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SYSTEM) INVENTORY M. (U) DEFENSE LOGISTICS AGENCY
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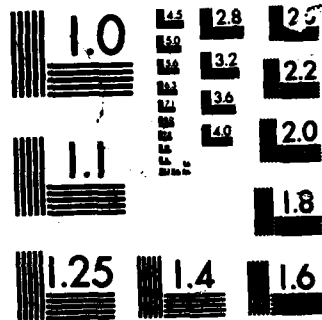
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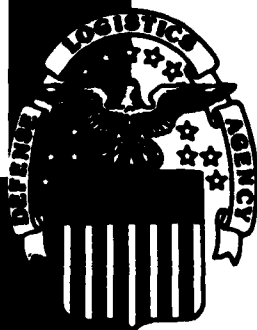
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DEPARTMENT OF DEFENSE

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Camden Station
Alexandria, Virginia 22304-6100

UNIFORM SAMMS INVENTORY MANAGEMENT SIMULATION (USIMS) USER'S GUIDE

Operations Research and Economic Analysis Office

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Uniform SAMMS Inventory Management Simulation
User's Guide

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January 1986

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Operations Research and Economic Analysis Office
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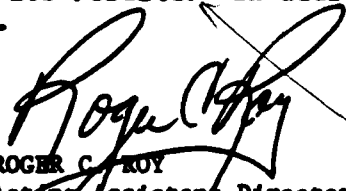
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FOREWORD

Inventory management within the Defense Logistics Agency is accomplished with the aid of the DLA Standard Automated Materiel Management System (SAMMS). The Uniform SAMMS Inventory Management Simulation (USIMS) is an operations research (OR) tool which permits evaluation of alternative inventory policies or environmental impacts on the performance of Defense Supply Centers (DSCs). USIMS uses a small sample of items in conjunction with a Monte Carlo simulation of various key SAMMS events to produce a wide range of inventory statistics on a proposed set of inventory policies.

The USIMS was developed in the early 1970s. In the early 1980s, a phased approach to enhancing the USIMS package was agreed upon by the USIMS Steering Group, which consists of Headquarters and DSC OR personnel.

One area of USIMS's enhancements involved improved documentation in the form of a user's guide. This guide is to provide users with theoretical background to the simulation, information necessary to run USIMS and assistance in the interpretation of its results. In addition, an introduction for new users is provided.


ROGER C. ROY
Acting Assistant Director,
Policy and Plans

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I. INTRODUCTION

A. Background

Inventory management within the Defense Logistics Agency is accomplished with the aid of the DLA Standard Automated Materiel Management System (SAMMS). The Uniform SAMMS Inventory Management Simulation (USIMS) is an operations research (OR) tool which permits evaluation of alternative inventory policies or environmental impacts on the performance of Defense Supply Centers (DSCs). USIMS uses a small sample of items in conjunction with a Monte Carlo simulation of various key SAMMS events to produce a wide range of inventory statistics on a proposed set of inventory policies.

The DLA Operations Research and Economic Analysis Office developed USIMS in the early 1970s. Until the early 1980s, higher priority OR projects prevented maintenance and improvements to USIMS. Then, a USIMS Steering Group, which consists of Headquarters and DSC OR personnel, was formed and agreed to a phased approach to enhancing the USIMS package. Phase one focused on accomplishing the most needed enhancements to the model. These improvements involved requisition generation, requisition size distributions, event sequencing, extension of run lengths, change to the large procurement threshold, and the separation and updating of lead time distributions, to name a few. One of the most prominent enhancements identified for phase one was the development of this USIMS user's guide.

B. Objectives. This user's guide has three purposes. The first purpose of this guide is to provide broader insight into the theory behind USIMS, its operations, and the interpretation of results of the model. The second purpose of this guide is to document the enhancements made to USIMS. The reader can refer to the Appendix E for changes to the USIMS package. The third purpose is to provide new users with the readings and training required to become familiar with the simulation package. After reading this section, the new user should proceed to Appendix N, which is an introduction for new users.

C. Description of Guide Structure and Overview of Appendices. This document is intended to be used in conjunction with the SAMMS and USIMS documentation published in the DLA Manuals. A familiarity with the SAMMS system and the previous version of USIMS is assumed in the appendices of this guide. The Users' Guide is intended as a reference work to answer specific questions and provide information on specific points that are not clearly spelled out in the SAMMS Manuals. The first three sections of the guide give a broad, introductory description of the USIMS package. Subsequent sections provide more detailed information on the programs, execution of these programs, and analysis of the output. Then, the appendices, placed in alphabetical order to facilitate easy access to the user's specific question, contain technical and detailed information on specific topics. Any appendices that may be published after the initial edition will be added on the end in the table of contents.

II. SYSTEM OVERVIEW. The USIMS System is a batch processing package. It uses a small sample of items to gauge activity in a larger inventory system. Parameter cards play an important role in controlling each of the segments of USIMS. Three main segments make up the USIMS package: an extraction segment, a front-end processor, and the simulation itself. In order to run the simulation segment for a particular time frame, both the extraction and front-end portions must have been run previously. The segments and their components are described below in general terms. Figure 1 below shows an overview of the USIMS package with data input and output. Detailed descriptions are given in section IV, the system description.

A. Sample Data Extraction. This segment of USIMS is composed of three computer programs, USBA50, USBA60, and USBA70, written in the COBOL language. These extraction programs are maintained by the DLA Systems Automation Center (DSAC) in Columbus, Ohio. The initial operation in USIMS is to obtain a statistical sample of National Stock Numbers (NSNs). The sample is based on the following annual dollar demand categories:

\$0.01 -	\$400
\$400.01 -	\$4500
\$4500.01 -	\$15000
\$15000.01 -	\$50000
\$50000.01 -	\$100000
over \$100000	

Sample sizes for each category are based upon variations of demand frequency, dollar demands, and the quantity demanded. After selecting the requested percentage of NSNs from each stratified category, they are matched against various SAMMS files to obtain the data elements needed for the simulation. The programs validate all selected data elements and either reject, accept, or modify these to a predetermined value. Certain items may be added or deleted at this point in the processing. Besides producing a magnetic tape with simulation data records, this segment also produces an NSN selection summary report (F-424) and a report of NSNs that have been deleted (F-425). Once a sample of NSNs has been selected, it may be repetitively used for subsequent simulation runs. At any time the sample is deemed no longer representative of the DSC population, a new sample may be selected. A program block diagram of this segment, shown in Figure 2, indicates that each of the programs follows the previous in sequence.

B. Sample Data Statistics and Formatting. Segment two is written in the FORTRAN language and is usually referred to as the front-end program or FRONT. The purposes of this segment are (1) to further refine the sample data through a series of options, (2) to provide relevant statistics, (3) to generate certain parameter values that are required by segment three, and (4) to produce a sample data file in a format that facilitates fast reading by the simulation model. In addition, various reports are also generated (F-426) to facilitate analysis of the sampled items. A program block diagram of this segment is presented in Figure 3.

Figure 1

SYSTEM/USINS
OVERVIEW CHART

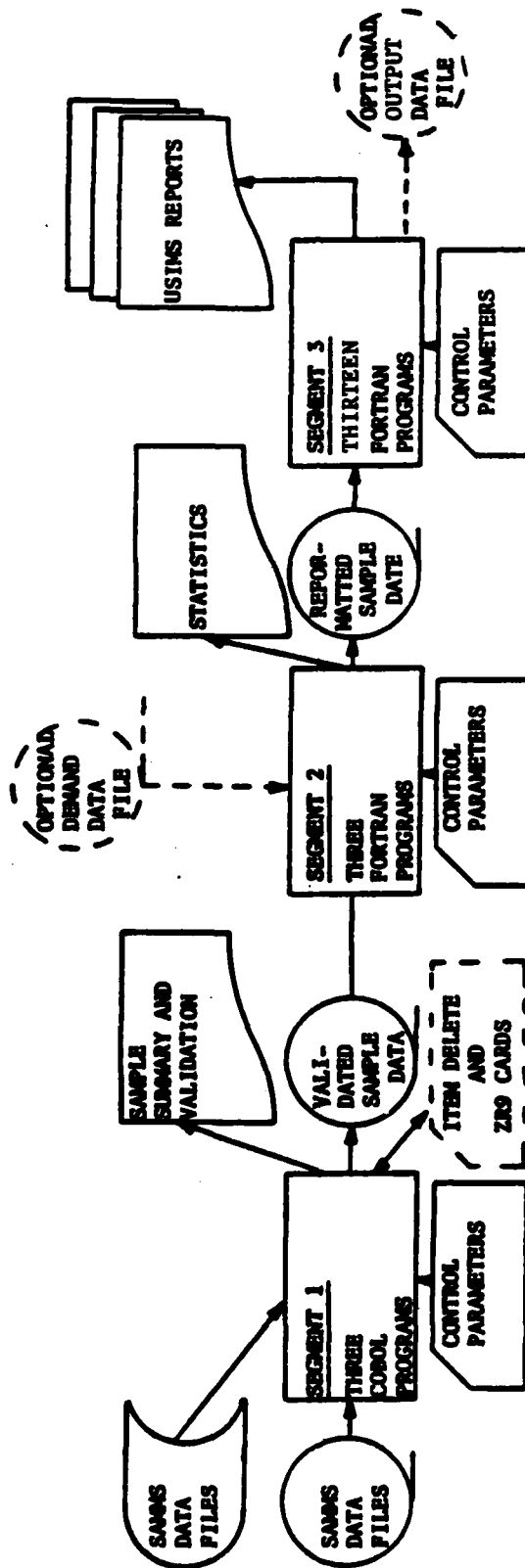


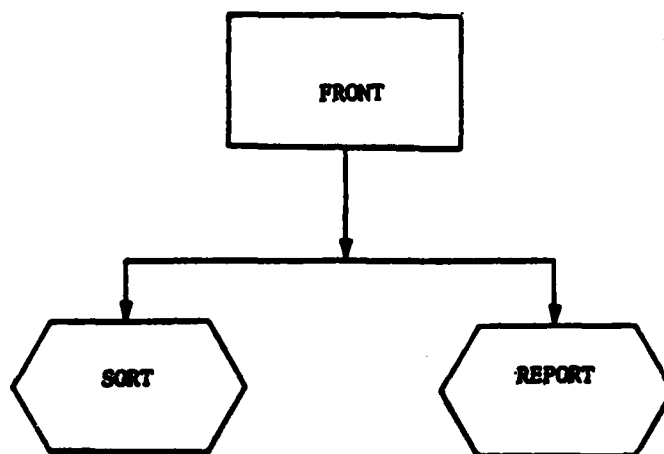
Figure 2

DATA EXTRACTION PROGRAM CHART



Figure 3

STATISTICS AND DATA PREPARATION PROGRAM CHART



C. Simulation Model

This segment of the USIMS system consists of FORTRAN language programs which simulate the DLA Inventory System. The decision criteria and the computations used in the simulation are those used in SAMMS.

