (6,11500)
847 WRITE (6,10100)
848 WRITE (6,10300)
849 WRITE (6,11600)
850 WRITE (6,10300)
851 3000 WRITE (6,11700) K,AMSN(K),ADESC(K),COST(K),CLASS(K),DSER(K),DUNS
852 *ER(K),WRES(K),WRESU(K),DAYID(K),SUM,SUMT
853 DO 3200 K=1,NP
854 IF (MOD(K-1)*3,60).NE.0) GO TO 3100
855 WRITE (6,10000) CASE
856 WRITE (6,11800)
857 WRITE (6,11900)
858 WRITE (6,12000)
859 WRITE (6,10300)
860 C
861 C PRINT THE UNADJUSTED (I.E., ASL/PLL ONLY) PARTS DEPLOYMENT
862 C
863 3100 WRITE (6,12100) K,AMSN(K),ADESC(K)
864 3200 WRITE (6,12200) (PTDEP(K,L),L=1,24)
865 C
866 C THRU STMT 3500, DISTRIBUTE INITIAL (SERV & UNSERV) DEPOT AND INITIAL
867 C (SERVICEABLE) WAR RESERVE STOCKS OVER DAYS. IN EACH DISTRIBUTION
868 C IFDAY IS FIRST DAY OF RECEIPT, ILDAY IS LAST DAY AND DAMT IS
869 C AMOUNT RECEIVED PER DAY.
870 C
871 3300 DO 3500 K=1,NP
872 IFDAY=DLAG+1
873 ILDAY=DLAG+DDIS
874 DAMT=DSER(K)/DDIS
875 C
876 C INITIAL DEPOT SERVICEABLES ARE DISTRIBUTED
877 C
878 CALL DIST (IFDAY,ILDAY,DAMT,K)
879 IFDAY=OST(K)+1.
880 DREP=DCY(K)-2.*OST(K)
881 X=DREP
882 IF (DREP.LT.1.) DREP=1.000
883 ILDAY=OST(K)+DREP
884 DAMT=((1.-DC(K))*DUNSER(K))/DREP
885 C
886 C INITIAL DEPOT UNSERVICEABLES ARE DISTRIBUTED (LESS CONDEMNATIONS)
887 C
888 CALL DIST (IFDAY,ILDAY,DAMT,K)
889 AMT=((1.-ZNRT(K))*WRESU(K)*(1.-BC(K))
890 IFDAY=1
891 IF (BCY(K).LT.1.) BCY(K)=1.
892 ILDAY=BCY(K)
893 DAMT=AMT/BCY(K)
894 C
895 C INITIAL UNSERVICEABLE WAR RESERVES REPAIRED AT RETAIL ARE DISTRIBUTED
896 C
897 CALL DIST (IFDAY,ILDAY,DAMT,K)
898 AMT=ZNRT(K)*WRESU(K)*(1.-DC(K))
899 IFDAY=1+2.*OST(K)
900 ILDAY=2.*OST(K)+DREP
901 DAMT=AMT/DREP

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902 C
903 C INITIAL UNSERVICEABLE WAR RESERVES REPAIRED AT DEPOT ARE DISTRIBUTED
904 C (INITIAL SERVICEABLE WAR RESERVES,ALREADY IN-PLACE,ARE NOT DISTRIBUTED)
905 C
906 CALL DIST (IFDAY,ILDAY,DAMT,K)
907 IF (IPRT1.LE.0) GO TO 3500
908 IF (MOD((K-1)*3,60).NE.0) GO TO 3400
909 WRITE (6,10000) CASE
910 WRITE (6,12300)
911 WRITE (6,11900)
912 WRITE (6,12000)
913 WRITE (6,10300)
914 C
915 C WRITE PART ID. IF THE PART IS AN INITIAL DEPOT UNSERVICEABLE WITH
916 C A REPAIR TIME=0,PRINT A WARNING
917 C
918 3400 IF (X.GE..0001.OR.DAMT.LE..001) WRITE (6,12100) K,AMSN(K),A
919 + DESC(K)
920 IF (X.LT..0001.AND.DAMT.GT.001) WRITE (6,12400) K,AMSN(K),A
921 + DESC(K)
922 C
923 C PRINT THE ADJUSTED (INITIAL UNSERVICEABLE DEPOT & WAR RES STKS &
924 C ASL/PLL DEPLOYED AFTER DAY 1) PARTS DEPLOYMENT (EXCLUDES IN-PLACE
925 C ASL/PLL AND SERVICEABLE WAR RESERVES)
926 C
927 WRITE (6,12200) (PTDEP(K,L),L=1,24)
928 3500 CONTINUE
929 IF (IPRT1.LE.0) GO TO 3800
930 C
931 C PRINT THE SCENARIO INPUT DATA SUMMARY
932 C
933 DO 3700 J=1,NW
934 IF (MOD(J-1,51).NE.0) GO TO 3600
935 WRITE (6,10000) CASE
936 WRITE (6,12500)
937 WRITE (6,12600) ADDOST,CONVF,LIMIT,IESS
938 WRITE (6,12700) FHM,CLNCR,CLNCT
939 WRITE (6,12800) ZCOST
940 WRITE (6,12900)
941 WRITE (6,13000)
942 CALR=CALR+ALR(J)
943 3700 WRITE (6,13100) J,AC(J),FHR(J),AVH(J),ALR(J),CALR
944 3800 WRITE (6,10000) CASE
945 WRITE (6,13200)
946 C
947 C PRINT A REPORT SUMMARIZING OPTIONS SELECTED FOR THIS RUN
948 C
949 IF (ISEL.EQ.0) WRITE (6,13300) ISEL
950 IF (ISEL.EQ.1) WRITE (6,13400) ISEL
951 IF (ISEL.EQ.2) WRITE (6,13500) ISEL
952 IF (INFS.LT.0) WRITE (6,13600) NFS,ZDCV,ZNRTL,BREPL,FRLIM
953 IF (INFS.GE.0) WRITE (6,13700) NFS
954 IF (IORD.LE.0) WRITE (6,13800) IORD
955 IF (IORD.GT.0) WRITE (6,13900) IORD
956 IF (IOPT1.LE.0) WRITE (6,14000) IOPT1
957 IF (IOPT1.GT.0) WRITE (6,14100) IOPT1
958 IF (IOPT2.LE.0) WRITE (6,14200) IOPT2
959 IF (IOPT2.GT.0) WRITE (6,14300) IOPT2
960 IF (IOPT3.LE.0) WRITE (6,14400) IOPT3
961 IF (IOPT3.GT.0) WRITE (6,14500) IOPT3
962 IF (IOPT4.LE.0) WRITE (6,14600) IOPT4
963 IF (IOPT4.GT.0) WRITE (6,14700) IOPT4
964 IF (IOPT5.LE.0) WRITE (6,14800) IOPT5
965 IF (IOPT5.GT.0) WRITE (6,14900) IOPT5
966 IF (IPRT1.LE.0) WRITE (6,15000) IPRT1
967 IF (IPRT1.GT.0) WRITE (6,15100) IPRT1
968 IF (IPRT1.LE.0) WRITE (6,15200) IPRT1
969 IF (IPRT1.GT.0) WRITE (6,15300) IPRT1
970 WRITE (6,15400) INT,INT
971 DO 3900 I=1,NW
972 3900 DCOSTF(I)=0.
973 DO 4000 I=1,NP
974 4000 DOD(I)=COST(I)
975 KNT=0
976 C
977 C ORDER THE NO-SUB PART SET ACCORDING TO DECREASING UNIT COST (MOST
978 C EXPENSIVE PART FIRST)
979 C
980 NOUMMY=NP
981 DO 4300 K=1,NP
982 CALL MAXC (NOUMMY,NOUT)
983 IRC(K)=NOUT

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984      II=IRC(K)
985      IF (NP1.LE.0) GO TO 4200
986      DO 4100 L=1,NP1
987      IF (IFS(L).EQ.II) GO TO 4300
988 4100 CONTINUE
989      KNT=KNT+1
990      INS(KNT)=II
991 4300 DOO(II)=-1.
992      IF (IPRT1.LE.0) GO TO 4600
993  C
994  C PRINT SUMMARY PART DEPLOYMENTS FOR EACH PART (IN ORDER OF UNIT COST)
995  C
996      DO 4500 K=1,NP
997      II=IRC(K)
998      IF (MOD(K-1,51).NE.0) GO TO 4500
999      WRITE (6,10000) CASE
1000      WRITE (6,15500)
1001      WRITE (6,10300)
1002      WRITE (6,11650)
1003      WRITE (6,10300)
1004 4500 WRITE (6,11700) K,II,AMSN(II),ADESC(II),COST(II),CLASS(II)
1005 4600 CALR=0.
1006  C
1007  C COMPUTE THE MINIMUM NUMBER OF ACFT(ALLOWB(II)) REQUIRED TO MEET THE FLYING
1008  C PROGRAM/AVAILABILITY OBJECTIVE FOR EACH DAY I
1009  C
1010      WRITE (6,15600)
1011      DO 4700 I=1,NM
1012      CALR=CALR+ALR(II)
1013      ASURV(II)=AC(II)-CALR
1014      XX=AMAX1(0.,ASURV(II)*(1.-AVM(II)))
1015      YY=AMAX1(0.,ASURV(II)-FHR(II)/FHM)
1016      ALLOWB(II)=AMIN1(XX,YY)
1017      IF (ALLOWB(II).EQ.YY) IFHC(II)=0
1018      IF (ALLOWB(II).EQ.XX) IFHC(II)=1
1019 4700 CONTINUE
1020      TTFH=0.000001
1021  C
1022  C COMPUTE TOTAL FLYING HOURS IN THE FULL FLYING PROGRAM
1023  C
1024      DO 4800 I=1,NM
1025 4800 TTFH=TTFH+FHR(II)
1026  C
1027  C COMPUTE COEFFICIENTS USED BY FUNCTION SR IN THE CALCULATION OF
1028  C NET DEMAND
1029  C
1030      DO 4900 J=1,NP
1031      CF(J)=FR(J)*QPA(J)
1032      BF(J)=(1.-BC(J))*1.-ZNRT(J))*CF(J)
1033      DF(J)=(1.-DC(J))*1.-ZNRT(J))*CF(J)
1034 4900 CONTINUE
1035  C
1036  C IF ONLY ASSESSMENT CASES ARE TO BE PROCESSED, SKIP REQMT CALCULATIONS
1037  C
1038      IF (IOPT1.LE.0) GO TO 7600
1039      IND1=1
1040      IND2=2
1041  C
1042  C DETERMINE WHETHER ONLY RESIDUAL REQMTS(ISEL=0), ONLY TOTAL REQMTS(ISEL=1),
1043  C OR BOTH RESIDUAL AND TOTAL REQMTS(ISEL=2) ARE TO BE DONE IN THIS RUN
1044  C
1045      IF (ISEL.EQ.2) GO TO 5000
1046      IND1=1+ISEL
1047      IND2=1+ISEL
1048  C
1049  C THRU STMT 7500 PROCESS ALL REQUIREMENTS CALCULATIONS AND ASSOCIATED
1050  C CAPABILITY ASSESSMENTS FOR BOTH UNCONSTRAINED COST AND CONSTRAINED
1051  C COST CASES
1052  C
1053      5000 DO 7500 IND=IND1,IND2
1054      ACL=0.
1055      CL=CLNCT
1056      ICOST=0
1057      IF (IND.EQ.2) CL=CLNCR
1058  C
1059  C CALL SUBROUTINE UCRQPS TO COMPUTE THE UNCONSTRAINED COST REQMTS
1060  C SOLUTION. THEN CALL SUBROUTINE UCCAP TO GENERATE THE CAPABILITY
1061  C ASSESSMENT BASED ON THE UNCONSTRAINED COST SOLUTION
1062  C
1063      CALL UCRQPS (IND,IOPT4,IOPT5,IORD)
1064      CALL UCCAP (IND)
1065  C

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1066 C FOLLOWING STMTS THRU STMT 7600 PROCESS THE CONSTRAINED COST CASE:
1067 C IF THE COST LIMIT (CL) IS NEGATIVE, OMIT CONSTRAINED COST PROCESSING
1068 C
1069     IF (CL.LE.0.) GO TO 7500
1070     IW=NM
1071     UCNS=0.
1072     FRAC1=0.
1073
1074 C IF THIS IS A FULL SUB CASE ,OMIT CONSTR COST ALGORITHM 1 AND ONLY
1075 C PROCESS CONSTR COST ALGORITHM 2
1076 C
1077     IF (NP2.EQ.0) GO TO 6600
1078
1079 C UP TO STMT 6600 PROCESS THE CONSTR COST SOLUTION FOR ALGORITHM 1
1080 C
1081 C RECOMPUTE THE COST OF THE UNCONSTR COST SOLUTION
1082 C
1083 C
1084     DO 5100 J=1,NP2
1085         II=INS(J)
1086     5100 UCNS=UCNS+COST(II)*RNC$(II)
1087         WRITE (5,10000) CASE
1088         WRITE (6,15700)
1089
1090 C SAVE THE UNCONSTR COST SOLUTION IN AN ARRAY
1091 C
1092     DO 5200 J=1,NP
1093     5200 TRNC$(J)=RNC$(J)
1094
1095 C THRU STMT 5800, THE STANDARD PARCOM NO-SUB CONSTR COST ALGORITHM
1096 C OPERATES ON THE NO-SUB PART SET.
1097 C
1098     CL1=CL
1099     CNC=CINT-CL
1100
1101 C CNC IS THE $ AMOUNT OF THE UNCONSTR COST SOLUTION WHICH IS NOT AFFORDABLE
1102 C AND SO MUST BE "UNBOUGHT". IF CNC .LT. 0, THEN THE UNCONSTR COST
1103 C SOLUTION IS ALSO THE CONSTR COST SOLUTION
1104 C
1105     IF (CNC.GT.0.) GO TO 5300
1106     IF (IND.EQ.1) WRITE (6,15800)
1107     IF (IND.EQ.2) WRITE (6,15900)
1108     GO TO 7500
1109
1110 C UNDER ALGORITHM 1 LOGIC, THE NO-SUB PART SET REQMT IS "BOUGHT" FIRST
1111 C (OR, EQUIVALENTLY, THE FULL-SUB SET REQMT IS "UNBOUGHT" FIRST).
1112 C IF CNC .LT. 0, THE COST OF THE FULL-SUB PARTS IN THE UNCONSTR COST
1113 C SOLUTION (DCOST(INW)), THEN THE ENTIRE UNCONSTR COST NO-SUB REQMT
1114 C IS "BOUGHT" AND PART OF THE UNCONSTR COST FULL-SUB REQMT MUST BE
1115 C "UNBOUGHT", OTHERWISE THE ENTIRE UNCONSTR COST FULL-SUB REQMT IS
1116 C "UNBOUGHT" AND ONLY PART OF THE NO-SUB REQMT MUST BE "BOUGHT".
1117 C
1118     5300 IF (CNC.GT.DCOST(INW)) GO TO 5400
1119         CL1=UCNS
1120         CL2=CL-CL1
1121         GO TO 5900
1122     5400 IF (NP1.EQ.0) GO TO 5600
1123
1124 C BEFORE STARTING ALGORITHM 1 PROCESSING, INITIALIZE FULL-SUB REQUIREMENTS TO 0
1125 C
1126     DO 5500 J=1,NP1
1127         II=IFS(J)
1128     5500 RNC$(II)=0.
1129
1130 C TRNC$ STORES THE NO-SUB PARTS MIX PORTION OF THE SOLUTION FOR
1131 C ALGORITHM 1
1132 C
1133     5600 CL2=0.
1134         CL1=CL-CL2
1135         CNC=UCNS-CL1
1136         DO 5800 J=1,NP2
1137             II=INS(J)
1138             C=TRNC$(II)*COST(II)
1139             IF (C.LT.CNC) GO TO 5700
1140             TRNC$(II)=TRNC$(II)-CNC/COST(II)
1141             IW=NM
1142             GO TO 6200
1143     5700 TRNC$(II)=0.
1144         CNC=CNC-C
1145     5800 CONTINUE
1146         GO TO 6100
1147     5900 IFCC=1

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NEW

NEW

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1148 C DETERMINE IFCC, THE LAST DAY N FOR WHICH *CUM FULL-SUB REQMT COST
1149 C THRU DAY N* IS .LE. CL2 (THE AFFORDABLE AMOUNT OF FULL-SUB PARTS)
1150 C
1151 DO 6000 I=1, NW
1152 IF (DCOST1(I).GT.CL2) GO TO 6000
1153 IFCC=I
1154 BCL=DCOST1(I)
1155
1156 6000 CONTINUE
1157 WRITE (6,16000)
1158 6100 IF (CL2.GE.DCOST1(NW)) WRITE (6,16100)
1159 IF (CL2.LT.DCOST1(NW)) WRITE (6,16200) CL2,BCL,IFCC
1160 IW=NW
1161 NW=IFCC
1162
1163 C GENERATE THE FULL-SUB PARTS MIX ASSOCIATED WITH DAY IFCC
1164 C
1165 CALL UCRQPS (IND, IOPT4, IOPT5, IORD)
1166 WRITE (6,16300) CL, CL1
1167 WRITE (6,16300)
1168 IF (CL2.LE..0001) WRITE (6,16400)
1169 NW=IW
1170
1171 C MERGE THE JUST-COMPUTED FULL-SUB MIX (SUSTAINABILITY SOLUTION)
1172 C JUST COMPUTED WITH THE NO-SUB MIX *BOUGHT* EARLIER AND STORE
1173 C THIS COMBINED SOLUTION (FOR CONSTR COST ALGORITHM 1) IN TRNCS
1174 C
1175 DO 6300 I=1, NP2
1176 II=INS(I)
1177 RNC5(II)=TRNCS(II)
1178 DO 6400 I=1, NP
1179 TRNCS(I)=RNC5(I)
1180 TOT=0.
1181 DO 6500 I=1, NP
1182 TOT=TOT+COST(I)*RNC5(I)
1183 6500 RNC5(I)=RNC5(I)+STK(I)*(IND-1)
1184 IP=0
1185
1186 C CALL THE CAPABILITY ASSESSMENT ROUTINE (BUT DON'T PRINT RESULTS)
1187 C TO COMPUTE FNC, THE FRACTION FRACTION OF THE FLYING PROGRAM ACHIEVED
1188 C USING THE ALGORITHM 1 SOLUTION
1189 C
1190 CALL CCCAP (IND, LIMIT, CONVF, ITFH, KNTC, IP, FNC) NEW
1191 FRAC1=FNC
1192 WRITE (6,16500) FRAC1
1193
1194 C THRU STMT 6800, GENERATE THE SOLUTION FOR CONSTR COST ALGORITHM 2.
1195 C STORE THAT SOLUTION IN ARRAY XRNC5.
1196 C SUBROUTINE UCRQPS HAS ALREADY DETERMINED IDCC(IND), THE LAST DAY N
1197 C FOR WHICH *CUM TOTAL (I.E. ALL PARTS) REQMT COST THRU DAY N*
1198 C IS .LE. CL, THE (INPUT) COST LIMIT.
1199 C
1200 6600 IF (IDCC(IND).LE.1.OR.IDCC(IND).GE.NW) GO TO 7500
1201 NW=IDCC(IND)
1202 DO 6700 I=1, NW
1203 FWA(I)=FHW(I)
1204 CALL UCRQPS (IND, IOPT4, IOPT5, IORD)
1205 DO 6800 J=1, NP
1206 XRNC5(J)=RNC5(J)
1207 NW=IW
1208 IP=0
1209 6800 RNC5(J)=RNC5(J)+STK(J)*(IND-1)
1210
1211 C CALL THE CAPABILITY ASSESSMENT ALGORITHM TO COMPUTE THE FRACTION
1212 C FLYING PROGRAM COMPLETED WITH THE ALGORITHM 2 SOLUTION (BUT DON'T PRINT IT)
1213 C
1214 CALL CCCAP (IND, LIMIT, CONVF, ITFH, KNTC, IP, FNC)
1215 FRAC2=FNC
1216 WRITE (6,16600) FRAC2
1217
1218 C CHOOSE THE CONSTR COST ALGORITHM SOLUTION WHICH GIVES THE HIGHER
1219 C FRACTION FLYING PROGRAM ACHIEVED AND CALL SUBROUTINE CCLIST TO PRINT
1220 C THE SELECTED SOLUTION
1221 C
1222 IF (FRAC1.LE.FRAC2) GO TO 7100
1223 DO 6900 J=1, NP
1224 RNC5(J)=TRNCS(J)
1225 IG=1
1226 ACL=TOT
1227 CALL CCLIST (IG, IORD, IND)
1228 DO 7000 J=1, NP
1229 7000 RNC5(J)=TRNCS(J)+STK(J)*(IND-1)

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1230      IP=1
1231      CALL CCCAP (IND,LIMIT,CONVF,ITFH,KNTC,IP,FNC)
1232      GO TO 7400
1233      IG=2
1234      DO 7200 J=1,NP
1235      7200      RNCS(J)=XRNCS(J)
1236      CALL CCLIST (IG,IORD,IND)
1237      DO 7300 J=1,NP
1238      7300      RNCS(J)=XRNCS(J)+STK(J)*(IND-1)
1239      IP=1
1240      C
1241      C CALL THE CAPABILITY ASSESSMENT ALGORITHM AGAIN TO PRINT OUT ASSESSMENT
1242      C RESULTS FOR THE SELECTED CONSTR COST SOLUTION
1243      C
1244      CALL CCCAP (IND,LIMIT,CONVF,ITFH,KNTC,IP,FNC)
1245      7400      NW=IW
1246      DO 7450 I=1,NW
1247      7450      FMA(I)=FMR(I)
1248      7500      ICOST=0
1249      C
1250      C THRU STMT 8900 DO CAPABILITY ASSESSMENT OF 'CURRENT INVENTORY'
1251      C UNDER VARIOUS PARTIAL-SUB POLICIES
1252      C
1253      7600      DO 7700 K=1,NP
1254      7700      RNCS(K)=STK(K)
1255      IP=1
1256      IND=2
1257      C
1258      C DO A CAPABILITY ASSESSMENT FOR THE PART-SUB POLICY USED IN THE
1259      C REQMTS CALCULATIONS
1260      C
1261      CALL CCCAP (IND,LIMIT,CONVF,ITFH,KNTC,IP,FNC)
1262      KNTC=2
1263      C
1264      C RESET STOCK TO INITIAL LEVELS AND CLEAR FULL-SUB AND NO-SUB PART
1265      C ARRAYS PRIOR TO RESETTING THEM FOR A NEW PART-SUB POLICY)
1266      C
1267      7800      DO 7900 K=1,NP
1268      7900      RNCS(K)=STK(K)
1269      7900      INS(K)=0
1270      7900      IFS(K)=0
1271      C
1272      C READ ANOTHER PART-SUB POLICY IN TERMS OF EITHER THE NR & DESIGNATION
1273      C OF FULL-SUB PARTS (IF NP1FS .GT. 0) OR ELSE THE NR & DESIGNATION
1274      C OF NO-SUB PARTS (IF NP1NS .GT. 0). ONLY ONE SET IS READ.
1275      C
1276      READ (11,9100,END=16700) NP1FS,NP1NS
1277      IF ((NP1FS+NP1NS).LE.0) GO TO 16700
1278      IF (NP1FS.LE.0) GO TO 8200
1279      C
1280      C READ IN THE DESIGNATED FULL-SUB PARTS FOR THIS POLICY. ALL OTHER
1281      C PARTS ARE, BY DEFAULT, NO-SUB PARTS.
1282      C
1283      NP1=NP1FS
1284      READ (11,9100) (IFS(I),I=1,NP1FS)
1285      NP2=0
1286      DO 8100 K=1,NP
1287      DO 8000 I=1,NP1
1288      IF (IFS(I).EQ.K) GO TO 8100
1289      8000      CONTINUE
1290      NP2=NP2+1
1291      INS(NP2)=K
1292      8100      CONTINUE
1293      GO TO 8500
1294      8200      NP2=NP1NS
1295      C
1296      C READ IN THE DESIGNATED NO-SUB PARTS FOR THIS POLICY. ALL OTHER
1297      C PARTS ARE, BY DEFAULT, FULL-SUB PARTS.
1298      C
1299      READ (11,9100) (INS(I),I=1,NP1NS)
1300      NP1=0
1301      DO 8400 K=1,NP
1302      DO 8300 I=1,NP2
1303      IF (INS(I).EQ.K) GO TO 8400
1304      8300      CONTINUE
1305      NP1=NP1+1
1306      IFS(NP1)=K
1307      8400      CONTINUE
1308      8500      IF (NP1+NP2.LE.0) GO TO 8700
1309      C
1310      C PRINT THE COMPOSITION OF THE FULL-SUB PART SET FOR THIS PART-SUB
1311      C POLICY

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1312 C
1313 DO 8600 I=1,NP1
1314 IF=IFS(I)
1315 IF (MOD(I-1,50).NE.0) GO TO 8600
1316 WRITE (6,10000) CASE
1317 WRITE (6,10900) KNTC
1318 WRITE (6,10200)
1319 WRITE (6,10300)
1320 8600 WRITE (6,11000) II,AMSN(II),ADESC(II),COST(II),FR(II),ZNR(II),BCY
1321 + (II),DCY(II),BC(II),DC(II),STK(II)
1322 8700 IF (IOPT3.LE.0) GO TO 8900
1323 C
1324 PRINT THE COMPOSITION OF THE NO-SUB PART SET FOR THIS PART-SUB
1325 POLICY
1326 C
1327 DO 8800 I=1,NP2
1328 IF=INS(I)
1329 IF (MOD(I-1,50).NE.0) GO TO 8800
1330 WRITE (6,10000) CASE
1331 WRITE (6,11100) KNTC
1332 WRITE (6,10200)
1333 WRITE (6,10300)
1334 8800 WRITE (6,11200) II,AMSN(II),ADESC(II),COST(II),FR(II),ZNR(II),BCY
1335 + (II),DCY(II),BC(II),DC(II),STK(II)
1336 IND=2
1337 C
1338 COMPUTE AND PRINT CAPABILITY ASSESSMENT RESULTS FOR 'CURRENT INVENTORY'
1339 WITH THE NEW PART-SUB POLICY
1340 C
1341 8900 CALL CCCAP (IND,LIMIT,CONVF,TTFH,KNTC,IP,FNC)
1342 KNTC=KNTC+1
1343 C
1344 GO BACK AND PROCESS ANOTHER PART-SUB POLICY FOR USE IN CAPABILITY
1345 ASSESSMENT
1346 C
1347 GO TO 7800
1348 9000 FORMAT (2F5.2,I5,2F5.0)
1349 9100 FORMAT (16I5)
1350 9200 FORMAT (F5.0,F5.3,F5.0,F10.6)
1351 9300 FORMAT (1X,A16)
1352 9400 FORMAT (//)
1353 9500 FORMAT (2X,A15,F9.0,5X,F3.0,F5.0,5F3.0,I1,10X,I5)
1354 9600 FORMAT (//,5F6.0,/)
1355 9700 FORMAT (12)
1356 9800 FORMAT (A16)
1357 9900 FORMAT (10F10.0)
1358 10000 FORMAT (1H1,30X,'CASE= ',A16)
1359 10100 FORMAT (//, 'ITEMS RANK ORDERED IN NORMAL INPUT ORDER')
1360 10200 FORMAT (//, 'PART',5X,'MSN',14X,'DESCRIPTION',7X,'COST OST FAIL',
1361 + 'RT NRTS BCY DCY DRT BCIN DCON QPA ESS CLASS INIT STK')
1362 10300 FORMAT (//)
1363 10400 FORMAT (9X,A16,2X,A16,F8.0,F3.0,F8.6,F5.2,3F5.0,2F5.2,1X,F3.0,I5,1
1364 + 'QX,T10)
1365 10500 FORMAT (1X,I4,4X,A16,2X,A16,F8.0,F3.0,F8.6,F5.2,3F5.0,2F5.2,1X,F3.
1366 + 'Q,I5,1X,A8,F10.1)
1367 10600 FORMAT (//, 'TOTAL NR PARTS=',I4,' NR USED=',I4)
1368 10700 FORMAT (1X,F14.0,F15.0,I5)
1369 10800 FORMAT (1X,F9.1,I5,5X,10I5)
1370 10900 FORMAT (//, 'FULL SUB ITEMS FOR POLICY',I3)
1371 11000 FORMAT (1X,I4,4X,A16,2X,A16,F8.0,3X,F8.6,F5.2,2F5.0,5X,2F5.2,1X,10
1372 + 'X,'FULL SUB',F10.0)
1373 11100 FORMAT (//, 'NO SUB ITEMS FOR POLICY',I3)
1374 11200 FORMAT (1X,I4,4X,A16,2X,A16,F8.0,3X,F8.6,F5.2,2F5.0,5X,2F5.2,1X,10
1375 + 'X,'NO SUB',F10.0)
1376 11300 FORMAT (16F5.1)
1377 11400 FORMAT (16F5.2)
1378 11500 FORMAT (//,104X,'DEPLOYED')
1379 11600 FORMAT (//, 'RANK PART',8X,'ASN',18X,'DESCRIPTION',13X,'COST', 'CL
1380 + 'ASS',2X,'DSERV DUNSR WRSRV WRUNS DAY1 DAY2- TOT NC')
1381 11650 FORMAT (//, 'RANK PART',8X,'MSN',18X,'DESCRIPTION',13X,'COST')
1382 11700 FORMAT (2I5,5X,A16,5X,A16,1X,F14.0,1X,A8,1X,5F6.0,2F7.0)
1383 11800 FORMAT (//, 'UNADJUSTED PARTS DEPLOYMENT BY DAY INTERVAL')
1384 11900 FORMAT (//,
1385 + '-50 -55 -60 -65 -70 -75 -80 -85 -90 -95',
1386 + '-100')
1387 12000 FORMAT (//, '-105 -110 -115 -120')
1388 12100 FORMAT (15,2X,A16,2X,A16)
1389 12200 FORMAT (1X,20F6.0)
1390 12300 FORMAT (//, 'ADJUSTED (FOR DEPOT STKS) PARTS DEPLOYED BY INTERVAL'
1391 + ')
1392 12400 FORMAT (15,2X,A16,2X,A16,3X,'WARNING* DEPOT UNSERV STK W/ DEP',
1393 + 'OT REPAIR TIME=0 (CHGED TO 1)')