The sample data file from FRONT is read in and used as the initial starting point for the items. Items experience the same kinds of activities they would in the real world only at an accelerated speed of simulated time. The simulation generates quantities and dates for requisitions and returns based on historic item data and parameter card adjustments. The result is a laboratory where a user can determine the impact of inventory management and supply policy activities for an entire DSC.

The model is composed of several separate routines, each representing a portion of the DSC Inventory Management System. The main routine, which consists of two loops or program segments, item loop and timing loop, controls the simulation. The model can accommodate changes to over 250 management policies, varying them on a monthly basis and, in many cases, by Annual Dollar Value (ADV) category. The simulation can be run from one to 24 months for one to 99999 sample items. An extension run can be made by saving the item data file at the end of the 24 month run and using it as input to a new 24 month run. The model produces over 80 reports including an input parameter report, quarterly summary reports, and various detail reports. Figure 4 shows the simulation segment's subprograms in block diagram form.

III. CONCEPT OF OPERATION. The USIMS System has been designed to be as simple to operate and maintain as possible. This section outlines the basic operation of the USIMS package. A series of parameter cards controls the system in each of its three segments. Except for the selection of NSNs in the extraction segment, the USIMS system is extremely flexible and independent of any other processing. The NSN selection must be done at the start of each quarter during the update processing called the "blackout period."

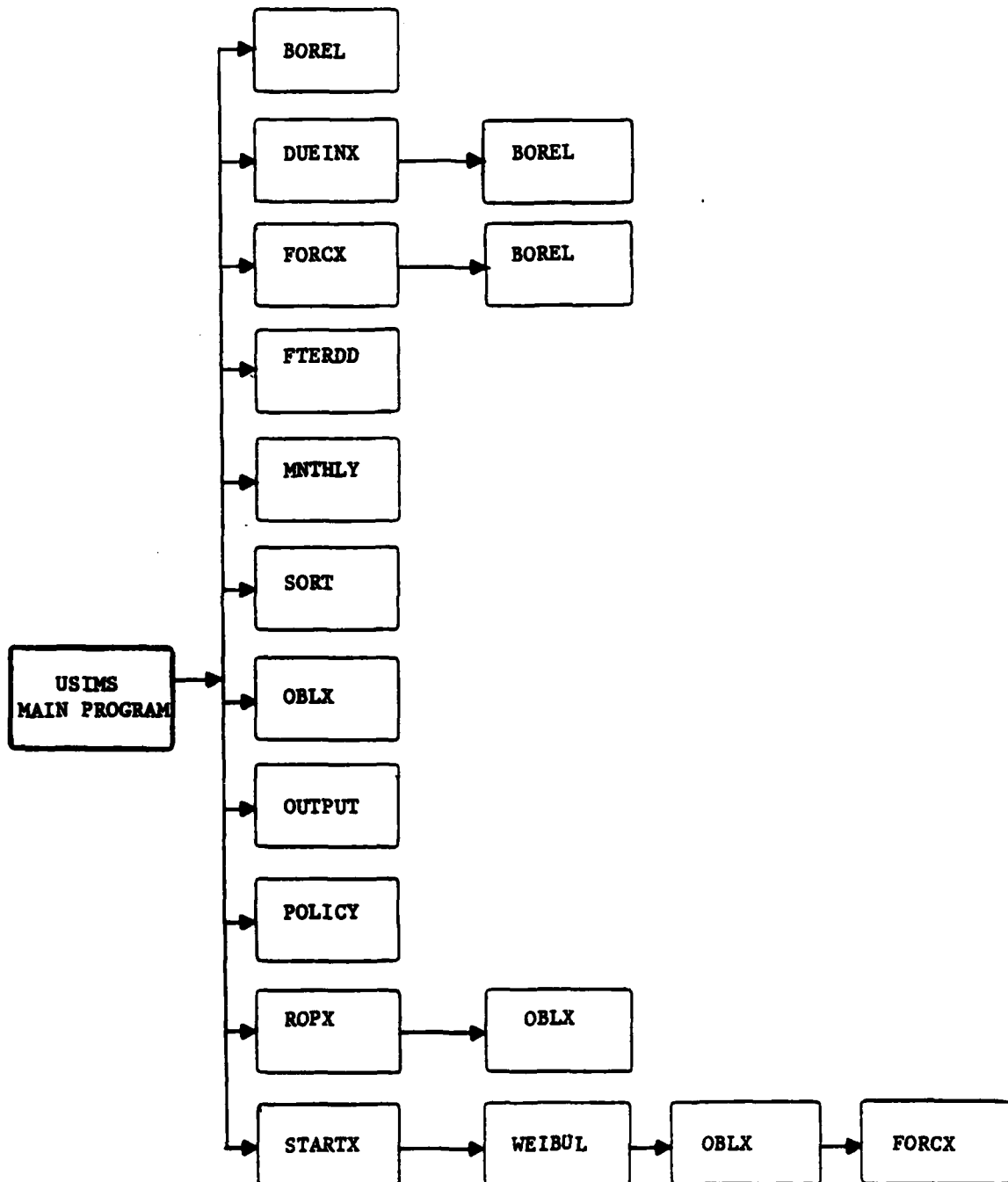
A. Extraction Segment

Before any programs are executed, a group of NSNs is selected from the SAMMS Fractionation Detail File, usually based on a past choice of an OR analyst building a sample file of NSNs for a DSC. The selection criteria, which control the sample size in each ADV category, are entered on a parameter card. Additionally, a parameter card must be entered which allows the user to omit certain stock classes. This segment is a part of the normal SAMMS processing and usually does not require intervention of the USIMS user.

Both of these mandatory parameter cards are validated in the program to ensure their accuracy. This initial step will generate a magnetic tape containing an 80 character record for each NSN selected in Supply Control Study Request Card format (ZR9). This tape serves a dual

Figure 4

USIMS PROGRAM CHART



purpose; it is used in the next step to match other SAMMS files and it may be punched into cards which then may be used to delete items in subsequent processing.

The next step in the selection process is to match the NSNs to a number of SAMMS data files and to extract from these files all of the data elements needed by the simulation model. All of the data elements are validated in the program for accuracy. If an element cannot be automatically corrected or adjusted, then the item is deleted from the sample. The user may also delete an item for any reason by entering that item's NSN on a parameter card. The final product of the selection process is a tape file known as USBAEDIT.

B. FRONT Segment. Once the sample has been extracted, the USBAEDIT tape containing this information may be processed at any time in segment two. Usually, an OR analyst will submit a job to execute this step. The FRONT program will further prepare, modify, expand, or delete an item's data. Again, the user has complete control through the use of up to five parameter cards. One of the options is the input of a user-created tape containing special demand data information. Layouts for this tape are included in Appendix O. As a part of segment two, a report, (F-426), will be generated showing the types of items, certain characteristics, and precision and confidence levels for the sample of items. At this point, the user should analyze the statistics report (F-426), and decide if the sample data is adequate for simulation or if FRONT should be rerun using different parameters or options. Once the sample is extracted, FRONT may be processed as many times as needed.

C. Simulation Segment. After an adequate sample has been obtained, segment three, the actual simulation, may be run by an OR analyst or other user. This simulation segment is known as USIMS, MAIN, or USIMS main. Requiring only one input file, the sample data, and at least ten parameter cards, USIMS is of straight-forward design. The parameter cards allow for varying the the run length, the sample size, eliminating returns processing, and so on. Also, over 250 policy changes may be exercised through the use of parameter cards. Three reports are output by the model (F-427, F-428, and F-429). They list the input parameter values, give a summary report, and provide a detailed report of results by month.

IV. SYSTEM DESCRIPTION

A. Description of Extract Segment

1. Introduction. The extraction program segment consists of three separate modules, USBA50, USBA60, and USBA70, all of which are written in COBOL and are maintained by the DLA Systems Automation Center (DSAC) in Columbus, Ohio.

2. USBA50

USBA50 selects a randomized sample stratified by annual dollar demand by use of three-digit National Item Identification Number (NIIN) selection numbers. Randomization is assured since NIIN numbers are insignificant (reference DLSC Catalog Manual M I-2; AR 708-12; GSA 5-55 M I-2, Chapter 2, Item Identification, Section 270). For example, if 001-003 were used, all stock numbers ending in 001, 002, and 003 would be selected. This would be three out of 1000 or a three tenths percent sample. It is required that the user know what size sample is desired for each ADV category. This can be determined by routine statistical analysis of the item population. To assist the user, the FRONT program provides a statistical test routine which will provide necessary sample sizes for specified levels of confidence and precision.

Input to USBA50 is a card (SAMMS Appendix B-296) specifying the beginning and ending NIIN digits (last three) for each ADV category. Additionally, a Federal Supply Class (FSC) omission card (SAMMS Appendix B-297) must be input which will result in those FSCs specified not being selected for the sample. If no FSCs are desired to be deleted, the card must still be input leaving the FSC fields blank. ADV categories based upon actual demand history are:

.01 - 400
400.01 - 4,500
4,500.01 - 15,000
15,000.01 - 50,000
50,000.01 - 100,000
Over 100,000

For an item to be selected, it must have been in the system two or more years and have a Supply Status Code (SSC) or a Future Supply Status Code (FSSC) not equal to 2, 3, 6, or 9. Additionally, it must be the head of the Family or a bachelor item.