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1394 12500 FORMAT (//,10X,'SCENARIO INPUT DATA SUMMARY')
1395 12600 FORMAT (//,5X,'LOST OFFSET=',F6.1,' DAYS DESIGED CONVERGECE=',F5
1396 *3,/,3X,'MAX ITERATIONS=',I3,3X,'MAX ESSENTIALITY=',I3)
1397 12700 FORMAT (//,5X,' MAX FLY HRS/ACFT/DAY=',F5.1,4X,'ADD-ON COST LI',*M
1398 *IT=',F12.0,/,1X,'TOTAL (INIT INV=0) RQMT COST LIMIT=',F13.0)
1399 12800 FORMAT (//,5X,' COST OF CURRENT INVENTORY=',F14.0)
1400 12900 FORMAT (//,13X,'CUM ACFT PROGRAM MIN REQ ACFT CUM ACFT')
1401 13000 FORMAT (7X,'DAY DEPLOYED FLY HRS AVAIL LOST',7X,'LOST')
1402 13100 FORMAT (5X,I5,F11.0,F10.0,F10.2,F8.1,F11.1)
1403 13200 FORMAT (//,10X,'***** OPTIONS CHOSEN FOR THIS RUN *****')
1404 13300 FORMAT (////,5X,'ISEL=',I3,' ** ONLY THE TOTAL (INIT STK=0)',* RQM
1405 *TS ARE COMPUTED IN THIS RUN ')
1406 13400 FORMAT (////,5X,'ISEL=',I3,' ** ONLY THE RESIDUAL (INIT STK=CURR',*
1407 * INV) RQMTS ARE COMPUTED IN THIS RUN ')
1408 13500 FORMAT (////,5X,'ISEL=',I3,' ** BOTH THE TOTAL (INIT STK=0) AND **
1409 *RESIDUAL (INIT STK=CURR INV) RQMTS ARE IN THIS RUN **')
1410 13600 FORMAT (//,5X,'NFS=',I3,' ** FULL SUB SET IS CHOSEN ACCORDING',*
1411 *TO A DEPOT REPAIR CYCLE EXCEEDING',F12.0,' DAYS OR MRTS',*EXCEEDI
1412 *NG',F6.3,/,15X,'OR RETAIL REPAIR TIME EXCEEDING',F8.0,' OR FAILU
1413 *RE RATE EXCEEDING',F9.6)
1414 13700 FORMAT (//,5X,'NFS=',I3,' ** FULL SUB SET IS SPECIFIED BY INPUT')
1415 13800 FORMAT (//,5X,'IORD=',I3,' ** COMPUTED RQMTS LISTS WILL BE IN ',*
1416 *ORDER OF DECREASING UNIT COST OF PART')
1417 13900 FORMAT (//,5X,'IORD=',I3,' ** COMPUTED RQMTS LISTS WILL BE IN ',*
1418 *ORDER OF DECREASING RQMT AMOUNT FOR PART')
1419 14000 FORMAT (//,5X,'IOPT1=',I3,' ** ONLY ASSESSMENT CASES WILL BE ',*O
1420 *NE IN THIS RUN')
1421 14100 FORMAT (//,5X,'IOPT1=',I3,' ** BOTH ASSESSMENT AND RQMT CASES',*
1422 *WILL BE DONE IN THIS RUN')
1423 14200 FORMAT (//,5X,'IOPT2=',I3,' ** THE FULL SUB PART SETS USED IN',*
1424 *ASSESSMENT CASES WILL NOT BE PRINTED')
1425 14300 FORMAT (//,5X,'IOPT2=',I3,' ** THE FULL SUB PART SETS USED IN',*
1426 *ASSESSMENT CASES WILL BE PRINTED')
1427 14400 FORMAT (//,5X,'IOPT3=',I3,' ** THE NO SUB PART SETS USED IN',* AS
1428 *SESSMENT CASES WILL NOT BE PRINTED')
1429 14500 FORMAT (//,5X,'IOPT3=',I3,' ** THE NO SUB PART SETS USED IN',* AS
1430 *SESSMENT CASES WILL BE PRINTED')
1431 14600 FORMAT (//,5X,'IOPT4=',I3,' ** THE UNCONSTR COST RQMTS LISTS',* W
1432 *ILL NOT BE PRINTED (BUT ARE COMPUTED)')
1433 14700 FORMAT (//,5X,'IOPT4=',I3,' ** THE UNCONSTR COST RQMTS LISTS',* W
1434 *ILL BE PRINTED')
1435 14800 FORMAT (//,5X,'IOPT5=',I3,' ** THE CUM RQMT BY DAY COST LISTS',*
1436 *WILL NOT BE PRINTED')
1437 14900 FORMAT (//,5X,'IOPT5=',I3,' ** THE CUM RQMT BY DAY COST LISTS',*
1438 *WILL BE PRINTED')
1439 15000 FORMAT (//,5X,'IPRT=',I3,' ** THE SCENARIO INPUT DATA SUMMARY',*
1440 *WILL NOT BE PRINTED')
1441 15100 FORMAT (//,5X,'IPRT=',I3,' ** THE SCENARIO INPUT DATA SUMMARY',*
1442 *WILL BE PRINTED')
1443 15200 FORMAT (//,5X,'IPRT1=',I3,' ** THE FULL SUB AND NO SUB PART',* S
1444 *ETS (FOR RQMT CASES) WILL NOT BE PRINTED',/,13X,'NOR WILL',*THE I
1445 *NPUT-ORDERED AND COST-ORDERED PARTS INPUT LISTS')
1446 15300 FORMAT (//,5X,'IPRT1=',I3,' ** THE FULL SUB AND NO SUB PART',* S
1447 *ETS (FOR RQMT CASES) WILL BE PRINTED',/,13X,'AS WILL',*THE INPUT-
1448 *ORDERED AND COST-ORDERED PARTS INPUT LISTS')
1449 15400 FORMAT (//,5X,'INT=',I3,' ** THE PARTIAL SUB RQMT ALGORITHM',* WI
1450 *LL TEST AT INTERVALS OF',I3,' (ALLOWABLE NMCS ACFT)')
1451 15500 FORMAT (//,10X,'ITEMS RANK ORDERED BY DECREASING PART COST')
1452 15600 FORMAT (1H1)
1453 15700 FORMAT (//,20X,'*** CONSTRAINED COST SOLUTION EVALUATION',* REPORT
1454 * ***',/))
1455 15800 FORMAT (1H1,/,10X,'THE UNCONSTR COST TOTAL RQMT SOLUTION IS',* AL
1456 *SO THE CONSTR COST TOTAL RQMT SOLUTION')
1457 15900 FORMAT (1H1,/,10X,'THE UNCONSTR COST RESIDUAL RQMT SOLUTION IS',*
1458 *ALSO THE CONSTR COST RESIDUAL RQMT SOLUTION')
1459 16000 FORMAT (//,10X,'ALL (NO SUB) PARTS ARE AFFORDABLE IN CONSTRAINED',*
1460 *COST SOLUTION 1')
1461 16100 FORMAT (//,10X,'ALL FULL SUB PARTS ARE AFFORDABLE IN CONSTRAINED',*
1462 *COST SOLUTION 1')
1463 16200 FORMAT (//,5X,F12.0,3X,'APPROXIMATED BY',F12.0,' CUM FULL SUB',*
1464 *PART COST THRU DAY',I4,' IS USED TO BUY FULL SUB PARTS')
1465 16300 FORMAT (//,10X,'CONSTR COST LIMIT=',F12.0,3X,'OF WHICH',F12.0,3X,'
1466 *CAN BE USED',/,10X,'TO BUY (NO SUB) PARTS FROM THE UNCONSTR',*
1467 *COST SOLUTION')
1468 16400 FORMAT (//,10X,'NO FULL SUB PARTS ARE AFFORDABLE IN CONSTRAINED',*
1469 *COST SOLUTION 1')
1470 16500 FORMAT (//,5X,'THE FIRST CONSTR COST SOL YIELDS AN AVG FRAC',* PGM
1471 *FLY HRS ACH=',F5.3)
1472 16600 FORMAT (//,5X,'THE 2ND (SUSTNBLTY) CONSTR COST SOL YIELDS AN',* AVG
1473 *FRAC FM ACH=',F5.3)
1474 16700 END

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SUBROUTINE CCCAP

```

1  SUBROUTINE CCCAP (IND,LIMIT,CONVF,TTFH,KNTC,IP,FNC)
2  NAME: CCCAP          TYPE: SUBROUTINE
3
4  C PURPOSE: THE CCCAP (CONSTRAINED COST CAPABILITY ASSESSMENT) SUBROUTINE
5  C COMPUTES FLEET CAPABILITY ASSESSMENT (AVG AVAILABILITY, FRACTION FLYING
6  C PROGRAM ACHIEVED, PGM FLYING HRS /ACFT/DAY ) BASED ON THE CONSTRAINED COST
7  C SOLUTION BEING STOCKED IN THE WAR RESERVE
8
9  C CALLED BY: MAIN PROGRAM
10
11 C CALLS
12 C   -FUNCTION SR: COMPUTES CUMULATIVE NET DEMAND THRU A SPECIFIED DAY
13 C   FOR A SPECIFIED PART
14
15 C FILES USED : INPUT - NONE
16 C               OUTPUT - UNIT 6 (PRINT)
17
18 C ARGUMENTS
19
20 C NAME          TYPE          DESCRIPTION
21
22 C IND          FIXED          INDICATOR OF WHETHER TOTAL (INIT STK=0) OR
23 C              RESIDUAL (INIT STK='CURRENT INVENTORY') REQMTS
24 C              ARE BEING PROCESSED. IND=1 INDICATES TOTAL
25 C              REQMTS. IND=2 INDICATES RESIDUAL REQMTS.
26
27 C LIMIT        FIXED          THE MAXIMUM NUMBER OF ITERATIONS (PER DAY)
28 C              WHICH THE CONSTRAINED COST CAPABILITY
29 C              ASSESSMENT ALGORITHM (SUBROUTINE CCCAP)
30 C              WILL PERFORM BEFORE IT TERMINATES
31
32 C CONVF        REAL           THE CONVERGENCE THRESHOLD (INPUT) USED IN THE
33 C              CAPABILITY ASSESSMENT WITH CONSTRAINED COST OR
34 C              WITH 'CURRENT INVENTORY'
35
36 C TTFH         REAL           TOTAL FLYING HOURS IN THE FULL SCENARIO
37 C              FLYING PROGRAM
38
39 C KNTC         FIXED          THE PARTIAL-SUB POLICY BEING PROCESSED. KNTC=1
40 C              IS THE POLICY USED IN REQMTS CALCULATIONS AND
41 C              IN THE 1ST 'CURRENT INVENTORY' CAPABILITY
42 C              ASSESSMENT. KNTC=2,3... ARE ADDITIONAL POLICIES
43 C              (INPUT) USED ONLY IN CAPABILITY ASSESSMENTS
44 C              OF CURRENT INVENTORY
45
46 C IP          FIXED          INDICATOR TELLING THE CONSTR COST CAPABILITY
47 C              ASSESSMENT ROUTINE (CCCAP) WHETHER TO PRINT THE
48 C              AMOUNT OF SOLUTION REQMT. THIS IS SET BY THE
49 C              MAIN PROGRAM.
50
51 C FNC          REAL           FRACTION OF FLEET FLYING HR PROGRAM (FULL WAR)
52 C              WHICH CAN BE ACHIEVED WITH THE CONSTR COST
53 C              SOLUTION INVENTORY OR WITH 'CURRENT INVENTORY'
54
55 C LOCAL ARRAYS
56
57 C NAME          DIMENSION  TYPE          DESCRIPTION
58
59 C DMDT(J)       300        REAL          WORKING VARIABLE USED IN THE CALC OF NET DEMAND
60 C              FOR PART J ON DAY I DURING ITERATIONS (TO COMPUTE
61 C              ACHIEVED FLYING HRS) FOR EACH DAY
62
63 C FHNCI(I)      120        REAL          NUMBER OF ACHIEVED PROGRAM FLYING HRS ON DAY I
64
65 C FHNZI(I)      120        REAL          FRACTION OF PROGRAM FLYING HRS WHICH ARE ACHIEVED
66 C              ON DAY I
67
68 C COMMON BLOCK (UNLABELED) ENTRIES
69
70 C NAME          DIMENSION  TYPE          DESCRIPTION
71
72 C AC(I)         120        REAL          NR ACFT DEPLOYED ON DAY I
73
74
75
76
77
78
79
80
81

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82	ALLOWB(I)	120	REAL	MAXIMUM ALLOWABLE NMCS AC ON DAY I WHICH
83				WILL STILL ALLOW ACHIEVEMENT OF CASE OBJECTIVE
84				(FLYING HOUR AND AVAILABILITY) ON DAY I
85	ASURV(I)	120	REAL	NR AC SURVIVING (NOT ATTRITTED) ON DAY I
86	AVAVG(I)	6	REAL	AVAVG(1)=AVG ACFT AVAIL ,FROM CAPABILITY
87				ASSESSMENT, BASED ON STOCKAGE OF EITHER
88				CURR INV OR (CURR INV + COMPUTED ADD-ON
89				REQTS SOLUTION)
90				AVAVG(2)=AVG MIN ACFT REQ'D TO ACHIEVE
91				THE FLYING HR/AVAILABILITY OBJECTIVE.
92				AVAVG(3)=AVG FLY HR/AVAIL ACFT / DAY
93				,FROM CAPABILITY ASSESSMENT, BASED ON
94				EITHER CURR INV OR (CURR INV + THE SOLUTION
95				REQMT) BEING STOCKED.
96				
97				
98				
99				
100				
101	CASE		CHAR	CASE ID
102	CL	1	REAL	THE COST LIMIT (AS SPECIFIED BY INPUT) USED
103				IN THE CONSTRAINED COST REQTS CASE.
104	DMO(J)	300	REAL	WORKING VARIABLE USED IN CALCULATION OF
105				NET DEMAND(SR(I,J,...)) FOR PART J ON DAY I
106				DURING CAPABILITY ASSESSMENT.
107				WHEN (CUM)NET DMO THRU DAY I IS BEING
108				CALCULATED, DMO(J) IS (CUM) NET DMO THRU THE
109				PREVIOUS DAY, BASED ON AN INITIAL STK=0.
110	DOD(I)	300	REAL	ARRAY STORING THE ATTRIBUTE TO BE SORTED ON
111				IN SUBROUTINE HANC. IN MAIN PGM, THIS HAS PART
112				UNIT COST FOR PART J. IN SUBROUTINES CCLIST &
113				UCROPS, THIS HAS THE AMOUNT OF THE SOLUTION
114				REQMT FOR PART J.
115	FHA(I)	120	REAL	DURING THE CONSTR COST CAPABILITY ASSESSMENT
116				(SUBROUTINE CCAPS) THIS IS THE INITIAL ESTIMATE
117				FOR FLYING HRS ACHIEVED ON DAY I WHEN
118				EITHER CURR INV OR (CURR INV + COMPUTED
119				CONSTRAINED COST ADD-ON REQMT) IS STOCKED.
120				THIS IS RECURSIVELY COMPUTED.
121	FHM		REAL	MAXIMUM FLYING HRS PER ACFT PER DAY (INPUT)
122	FHPAPD(I)	3.120	REAL	FHPAPD(1,I)=FLYING HRS PER AVAILABLE ACFT PER
123				FOR DAY I UNDER THE SPECIFIED REPLACEMENT
124				POLICY BASED ON STOCKING (CURRENT INV +
125				THE UNCONSTRAINED COST SOLUTION)
126				
127				FHPAPD(3,I)=FLYING HRS PER AVAILABLE ACFT PER
128				FOR DAY I UNDER THE SPECIFIED REPLACEMENT
129				POLICY STOCKING EITHER CURRENT INVENTORY OR
130				(CURR INV + THE CONSTRAINED COST SOLUTION)
131	FHR(I)	120	REAL	FLEET PROGRAM FLYING HOURS REQUIRED ON DAY I
132				(ACCORDING TO THE INPUT FLYING HR PROGRAM)
133	ICOST	1	FIXED	INDICATOR WHICH TELLS SUBROUTINE UCROPS WHETHER
134				TO PRINT THE PARTS REQTS LIST (0=NO 1=ON*1).
135				REQTS LIST IS NOT PRINTED DURING CONSTRAINED
136				COST REQMT CALCULATIONS.
137	IFS(I)	300	FIXED	ARRAY STORING THE PARCOM PART NUMBERS OF THE
138				PARTS IN THE FULL-SUB PART SET.
139	INS(I)	300	FIXED	ARRAY STORING THE PARCOM PART NUMBERS OF THE
140				PARTS IN THE NO-SUB PART SET.
141	NP	1	FIXED	NR OF PART TYPES PROCESSED IN RUN. (THIS
142				EXCLUDES PART TYPES WITH ESSENTIALITY CODE
143				.LE. 1255 OR WITH A ZERO FAILURE RATE)
144	NP1	1	FIXED	TOTAL NUMBER OF 'PART NUMBERS' IN THE FULL-SUB
145				PART SET
146	NP2	1	FIXED	TOTAL NUMBER OF 'PART NUMBERS' IN THE NO-SUB
147				PART SET

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164 C NW 1 FIXED LENGTH(DAYS) OF SCENARIO
165 C
166 C PTDEP(J,K) 700,24 REAL TOTAL AMOUNT OF INITIAL STOCK FOR PART J
167 C RECEIVED AT THEATER(INCLUDING IN-PLACE STOCK)
168 C BETWEEN DAY 5*W-4 AND DAY 5*W
169 C
170 C CPA(J) 300 REAL THE 'QUANTITY PER APPLICATION' FOR PART J.
171 C I.E. THE STANDARD NUMBER OF ITEMS OF PART J
172 C INSTALLED ON EACH OPERATIONAL ACFT
173 C
174 C RNC(I) 100 REAL AC AVAILABILITY IMPLIED BY STOCKAGE OF
175 C (COMPUTED RQMT + CURRENT INVENTORY) OR BY
176 C STOCKAGE OF ONLY THE CURRENT INVENTORY
177 C
178 C RNC5(IJ) 300 REAL THE SUM OF THE COMPUTED RQMT FOR PART J AND
179 C THE CUM INITIAL STOCK ISSUED/DEPLOYED THRU
180 C DAY I
181 C
182 C SUMR(I) 100 REAL TOTAL STOCKOUTS OVER ALL PARTS IN THE NO-SUB
183 C PART SET, AS CALCULATED DAY I DURING
184 C CAPABILITY ASSESSMENT
185 C
186 C
187 C
188 C
189 C
190 C
191 C
192 C
193 C
194 C
195 C
196 C
197 C
198 C
199 C
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244 C
245 C

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COMMON

AC(120),	ACL(120),	ADESC(120),	ALLOW(120),
AVM(120),	AMS(120),	ASURV(120),	AVAVG(6),
COMDA(300),	BCY(300),	BFI(300),	CASE,
CNCS(120),	CFI(300),	CL,	CMINT,
DCOST(120),	COS(120),	CRNCS(300),	DCOST1(300),
DD(120),	DCY(300),	DE(300),	DMO(300),
FHR(120),	FHA(120),	FHM,	FHPAPD(3,120),
IFS(120),	ICO(120),	IOCC(2),	IFHC(120),
IPT(120),	IMSEL,	INS(300),	INT,
NP,	IRC(300),	IP(300),	ISHORT,
PTDEP(300,24),	NP1,	NP2,	NW,
SM(120,120),	CPA(300),	RNC(120),	RNC5(300),
TRNCS(300),	SRM(120,120),	STN(300),	SUMB(120),
	TST(120),	TSUMB,	

DIMENSION

DMO(120),	FHM(120),	FHM2(120)
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CHARACTER*16

ADESC,	ADSC,	AMSN,	CASE
--------	-------	-------	------

BMAX=1

AVAVG(1)=0

AVAVG(2)=0

IFHNC=0

TSURV=0

INCD=0

DO 100 I=1,NW

TSURV=TSURV+ASURV(I)

SUMR(I)=0

DO 100 K=1,3

100 FHPAPD(K,I)=0

DO 200 J=1,NP

DMO(IJ)=0

DMO(IJ)=0

200 DMO(IJ)=0

XX=ASURV(I)

TAV=0

C THRU STMT 1200 PROCESS EACH DAY

C

DO 1200 I=1,NW

IA=I-1/5+1

C SET RNC5=REQMT +ISSUED INITIAL STOCK THRU DAY I

C

DO 300 J=1,NP

300 RNC5(IJ)=RNC(IJ)+(IND-1)*PTDEP(IJ,IA)/5

C CALCULATE INITIAL ESTIMATED ACFT AVAILABLE THIS DAY AS THOSE AVAILABLE

C YESTERDAY+NEWLY DEPLOYED ACFT. THEN CALCULATE ESTIMATED FLYING HOURS

C ACHIEVED BASED ON THE ESTIMATED ACFT AVAILABLE.

C

IF (I.GT.1) XX=RNC(I-1)*ASURV(I-1)+AC(I)-AC(I-1)

FHA(I)=AMIN(XX,FHM,FHR(I))

IND=0

IF (IND.EQ.1) GO TO 1200

C THRU STMT 500 NO MP5 ACFT ASSESSMENT FOR THE NO-SUB SET.

C ZP=NET DEMAND (BACKORDERS) FROM PART K SUMR(I)= TOTAL NO-SUB BACKORDERS

C TOTAL MP5 ACFT FROM ALL NO-SUB PARTS ON DAY I.

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246 C
247 400 DO 500 K=1,NP2
248     II=INS(K)
249     XX=OMDT(II)
250     OMDT(II)=SR(II,II,XX)
251     ZP=OMDT(II)-RNC(II)
252     SUMB(I)=SUMB(I)+AMAX1(0.,ZP)
253 500 IF (NP1.EQ.0) GO TO 800
254 C
255 C THRU STMT 700 DO NMCS ACFT ASSESSMENT FOR THE FULL-SUB SET.
256 C BOFCS=NET DEMAND (BACKORDERS) FROM PART K/QPA = NMCS ACFT FROM THIS
257 C FULL-SUB PART. BMAX = TOTAL NMCS ACFT FROM ALL FULL-SUB PARTS PROCESSED
258 C
259     BMAX=0.
260     DO 700 K=1,NP1
261         II=IFS(K)
262         XX=OMDT(II)
263         OMDT(II)=SR(II,II,XX)
264         BOFCS=(OMDT(II)-RNC(II))/QPA(II)
265         IF (BOFCS.LE.0.) BOFCS=0.
266         BMAX=AMAX1(BMAX,BOFCS)
267 700 CONTINUE
268 C
269 C CALCULATE AUNCS=TOTAL AVAILABLE (NON-NMCS) ACFT FROM ALL PARTS. THEN
270 C CONVERT IT TO A FRACTION AVAILABLE.
271 C
272 800 AUNCS=AMAX1(0.,ASURV(I)-SUMB(I)-BMAX)
273     FMNC(I)=AMIN1(FHR(I),AUNCS*FHM)
274     FHPAD(3,I)=AMIN1(FHM,FHR(I)/(AUNCS+.01))
275     FMNZ(I)=FMNC(I)/(FHR(I)+.000001)
276     AUNCS=AUNCS/(ASURV(I)+.00001)
277 C
278 C CHECK WHETHER ITERATIONS SHOULD STOP. COMPUTE Z=DIFFERENCE BETWEEN
279 C INITIAL EST FLYING HRS AND CALCULATED FLYING HRS ACHIEVED CHECK
280 C IF Z/(AVG DAILY PGM FLYING HRS).LT. CONVFINPUT). IF SO,
281 C CONVERGENCE IS CLOSE ENOUGH TO TERMINATE ITERATIONS. ALSO CHECK
282 C IF ITERATIONS IS .GE. LIMIT(INPUT). IF SO, STOP ITERATIONS.
283 C
284     Z=ABS(FMNC(I)-FHA(I))
285     INDX=INDX+1
286     IF (INDX.GE.LIMIT.OR.(Z/(TTFH+1.)).LE.(CONVF/NM).OR.INDX.GT.30)
287     * GO TO 1000
288 C
289 C CALC NEW EST FLYING HRS ACHIEVED (USED IN SUBROUTINE SR TO CALC NET DEMAND)
290 C
291     FHA(I)=.5*(FHA(I)+FMNC(I))
292     BMAX=0.
293     SUMB(I)=0.
294 C
295 C RESET CUM DEMAND THRU LAST DAY WHEN A NEW ITERATION IS TO RESUME
296 C
297     DO 900 J=1,NP
298     900 OMDT(J)=OMD(J)
299     GO TO 400
300 1000 TFMNC=TFMNC+FMNC(I)
301     DO 1100 J=1,NP
302 1100 OMD(J)=OMD(J)
303 C
304 C CALC THE AVG DAILY DISCREPANCY(Z) BETWEEN THE STARTING AND ENDING DAILY
305 C FLYING HR ESTIMATES, EXPRESSED AS A % OF AVG DAILY FLYING PGM. ACCUMULATE
306 C THE AVG FRACTION OF THE FLYING PGM THAT IS ACHIEVED (FNC). CALC AVG
307 C ACFT AVAILABILITY (AX) REQUIRED TO ACHIEVE THE DAY'S FLYING HR AND AVAIL
308 C OBJECTIVES
309 C
310     TNCD=TNCD+Z
311     RNC(I)=AUNCS
312     TAV=TAV+RNC(I)*ASURV(I)
313 1200 CONTINUE
314     Z=100.*TNCD/(TFMNC+.001)
315     FNC=TFMNC/TTFH
316     IF (IP.EQ.0) RETURN
317 C
318 C PRINT THE CAPABILITY ASSESSMENT RESULTS ON A DAILY BASIS, W/AVERAGES
319 C
320     DO 1400 I=1,NM
321     SUMB(I)=SUMB(I)/(ASURV(I)+.00001)
322     AX=1.-(ALLOWB(I)/(ASURV(I)+.000001))
323     IF (MOD(I-1,50).NE.0) GO TO 1300
324     WRITE (6,1500) CASE
325     IF ((ICOST.EQ.1.AND.IND.EQ.1) WRITE (6,1600)
326     IF ((ICOST.EQ.1.AND.IND.EQ.2) WRITE (6,1700)
327     IF ((ICOST.EQ.C) WRITE (6,1800) MNTC

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328       IF (ICOST.EQ.1) WRITE (6,1903) CL
329       WRITE (6,2000)
330
331 C      CALC AVG ACFT AVAILABILITY(AVAVG(1)),WEIGHTED BY DAILY NR OF ACFT SURVIVING.
332 C      CALC AVG ACHIEVED PGM FLYING HRS/ACFT/DAY(AVAVG(3)),WEIGHTED BY DAILY NR
333 C      OF ACFT AVAILABLE.
334
335 C
336       WRITE (6,2100) Z
337       WRITE (6,2000)
338       WRITE (6,2200)
339       WRITE (6,2300)
340       WRITE (6,2400)
341       WRITE (6,2000)
342
343 1300   AVAVG(1)=AVAVG(1)+RNC(I)*ASURV(I)/TSURV
344       AVAVG(3)=AVAVG(3)+FHPAPD(3,I)*RNC(I)*ASURV(I)/TAV
345 1400   WRITE (6,2500) I,RNC(I),AX,I,FHNZ(I),FHPAPD(3,I)
346       WRITE (6,2600) AVAVG(1),AVAVG(2),FNC,AVAVG(3)
347       RETURN
348
349 1500   FORMAT (1H1,30X,"CASE= ",A16)
350 1600   FORMAT (/,1X,"** FORCE CAPABILITY WITH CONSTR COST TOTAL ",RQM1
351       + " SOLUTION STOCKED AT RETAIL",//," * INO POST D-DAY PARTS DEPLOYED
352       + " **")
353 1700   FORMAT (/,1X,"** FORCE CAPABILITY WITH CONSTR COST RESIDUAL ",R
354       + " QMT SOLUTION STOCKED & DEPLOYED **")
355 1800   FORMAT (/,1X,"** FORCE CAPABILITY GIVEN THE CURRENT",INV," EN
356       + " TORY STKED & DEPLOYED FOR POLICY",I3," **")
357 1900   FORMAT (///,10X,"COST LIMIT OF",F12.0)
358 2000   FORMAT (/)
359 2100   FORMAT (" TOTAL FLY HRS CONVERGED TO",* WITHIN*,F7.3,* PERCENT*)
360 2200   FORMAT (9X," ACHIEVED",22X," ACHIEVED")
361 2300   FORMAT (11X," ACFT",22X," FRACTION",4X," FLY HRS/AC")
362 2400   FORMAT(6X," DAY",5X," AVAIL",3X," REQ AVAIL",6X," DAY",3X," FH PGM",11X,
363       + "/DAY")
364 2500   FORMAT (5X,I4,5X,F5.3,7X,F5.3,5X,I4,4X,F5.3,6X,F8.1)
365 2600   FORMAT (/," AVERAGES ",4X,F5.3,7X,F5.3,13X,F5.3,10X,F5.1)
366       END

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CAA-D-85-3

(NOT USED)

SUBROUTINE CCLIST

```

1 SUBROUTINE CCLIST (IG,IORD,IND)
2 NAME: CCLIST TYPE: SUBROUTINE
3
4 PURPOSE: THE CCLIST (CONSTRAINED COST REQUIREMENTS LIST) SUBROUTINE
5 PRINTS THE CONSTRAINED COST REQUIREMENTS SOLUTION.
6
7 CALLED BY: MAIN PROGRAM
8
9 CALLS
10 -SUBROUTINE MAXC: ORDERS THE LIST OF REQUIREMENTS TO BE PRINTED
11 OUTPUT - UNIT 6 (PRINT)
12
13 FILES USED :OUTPUT - UNIT 6 (PRINT)
14 INPUT - NONE
15
16 LOCAL ARRAYS : NONE
17
18 ARGUMENTS
19
20 NAME TYPE DESCRIPTION
21
22 IG FIXED INDICATOR TO SUBROUTINE CCLIST OF WHETHER CONSTR
23 COST ALGORITHM 1 (IG=1) OR CONSTR COST ALGORITHM
24 2 (IG=2) WAS USED TO DETERMINE THE FINAL CONST
25 COST SOLUTION
26
27 IND FIXED INDICATOR OF WHETHER TOTAL (INIT STK=0) OR
28 RESIDUAL (INIT STK= 'CURRENT INVENTORY') REQMTS
29 ARE BEING PROCESSED .IND=1 INDICATES TOTAL
30 REQMTS. IND=2 INDICATES RESIDUAL REQMTS.
31
32 IORD FIXED RUN OPTION (INPUT). IF IORD .LE. 0, THEN THE
33 SOLUTION REQMTS LISTS WILL BE ORDERED ACCORDING
34 TO DECREASING UNIT COST OF PART. IF OPT3 .GT. 0
35 THE REQMTS LISTS ARE ORDERED BY (DECREASING)
36 AMOUNT OF SOLUTION REQMT.
37
38 COMMON BLOCK (UNLABELED) ENTRIES
39
40 NAME DIMENSION TYPE DESCRIPTION
41
42 ACL 1 REAL THE AMOUNT ($) OF SUSTAINABILITY DOLLARS,
43 BASED ON THE *CUM REQMT COST THRU DAY N,
44 TABLES, WHICH IS THE CLOSEST APPROXIMATION
45 TO THE INPUT COST LIMIT FOR THE CONSTRAINED
46 COST CASE
47
48 ADESC(IJ) 300 CHAR 16 CHAR DESCRIPTION OF SPARE PART J
49
50 AMSN(IJ) 300 CHAR IDENTIFICATION NR (NSN) OF SPARE PART J
51
52 CASE CHAR CASE ID
53
54 CL 1 REAL THE COST LIMIT (AS SPECIFIED BY INPUT) USED
55 IN THE CONSTRAINED COST REQMTS CASE.
56
57 CMCS(IJ) 300 REAL TOTAL COST OF REQMT FOR PART J USING
58 THE SPECIFIED PART REPLACEMENT POLICY.
59
60 COST(IJ) 300 REAL COST OF A SINGLE ITEM OF PART J. THIS IS
61 ALSO DENOTED AS *PART UNIT COST*.