The output from USBA50 will consist of: a tape file of Document Identifier Code (DIC) ZR9 cards, an NSN selection sample report, and a selected NSN tape file which is input to USBA60. The tape containing ZR9 data may be punched and the cards input to the SAMMS system to obtain supply control studies. The tape containing the selected NSNs may also be punched and the cards input to USBA60 in order to delete certain NSNs.

3. USBA60 and USBA70 Processing

Programs USBA60 and USBA70 take NSNs previously selected and match them against major item SAMMS files and extract specified data. In the process, they eliminate items or correct data elements in accordance with the validation criteria specified in Appendix CC of this guide. NSNs will also be eliminated if they match an NSN deletion card that is optionally input. For all extracted data that pertains to one NSN and is acceptable, a simulation record is built. In addition to the basic record, immediately following may be trailer records for dues-in from return, dues-in from procurement, and/or backorders. USBA60 must be scheduled during the "blackout period" at the start of each quarter.

Input to the programs comes from the following SAMMS files:

- a. Month End Asset (MEA)
- b. Due-In
- c. National Inventory Record (NIR)
- d. Backorder
- e. Supply Control File (SCF)

Additionally, the selected stock number file and an optional NSN deletion card(s) are input (SAMMS B-295).

Output consists of the simulation data file and two summary reports, SAMMS Appendix F-425, Part A and B. Part A is an NSN summary report indicating the number of items in the sample by ADV, and Part B shows the items deleted and the reason for deletion.

Due-in and backorder information is extracted for all family members associated with the USIMS selected NSNs. All dates specified in the output records will be converted to the number of days preceding or following the Julian date of the cutoff date that the SAMMS files are updated. The number of days will be signed.

B. Description of FRONT Segment

1. Introduction. The front-end program reads (1) the simulation data file, (2) various parameter cards, and (3) an optional demand file. Through the parameter cards, a number of options may be exercised which alter or delete items or attributes of the items. For example, backorders may be deleted from the sample. FRONT also performs a statistical analysis on the data to determine optimal sample sizes for various confidence levels and precisions. It also determines the confidence level and precision of the simulation data file. A number of reports which describe the data in various breakouts are

produced by the program. The simulation data file is restructured and output to a file (either tape or disk) with an unformatted write to a machine-readable format. This facilitates the fastest possible input to the simulation model itself.

2. Inputs. The following data files and input cards are read by the front-end FORTRAN Program:

a. The simulation data tape from the extract segment. This tape provides all the specific data for each item selected for use in the simulation.

b. Input cards. These cards provide the option values, item population sizes, and other data. The input cards (SAMMS B-298) are made up of five specific formats designated A-E. Card A provides the population size by annual value of demand categories, the annual value of demand, the annual number of requisitions for the DSC, and the initial percentage of Issue Priority Groups (IPGs) I and II settings. (This will be necessary until SAMMS change is programmed. They can be estimated from MILSTEP reports.) Card B contains the sixteen options which can be exercised. The option values not only determine if the option is to be exercised, but also establish the limits to which the option will be exercised. For example, one option allows deletion of all backorders that are so many days old. The option value on the parameter card would be set to that number of days. A blank field means the option is not exercised. Cards C, D, and E provide the Federal Supply Groups (FSGs), FSCs, and NIINs which are being deleted from the sample.

c. Optional demand tape. This program normally uses quarterly demand data from the edited simulation data tape, and converts the quarterly demands and requisitions to monthly values. However, the demands and frequencies, read from the optional tape, are actual monthly data, and no conversion is necessary. A format for the optional tape is provided in Appendix O, Optional Demand Data Distribution Input.

3. Description of Front-End Reports (SAMMS Appendix F-426). The FORTRAN front-end program generates 11 reports for the user to determine the adequacy of the data sample. The first report displays the input parameters and the effect of exercising any of the 16 options. The second report displays the type of items and their ADV category. The type of items are NSO, replenishment, VIP, non-VIP, non-VIP monthly, or all items. The third report gives an item count by annual requisition frequency and ADV category. The fourth report gives the number of dues-in and their dollar value by ADV category and by their receipt status, that is, whether the dues-in are overdue (late) or yet to be received. Report five is similar to report four except that the data accumulated is for returns. Report six displays the number and dollar value of backorders. Report seven displays the number and dollar value of direct deliveries outstanding. Reports

eight and nine show the optimum sample size based on ADV and then based on annual requisition frequency. Reports ten and eleven give the actual sample precision also based on ADV and annual requisition frequency.

4. Sample Analysis. The front-end program performs a statistical analysis on the data sample. The analysis is in two parts. The first part determines required sample sizes for five confidence levels (99.9, 99.0, 95.0, 90.0, and 85.0), and three precision levels (0.05, 0.10, and 0.15). Separate sample sizes are determined for two distinct attributes of the data, the annual dollar value of demands, and requisition frequencies. The data used to determine the required sample sizes is the unrevised sample data obtained from (USBA70) data extraction program. Also, the DSC item population sizes by annual value of demand categories, the total annual value of demand, and total annual requisition frequencies for the DSC, are required. These values are provided on input Card A. The second part of the statistical analysis determines, for the five confidence levels, the precision of the actual sample being used after all options have been exercised. The sample format of these reports are given in SAMMS Appendix F-426. The formulations used to compute the sample sizes and precisions are given in Appendix X, Sampling Methods in the Simulation.

5. Additional Front-End Program Tasks

a. The front-end program releases backorders if there is stock available for the item. Partial releases are also made.

b. The program limits the number of backorders, direct deliveries, returns, and dues-in to the array sizes utilized in the simulation.

c. The quarterly demands and requisition frequencies which are input from the data extraction program are converted to monthly demands and frequencies. This is accomplished by using a random number to determine the month (first, second or third month of the particular quarter) and then multiplying by the average demand for the quarter. This is repeated for all items.

d. The program sorts all backorders, direct deliveries outstanding, dues-in, and returns by date sequence on an "oldest first" basis.

e. The program factors the returns received to DIC FTE Required Delivery Dates (RDDs).

f. The program allows one to eliminate a maximum number of items by FSGs, FSCs, and NSNs from processing.

C. Description of USIMS Segment

1. Introduction. The model is composed of several separate routines, most representing an activity of the DLA Inventory Management System. Generalized application flow charts for the original USIMS are in SAMMS Appendix E-510-P, Part III.

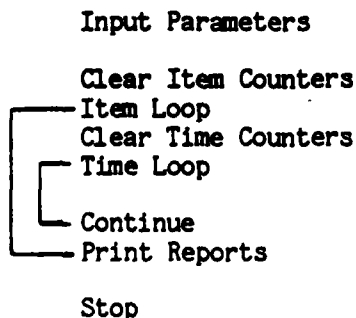
2. Main Routine. This routine consists of two major programming segments: item loop and timing loop. Through the execution of these loops the entire simulation is controlled. The functions performed by each of the major loops are:

a. Item Loop - This loop or program segment causes the model to go through one item at a time until all items have been simulated. Each item is totally processed through the simulation for the length of time specified by the parameter input. Data for reports are accumulated as the item is processed.

b. Timing Loop - This loop causes the model to chronologically simulate inventory activity by treating each inventory activity as an event with a date. The loop then searches a variable called DATE(I). In this array the times of each event, with variable I designating event number, are stored. The DATE(I) with the lowest date determines the next event to occur. Time is then advanced to DATE(I) and the corresponding event is called. After the event has occurred, the respective DATE(I) is updated to the next time for that event, and the search is repeated.

3. Events in USIMS. USIMS is comprised of 12 basic events. Each event has a time assigned to it. This time is determined by the nature of the event and is kept in a DATE(I). The value assigned for the time of an event is a real number and as such, has a whole number part and a decimal part. The whole number part denotes the day that the event is to occur while the decimal part indicates the priority of the event (which would be utilized to determine the sequence of those events that occur on the same day). The date array table (Appendix BB, Timing) depicts the events, their time value, and their subscript or number in the date array.

4. Structure of USIMS. The program structure of the main routine is as follows:



5. Names of Subroutines. The simulation model comprises the main program and 12 subroutines.

- a. USIMS - Main program that
 - (1) contains item and time loops;
 - (2) generates and processes requisitions; and
 - (3) contains the disposal routine.
- b. BOREL - Releases backorders.
- c. DUEINX - Processes dues-in from procurement and returns.
- d. FORCX - Performs the monthly/quarterly forecast and annual review.
- e. FTERDD - Generates and processes reports of customer excess.
- f. INIT - Block data subroutine to initialize common block.
- g. OBLX - Accumulates obligations of procurements and direct deliveries, and updates direct delivery files.
- h. OUTPUT - Computes totals, averages, and scales the output arrays before printing the summary and detail reports.
- i. POLICY - Makes changes to the policy table.
- j. ROPX - Computes procurement quantity, generates delivery date.
- k. MNTHLY - Accumulates monthly data.
- l. STARTX - Reads in item data.
- m. WEIBUL - Establishes requisition interarrival pattern for the item.

6. Returns-Processing. A field or switch is provided on the input cards which will permit deletion of the returns portion of the simulation. Use of this switch to eliminate returns will result in the simulation running faster. Simulation of returns may also be deleted by setting Management Policy Table 113 equal to zero (returns frequency adjustment factor). This method will not significantly decrease the computer run time.

C. Descriptions of USIMS Subprograms

1. BOREL. This subprogram accumulates statistics, releases all backorders for an IPG designation, and updates the respective backorder file. BOREL is called from MAIN so that backorders and requisitions may be processed by IPG and date. It is also called from DUEINX if a receipt occurred and no requisitions are to be generated. Finally, FORCX calls BOREL after recomputing levels.

2. DUEINX

This subroutine processes receipts from procurement or customer return. It is called from the main program. Within the returns portion, a due-in is classified as creditable or non-creditable and on-time or late. Probability of receipt of a creditable/non-creditable return or late return is controlled through the policy table. Returns not arriving on time are recategorized as late and placed back in the file to arrive at a random time up to 51 days in the future. Late arrivals automatically are classified as non-creditable, and if they do not arrive on the late date, they are dropped from the file. In addition to scheduled returns, DUEINX processes unscheduled automatic returns and computes the automatic return date and quantity.

After processing a receipt (procurement or return), the subroutine releases any backorders. First it determines whether or not a requisition is to be generated on the current date in simulated time. In the case where no requisition is generated, it checks to see if any backorders are on file. If so, it calls BOREL to release them. Back-order release is done in priority group sequence, so that materiel just received is first used to fill the highest priority backorders. In the case where a requisition is to be generated, a value or switch is set so that MAIN generates the requisitions and then releases the backorders and requisitions by priority.

3. FORCX. This subroutine computes a demand forecast for an item and then calculates the requirement levels in accordance with the demand forecast. It is called from STARTX at the outset of the simulation. Then it is called from MAIN as time passes, (monthly for VIP items and quarterly for all others). Upon entering the routine, the applicable percentage of non-recurring demand is computed if it is the end of the quarter. The correct alpha factor is determined and the next date to enter FORCX is established. Tracking signal adjustment is made; the quarterly forecast, EOQ, VSL, and levels are computed. The VSL used is the DoD time-weighted requisitions short model. Control levels are set based on the latest system percent of demand by issue priority groups (IPG). When SAMMS is programmed to compute individual item priority percentages for the SCF, USIMS will be modified accordingly. At present, the values read in from the front-end program are used the first year in setting control levels. The generated percentages are used the second year for all items. Returns are forecasted. Then, because the stock reservation for priorities may have changed, an attempt is made to release any backorders. Finally, the reorder point (ROP) is checked.

4. ETERDD. This subroutine processes notices of materiel returns from retail customers. It is called only from the main program. It computes a returns quantity using a log normal distribution (ratio of quantity to average return size) and then, based upon the net asset position, determines the quantity to be received and whether it will be creditable or non-creditable. A three-field returns array is maintained; the first being the quantity, second is date due-in, and third, the credit code. These codes are as follows: two is creditable, three is non-creditable. (In DUEINX if the return is late, the credit code is changed to a five to designate a late non-creditable return.) The date due-in is established by the returns lead time specified in the policy table. If the net asset position and the quantity generated are such that a portion is to be returned with credit and a portion without credit, two returns (instead of one) are placed into the array. The date of the next return (FTE) is then generated using an exponential interarrival time distribution.

5. INIT. This subroutine initializes data elements in the common block either to zeroes or appropriate values. It is not specifically called, but its presence causes it to be executed.

6. OBLX. This subroutine performs several functions mostly dealing with obligations. It is called from the main program, ROPX, and STARTX. A control code determines which of the six functions are performed within the subroutine. The sixth function is always performed if one of the first five is performed. The functions are:

- a. Obligate procurement dues-in.
- b. Obligate IPG I direct deliveries.
- c. Obligate IPG II direct deliveries.
- d. Closeout IPG I direct deliveries.
- e. Closeout IPG II direct deliveries.
- f. Determine the next date to come to the subroutine.

7. POLICY. This subroutine makes changes to the simulation's policy table. It is called only from the main program (USIMS). Based upon the parameter cards input to the simulation, any of the policy table default values may be changed by this program. A change remains in effect until it is changed again. The specific variables and their default values are shown in Appendix S, Policy Table Default Values.

8. ROPX. This subroutine causes buys to be initiated. It is called from the main program when the net assets are less than or equal to the ROP. The approved force acquisition objective (ROBJ) is computed using the appropriate procurement cycle period. The buy quantity computed is adjusted for expected returns, minimum dollar system buy, and minimum buy quantity. A variable lead time is computed based upon lead time distributions that apply to various DCSs. If a

procurement request occurs within a specified number of days since the previous procurement request, a consolidated procurement is made.

9. MNTHLY. This subroutine is called monthly from the main program. It updates certain monthly report variables, determines the new requisition date due to the new monthly frequency, and resets various accumulators.

10. STARTX. This subroutine initializes values for each item. It is called only by the main program. It reads the items' initial ADV category, computes the average issue quantities used in requisitioning and returns quantity generators, initializes all dates, and determines the initial level computations for returns.

11. USIMS. This is the MAIN program. It reads the parameter cards, initializes the dates, and establishes the item loop. It places items in dollar demand categories based upon actual demand history. During the simulation, items do not migrate from one category to another. It then initializes the policy tables and controls the timing loop. Imbedded in the timing loop are the call statements to the other subroutines with the exception of the disposal and requisition functions, which are included in the MAIN program.

a. Disposals. The disposal function is entered every 90 days if there are no dues-in from procurement. After entering, net assets are computed and compared to the retention level. If there is excess, the dollar value is computed and compared to the automatic disposal dollar value. If the criteria is exceeded, the dollar value is compared to the dollar value for reviewed disposals. If the criteria is met, the reviewed disposal counters are incremented. If the disposal control value or switch, which is set in the parameter cards, equals two, the stock on hand is reduced; otherwise, it is not decremented.

b. Requisitioning. Upon entering the requisition function, the next requisition is generated. If the date of the next requisition is not greater than the processing date, another requisition is generated. The process continues until the date of the next requisition is greater than the current date. This also determines the number of requisitions to be processed that day. For each requisition, a quantity and priority is generated. The requisitions are then processed by IPG. If there are backorders, and a receipt (either from procurement or returns) occurred that day, they are released by priority before the requisitions are processed. As each requisition is processed, the type of demand, recurring/non-recurring, is generated. The requisition is either issued or backordered, based upon the stock level, control level, and IPG. If the item is to be backordered and is an IPG I or II, then it is determined whether or not a direct delivery should be made; if stock is due-in within the specific number of days of management policies 86 and 87, it is placed on backorder. After processing all requisitions for the day, net assets are computed, and if less than the ROP, ROPX is called.

12. OUTPUT. After the last sample item is processed, control is transferred to this routine which performs the following functions. Scaling factors are computed and applied to all results to produce expected population statistics. Row and column totals are computed along with the average row and quarterly column. Some values in reports are divided by 1,000 to reduce the magnitude of the results for printing purposes. Both summary reports and detail reports are printed from this routine.

13. WEIBUL. When values for each item are initialized in STARTX, this subroutine establishes the distribution parameters to be used in generating requisition interarrivals. These values are based on the hits per year the item encountered in the past. A modified Weibull distribution is used to reflect the bias towards requisitions arriving within a 24 hour period.

V. EXECUTION PROCEDURES

A. Introduction. This chapter is intended to instruct a user how to execute both the front-end program, FRONT and the simulation model itself, USIMS. Each subparagraph will present a brief review of each model segment.

B. Running FRONT. The purposes of FRONT are to further select items for the simulation, to reformat the data records into unformatted FORTRAN records, and to provide statistical information about the sample. There are three steps which are required to run FRONT: (1) gather information needed to prepare the FRONT parameter cards; (2) preparation of data sets for run execution; and (3) job submission.

1. The information required for the preparation of the parameters pertains to the characteristics of the Defense Supply Center for which a run is being made and the specific options chosen by the analyst as they pertain to the project. To execute FRONT, parameter cards A and B are mandatory. For card A, obtain the percentages for requisitions in the priority groupings, the returns factor used by the DSC, the DSC total annual demand value and requisition frequency from the Directorate of Supply Operations or other source. Obtain the Fractionation Report to derive the DSC item population totals by each annual dollar value grouping. (Note: the Fractionation Report is also the source for certain information needed to run USIMS; refer to the Appendix H, Fractionation Report and Appendix P, Parameter Card Layouts to obtain further information on how to extract the data and for the input format required).

2. The second step involves the preparation of data files for the execution of FRONT. Obtain the data set name and volume serial number of the most current USBAEDIT tape (or the tape for the time frame under consideration) from the local tape library. Usually these tapes are cataloged data sets, so no further information is needed.

Prepare parameter cards A and B as a minimum either as a card deck or a file in 80 - 80 format on disk. On parameter card B the various user options (see appendices I and P on FRONT Options and Parameter Card Layouts) are specified. Parameter cards C, D, and E are required if Options 12 (card C), Option 13 (card D), or Option 14 (up to 50 cards of type E) are selected. There should also be a ready-made procedure to execute FRONT; obtain the name of this procedure from the local Office of Telecommunications and Information Systems (or equivalent).

3. The final step is the submission of a job, either a card deck or through the local time-sharing network to the mainframe computer. The parameter cards will be the SYSIN override to the procedure, the USBAEDIT tape will be the FT08F001, and an output file, usually a tape, will be the FT09F001 override.

C. Running USIMS. USIMS is the simulation model itself. It requires a sample data file and parameter cards to execute. There are three steps which are required to run USIMS: (1) gather information needed to prepare the USIMS parameter cards; (2) preparation of data sets for run execution; and (3) job submission.

1. The information required for the preparation of the parameters pertains to the characteristics of the Defense Supply Center for which a run is being made and the specific options chosen by the analyst as they pertain to the project. To execute USIMS, parameter cards one through ten (0 is used as the one-digit code for this tenth parameter card) are mandatory. For card one through three, obtain the Fractionation Report to derive the DSC item population totals, the Numeric Stockage Objective population totals, and the Very Important Program Item totals by each annual dollar value grouping. (Note: the Fractionation Report is also the source for certain information needed to run FRONT; also refer to the appendices H and P on the Fractionation Report and Parameter Card Layouts to obtain further information on how to extract the data and for the input format required). The number of items in the sample, the number of Numeric Stockage Objective items in the sample, and the number of Very Important Program Items are obtained from the F-426 Report, the output from the front-end processing. The System Constant and Backorder Goal can be obtained from the F-67 Report or from the Directorate of Supply Operations at the applicable DSC or other source. Obtain the number of days between consolidation of procurements from Supply Operations. On parameter card four the various user options (see Appendix P, Parameter Card Layouts) can be specified. For cards five and six, obtain data for the administrative and production lead time distributions from the Appendix K, Lead Time Distributions. Use data for the empirical requisition size distributions from the Appendix W, Requisition Processing Problems for cards seven and eight. Review appendices R and S on Policy Table Adjustments and Policy Table Default Values; consult with Supply Operations at the DSC in question to determine which of the default values do not apply to the center. Parameter card(s) nine must be coded for these policies with an effective month of one. Review subparagraph E, Report Titles in USIMS and select which reports are required for the project on card ten (0 is used as the one-digit code for this tenth parameter card).