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164 700 FORMAT (/,21X,' TOTAL (INIT STK=0) STK RQMTS ')
165 800 FORMAT (/,30X,' RESIDUAL (INIT STK=CURR STK) STK RQMTS ')
166 900 FORMAT (/)
167 1000 FORMAT (//,10X,' COST LIMIT OF',F12.0,' APPROXIMATED BY',F12.0,/,/,
168 *10X,' USING A COMBINED (CHEAPEST NO SUB PARTS)/SUSTNBLTY SOL ')
169 1100 FORMAT (//,10X,' COST LIMIT OF',F12.0,' APPROXIMATED BY',F12.0,/,/,
170 *10X,' USING A SUSTAINABILITY SOLUTION FOR COST THRU',I4,' DAYS')
171 1300 FORMAT (10X,' PART NR',17X,' PART',21X,' RQMT',7X,' COST',10X,' COST')
172 1400 FORMAT (2X,15,110,5X,A16,2X,A16,F8.1,F12.0,F6.2,4X)
173 END

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CAA-D-85-3

(NOT USED)

A-30

SUBROUTINE DIST

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SUBROUTINE DIST (IFDAY,ILDAY,DAMT,K)
NAME: DIST TYPE: SUBROUTINE
PURPOSE: THE DIST (PARTS DISTRIBUTION) SUBROUTINE DISTRIBUTES THE
STARTING SPARES STOCK OF A PART TYPE OVER A SERIES OF 5-DAY INTERVALS
CALLED BY: MAIN PROGRAM
CALLS : NONE
FILES USED : NO FILES READ OR WRITTEN

ARGUMENTS
NAME TYPE DESCRIPTION
IFDAY FIXED FIRST DAY OF PERIOD OVER WHICH THE STOCK IS
DISTRIBUTED (THE DISTRIBUTION PERIOD)
ILDAY FIXED LAST DAY OF PERIOD OVER WHICH THE STOCK IS DISTRIBUTED
DAMT REAL AVERAGE AMOUNT OF STOCK DISTRIBUTED EACH DAY DURING
THE DISTRIBUTION PERIOD
K FIXED PART NUMBER OF THE PART BEING DISTRIBUTED

LOCAL ARRAYS : NONE

COMMON BLOCK (UNLABELED) ENTRIES
NAME DIMENSION TYPE DESCRIPTION
PTDEP(I,J,K) 300,24 REAL TOTAL AMOUNT OF INITIAL STOCK FOR PART J
RECEIVED AT THEATER (EXCLUDING IN-PLACE STOCK)
BETWEEN DAY 5+K-4 AND DAY 5+K

COMMON
AC(120), ACL, ADESC(300), ALLOW1(120),
ALLOWB(120), AMSN(300), ASURV(120),
AVH(120), BCY(300), BF(300), AVAVE(6),
CDMDA(300), CF(300), CL, CASE,
CMINT,
CMCS(300), COST(300), CRMCS(300), DCOST(300),
DCOSTF(120), DCY(300), DF(300), DMD(300),
DOD(300), FMA(120), FHM, FMPAPD(3,120),
FHR(120), ICOST, IDCC(2), IFMC(120),
IFS(300), INSEL, INS(300), INT,
IPT(100), IRC(300), IRO(300), ISMORT,
NP, NP1, NP2, NM,
PTDEP(300,24), OPA(300), RNC(120), RNC5(300),
SM(120,100), SRMAX(300), STK(300), SUMB(120),
TRNCS(300), TSTK(300), TSUMB
CHARACTER*16
ADESC, ADSC, AMSN, CASE

CALCULATE :
D1=5-(NR OF DAYS OF DISTRIBUTION IN FIRST 5-DAY INTERVAL OF DISTRIBUTION PERIOD)
DL=NR OF DAYS OF DISTRIBUTION IN LAST 5-DAY INTERVAL OF DISTRIBUTION PERIOD
I1=ORDINAL NR IN FULLWARIOF FIRST 5-DAY INTERVAL IN DISTRIBUTION PERIOD
IL=ORDINAL NR IN FULLWARIOF LAST 5-DAY INTERVAL IN DISTRIBUTION PERIOD

D1=-(11IFDAY-1)/5)*5+IFDAY-1
DL=-(11ILDAY-1)/5)*5+ILDAY
I1=MIND(24,(11IFDAY-1)/5+1)
IL=MIND(24,(11ILDAY-1)/5+1)
IF (I1.LT.IL) GO TO 100
PTDFP(K,I1)=PTDEP(K,I1)+(DL-D1)*DAMT
RETURN
100 DO 200 I=I1,IL
IF (1.EQ.I1) PTDEP(K,I)=PTDEP(K,I)+(5.-D1)*DAMT