2. The second step involves the preparation of data files for the execution of USIMS. This sample item data file may have been written on disk or tape. For a tape file, obtain the data set name and volume serial number of the tape produced in the execution of FRONT. Usually these tapes are written as file one and as a standard label, so no further information is needed. With the information gathered from one above, prepare parameter cards one through ten (0 is used as the one-digit code for the tenth parameter card) as either a card deck or a file in 80 - 80 format on disk. There should also be a ready-made procedure to execute USIMS; obtain the name of this procedure from the Office of Telecommunications and Information Systems (or equivalent).

3. The final step is the submission of a job, either a card deck or through the local time-sharing network to the mainframe computer. Here a number of overrides may be necessary. The parameter cards will be the SYSIN override to the procedure. The tape or disk data set produced in FRONT will be the FT09F001 input file. An output file to save non-selected reports, usually a tape, can be the FT11F001 override, otherwise include an FT11F001 DD DUMMY card. An output file, usually a tape, can be the FT16F001 override to write out records at the end of the run for a continuation run after the 24 months; if this is not desired, include an FT16F001 DD DUMMY override card. The procedure should already contain the FT15F001 file of random numbers.

D. USIMS User Interface System. A USIMS user interface system has been installed on the DLA Operations Research Analysis Network (DORAN) computer system. Its purpose is to help the user construct the JCL streams and parameter cards necessary to submit both FRONT and USIMS runs. It is available through option L.U from the main menu. This system is menu-driven with a full tutorial and help screens to assist the user when necessary. The system will submit one job at a time. It keeps track of its own data sets, so that a user does not need to know volume numbers, and the like. It uses a standard naming convention, USM.XCYYQ, where USM stands for USIMS, X for the type of data set, disk (D) or tape (T), C is the center, YY is the year, and Q is the fiscal quarter. Once parameter card entries are input for a particular center, these are retained as the default values for that center until modified again. Regardless of the defaults established, any user has the flexibility to maintain data sets for special projects.

VI. OUTPUT ANALYSIS

A. Introduction

More than eighty reports are currently generated by the simulation model, USIMS. The first report lists the input parameter values and any policy changes that are entered. The purpose of this report is to provide a visual verification of control values. The second report is both a summary report and table of contents to the succeeding reports. It provides the report title and results obtained for the total column of the detail reports.

The detail results of the simulation are contained in the next 80 one-page reports. The reports are printed in common format utilizing the self-explanatory headings listed in subparagraph E, Report Titles in USIMS. The reports are broken out horizontally by ADV Category, VIP item, NSO item, totals, and quarterly totals. The vertical breakout is by the number of months that were simulated. A total row and an average row are also listed. The "DATE PROCESSED" is picked up from the USIMS parameter card four and in no way is used in the simulation.

B. Results of Simulation

A 1981 study by Lt Strouse of the DGSC OR office provides a detailed analysis of how simulation results vary with the choice of random numbers. This phenomenon supports the theory behind the use of simulations as a tool in viewing stochastic processes. One key indicator, stock availability, can vary by a few full percentage points. This variability, at least in comparison to real world availability values which rarely change by more than a few tenths of a percent from month to month, has caused some concern that the simulation is too inexact and not useful. Careful examination of the study in question, however, shows that the variables of concern in different simulation runs using different random seeds track along a band of values with the same overall trend. One would expect different individual results but hope for the same general trend.

Among others, the previously cited Law and Kelton text on simulation provides insight into the task of interpreting results of simulations. In their chapter on output analysis, the authors note that "[the] most common mode of operation is to make a single simulation run of somewhat arbitrary length and then treat the resulting simulation estimates as being the 'true' answers for the model. Since these estimates are random variables which may have large variances, they could, in a particular simulation run, differ greatly from the corresponding true answers." The authors point out the need for making many replications of a simulation in order to reduce the variability of results when comparing two systems or in predicting the outcome of the variables of interest. Writing on the same subject and incorporating many authors' findings, Schmeiser (in Operations Research, Vol. 30, No. 3, May - June, 1982) concludes that between ten and thirty runs of a simulation is a reasonable number of replications for any simulation. The point is that making only a few simulation runs (one base and one alternative) does not represent sound OR practice. Given the

availability of computer time, the OR analyst must judge how many runs are required to test a given set of conditions. The more runs one can make, the more confident one can be that the outcomes are representative.

C. Analysis Of Results. After the analyst has made a number of runs of both a baseline and an alternative scenario, one must assess what the simulation shows. One should not reasonably expect to obtain values that can be used in an accurate and predictive manner. Instead, USIMS can best be used to obtain a relative change in comparison to some baseline value or original policy. For instance, if an average supply availability over a number of baseline runs is 93.5 %, this should not be interpreted as the future projection of supply availability over the next months for the center. Instead, say the alternative scenario shows an average availability of 94.2 %. To properly interpret the results, it is recommended that the analyst divide the alternative result by the original baseline value (here, this yields about 1.007, for a change of less than one percent) to obtain a comparison. With such a slight change, the analyst should carefully consider the standard deviation of the runs and the confidence intervals provided by the application of the T-statistic. This slight change may prove to be statistically insignificant. Therefore, the analyst must carefully consider how the results are presented to the client.

D. Report Titles in FRONT. The following reports are printed out as F-426 reports from the FRONT module:

<u>PAGE/ REPORT NUMBER</u>	<u>ARRAY NAME</u>	<u>REPORT TITLE</u>
2	ITMTYP	TYPE OF ITEM BY ADV AFTER OPTIONS HAVE TAKEN EFFECT
2	FRECNT	ANNUAL FREQUENCY OF SAMPLE ITEMS BY ADV AFTER OPTIONS HAVE TAKEN EFFECT
3	PROC XMONY1 DUIN XMONY2	NUMBER AND DOLLAR VALUE OF DUES-IN FOR PROCUREMENT AFTER OPTIONS HAVE TAKEN EFFECT
3	RETDUE XMONY3 RETURN XMONY4	NUMBER AND DOLLAR VALUE OF DUES-IN FOR RETURNS AFTER OPTIONS HAVE TAKEN EFFECT
4	DAYSBO XMONY5	NUMBER AND DOLLAR VALUE OF BACKORDERS AFTER OPTIONS HAVE TAKEN EFFECT
4	DAYSDD XMONY6	NUMBER AND DOLLAR VALUE OF DIRECT DELIVERIES OUTSTANDING
5	YNUM	OPTIMUM SAMPLE SIZE BASED ON ANNUAL DEMAND VALUE BEFORE OPTIONS HAVE TAKEN EFFECT
5	XNUM	OPTIMUM SAMPLE SIZE BASED ON ANNUAL REQUISITION FREQUENCY BEFORE OPTIONS HAVE TAKEN EFFECT
6	PRECD	ACTUAL SAMPLE PRECISION BASED ON ANNUAL DEMAND VALUE AFTER OPTIONS HAVE TAKEN EFFECT
6	PRECF	ACTUAL SAMPLE PRECISION BASED ON ANNUAL REQUISITION FREQUENCY AFTER OPTIONS HAVE TAKEN EFFECT

E. Report Titles in USIMS. The following detail reports can be generated from USIMS:

<u>PAGE/ REPORT NUMBER</u>	<u>ARRAY NAME</u>	<u>REPORT TITLE</u>
1	VRDEM	VALUE OF RECURRING DEMAND (IN 000)
2	VNRDM	VALUE OF NON-RECURRING DEMAND (IN 000)
3	XXREQ	NUMBER OF RECURRING REQUISITIONS
4	XNRRQ	NUMBER OF NON-RECURRING REQUISITIONS
5	XREQ1	NUMBER OF REQUISITIONS IPG 1
6	XREQ2	NUMBER OF REQUISITIONS IPG 2
7	XREQ3	NUMBER OF REQUISITIONS IPG 3
8	XPRLT	NUMBER OF PROCUREMENTS LESS THAN \$25000
9	XPRGT	NUMBER OF PROCUREMENTS GREATER THAN \$25000
10	XPRBP	NUMBER OF PROCUREMENTS (POTENTIAL AUTOMATED SMALL PURCHASE)
11	XPRRP	NUMBER OF PROCUREMENTS (NOT AUTOMATED SMALL PURCHASE)
12	XSND0	NUMBER OF NSNS WITH BACKORDERS
13	XFSDD	NUMBER OF NSNS WITH DIRECT DELIVERIES
14	XDOR	NUMBER OF BACKORDERS ESTABLISHED BB
15	XDODS	NUMBER OF BACKORDERS ESTABLISHED BV
16	XBO1	NUMBER OF BACKORDERS ESTABLISHED IPG 1 BB
17	XBV1	NUMBER OF BACKORDERS ESTABLISHED IPG 1 BV
18	XBO2	NUMBER OF BACKORDERS ESTABLISHED IPG 2 BB
19	XBV2	NUMBER OF BACKORDERS ESTABLISHED IPG 2 BV