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82      IF (I.EQ.IL) PTDEP(K,I)=PTDEP(K,I)+DL*DAMT
83      IF (I.GT.II.AND.I.LT.IL) PTDEP(K,I)=PTDEP(K,I)+S.*DAMT
84      200 CONTINUE
85      RETURN
86      END
```

SUBROUTINE MAXC

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1  SUBROUTINE MAXC (NDUMHY,NOUT)
2  NAME: MAXC TYPE: SUBROUTINE
3  PURPOSE: THE MAXC SUBROUTINE FINDS THE SUBSCRIPT OF THE LARGEST IN VALUE
4  MEMBER OF AN ARRAY (DOD(J))
5
6  CALLED BY:
7  - MAIN PROGRAM
8  - SUBROUTINE UCROPS
9  - SUBROUTINE CCLIST
10
11 CALLS : NONE
12
13 FILES USED : NO FILES READ OR WRITTEN
14
15 ARGUMENTS
16
17 NAME TYPE DESCRIPTION
18
19 NDUMHY FIXED THE NR OF ITEMS IN THE ARRAY BEING PROCESSED
20
21 NOUT FIXED THE SUBSCRIPT ASSOCIATED WITH THE LARGEST VALUE
22 IN ARRAY DOD(J) AT EACH CALL OF THIS SUBROUTINE
23
24 LOCAL ARRAYS : NONE
25
26 COMMON BLOCK (UNLABELED) ENTRIES
27
28 NAME DIMENSION TYPE DESCRIPTION
29
30 DOD(J) 300 REAL ARRAY STORING THE ATTRIBUTE TO BE SORTED ON
31 IN SUBROUTINE MAXC. IN MAIN PGM, THIS HAS PART
32 UNIT COST FOR PART J. IN SUBROUTINES CCLIST &
33 UCROPS, THIS HAS THE AMOUNT OF THE SOLUTION
34 REQMT FOR PART J.
35
36 COMMON
37 AC(120), ACL, AOESC(300), ALLOW1(120),
38 ALLONB(120), AMSN(300), ASURV(120), AVAV6(6),
39 AVN(120), BCY(300), BF(300), CASE,
40 CDMOA(300), CF(300), CL, CHINT,
41 CNCS(300), COST(300), CRNCS(300), OCOST1(300),
42 OCGSTF(120), OCY(300), OF(300), DMO(300),
43 DOD(300), FMA(120), FHM, FHPAPO(3,120),
44 FHR(120), ICOST, IDCC(2), IFHC(120),
45 IFS(300), INSEL, INS(300), INT,
46 IPT(100), IRC(300), IPQ(300), ISHORT,
47 NP, NP1, NP2, NM,
48 PTOEP(300,24), OPA(300), RNC(120), RNC5(300),
49 SH(120,100), SRMAX1(300), STR(300), SUMB(120),
50 TRNCS(300), TSTK(300), TSUMB
51
52 CHARACTER*16
53 ADESC, ADSC, AMSN, CASE
54
55 SHAX=-1.
56 JMAX=1
57 DO 100 J=1,NDUMHY
58 I=DOD(J)
59 ZMAX=ZMAX1(SHAX,I)
60 IF (ZMAX.LE.SHAX) GO TO 100
61 JMAX=J
62 SHAX=ZMAX
63
64 100 CONTINUE
65 NOUT=JMAX
66 RETURN
67 END

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CAA-D-85-3

(NOT USED)

SUBROUTINE NCRNCT

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1  SUBROUTINE NCRNC (ND,I2,IND)
2  NAME: NCRNC      TYPE: SUBROUTINE
3
4  PURPOSE: THE NCRNC (NO CANNIBALIZATION REQUIREMENTS) SUBROUTINE
5  GENERATES A LEAST COST REQMTS MIX OF SPARE PARTS NEEDED TO ACHIEVE A
6  FLEET FLYING HR PROGRAM/AVAILABILITY OBJECTIVE USING A USER-SPECIFIED
7  PARTS REPLACEMENT POLICY AND UNCONSTRAINED COSTS.
8
9  CALLED BY: SUBROUTINE UCROPS
10
11  CALLS
12  -FUNCTION SR: COMPUTES CUMULATIVE NET DEMAND THRU A SPECIFIED DAY
13  FOR A SPECIFIED PART
14
15  FILES USED : NO FILES READ OR WRITTEN
16
17
18  ARGUMENTS
19
20  NAME          TYPE          DESCRIPTION
21  ND            FIXED        CURRENT DAY BEING PROCESSED
22
23  I2            FIXED        NR OF ALLOWABLE NMCS ACFT ASSOCIATED WITH THE
24  NO-SUB PART SET AT THIS STAGE OF THE REQMT ALGORITHM
25
26  IND           FIXED        INDICATOR OF WHETHER TOTAL (INIT STK=0) OR
27  RESIDUAL (INIT STK=CURRENT INVENTORY) REQMTS
28  ARE BEING PROCESSED .IND=1 INDICATES TOTAL
29  REQMTS. IND=2 INDICATES RESIDUAL REQMTS.
30
31
32  LOCAL ARRAYS
33
34  NAME          DIMENSION  TYPE          DESCRIPTION
35  SUMBZ(I)      120      REAL          CUMULATIVE RAW (INIT STK=0) DEMANDS
36  (ALL PARTS) THRU DAY I
37
38  SUMP(I)        120      REAL          TOTAL UNITS(ALL PARTS) STOCKED IN EXCESS
39  OF EXPECTED DEMAND ON DAY I)
40
41
42  COMMON BLOCK (UNLABELED) ENTRIES
43
44  NAME          DIMENSION  TYPE          DESCRIPTION
45
46  ALLOW(I)      120      REAL          THE "ALLOWABLE NMCS ACFT" FOR THE NO-SUB
47  SET ON DAY I, COMPUTED AFTER DAY I IS PROCESSED.
48  AFTER IT IS CALCULATED FOR DAY I, IT IS FIXED
49  DURING ITERATIVE CALCULATIONS (INVOLVING DAYI)
50  FOR NO-SUB REQMTS ON LATER DAYS.
51
52  ALLOWB(I)     120      REAL          MAXIMUM ALLOWABLE NMCS AC ON DAY I WHICH
53  WILL STILL ALLOW ACHIEVMENT OF CASE OBJECTIVE
54  (FLYING HOUR AND AVAILABILITY) ON DAY I
55
56  CONDA(J)      300      REAL          ARRAY USED TO STORE THE CUMULATIVE NET DEMAND
57  (BASED ON INITIAL STK=0) FOR PART J ON THE
58  SCENARIO DAY BEING PROCESSED
59
60  CRNCS(IJ)     300      REAL          THE UNCONSTRAINED COST SOLUTION REQMT FOR
61  PART J AT ANY STAGE OF THE PARTIAL SUB
62  REQUIREMENT CALCULATION ALGORITHM.
63
64  INSI(J)       300      FIXED        ARRAY STORING THE PARCOM PART NUMBERS OF THE
65  PARTS IN THE NO-SUB PART SET.
66
67  INT           1        FIXED        THE INTERVAL AT WHICH THE PARTIAL SUB
68  COMPUTATION ALGORITHM (ROUTINE UCROPS)
69  INCREMENTS VALUES FOR "ALLOWABLE NMCS ACFT"
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AT EACH STAGE OF CALCULATION OF SEPARATE REQMT SOLUTIONS FOR THE FULL-SUB SET AND THE NO-SUB SET. ALWAYS SET=1 FOR RELIABLE RESULTS. ITS VALUE IS SET =1 IN THE PROGRAM CODE.

NP2 1 FIXED TOTAL NUMBER OF *PART NUMBERS* IN THE NO-SUB PART SET

RNCST(J) 300 REAL TOTAL REQMT(INIT STK=0) FOR PART J USING A *NO SUBSTITUTION* REPLACEMENT POLICY WITH UNCONSTRAINED COST

TSUMB 1 REAL THE TOTAL NET STOCKOUT FROM ALL NO-SUB PARTS PROCESSED AT ANY STAGE OF THE NO-SUB REQMTS CALCULATION PORTION OF THE PARTIAL SUB REQMT ALGORITHM

COMMON
 * AC(120), ACL,
 * ALLOWB(120), AMSN(300), ADESC(300), ALLOW1(120),
 * AVH(120), BCY(300), ASURV(120), AVAVG(6),
 * CDMOA(300), CF(300), BF(300), CASE,
 * CNCS(300), COST(300), CL, CHINT,
 * DCOSTF(120), DCY(300), CRNCS(300), DCOST(1300),
 * DOD(300), FHA(120), DF(300), DMO(300),
 * FHR(120), ICOST, FHM, FHPAP(3,120),
 * IFS(300), IMSEL, IDCC(2), IFHC(120),
 * IPT(100), IRC(300), INS(300), INT,
 * NP, NP1, IRO(300), ISHORT,
 * PTOFP(300,24), QPA(300), RNC(120), NW,
 * SM(120,100), SRMAY1(300), RNCST(300),
 * TRNCS(300), TSTK(300), STK(300), SUMB(120),
 * TSUMB
 DIMENSION
 * SUMBZ(120), SUMP(120)
 * CHARACTER*16
 * ADESC, ADSC, AMSN, CASE
 NA=ALLOWB(ND)*.5
 IF (I2.LT.NA) 60 TO 200
 SUMP=0.
 TSUMB=0.
 DO 100 L=1,NO
 SUMP(L)=0.
 100 SUMBZ(L)=0.
 200 TOTZ=0.

ALL PARTS ARE PROCESSED FOR THIS DAY(ND) IN THE FOLLOWING LOOP

DO 700 K=1,NP2
 II=INSIK)

MAKE A DIRECT CALCULATION OF NET DEMAND(BASED ON INIT STK=0) ONLY FOR THE COMBINATION (II, I2) IN WHICH ALLOWED NMCS ACFT FOR THE NO-SUB PARTS(I2)=ALLOWED NMCS ACFT FOR ALL PARTS(ALLOWB(ND)) OTHERWISE DO A SHORT-CUT CALCULATION

IF (I2.LT.NA) 60 TO 400
 CDMOA(II)=0.

ASSUME THAT THE (PREVIOUSLY COMPUTED) MIN REQMT(RNCS) PLUS ISSUED STOCK AS OF THIS DAY(ITSK) ARE *BOUGHT*, I.E. THESE ARE *SUNK* COSTS.

CRNCS(II)=RNCS(II)
 IF (IND.EQ.2) CRNCS(II)=TSTK(II)+RNCS(II)

FOR EACH PART, RECURSIVELY COMPUTE THE EFFECTS OF REQMT *BUYS* THRU ALL DAYS UP TO CURRENT DAY I IN THE FOLLOWING LOOP.

CALC CUMULATIVE NET DEMAND (CMD) FOR PART II THRU DAY I. THEN CALC (SUMBZ(II)) TOTAL NET DEMAND THRU DAY I OVER THE K MOST EXPENSIVE PART TYPES. FINALLY CALC (TSUMB) THE NET TOTAL STOCKOUT (*MOLES*) THRU DAY I AND SET THE REQMT FOR PART II= THE DIFFERENCE BETWEEN THE NET TOTAL STOCKOUT AND THE ALLOWABLE STOCKOUT(ALLOWB(II)). THIS CALC IMPLICITLY ASSUMES (THRU SUMP) THAT THE REQMTS FOR THE (K-1) MOST EXPENSIVE PARTS HAVE BEEN COMPUTED AND BOUGHT.

DO 300 I=1,NO
 CMD=CDMOA(II)
 CDMOA(II)=SRIT,II,CMD)
 IF (IND.EQ.2) SUMP(I)=SUMP(I)+AMAX1(0.,(CRNCS(II)-CDMOA(II)))
 SUMBZ(II)=SUMBZ(II)+CDMOA(II)

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164      TSUMB=AMAX1(SUMBZ(I)-SUMR+SUMP(I),0.)
165      IF ((TSUMB-CRNC(I))>.GE.ALLOW(I)) CRNC(I)=TSUMB-ALLOW(I)
166 300 CONTINUE
167 C
168 C CALC (SUMR) TOTAL UNITS STOCK REQUIRED FOR THE K MOST EXPENSIVE
169 C PARTS
170 C
171      SUMR=SUMR+CRNC(I)
172      GO TO 700
173 C
174 C THE FOLLOWING IS THE SHORT-CUT CALCULATION OF REQMTS FOR THE NO-SUB
175 C CASE, GIVEN THE THE BASE REQMT, I.E. THE DIRECTLY COMPUTED NO-SUB
176 C REQMT FOR THE CASE WITH ALLOWED NMCS ACFT FOR THE NO-SUB SET(I2)=NA,
177 C THEN, IF N FEWER NMCS ACFT ARE ALLOWED (FOR THE NO-SUB SET), THE
178 C COST EFFECTIVE APPROACH IS TO BUY N MORE OF THE CHEAPEST PARTS WHOSE
179 C REQMTS IN THE BASE(I2=NA) SOLUTION(=INIT STK) ARE .LT. THEIR NET DEMAND.
180 C FRACTIONAL REQMTS IN THE BASE SOLUTION COMPLICATED THE PROGRAMMING.
181 C
182 400 ZINT=MIN0(INT,NA-I2)
183      IF (I2>.GE.(TSUMB+.5)) RETURN
184      IL=INS(NP2-K+1)
185      IF ((CRNC(IL)+(IND-1)*ZINT+TSTK(IL))>.GE.COMDA(IL)) GO TO 700
186      Z=CRNC(IL)+ZINT
187      TZ=Z+(IND-1)*ZINT+TSTK(IL)-COMDA(IL)
188      IF (TZ>.LE.0) GO TO 500
189      CRNC(IL)=COMDA(IL)-(IND-1)*ZINT+TSTK(IL)
190      TOTZ=TOTZ+ZINT-TZ
191      IF (TOTZ>.LT.ZINT) GO TO 700
192      CRNC(IL)=CRNC(IL)-TOTZ+ZINT
193      GO TO 600
194 500 CRNC(IL)=CRNC(IL)+AMIN1(ZINT-TOTZ,ZINT)
195 600 TSUMB=TSUMB-ZINT
196      RETURN
197 700 CONTINUE
198      IF (I2>.EQ.NA) TSUMB=TSUMB-CRNC(I)
199      IF (I2>.LT.NA.OR.IND>.EQ.1) RETURN
200 C
201 C FOLLOWING CONVERTS REQMT TO AN ADD-ON(RESIDUAL) REQMT BY SUBTRACTING
202 C OUT INITIAL STOCK(TSTK)ISSUED THRU THIS DAY(ND)
203 C
204      DO 800 K=1,NP2
205          J=INS(K)
206 800 CRNC(J)=CRNC(J)-TSTK(J)
207      RETURN
208      END

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CAA-D-85-3

(NOT USED)

SUBROUTINE UCCAP

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1  SUBROUTINE UCCAP (IND)
2  NAME: UCCAP TYPE: SUBROUTINE
3
4  PURPOSE: THE UCCAP (UNCONSTRAINED COST CAPABILITY ASSESSMENT) SUBROUTINE
5  COMPUTES FLEET CAPABILITY (AVG AVAILABILITY, PGM FLYING HRS/ACFT/DAY) BASED
6  ON THE UNCONSTRAINED COST SOLUTION REQMT BEING STOCKED IN THE WAR RESERVE
7
8  CALLED BY: MAIN PROGRAM
9
10 CALLS
11 -FUNCTION SR: COMPUTES CUMULATIVE NET DEMAND THRU A SPECIFIED DAY
12 FOR A SPECIFIED PART
13
14 FILES USED : INPUT - NONE
15 OUTPUT - UNIT 6 (PRINT)
16
17 ARGUMENTS
18
19 NAME TYPE DESCRIPTION
20
21 IND FIXED INDICATOR OF WHETHER TOTAL (INIT STK=0) OR
22 RESIDUAL (INIT STK= "CURRENT INVENTORY") REQMTS
23 ARE BEING PROCESSED. IND=1 INDICATES TOTAL
24 REQMTS. IND=2 INDICATES RESIDUAL REQMTS.
25
26 LOCAL ARRAYS : NONE
27
28 COMMON BLOCK (UNLABELED) ENTRIES
29
30 NAME DIMENSION TYPE DESCRIPTION
31
32 ALLOWB(I) 120 REAL MAXIMUM ALLOWABLE NMCS AC ON DAY I WHICH
33 WILL STILL ALLOW ACHIEVEMENT OF CASE OBJECTIVE
34 (FLYING HOUR AND AVAILABILITY) ON DAY I
35
36 ASURV(I) 120 REAL NR AC SURVIVING (NOT ATTRITTED) ON DAY I
37
38 AVAVG(I) 6 REAL AVAVG(1)=AVG ACFT AVAIL FROM CAPABILITY
39 ASSESSMENT, BASED ON STOCKAGE OF EITHER
40 CURR INV OR (CURR INV + COMPUTED ADD-ON
41 REQMTS SOLUTION)
42
43 AVAVG(2)=AVG MIN ACFT REQ'D TO ACHIEVE
44 THE FLYING HR/AVAILABILITY OBJECTIVE.
45
46 AVAVG(3)=AVG FLY HR/AVAIL ACFT / DAY
47 FROM CAPABILITY ASSESSMENT, BASED ON
48 EITHER CURR INV OR (CURR INV + THE SOLUTION
49 REQMT) BEING STOCKED.
50
51 AVH(I) 120 REAL AC AVAILABILITY CONSTRAINT (MIN REQUIRED
52 NON-NMCS ACFT) FOR DAY I.
53
54 CASE CHAR CASE ID
55
56 COMDA(J) 300 REAL ARRAY USED TO STORE THE CUMULATIVE NET DEMAND
57 (BASED ON INITIAL STK=0) FOR PART J ON THE
58 SCENARIO DAY BEING PROCESSED
59
60 DMD(J) 300 REAL WORKING VARIABLE USED IN CALCULATION OF
61 NET DEMAND (SR(I,J,...)) FOR PART J ON DAY I
62 DURING CAPABILITY ASSESSMENT.
63 WHEN (CUM) NET DMD THRU DAY I IS BEING
64 CALCULATED, DMD(J) IS (CUM) NET DMD THRU THE
65 PREVIOUS DAY.
66
67 DOD(J) 300 REAL ARRAY STORING THE ATTRIBUTE TO BE SORTED ON
68 IN SUBROUTINE MAXC. IN MAIN PGM, THIS WAS PART
69 UNIT COST FOR PART J. IN SUBROUTINE CCLIST &
70 UCRQPS, THIS WAS THE AMOUNT OF THE SOLUTION
71 REQMT FOR PART J.
72
73 FHM REAL MAXIMUM FLYING HRS PER ACFT PER DAY (INPUT)
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AD-A152 530

EXTENDED PARTS REQUIREMENTS AND COST MODEL (PARCOM)
FUNCTIONAL DESCRIPTIO. (U) ARMY CONCEPTS ANALYSIS
AGENCY BETHESDA MD W J BAUMAN MAR 85 CAA-D-85-3

2/2

UNCLASSIFIED

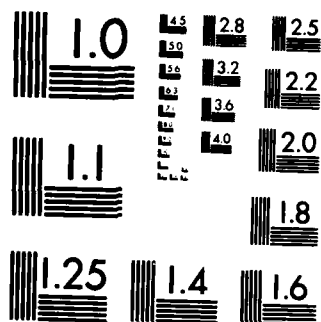
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MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

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87 FHPAPO(K,I) 3.120 REAL FHPAPO(1,I)=FLYING HRS PER AVAILABLE ACFT PER
88 FOR DAY I UNDER THE SPECIFIED REPLACEMENT
89 POLICY BASED ON STOCKING (CURRENT INV *
90 THE UNCONSTRAINED COST SOLUTION)
91
92 FHPAPO(3,I)=FLYING HRS PER AVAILABLE ACFT PER
93 FOR DAY I UNDER THE SPECIFIED REPLACEMENT
94 POLICY STOCKING EITHER CURRENT INVENTORY OR
95 (CURR INV * THE CONSTRAINED COST SOLUTION)
96
97 FMR(I) 120 REAL FLEET PROGRAM FLYING HOURS REQUIRED ON DAY I
98 (ACCORDING TO THE INPUT FLYING HR PROGRAM)
99
100 IFNC(I) 120 FIXED INDICATOR TELLING WHICH CONSTRAINT, FLY HR PGM
101 (IFNC(I)=0) OR ACFT AVAILABILITY (IFNC(I)=1),
102 DETERMINES REQUIRED DAILY FLEET AVAILABILITY
103 FOR DAY I
104
105 IFS(I) 300 FIXED ARRAY STORING THE PARCOM PART NUMBERS OF THE
106 PARTS IN THE FULL-SUB PART SET.
107
108 INS(I) 300 FIXED ARRAY STORING THE PARCOM PART NUMBERS OF THE
109 PARTS IN THE NO-SUB PART SET.
110
111 NP 1 FIXED NR OF PART TYPES PROCESSED IN RUN. (THIS
112 EXCLUDES PART TYPES WITH ESSENTIALITY CODE