<u>PAGE/ REPORT NUMBER</u>	<u>ARRAY NAME</u>	<u>REPORT TITLE</u>
20	XBO3	NUMBER OF BACKORDERS ESTABLISHED IPG 3 BB
21	VANB1	VALUE OF BACKORDERS ESTABLISHED IPG 1 BB (IN 000)
22	VANB2	VALUE OF BACKORDERS ESTABLISHED IPG 2 BB (IN 000)
23	VANB3	VALUE OF BACKORDERS ESTABLISHED IPG 3 BB (IN 000)
24	TVDO	AVERAGE TOTAL BACKORDER VALUE PER DAY BB BV (IN 000)
25	ANBF1	AVERAGE NUMBER OF BACKORDERS ON FILE PER DAY IPG 1 BB
26	ANBFV1	AVERAGE NUMBER OF BACKORDERS ON FILE PER DAY IPG 1 BV
27	ANBF2	AVERAGE NUMBER OF BACKORDERS ON FILE PER DAY IPG 2 BB
28	ANBFV2	AVERAGE NUMBER OF BACKORDERS ON FILE PER DAY IPG 2 BV
29	ANBF3	AVERAGE NUMBER OF BACKORDERS ON FILE PER DAY IPG 3 BB
30	ANB1/ANBOR1	AVERAGE DAYS TO RELEASE A BACKORDER IPG 1 BB BV
31	ANB2/ANBOR1	AVERAGE DAYS TO RELEASE A BACKORDER IPG 2 BB BV
32	ANB3/ANBOR3	AVERAGE DAYS TO RELEASE A BACKORDER IPG 3 BB
33	VRCOM	COMMITMENT VALUE (PROCUREMENT) (IN 000)
34	VDSCM	COMMITMENT VALUE (DIRECT DELIVERY) (IN 000)
35	VROBL	OBLIGATION VALUE (PROCUREMENT) (IN 000)

<u>PAGE/ REPORT NUMBER</u>	<u>ARRAY NAME</u>	<u>REPORT TITLE</u>
36	VDSOB	OBLIGATION VALUE (DIRECT DELIVERY) (IN 000)
37	VREC	RECEIPTS VALUE (PROCUREMENT) (IN 000)
38	VRET	RECEIPTS VALUE FOR RETURNS (IN 000)
39	VCLV1	VALUE OF CONTROL LEVEL 1 END OF MONTH (IN 000)
40	VCLV2	VALUE OF CONTROL LEVEL 2 END OF MONTH (IN 000)
41	VADI	AVERAGE VALUE OF DUES-IN PER DAY (IN 000)
42	VASOH	AVERAGE VALUE OF STOCK ON HAND PER DAY (IN 000)
43	VSOH	VALUE OF STOCK ON HAND END OF MONTH (IN 000)
44	VEOQ	VALUE OF EOQ END OF MONTH (IN 000)
45	VVSL	VALUE OF VARIABLE SAFETY LEVEL END OF MONTH (IN 000)
46	VQFD	VALUE OF QFD END OF MONTH (IN 000)
47	VGRSL	NET SALES (IN 000)
48	XADISP	NUMBER OF AUTOMATIC DISPOSALS
49	VADISP	VALUE OF AUTOMATIC DISPOSALS (IN 000)
50	XRDISP	NUMBER OF DISPOSALS REVIEWED
51	VRDISP	VALUE OF DISPOSALS REVIEW (IN 000)
52	XFTEC	NUMBER OF FTES ACCEPTED WITH CREDIT
53	VFTEC	VALUE OF FTES ACCEPTED WITH CREDIT
54	XFTEPC	NUMBER OF FTES ACCEPTED WITH PARTIAL CREDIT
55	VFTEPC	VALUE OF FTES ACCEPTED WITH PARTIAL CREDIT

<u>PAGE/ REPORT NUMBER</u>	<u>ARRAY NAME</u>	<u>REPORT TITLE</u>
56	XFTEPN	NUMBER OF FTES ACCEPTED WITH PARTIAL NO CREDIT
57	VFTEPN	VALUE OF FTES ACCEPTED WITH PARTIAL NO CREDIT
58	XFTENC	NUMBER OF FTES ACCEPTED WITH NO CREDIT
59	VFTENC	VALUE OF FTES ACCEPTED WITH NO CREDIT
60	XFTER	NUMBER OF FTES REJECTED
61	VFTER	VALUE OF FTES REJECTED
62	RPT58 XXREQ + XNRRQ	TOTAL NUMBER OF REQUISITIONS
63	RPT59 XPRLT + XPRGT	TOTAL PROCUREMENT REQUESTS INITIATED
64	RPT60 (XRREQ + XNRRQ - XDOR - XDODS) / (XRREQ + XNRRQ) * 100	TOTAL SUPPLY AVAILABILITY
65	RPT61 (XREQ1 - XBO1 - XBV1) / (XREQ1) * 100	SUPPLY AVAILABILITY IPG 1
66	RPT62 (XREQ2 - XBO2 - XBV2) / (XREQ2) * 100	SUPPLY AVAILABILITY IPG 2
67	RPT63 (XREQ3 - XBO3) / (XREQ3) * 100	SUPPLY AVAILABILITY IPG 3
68	RPT64 ANBF1 + ANBF2 + ANBF3	AVERAGE NUMBER OF BACKORDERS PER DAY BB
69	RPT65 ANBFV1 + ANBFV2	AVERAGE NUMBER OF BACKORDERS PER DAY BV
70	RPT66 (ANB1 + ANB2 + ANB3) / (ANBOR1 + ANBOR2 + ANBOR3)	TOTAL AVERAGE DAYS TO RELEASE A BACKORDER BB

<u>PAGE/ REPORT NUMBER</u>	<u>ARRAY NAME</u>	<u>REPORT TITLE</u>
71	RPT67 (VANB1 + VANB2 + VANB3) / 1000	TOTAL VALUE OF BACKORDERS ESTABLISHED BB (IN 000)
72	RPT68 VRCOM + VDSCM	TOTAL COMMITMENT VALUE (IN 000)
73	RPT69 VROBL + VDSOB	TOTAL OBLIGATION VALUE (IN 000)
74	RPT70 VROBL + VDSOB - VGRSL	NET INVESTMENT CHANGE (IN 000)
75	RPT71 XFTEC + XFTEPC	NUMBER OF FTES ACCEPTED WITH TOTAL AND PARTIAL CREDIT
76	RPT72 VFTEC + VFTEPC	VALUE OF FTES ACCEPTED WITH TOTAL AND PARTIAL CREDIT
77	RPT73 XFTEPN + XFTEPC	NUMBER OF FTES ACCEPTED WITH TOTAL AND PARTIAL NO CREDIT
78	RPT74 VFTEPN + VFTEPC	VALUE OF FTES ACCEPTED WITH TOTAL AND PARTIAL NO CREDIT
79	VALMAD	VALUE OF MAD LEAD TIME END OF MONTH (IN 000)
80	MIGRAT	MIGRATION REVIEW

Appendix A

Alpha Factors

SAMMS uses a form of the double exponential smoothing technique to forecast future demands. Essential to this forecasting method are alpha weighting factors, which assign weights to the most recent period of demand.

USIMS also handles these alpha factors. The values recorded on the USBAEDIT tape extracted from SAMMS files at quarter end represent the alpha factor of the items, but they do not show this alpha value directly. Instead, zeros are recorded in this field most of the time indicating in SAMMS that the alpha factor is to be based on the center specific policy table value in SAMMS. In order to reconstruct these policy table values accurately in USIMS, alpha factor inputs (USIMS parameter card nine, policy cards number two, three, four, and five) are needed in the parameter cards. When a value of other than zero appears in the alpha field on the USBAEDIT tape, that value is the alpha factor that has been input to the Supply Control File (SCF) by the item manager. This instance rarely occurs, however.

Since USIMS requires the alpha values directly, they must be reconstructed. The forecasting subroutine, FORCX, handles this aspect of the inventory system. The following methodology is used: (1) for items "out of track" where a corrective factor needs to be applied with zero as the input alpha value (that is, no item manager input), the normal and correcting factors are added together (NOTE: here SAMMS pulls the proper value of the total correcting factor from its own policy table - therefore, the sum of the normal alpha factor and the corrective factor, VIP or non-VIP should equal that SAMMS corrective policy table value); (2) for other items, those not requiring the application of the corrective factor, the normal default value is used; (3) for items with item manager input alphas, those values are used directly if no corrective factor application is required; (4) for those items with manual input and the need for application of the corrective factor, the USIMS policy table corrective factor, (VIP or non-VIP, as the case may be), is added to the alpha of record.

Therefore, when the DSC values differ from the simulation default values, one must provide policy cards (USIMS parameter card nine) for the alpha values to apply the alpha of record properly. Cards for policy values two and three are for the normal alpha factors. The correcting alpha factors also have simulation default values and USIMS parameter card type nine for policies four and five regulates the correcting alpha factors. Once the item is initialized and the simulation begins for that item, the alpha of record on the input tape is no longer needed.

Appendix B

Alpha Switch

The alpha switch is one input on USIMS parameter card four. Coding the switch '0' makes the simulation use the policy table default value (either the simulation default or the value specified in cards two, three, four, and five) for all items regardless of the alpha value present on the USBAEDIT tape. Coding the switch '1' forces the simulation to use the value found in the alpha field as the normal alpha factor in the first month of the simulation to obtain the alpha factor to be used in the forecasting process. If the value is zero, the item is treated as a policy alpha item and given the policy default alpha value. If the value is greater than zero, the item is treated as if the item manager has input this alpha value.

Appendix C

Availability

Past users of USIMS have noted that stock availability values derived from the model increase over time, especially in the first months after the simulation started. This simulation phenomenon seems to operate almost independently of commodity or policy parameters being simulated with the exception of the Medical commodity. Considerable efforts have been made to detect the source of this phenomenon. Isolation of this phenomenon has not yet been successful, since the measure of availability depends so heavily on requisition generation, receipts, returns, buy generation, and so on. When tested in the extended run scenario (to 48 months), availability did tend to stabilize on a higher level than at the outset.