113 .LE. 1ESS OR WITH A ZERO FAILURE RATE)
114
115 NP1 1 FIXED TOTAL NUMBER OF 'PART NUMBERS' IN THE FULL-SUB
116 PART SET
117
118 NP2 1 FIXED TOTAL NUMBER OF 'PART NUMBERS' IN THE NO-SUB
119 PART SET
120
121 NM 1 FIXED LENGTH(DAYS) OF SCENARIO
122
123 PTDEP(J,K) 300.24 REAL TOTAL AMOUNT OF INITIAL STOCK FOR PART J
124 RECEIVED AT THEATER (EXCLUDING IN-PLACE STOCK)
125 BETWEEN DAY 54K-4 AND DAY 54K
126
127 QPA(I) 300 REAL THE 'QUANTITY PER APPLICATION' FOR PART J.
128 I.E. THE STANDARD NUMBER OF ITEMS OF PART J
129 INSTALLED ON EACH OPERATIONAL ACFT
130
131 RNC(I) 120 REAL AC AVAILABILITY WHEN TOTAL REQ(INIT STK=0)
132 IS STOCKED USING A 'NO SUBSTITUTION'
133 REPLACEMENT POLICY WITH UNCONSTRAINED COST
134
135 RNC(I) 300 REAL TOTAL REQMT(INIT STK=0) FOR PART J USING A
136 'NO SUBSTITUTION' REPLACEMENT POLICY
137 WITH UNCONSTRAINED COST
138
139 STR(I) 300 REAL INITIAL SERVICEABLE STOCK OF PART J. IT IS THE
140 SERVICEABLE WAR RESERVE * (IN-PLACE ASL/PLL
141 ON DAY 1)
142
143 SUNB(I) 120 REAL TOTAL STOCKOUTS OVER ALL PARTS IN THE NO-SUB
144 PART SET AS CALCULATED DAY 1 DURING
145 CAPABILITY ASSESSMENT
146
147 TSTR(I) 300 REAL THE CUMULATIVE STOCK DEPLOYED FOR PART J ON
148 THE DAY BEING PROCESSED
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COMMON

AC(120),	ACL,	ADESC(300),	ALLOW(120),
ALLOWB(120),	AMSN(300),	ASURV(120),	AVAVB(16),
AVM(120),	BCY(300),	BF(300),	CASE,
CDMDA(300),	CF(300),	CL,	CHINT,
CNCS(300),	COST(300),	CRNC(300),	OCOST(1300),
OCOST(120),	OCY(300),	OF(300),	OMOI(300),
ODD(300),	FMA(120),	FMR,	FHPAPO(3,120),
FMR(120),	ICOST,	IDCC(12),	IFNC(120),
IFS(300),	INSEL,	INS(300),	INT,
IP(100),	IRC(300),	IRI(300),	ISHORT,
NP,	NP1,	NP2,	NM,
PTDEP(300,24),	QPA(300),	RNC(120),	RNC(300),
SH(120,100),	SRMAX(1300),	STR(300),	SUNB(120),
TRNC(300),	TSTR(300),	TSUM,	
CHARACTER=16			
ADESC,	AOSC,	AMSN,	CASE,
RAV			

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164 TAV=0.
165 TAV1=0.
166 DO 100 I=1,NP
167 TSTK(I)=STK(I)
168 DOD(I)=0.
169 100 DMD(I)=0.
170 DO 300 L=1,NW
171 DO 200 I=1,3
172 FMPAPD(I,L)=0.
173 200 SUMB(I)=0.
174 DO 400 I=1,3
175 AVAVG(I)=0.
176
177 C THRU STMT 1000 PROCESS EACH DAY I
178 C
179 DO 1000 I=1,NW
180 IA=(I-1)/5+1
181
182 C SET TSTK(I)= ISSUED INITIAL STK THRU DAY I
183 C
184 DO 500 J=1,NP
185 500 TSTK(J)=TSTK(J)+PTDEP(J,IA)/5.
186 BMAX=0.
187 IF (NP2.EQ.0) GO TO 700
188
189 C THRU STMT 500 DO NMCS ACFT ASSESSMENT FOR THE NO-SUB SET.
190 ZP=NET DEMAND (BACKORDERS)FROM PART K SUMB(I)= TOTAL NO-SUB BACKORDERS
191 C =TOTAL NMCS ACFT FROM ALL NO-SUB PARTS ON DAY I.
192 C
193 DO 600 K=1,NP2
194 II=INS(K)
195 X=DMD(II)
196 DMD(II)=SR(I,II,X)
197 ZP=RNCS(II)
198 IF (IND.EQ.2) ZP=RNCS(II)+TSTK(II)
199 600 SUMB(I)=SUMB(I)+AMAX1(0.,DMD(II)-ZP)
200 700 IF (NP1.EQ.0) GO TO 900
201
202 C THRU STMT 700 DO NMCS ACFT ASSESSMENT FOR THE FULL-SUB SET.
203 BOFCS=NET DEMAND (BACKORDERS)FROM PART K/OPA = NMCS ACFT FROM THIS
204 C FULL-SUB PART. BMAX = TOTAL NMCS ACFT FROM ALL FULL-SUB PARTS PROCESSED
205 C
206 DO 800 K=1,NP1
207 II=IFS(K)
208 X=DMD(II)
209 DMD(II)=SR(I,II,X)
210 ZP=RNCS(II)
211 IF (IND.EQ.2) ZP=RNCS(II)+TSTK(II)
212 BOFCS=(DMD(II)-ZP)/OPA(II)
213 IF (BOFCS.LE.0.) BOFCS=0.
214 BMAX=AMAX1(BMAX,BOFCS)
215 800 CONTINUE
216
217 C CALC ACFT AVAILABLE (RNC(I)) FOR DAY I AS SURVIVING ACFT-TOTAL COMBINED
218 C (ALL PARTS) NMCS ACFT. CALC PGM FLYING HRS/ACFT/DAY=FMPAPD(1,I) AND
219 C ACCUMULATE (TAV1) THE ACFT AVAILABLE.
220 C
221 900 RNC(I)=AMAX1(0.,ASURV(I)-BMAX-SUMB(I))/(ASURV(I)+.00001)
222 FMPAPD(1,I)=AMIN1(FHM,FHR(I)/(ASURV(I)-BMAX-SUMB(I)+.0001)
223 TAV1=TAV1+RNC(I)+ASURV(I)
224 1000 CONTINUE
225 TSURV=0.
226
227 C PRINT THE TABLE OF DAILY UNCONSTR COST CAPABILITY ASSESSMENT W/AVGS
228 C
229 DO 1200 I=1,NW
230 AX=1.-(ALLOWB(I)/(ASURV(I)+.000001))
231 IF (MOD(I-1,50).NE.0) GO TO 1100
232 WRITE (6,1400) CASE
233 WRITE (6,1500)
234 IF (IND.EQ.1) WRITE (6,1600)
235 IF (IND.EQ.2) WRITE (6,1700)
236 WRITE (6,1800)
237 WRITE (6,1800)
238 WRITE (6,1950)
239 WRITE (6,2000)
240 WRITE (6,2100)
241 WRITE (6,1800)
242 1100 TSURV=TSURV+ASURV(I)
243
244 C CALC AVG ACFT AVAILABLE (AVAVG(1)),WEIGHTED BY DAILY NR OF ACFT SURVIVING.
245 C CALC AVG PGM FLYING HRS/ACFT/DAY (AVAVG(3)),WEIGHTED BY DAILY NR OF ACFT

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246 C AVAILABLE.
247 C
248     AVAVG(1)=AVAVG(1)+RNC(I)*ASURV(I)
249     AVAVG(2)=AVAVG(2)+AX*ASURV(I)
250     AVAVG(3)=AVAVG(3)+FHPAPD(1,I)*RNC(I)*ASURV(I)/(TAV1+.0001)
251     RAV=" FLYING HP PROG"
252     IF (IFHC(I).EQ.1) RAV=" AVAIL CONSTRAIN"
253 1200 WRITE (6,2200) I,RNC(I),AX,RAV,AVH(I),FHPAPD(1,I),I
254     DO 1300 K=1,2
255 1300 AVAVG(K)=AVAVG(K)/TSURV
256     WRITE (6,2300) (AVAVG(K),K=1,3)
257     RETURN
258 1400 FORMAT (1H1,30X,"CASE= ",A16)
259 1500 FORMAT (/,1X,"** FORCE CAPABILITY GIVEN THAT THE COMPUTED",* REQU
260     *IREMENT (FOR EACH POLICY) IS STOCKED **")
261 1600 FORMAT (//,1X,"** ASSUMES TOTAL(INIT ST(=0) REQMTS",* STOCKED AT
262     *RETAILING POST O-DAY PARTS DEPLOYED) **")
263 1700 FORMAT (//,15X,"** CASES ASSUME RESIDUAL(INIT STK=CURR STK)",* RE
264     *QMTS ARE STOCKED AND DEPLOYED **")
265 1800 FORMAT (/)
266 1950 FORMAT (/,16X,"AIRCRAFT AVAILABILITY",27X,"ACHIEVED")
267 2000 FORMAT (21X,"ACHIEVED",33X,"FLY HRS/AC")
268 2100 FORMAT (14X,"DAY",6X,"AVAIL",* REQ AVAIL AVAIL",* SOURCE",* AVAI
269     *L",6X,"/DAY",5X,"DAY")
270 2200 FORMAT (14X,14,F10.3,6X,F5.3,A16,F5.2,F10.1,18)
271 2300 FORMAT (/,1X," AVERAGE=",10X,F5.3,6X,F5.3,21X,F10.1)
272     END

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SUBROUTINE UCRQPS

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1      SUBROUTINE UCRQPS (IND,IOP14,IOP15,IORD)
2      NAME: UCRQPS      TYPE: SUBROUTINE
3
4      PURPOSE: THE UCRQPS (UNCONSTRAINED COST ROMNTS-PARTIAL SUBSTITUTION)
5      SUBROUTINE COMPUTES AND PRINTS THE LEAST COST ROMNTS MIX OF SPARE PARTS
6      PARTS NEEDED, GIVEN UNCONSTRAINED FUNDS, TO ACHIEVE THE CASE OBJECTIVE
7
8      CALLED BY: MAIN PROGRAM
9
10     CALLS
11     -FUNCTION SR: COMPUTES CUMULATIVE NET DEMAND THRU A SPECIFIED DAY
12     FOR A SPECIFIED PART
13     -SUBROUTINE MAXC: ORDERS LIST OF PART ROMNTS TO BE PRINTED
14     -SUBROUTINE NCRNC: COMPUTES THE ROMNT SOLUTION FOR THE "NO SUB" PART
15     SET AND A SPECIFIC ALLOWED STOCKOUT FOR THAT SET
16
17     FILES USED : INPUT - NONE
18                  OUTPUT - UNIT 6 (PRINT)
19
20     ARGUMENTS
21
22     NAME          TYPE          DESCRIPTION
23
24     IND            FIXED        INDICATOR OF WHETHER TOTAL (INIT STK=0) OR
25     RESIDUAL (INIT STK=CURRENT INVENTORY) REQMTS
26     ARE BEING PROCESSED. IND=1 INDICATES TOTAL
27     REQMTS. IND=2 INDICATES RESIDUAL REQMTS.
28
29     IOP14          FIXED        RUN OPTION (INPUT). IF IOP14 .LE. 0, THEN THE
30     UNCONSTN COST SOLUTION REQMTS LIST WILL NOT
31     BE PRINTED (BUT WILL BE COMPUTED INTERNALLY).
32     IF IOP14 .GT. 0 THE LIST WILL BE PRINTED.
33
34     IOP15          FIXED        RUN OPTION (INPUT). IF IOP15 .LE. 0, THEN THE
35     CUMULATIVE (UNCONSTN COST) REQMTS COSTS THRU
36     DAY N° LIST WILL NOT BE PRINTED. IF IOP15 .GT. 0
37     THE LIST WILL BE PRINTED.
38
39     IORD           FIXED        RUN OPTION (INPUT). IF IORD .LE. 0, THEN THE
40     SOLUTION REQMTS LISTS WILL BE ORDERED ACCORDING
41     TO DECREASING UNIT COST OF PART. IF IOP15 .GT. 0
42     THE REQMTS LISTS ARE ORDERED BY (DECREASING)
43     AMOUNT OF SOLUTION REQMT.
44
45     LOCAL ARRAYS
46
47     NAME          DIMENSION  TYPE          DESCRIPTION
48     RMIN(IJ)      300        REAL          STORES EITHER 0 OR CRNC(IJ) FOR PART J
49
50     COMMON BLOCK (UNLABELED) ENTRIES
51
52     NAME          DIMENSION  TYPE          DESCRIPTION
53
54     ACL           1          REAL          THE AMOUNT(S) OF SUSTAINABILITY DOLLARS,
55     BASED ON THE "CUM REQMT COST THRU DAY N°
56     TABLES WHICH IS THE CLOSEST APPROXIMATION
57     TO THE INPUT COST LIMIT FOR THE CONSTRAINED
58     COST CASE
59
60     ADESC(IJ)     300        CHAR          16 CHAR DESCRIPTION OF SPARE PART J
61
62     ALLOW(IJ)     120        REAL          THE "ALLOWABLE NRCS ACFT" FOR THE NO-SUB
63     SET ON DAY I, COMPUTED AFTER DAY I IS PROCESSED.
64     AFTER IT IS CALCULATED FOR DAY I, IT IS FIXED
65     DURING ITERATIVE CALCULATIONS (INVOLVING DAYI)

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1000	ALLOWB(I)	120 REAL	FOR NO-SUB REQMTS ON LATER DAYS.
1001			MAXIMUM ALLOWABLE NMCS AC ON DAY I WHICH
1002			WILL STILL ALLOW ACHIEVEMENT OF CASE OBJECTIVE
1003			(FLYING HOUR AND AVAILABILITY) ON DAY I
1004	AMSN(J)	300 CHAR	IDENTIFICATION NR(NSN) OF SPARE PART J
1005	CASE	CHAR	CASE ID
1006	CDMDA(I)	300 REAL	ARRAY USED TO STORE THE CUMULATIVE NET DEMAND
1007			(BASED ON INITIAL STK=0) FOR PART J ON THE
1008			SCENARIO DAY BEING PROCESSED
1009	CL	1 REAL	THE COST LIMIT (AS SPECIFIED BY INPUT) USED
1010			IN THE CONSTRAINED COST REQMTS CASE.
1011	CMINT	1 REAL	TOTAL COST OF THE REQMT FOR THE UNCONSTRAINED
1012			COST CASE
1013	CNCS(I)	300 REAL	TOTAL COST OF REQMT FOR PART J USING
1014			THE SPECIFIED PART REPLACEMENT POLICY.
1015	COST(I)	300 REAL	COST OF A SINGLE ITEM OF PART J. THIS IS
1016			ALSO DENOTED AS "PART UNIT COST".
1017	CRNCS(I)	300 REAL	THE UNCONSTRAINED COST SOLUTION REQMT FOR
1018			PART J AT ANY STAGE OF THE PARTIAL SUB
1019			REQUIREMENT CALCULATION ALGORITHM.
1020	DCOST1(I)	120 REAL	THE TOTAL CUMULATIVE REQMTS COST THRU DAY I
1021			FOR THE FULL SUB PARTS ONLY. I.E. THIS IS
1022			THE PORTION OF THE "CUM REQMTS COST THRU DAY N"
1023			ENTRY WHICH IS ASSOCIATED WITH THE FULL SUB
1024			PART SET.
1025	DCOSTF(I)	120 REAL	CUMULATIVE COST OF THE FULL REQUIREMENT
1026			(ALL PARTS) THRU DAY I USING THE SPECIFIED
1027			PART REPLACEMENT POLICY WITH UNCONSTRAINED
1028			COST.
1029	DDB(I)	300 REAL	ARRAY STORING THE ATTRIBUTE TO BE SORTED ON
1030			IN SUBROUTINE NARC. IN MAIN PGM, THIS WAS PART
1031			UNIT COST FOR PART J. IN SUBROUTINES CCLIST &
1032			UCROPS, THIS WAS THE AMOUNT OF THE SOLUTION
1033			REQMT FOR PART J.
1034	ICOST	1 FIXED	INDICATOR WHICH TELLS SUBROUTINE UCROPS WHETHER
1035			TO PRINT THE PARTS REQMTS LIST (0=DO 1=DO NOT).
1036			REQMTS LIST IS NOT PRINTED DURING CONSTRAINED
1037			COST REQMT CALCULATIONS.
1038	IOCC(IND)	2 FIXED	STORES, FOR EITHER TOTAL(IND=1) OR RESIDUAL
1039			(IND=2), THE LATEST DAY FROM THE "CUM COST
1040			REQMT THRU DAY N" TABLE (FROM THE UNCONST
1041			COST CASE) FOR WHICH ASSOCIATED CUM COST
1042			IS LESS THAN OR = THE INPUT-SPECIFIED COST
1043			LIMIT USED IN THE CONSTRAINED COST CASE.
1044	IFS(I)	300 FIXED	ARRAY STORING THE PARCON PART NUMBERS OF THE
1045			PARTS IN THE FULL-SUB PART SET.
1046	INSEL	FIXED	NUMBER OF PART TYPES FOR WHICH INDIV ITEM
1047			"CUMULATIVE (UNCONST COST) SOLUTION REQMTS
1048			THRU DAY N" ARE DESIRED. (SEE SMT(I,J) &
1049			IPY(I) BELOW)
1050	INT	1 FIXED	THE INTERVAL AT WHICH THE PARTIAL SUB
1051			COMPUTATION ALGORITHM (ROUTINE UCROPS)
1052			INCREMENT VALUES FOR "ALLOWABLE NMCS ACFT"
1053			AT EACH STAGE OF CALCULATION OF SEPARATE REQMT
1054			SOLUTIONS FOR THE FULL-SUB SET AND THE NO-SUB
1055			SET. ALWAYS SET=1 FOR RELIABLE RESULTS. ITS
1056			VALUE IS SET =1 IN THE PROGRAM CODE.
1057	IPY(I)	5 FIXED	ARRAY STORING INTERNAL PART NRS (SUBSCRIPTS)
1058			FOR PARTS FOR WHICH A CUMULATIVE DAY BY DAY
1059			REQUIREMENT HISTORY IS TO BE PRINTED
1060	IRC(I)	300 FIXED	ARRAY CONTAINING PART NUMBERS ORDERED ACC TO
1061			DECREASING PART UNIT COST FOR ASSOCIATED PART

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INR(IJ) 300 FIXED ARRAY CONTAINING PART NUMBERS ORDERED ACC TO
 DECREASING SOLUTION REQMT AMOUNT FOR ASSOCIATED
 PART

NP 1 FIXED NR OF PART TYPES PROCESSED IN RUN. (THIS
 EXCLUDES PART TYPES WITH ESSENTIALITY CODE
 .LE. 1ESS OR WITH A ZEPO FAILURE RATE)

NP1 1 FIXED TOTAL NUMBER OF 'PART NUMBERS' IN THE FULL-SUB
 PART SET

NP2 1 FIXED TOTAL NUMBER OF 'PART NUMBERS' IN THE NO-SUB
 PART SET

NW 1 FIXED LENGTH(DAYS) OF SCENARIO

PTDEP(J,K) 300.24 REAL TOTAL AMOUNT OF INITIAL STOCK FOR PART J
 RECEIVED AT THEATER(INCLUDING IN-PLACE STOCK)
 BETWEEN DAY 50K-4 AND DAY 50K

QPA(IJ) 300 REAL THE 'QUANTITY PER APPLICATION' FOR PART J.
 I.E. THE STANDARD NUMBER OF ITEMS OF PART J
 INSTALLED ON EACH OPERATIONAL ACFT

SMI(I,J) 120,100 REAL THE CUMULATIVE (UNCONSTR COST) SOLUTION REQMT
 THRU DAY I FOR PART IPT(IJ)

SRMAX1(IJ) 300 REAL A WORKING VARIABLE USED IN THE CALCULATION OF
 THE UNCONSTR COST REQMT FOR A PART J IN THE
 FULL-SUB SET. IT IS THE RUNNING MAXIMUM (OVER
 TIME) OF THE NET DEMAND (INCLUDING INITIAL STK)
 FOR PART J THRU THE DAY BEING PROCESSED

STK(IJ) 300 REAL INITIAL SERVICEABLE STOCK OF PART J. IT IS THE
 SERVICEABLE WAR RESERVE * (IN-PLACE ASL/PLL
 ON DAY 1)

TSTK(IJ) 300 REAL THE CUMULATIVE STOCK DEPLOYED FOR PART J ON
 THE DAY BEING PROCESSED

DIMENSION
 * RMN(300)
 * COMMON
 * AC(120), ACL, ADESC(300), ALLOW1(120),
 * ALLOWB(120), AMSN(300), ASURV(120), AVAV6(6),
 * AVH(120), BCY(300), BF(300), CASE,