A number of possibilities have been explored to compensate for this phenomenon. One method is to use the relative change to a baseline value in place of the value straight from the detail report. In other words, a baseline run may yield an availability of 95.1 %, obviously, much too high. The alternative run may yield an availability of 96.2 %. If variance is low enough, one could conclude a statistically significant difference of

$$96.2 / 95.1 - 100 = 1.016 - 1.000 = .016 \text{ or } 1.6 \% \text{ relative increase.}$$

If the true availability of the DSC is 88.9 %, they we multiply 88.9 X 1.016 to obtain the projected availability of 90.32 based on USIMS. Another method would be to add a section of code to simulate processes that impact availability negatively, denials, litigation, and suspended stocks, for example. Because these events are not included in USIMS, availability is overstated.

Appendix D

Buying (Excessive)

One of the problems mentioned in the discussions of the old version of USIMS involves the buy generation process. It has been asserted that stock was being purchased too frequently and in excessively large quantities in comparison to the real world. These errors may easily contribute to the problem of increasing availability. Like supply availability, the problem involves the interaction of many areas of the supply chain and remains hard to isolate and analyze. This problem has also been investigated in the course of the enhancement process, but nothing conclusive to either prove or disprove these suspicions could be substantiated. One of the reasons for frequent buying may have been in the treatment of dues in from returns (see Appendix Z on special USIMS variables).

Appendix E

Changes In The Enhanced USIMS Package

A. Changes to Coding of FRONT. The following changes were made to the FRONT portion of the USIMS model:

1. Added Block Data subprogram (INIT2) to initialize variables.
2. Changed to named common blocks.
3. Added logical variable END10, changed variable names, added variables (I15CTR, I16CTR, X16QTY), and changed dimensions of ITMTYP, NOP to accommodate new option 16.
4. Changed coding at statements 618, 623, 628 to streamline processing.
5. Changed coding in option 2 (use of special monthly demand tape) to account for the possibility of hitting end of file on this tape before end of file on extract (use of END10) to allow for processing of end of file on the input.
6. Changed order of lines in option 15 (used to delete items in a buy position).
7. Added new option 16 to generate a buy for items in a buy position.
8. Changed the calculation of the reorder point for NSO type items.
9. Changed labels for ITMTYP as follows:
 - Type 1 NSO items
 - Type 2 all replenishment items
 - Type 3 all VIP items
 - Type 4 all non-VIP items
 - Type 5 non-VIP monthly items
 - Type 6 all items (total)
10. Deleted lines in Report no longer needed to print item information.
11. Changed ranges for demands per year.
12. Changed format 101, the B parameter card, to accommodate the new I3 format for NOP16, to generate buys.
13. Added print out line for option 16 on FRONT output report.

14. Because the COBOL extract pulls one trailer record for each destination due in on a YPG or contract, coding was added to consolidate due in lines for different destinations on the same buy.

15. Changed code in sort routine.

16. Changed calculation of new VIP alpha factors when items change from non-VIP to VIP.

17. Changed coding to allow the item's essentiality code on the USBAEDIT tape to be used instead of assuming value of 1.0.

B. Changes to Coding of USIMS. The following is a list of changes made in the course of DLA-LO(DORO)'s work on Phase One of the enhancement of USIMS.

1. Changed small procurement maximum to \$25000.

2. Changed titles of appropriate reports to reflect above change one.

3. Changed consolidation of buy procedures in ROPX to ensure that the consolidated buy is recorded in the proper month.

4. Changed title on reports 10 and 11.

5. Changed defaults of NSOMAX and BUYMAX.

6. Enhanced various aspects of NSO computation and handling.

7. Changed calculation for returns frequency to use 361 instead of 360 in denominator.

8. Changed POLICY for check of initial monthly value to skip processing if month one.

9. Added new random number generator index IS9 for determining recurring versus non-recurring demand.

10. Changed to skip parts of FORCX for NSO items.

11. Removed erroneous coding in DGSC version of FORCX.

12. Changed disposal routine to ignore dues-in.

13. Changed sequence of events in monthly determination. (See Appendix BB, Timing).

14. Changed to reflect new control level policies by initializing F1 and F2.

15. Changed FORCX's handling of negative QFDs.

16. Changed determination of ALPHA from tape.
17. Eliminated portions of STARTX that could be handled in FORCX when called in first month; call FORCX in month one to complete the forecasting previously assumed done in extraction.
18. Eliminated certain lines in FORCX as they pertain to ALPHX.
19. Corrected TSLIM determination.
20. Changed VSL calculations in FORCX.
21. Implemented a new BOREL and changed calls from various routines to use BOREL.
22. Changed AMAD calculation in FORCX.
23. Changed calculation of ERETQT to be in FORCX and added this variable to common block.
24. Changed MAIN to account for new call of FORCX from STARTX.
25. Changed FTERDD portions to use LE (less than or equal to) instead of LT (less than).
26. Changed OUTPUT to allow output reports to be selected; note that new parameter cards (USIMS parameter card 0) are required and that non-selected printed reports can be written out to tape or disk file - see Appendix J, JCL considerations.
27. Changed AERQ portion of FORCX.
28. Changed routine in FORCX on AMADLT.
29. Changed MAD multiplier in FORCX.
30. Changed to named common blocks and used BLOCK DATA subprogram called INIT1 to initialize values.
31. Changed second occurrence of IS7 to be new index, IS1.
32. Changed placement of BLT calculation routine in FORCX.
33. Changed various uses of random numbers to be read in from a tape with one million random numbers, using 6000 elements in RNTAB, 6000 elements in RLTAB, and 6000 elements in RVTAB. RVTAB is filled by applying a formula from the Fishman book (see pages 410 through 412).

34. Changed format of parameter card one to allow 99999 items as the maximum instead of 9999.
35. Dropped safety level adjustment in MNTHLY.
36. Changed large purchase threshold to be a parameter input on policy card.
37. Changed to parameterized EOQ cutoff limits.
38. Changed FORCX and report title to obtain Report 79 on MAD over the lead time.
39. Imposed lower limit on RPLT, the sum of ALT and PLT, of 30 days.
40. Simplified code in OUTPUT.
41. Changed MAIN to write out new file, number 16, to be used as the input file in extending run time to beyond 24 months; SORT2 is also called and needs to be compiled.
42. Changed some reports to show average instead of totals.
43. Changed STARTX to dispose of assets after call to FORCX.
44. Added various variables to Common Block.
45. Changed reports 21-24 and 74 to be in thousands of dollars.
46. Changed coding in SORT2 to conform with changes in FRONT.
47. Changed format 100 in MAIN to accommodate more than 100 thousand items in ADV group two.
48. Added reading in of new parameter cards five and six for the ALT and PLT distributions.
49. Changed coding to make old parameter card five (for policies) to be nine.
50. Added reading of new requisition size distributions on cards seven and eight.
51. Added second page to F-427 Report to include printing of data distributions for requisitioning and lead times.
52. Changed determination and application of lead time distributions to use days of deviation and linear interpolation between points in the distribution.

53. Changed calculation for award and receipt dates in array DUE for each buy.

54. Added minimum check for both administrative and production lead time of 30 days.

55. Added variable ITEMS1 in item loop to allow compilation under the "VS FORTRAN" compiler.

56. Changed array TITLES and added new equivalence statements in OUTPUT to avoid compiler warning using new "VS" compiler.

57. Added integer functions on values QT in MAIN for partial releases to rectify problems in BOREL.

58. Added additional common block elements in REQS1 to accommodate new requisition interarrival algorithm. Added this common block to STARTX, MNTHLY, MAIN, and POLICY.

59. Made changes in STARTX, MNTHLY, and MAIN to incorporate new algorithm. Monthly values are no longer used; instead, a yearly requisition rate is used.

60. Added new subprogram WEIBUL, which initializes parameters of the requisition arrival process. The subprogram also has the REQNS1 common block. It calls none and is called by STARTX and POLICY.

61. Since the variable UFREQ is no longer needed, all references to it were removed from MAIN, STARTX, MNTHLY, and POLICY.

62. To calculate a requisition size in months for which the frequency was zero, the yearly average requisition size YRAVSZ is calculated in STARTX and used in the array UAIQ. Changes were made in STARTX and POLICY.

63. Parameter card four in USIMS was changed to read in variables DUMMYC and DUMMYM, both of which are used in determining the requisition interarrivals for Construction and Medical commodities. Formats in MAIN to read and write this parameter card were changed.

64. Warning messages in STARTX and POLICY have been added to print out when the policy variable PCF is less than or equal to zero. The variable HITSPY (hits per year) is set to zero and will cause a divide by zero error.

65. Added a screen not to call BOREL in DUEINX.

66. Added integer function for AUT1 in STARTX.

67. Added check for AUT1 being zero in DUEINX.

68. Added checks in MNTHLY and STARTX for RNRADJ.

69. Changed array RNRARR to use the random number stream.

70. Changed title of output reports from DSAH-LOO to DLA-LO.

71. Changed dimensions of arrays QUNOB1, QUNOB2, and QUNOB3 to accommodate more backorders and reduce the number of "wasted" requisitions (see ERROR MESSAGES IN USIMS). All common blocks were accordingly changed.

72. Initialized the top limits of the requisition size distributions to 50 instead of 12. (Research was done on all commodities and the mean requisition size in the interval labelled over 10 was about 20).

73. Initialized the top limits of the lead time days distributions to 200 instead of 100. (Research should be done on each commodity by the appropriate DSC OR team to determine the mean in the interval labelled over 70).

74. Initialized all of the random number stream indices in INIT1 in increments of 100 to prevent possible unwanted interactions. Previously, all random number stream indices started from the one and may have progressed in unison.

75. Corrected coding of alpha values in STARTX and FORCX to allow item manager manual input of alpha factors to be read in properly.

C. Parameter Card Changes in FRONT. The following changes were made to the parameter card formats:

The B parameter card of FRONT has two fields, each I3 in length, in cc 61 - 63 and 64 - 66, for options 15 and 16. Like the other options for FRONT, leave these options blank if not desired in the FRONT run. See Appendix I, FRONT OPTIONS, for further details.

D. Parameter Card Changes in USIMS. The following changes were made to the parameter card formats:

1. The number of items in the sample was increased to 99999 by deleting one of the blank spaces at the end of the input data but before '861' on parameter card one of USIMS. One blank space from the end was deleted to make room for up to 999999 items in ADV group two.