 * CMDOA(300), CF(300), CL, CMINT,
 * CRNCS(300), COST(300), CRNCS(300), DCOST1(300),
 * DCOSTF(120), DCY(300), DF(300), DMO(300),
 * DOD(300), FMA(120), FMM, FWPAPD(13,120),
 * FMR(120), ICOS, IDCC(2), IFMC(120),
 * IFS(300), IMSEL, INS(300), INT,
 * IPT(100), IRC(300), IRO(300), ISHORT,
 * NP, NP1, NP2, NW,
 * PTDEP(300,24), QPA(300), RNC(120), RNC(300),
 * SM(120,100), SRMAX1(300), STK(300), SUMB(120),
 * TRNCS(300), TSTK(300), TSUMB,
 * CHARACTER*16
 * ADESC, AMSN, CASE
 DO 100 K=1,IMSEL
 DO 100 I=1,120
 100 SMI(I,K)=0.
 DO 200 J=1,NP
 TSTK(IJ)=STK(IJ)
 RNC(IJ)=0.
 CRNCS(IJ)=0.
 CMDOA(IJ)=0.
 200 SRMAX1(IJ)=-999.
 INITIALIZE ACHIEVED DAILY STOCKOUTS FROM NO-SUB PARTS
 DO 300 I=1,NW
 ALLOW1(I)=ALLOWB(I)
 DCOST1(I)=0.
 300 DCOSTF(I)=0.
 THRU STMT 1600 COMPUTE THE UNCONSTR COST REQMTS SOLUTION. PROCESS
 ALL PARTS ON EACH SUCCESSIVE DAY
 DO 1600 I=1,NW
 IA=II-1/5+1

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246 TALLOW=ALLOW(I)
247 CMINT=9999999999.
248 NA=ALLOW(I)*1.5
249 DO 400 J=1,NP
250 TSTK(I)=TSTK(I)+PTDEP(J,IA)/5.
251 400 RMIN(I)=0.
252 ZINT=INT
253 IADD=0
254 IF (MOD(NA-1,INT).NE.0) IADD=1
255 MULT=((NA-1)/INT)*IADD
256 NAD=MULT*INT+1
257 LAST=0
258
259 C THRU SYMT 1500, COMPUTE REQMTS AND COSTS SEPARATELY FOR THE FULL-SUB
260 C AND THE NO-SUB PART SETS FOR ALL COMBINATIONS I1,I2 WITH I1*I2=
261 C (ALLOWED NMCS ACFT FOR DAY I) + 1
262 C
263 DO 1500 I1=1,NAD,INT
264 L2=MIND(I1,NA)
265 I1=L2-1
266 I2=NA-I1-1
267 ALLOW(I1)=I2
268
269 C IF THERE ARE NO FULL-SUB PARTS, SKIP FULL-SUB PROCESSING
270 C
271 IF (NP1.EQ.0) GO TO 700
272
273 C THRU SYMT 600, DO REQMT CALCULATIONS ON THE FULL-SUB PART SET
274 C
275 DO 600 JA=1,NP1
276 J=IFS(JA)
277 IF (L2.GT.1) GO TO 500
278 CMD=CMDA(J)
279
280 C COMPUTE NET DEMAND FOR PART J BASED ON INIT STK=0 THEN ADJUST(XXX)
281 C FOR DISTRIBUTED STOCK
282 C
283 CMDA(J)=SR(I,J,CMD)
284 XXX=CMDA(J)
285 IF (IND.EQ.2) XXX=XXX-TSTK(J)
286 IF (XXX.GE.SRMAX(I,J)) SRMAX(I,J)=XXX
287
288 C COMPUTE THE DAY REQMT
289 C
290 CRNCS(J)=AMAX(0.,SRMAX(I,J))
291 GO TO 600
292 IF (L1.GE.NA) ZINT=NA-LAST
293
294 C WHEN THE ALLOWED NMCS ACFT IS INCREASED BY INT, THEN THE REQMT FOR
295 C A PART IS REDUCED BY INT*QPA. (INT=1 AS SET IN THE MAIN PROGRAM)
296 C
297 CRNCS(J)=AMAX(0.,CRNCS(J)-ZINT*QPA(J))
298
299 C CALC REQMT FOR EACH PART J OF THE FULL-SUB PART SET, THRU THIS COMBINATION
300 C OF I1 & I2, AS THE MAX OF THE DAY REQMTS (FOR THE PART) OVER ALL DAYS PROCESSED
301 C
302 600 CRNCS(IJ)=AMAX(CRNCS(IJ),CRNCS(J))
303
304 C CALL THE NO-SUB REQMTS CALCULATION ROUTINE TO OPERATE ON THE NO-SUB
305 C PART SET
306 C
307 700 IF (NP2.GT.0) CALL NCRNC (I,I2,IND)
308 TOTC=0.
309
310 C CALCULATE TOTAL REQMTS COST FOR THIS COMBINATION OF I1,I2
311 C
312 DO 800 J=1,NP
313 TOTC=TOTC+COST(J)*CRNCS(IJ)
314 IF (TOTC.GE.CMINT) GO TO 1000
315 TALLOW=I2
316 CMINT=TOTC
317
318 C USE ONLY THR REQMTS FROM THE 'CHEAPEST' COMBINATION OF I1 & I2
319 C
320 DO 900 J=1,NP
321 RMIN(IJ)=CRNCS(IJ)
322 IF (L2.NE.NA.AND.NP1.NE.0) GO TO 1400
323 900
324 1000
325 C ASSUMING THERE ARE SOME FULL-SUB PARTS IN THIS POLICY, DON'T DO
326 C FINAL CALCULATIONS UNLESS ALL COMBINATIONS HAVE BEEN CHECKED
327 C

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328 C COMPUTE THE FINAL REQMT FOR EACH PART AS THE LARGEST OF THE PART
329 C REQMTS FOR THE 'CHEAPEST' COMBINATIONS OF I1 & I2
330 C
331 DO 1200 J=1,NP
332   RNCS(J)=AMAX1(RMIN(IJ),RNCS(J))
333 C
334 C COMPUTE 'CUM REQMT COST (ALL PARTS ) THRU DAY I'
335 C
336   DCOSTF(I)=DCOSTF(I)+RNCS(J)*COST(J)
337 C
338 C STORE 'CUM REQMT THRU DAY N' FOR THE PARTS SPECIFIED IN INPUT
339 C
340   DO 1100 M=1,IMSEL
341     IF (J.EQ.IPT(M)) SM(I,M)=RNCS(J)
342   1100 CONTINUE
343   1200 CNCS(IJ)=COST(J)+RNCS(IJ)
344     IF (NP1.EQ.0) GO TO 1600
345 C
346 C STORE 'CUM REQMTS COST THRU DAY I' FOR JUST THE FULL-SUB PARTS IN THE
347 C TOTAL(ALL PARTS) REQMT
348 C
349   DO 1300 J=1,NP1
350     I1=IFS(IJ)
351     1300 DCOST1(I1)=DCOST1(I1)+RNCS(I1)*COST(I1)
352     1400 IF (NP1.EQ.0) GO TO 1600
353     1500 LAST=L1
354 C
355 C SET ALLOWABLE NMCS ACFT FOR THE DAY JUST PROCESSED TO THE VALUE OF
356 C I2 USED IN COMPUTING THE SOLUTION REQMT FOR THAT DAY
357 C
358   ALLOW1(I1)=TALLOW
359   1600 CONTINUE
360   IF (ICOST.EQ.1) RETURN
361 C
362 C PRINT THE TOTAL REQMT COST
363 C
364   WRITE (6,2800) CASE
365   IF (IND.EQ.1) WRITE (6,2900)
366   IF (IND.EQ.2) WRITE (6,3000)
367   IF (ICOST.EQ.1) WRITE (6,3100) CL,ACL,IDCC(IND)
368   WRITE (6,3200)
369   WRITE (6,3300) CMINT
370   IF (ICOST.EQ.1) RETURN
371   IF (IORD.LE.0) GO TO 1900
372   IF (ICOST.EQ.1) RETURN
373   IF (IOPT4.LE.0.AND.ICOST.EQ.0) GO TO 2200
374 C
375 C IF IORD .GT. 0 ORDER THE REQMTS ACC TO DECREASING AMOUNT OF REQMT
376 C
377   DO 1700 I=1,NP
378     IRO(I)=0
379   1700 DOD(I)=PNCS(I)
380     NOUNNY=NP
381     DO 1800 K=1,NP
382       CALL MAXC (NOUNNY,NOUT)
383       IRO(K)=NOUT
384       II=IRO(K)
385     1800 DOD(II)=-1.
386 C
387 C PRINT THE LIST OF REQMTS FOR ALL PARTS
388 C
389   1900 DO 2100 I=1,NP
390     II=IRO(I)
391     IF (IORD.LE.0) II=IRC(II)
392     IF (MOD(II-1,50).NE.0) GO TO 2000
393     WRITE (6,2800) CASE
394     IF (IND.EQ.1) WRITE (6,3400)
395     IF (IND.EQ.2) WRITE (6,3500)
396     WRITE (6,3600)
397     IF (ICOST.EQ.1) WRITE (6,3100) CL,ACL,IDCC(IND)
398     WRITE (6,3600)
399     WRITE (6,3800)
400     WRITE (6,3600)
401     TC=100.*CNCS(II)/(CMINT+.000001)
402     2100 WRITE (6,3900) I,II,AMSN(II),ADESC(II),RNCS(II),CNCS(II),TC
403     2200 IF (ICOST.EQ.1) RETURN
404     ICOST=1
405     IF (IOPT5.LE.0) GO TO 2500
406 C
407 C PRINT THE TABLE OF 'CUM REQMT THRU DAY N' FOR THE (UP TO 100) PARTS
408 C SPECIFIED IN INPUT
409 C

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410      NN=INSEL/5
411      IF (MOD(INSEL,5).NE.0) NN=NN+1
412      IF (NN.GT.20) NN=20
413      DO 2400 L=1,NN
414          M1=IPT(1+(L-1)*5)
415          M2=IPT(2+(L-1)*5)
416          M3=IPT(3+(L-1)*5)
417          M4=IPT(4+(L-1)*5)
418          M5=IPT(5+(L-1)*5)
419      DO 2300 I=1,NW
420          IF (MOD(I-1,50).NE.0) GO TO 2300
421          WRITE (6,2800) CASE
422          IF (IND.EQ.1) WRITE (6,4000)
423          IF (IND.EQ.2) WRITE (6,4100)
424          WRITE (6,3600)
425          WRITE (6,4200) M1,M2,M3,M4,M5
426          WRITE (6,3600)
427          WRITE (6,4300) AMSN(M1),AMSN(M2),AMSN(M3),AMSN(M4),AMSN(M5)
428          WRITE (6,4300) ADESC(M1),ADESC(M2),ADESC(M3),ADESC(M4),ADESC(M
429          5)
430          WRITE (6,4400)
431          WRITE (6,3600)
432      2300 WRITE (6,4500) (I,SMI,I,K+(L-1)*5),K=1,5)
433      2400 CONTINUE
434      2500 IDCC(IND)=0
435
436      C PRINT THE TABLE OF *CUM REQTS COST THRU DAY N*
437      C
438      DO 2700 I=1,NW
439          IF (MOD(I-1,50).NE.0) GO TO 2600
440          WRITE (6,2800) CASE
441          IF (IND.EQ.1) WRITE (6,4600)
442          IF (IND.EQ.2) WRITE (6,4700)
443          WRITE (6,3600)
444          WRITE (6,4800)
445      2600 IF (DCOSTF(I).GT.CL) GO TO 2700
446          IDCC(IND)=1
447          ACL=DCOSTF(I)
448      2700 WRITE (6,4900) I,DCOSTF(I)
449          WRITE (6,3100) CL,ACL
450          WRITE (6,3150) IDCC(IND)
451      RETURN
452
453      2800 FORMAT (1H1,10X,'CASE= ',A16)
454      2900 FORMAT (1/,1X,'TOTAL (INIT STK=0) COST OF RQMTS')
455      3000 FORMAT (1/,1X,'RESIDUAL (INIT STK=CURR STK) COST OF RQMTS')
456      3100 FORMAT (1//,10X,'COST LIMIT OF',F12.0,' APPROXIMATED BY',F12.0)
457      3150 FORMAT (1//,10X,'WHICH IS THE CUM RQMT COST THRU DAY',I4)
458      3200 FORMAT (1/,1X,'POLICY',TOT COST)
459      3300 FORMAT (1/,1X,'PART SUB',F14.0)
460      3400 FORMAT (1/,30X,'TOTAL (INIT STK=0) STK RQMTS ')
461      3500 FORMAT (1/,30X,'RESIDUAL (INIT STK=CURR STK) STK RQMTS ')
462      3600 FORMAT (1/)
463      3700 FORMAT (10X,'PART NR',17X,'PART',21X,'RQMT',7X,'COST &COST')
464      3730 FORMAT (12X,15,110,5X,A16,2X,A16,F8.1,F12.0,F6.2,4X)
465      4000 FORMAT (1/,42X,'CUM TOTAL RQMT (INIT STK=0) REQUIRED THRU GIVEN DAY*
466      *)
467      4100 FORMAT (1/,42X,'CUM ADD-ON RQMT (INIT STK=CURR INVT) REQUIRED ',*THRU
468      * GIVEN DAY*)
469      4200 FORMAT (13X,5(6X,'PART NR',15,6X))
470      4300 FORMAT (13X,5(A16,8X))
471      4400 FORMAT (15X,'DAY',21X,'DAY',21X,'DAY',21X,'DAY')
472      4500 FORMAT (18X,5(110,F8.1,6X))
473      4600 FORMAT (1/,2X,'CUM TOTAL (INIT STK=0) COST OF REQ THRU GIVEN DAY')
474      4700 FORMAT (1/,2X,'CUM RESIDUAL (INIT STK=CURR STK) COST OF REQ THRU',
475      * GIVEN DAY*)
476      4800 FORMAT (1/,6X,'DAY',3X,' PART SUB')
477      4900 FORMAT (16X,13,3X,2F11.0)
478      END

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82                                     CONSTRAINED COST ADD-ON REQMT) IS STOCKED.
83                                     THIS IS RECURSIVELY COMPUTED.
84
85      C
86      C
87      C      COMMON
88      *      AC(120),      ACL,      ADESC(300),      ALLOW1(120),
89      *      ALLOWB(120),      AMSN(300),      ASURV(120),      AVAV6(6),
90      *      AVH(120),      BCY(300),      BF(300),      CASE,
91      *      CDMDA(300),      CF(300),      CL,      CMIN,
92      *      CNCS(300),      COST(300),      CRNCS(300),      DCOST1(300),
93      *      DCOSTF(120),      DCY(300),      DF(300),      DHD(300),
94      *      DOD(300),      FHA(120),      FHM,      FHPAPD(3,120),
95      *      FHR(120),      ICOST,      IDCC(2),      IFMC(120),
96      *      IFS(300),      IMSEL,      INS(300),      INT,
97      *      IPT(100),      IRC(300),      IRO(300),      ISHORT,
98      *      NP,      NP1,      NP2,      NW,
99      *      PTOFP(300,24),      QPA(300),      RNC(120),      RNCS(300),
100     *      SM(120,100),      SRMAX1(300),      STK(300),      SUMB(120),
101     *      TRNCS(300),      TSTK(300),      TSUMB
102     *      CHARACTER*16      ADESC,      ADSC,      AMSN,      CASE
103
104     C      CALC (ID,IB) THE DAYS ON WHICH *ITEMS RETURNING TODAY(DAY I)
105     C      FROM DEPOT* FAILED.
106     C
107     ID=I-DCY(I)
108     IB=I-BCY(I)
109     DRR=0.
110     BRR=0.
111
112     C      CALC (IDRR) RETURNING REPAIRS(RETURNING ON DAY I)FROM DEPOT AND
113     C      CALC (IBRR) RETURNING REPAIRS FROM RETAIL, THEN DETERMINE CUMULATIVE
114     C      NET DEMAND (THRU TODAY(DAY I)) BY ADD NET DEMANDS GENERATED
115     C      TODAY TO CUMULATIVE NET DEMANDS THRU YESTERDAY,
116
117     IF (ID.GT.0) DRR=DF(I)*FHA(ID)
118     IF (IB.GT.0) BRR=BF(I)*FHA(IB)
119     SR=CDMD*CF(I)*FHA(I)-DRR-BRR
120     RETURN
121     END

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APPENDIX B

REFERENCES

1. Aircraft Spares Stockage Methodology (Aircraft Spares) Study, CAA-SR-84-12, US Army Concepts Analysis Agency, April 1984
2. Overview/PARCOM Turnkey Project (OPTP), CAA-SR-84-33, US Army Concepts Analysis Agency, November 1984
3. Parts Requirements and Cost Model (PARCOM) User's Guide, CAA-D-84-10, US Army Concepts Analysis Agency, October 1984
4. Parts Requirements and Cost Model (PARCOM) Functional Description, CAA-D-84-15, US Army Concepts Analysis Agency, October 1984
5. Partial Substitution and other Modifications to the PARCOM Model, CAA-TP-84-11, US Army Concepts Analysis Agency, November 1984
6. Extended Parts Requirements and Cost Model (PARCOM) User's Guide, CAA-D-85-2, US Army Concepts Analysis Agency, March 1985

GLOSSARY

ABBREVIATIONS, ACRONYMS, AND SHORT TERMS

acft	aircraft
AF	allowed stockouts over the full-sub part set
AFH	achievable flying hours
AFLC	Air Force Logistics Command
AMC	US Army Materiel Command
AN	allowed stockouts over the no sub part set
AR	Army regulation
ASL	authorized stockage list(s)
avail	availability
avg	average
AVIM	aviation intermediate maintenance
AVSCOM	US Army Aviation Systems Command
AVUM	aviation unit maintenance
BC	retail (base) condemnation rate
BR	retail repair time
CAA	US Army Concepts Analysis Agency
calc	calculation(s)
CCSS	Commodity Command Standard System
CONUS	Continental United States
cont	continued
cum	cumulative
curr	current
DC	depot condemnation rate

CAA-D-85-3

DCSLOG	US Army Deputy Chief of Staff for Logistics
DESCOM	US Army Depot Systems Command
dmd	demand
DOD	Department of Defense
DRT	depot repair time
EFH	estimated flying hours
est	estimated
FH	flying hour(s)
FHP	flying hour program
fly hr	flying hour
FS	full sub (phase)
full sub	full substitution (replacement policy)
hr	hour
init	initial
MFHAD	maximum flying hours per aircraft per day
min	minimum
MSC	major subordinate command
NMC	not mission capable
NMCS	not mission capable (due to) supply
no sub	no substitution (replacement policy)
NS	no sub (phase)
NRTS	not repairable (at) this station
OPTP	Overview/PARCOM Turnkey Project
OST	order and ship time
PARCOM	Parts Requirements and Cost Model
pgm	(flying hour) program

PLL	prescribed load list(s)
pt	part
ret	returning (repairs)
QPA	quantity per application
rqmt(s)	requirement(s)
sub	substitution

END

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