2. A 0-1 switch was added to parameter card four in USIMS to indicate whether or not a data set showing simulation-end values should be output for use to extend the run. '0' means no; '1' means yes. The variables DUMMYC and DUMMYM are added as input on this card by deleting spaces from the end of line.

3. A parameter card number five has been added to read in a cumulative distribution of administrative lead time.

4. A parameter card number six has been added to read in a cumulative production lead time distribution.

5. A new parameter card number seven has been added to read in a requisition size distribution for items with a monthly average requisition size greater than five.

6. A new parameter card number eight has been added to read in a requisition size distribution for items with a monthly average requisition size less than or equal to five.

7. In conjunction with these changes old USIMS policy cards number five were revised to be number nine.

8. Two zero parameter cards of input have been added and are required. These commence with 'ZTHS9-' and end '860.' The remaining 71 fields on each card are 0-1 switches to write output reports to the printer. '0' means do not write the report to printer, but if FT11F001 is used, the non-selected reports will be written to tape; if '1' is entered, the report is printed out and not written to FT11F001. The 0-1 switch for each card column refers to the report in question. Note that the first column available is cc 7, which corresponds to report one; the last cc on the first card is cc 77, which corresponds to report number 71. On card two (also starting 'ZTHS9-' and ending '860'), the first available column is again cc 7, which corresponds to report 72; reports beyond cc 15 do not refer to any reports and may be zero-filled or filled with ones.

Appendix F

Demands

The FRONT module breaks the recorded quarterly demands from the USBAEDIT file into monthly values by a random number process. The value for each month's demand frequency (and quantity) is preserved in arrays called FREMNR and FREMR (DEMMNR and DEMMR). In the original version of USIMS, the value for each of the 12 months was repeated in the second year of the simulation. The value for month one was the same as the value for month 13. These monthly values were used to determine requisition sizes and interarrivals.

The new version of USIMS uses only some of these monthly values. For the average requisition size, it retains and uses these values with the exception of those months for which the demand frequency is zero. In this instance, a frequency of zero would give a divide by zero error when determining an average requisition size. To eliminate this problem, the yearly average requisition size is used. In place of monthly arrival rates (demand frequencies), the yearly arrival rate is used for all months. For a more detailed discussion, see Appendix W, Requisition Processing Problems.

Appendix G

Error Messages

A. Data Extraction Program. The following are error messages associated with the data extraction program:

unmatched to SCF

NSN dropped due to control

SCF age of item field indicates new item

SCF procurement cycle months are non-numeric

SCF procurement cycle field is zero months

SCF current SSC is (x), where x can be 2,3,6, or 9

SCF FSSC is (x), where x can be 2,3,6, or 9

SCF catalog change code is (xx), where xx can be LL, DD, DL, DM, DP, DQ, DW, RA, RB, RD, RL, RM, CO

unmatched to month-end asset (MEA) file

SCF unit price field is non-numeric

SCF fixed safety level months field is non-numeric

no demand for one year

MEA on hand issuable assets field

month-end asset at end

SCF NSO quantity field is zero for item category code ICC -(x), where x can be 2 or B

unmatched to the National Inventory Record (NIR)

B. FRONT Program. The following is the error message associated with the data FRONT module:

parameter card missing or out of sequence

C. USIMS Program. The following are error messages associated with the data USIMS module:

simulation run aborted

parameter card is either missing or out of
sequence correct the error condition and
reenter

error condition xx for NSN xxxxxxxxxxxx, where
xx can be from 1 to 16 and the thirteen digit
number represents the NSN. Error codes 1
through 16 are explained below.

CODE
(NERCTR)

EXPLANATION

- | | |
|----|--|
| 1 | The requisition generator attempted to generate more IPG I requisitions on a given day than could be stored in the array. |
| 2 | Same as error one but for IPG II requisitions. |
| 3 | Same as error one but for IPG III requisitions. |
| 4 | Requisition processing attempted to make an IPG I direct delivery which would have exceeded the array size. Requisition counters are incremented but the requisition is wasted. |
| 5 | Same as error four but for IPG II direct deliveries. |
| 6 | Requisition processing attempted to backorder an IPG I requisition which would have exceeded the array size. Requisition counters are incremented but the requisition is wasted. |
| 7 | Same as error six but for IPG II requisitions. |
| 8 | Same as error six but for IPG III requisitions. |
| 9 | An error occurred in handling the procurement due-in array. The date due in does not match the current date. |
| 10 | An attempt was made to increment the returns array as the result of an FTE generation but the returns array is filled. The return is wasted. |
| 11 | Current date does not match the obligation date of a procurement. Processing will continue. |
| 12 | Same error as 11 but for IPG I direct delivery. |
| 13 | Same error as 11 but for IPG II direct delivery. |

- 14 Current date does not match the delivery date of an IPG I direct delivery. Processing will continue.
- 15 Same as error 14 but for IPG II direct delivery.
- 16 Procurement processing attempted to create more procurements than the array allows. The procurement is not created.

NOTE: These numbers correspond to the NERCTR in Appendix Z on special variables in USIMS.

Appendix H

Fractionation Report

This SAMMS report is the source of statistics for the scaling done in USIMS. Specifically, it is the source of population numbers for FRONT parameter card A and USIMS parameter card one, two, and three. Since USIMS is only concerned with family heads, (one item is the preferred or standard item, the family head, while other family members are specific, non-standard, or non-preferred items), only the reports for family heads should be used as the source of information about the population of items. Also, only those items which have experienced demand over the past year should be included in the count. The Fractionation Report uses more detailed categories than the six in USIMS. Therefore, one must be sure to include all items of the appropriate dollar value groupings and sub-groupings.

Note that when weapons items or NSO items are deleted from the sample in FRONT, it is necessary to adjust the population values recorded on USIMS parameter card one in card columns (cc) 33 through 65. Failure to do so (merely using the counts for all items that are family heads by dollar value groupings) assumes that the items deleted from the sample were in the same proportion to the population as a whole.

Since the scaling is done on a proportional basis by dollar value grouping (ICAT), the values for one particular item are scaled to represent the population in that dollar grouping, and then all dollar groupings are summed to find the total value for the entire population. Hence, a scaling factor is used as the multiplier and is computed as a ratio of the number of items in the population compared to the number of items in the sample.

Appendix I

FRONT Options

The following 16 separate options apply to the execution of the data preparation module, FRONT.

Option 1 can be used to delete or select weapons system items. It is input in cc 12 on the B parameter card. One is used to delete non-weapons items, and two deletes all weapons items.

Option 2 pertains to the use of a special demand tape by months; if desired, code one in cc 13 to use this option.

Option 3 converts items to VIP status based on a dollar value threshold. To exercise this option, code the eight digit value of annual demand desired as the breakpoint in cc 14 - 21.

Option 4 converts items to VIP status based on a requisition frequency. To use this option, enter the five digits representing the value above which items will change to VIP status in cc 22 - 26.

Option 5 deletes all backorders of an age in days equal to or greater than the value of the option entered in cc 27 - 31.

Note that by entering 00001, all backorders are deleted.

Option 6 deletes all late dues-in of an age in days equal to or greater than the value of the option entered in cc 32 - 36.

Note that entering 99999 causes all late dues-in to be deleted.

Option 7 deletes all returns of an age in days equal to or greater than the value of the option coded in cc 37 - 41 on the B parameter card. Again note that entering 99999 in this field will cause all returns to be deleted.

Option 8 reduces the stock on hand to the retention limit. The value of this option, which is coded in cc 42 - 46, represents the number of quarters of demand desired for the retention limit.

Option 9 deletes all direct delivery records of an age in days greater than or equal to the value of the option coded in cc 47 - 51 of the B parameter card. Entering 00001 causes all direct deliveries to be dropped.

Option 10 can delete items. Enter in cc 52 - 56 the number of months shelf life below which items will be dropped from consideration.

Option 11 deletes NSO items. Enter one in cc 57 to delete all NSO items or two in cc 57 to delete non-NSO (replenishment) items.

Option 12 deletes items by FSG. Enter one in cc 58 and be sure to use parameter card C.

Option 13 deletes items by FSC. Enter one in cc 59 and be sure to use parameter card D.

Option 14 deletes items by NSN. Enter one in cc 60 and be sure to use appropriate parameter card E.

Option 15 deletes items in a buy position. Enter a number between 001 and 100 in cc 61 - 63. The value of the option indicates what per cent of all items in a buy position will actually be dropped. Coding the option with 100 or more will cause all items in a buy position to be dropped from consideration. Note that if a small sample is chosen so that the sample yields fewer than 100 items that are in a buy position, the number of items deleted will be the option value. This feature applies to every 100 items, since the program cannot know in advance how many items will be in the buy position. See also the note to Option 16.

Option 16 is used to create a due in from procurement for items in a buy position. To exercise the option, code a number from 001 to 100 in cc 64 - 66 to indicate, as in option 15, the per cent of items for which buys will be made. This is a new option implemented as a result of the fact that the COBOL extract program does not pick up recommended buys and consider these as due in. As in option 15, one would expect a certain per cent of the items to actually be in a buy position at the quarter end. Choosing a value of 100 or more causes buys to be generated for all items in a buy position. NOTE: it makes little sense to exercise both options 15 and 16 at the same time; the intent is exactly the opposite, as 15 drops the item from consideration while 16 creates a due-in for the item. The same note about small numbers of items in a buy position (see Option 15) applies here as well.

Both cards A and B are mandatory to run the FRONT module. All options not exercised should be left blank. All options are integer values and are right justified.

Appendix J

Job Control Language (JCL) Considerations

The DLA Operations Research Analysis Network (DORAN) consists of a mainframe computer, IBM or IBM compatible, linked to Headquarters and Center Operations Research staffs. Each DSC also has IBM or compatible computer equipment. Operations Research work is executed on these machines in a batch mode. USIMS is one such program run in this environment requiring IBM JCL statements.

In the past a number of cataloged procedures were used to execute both FRONT and USIMS. Modified cataloged procedures are distributed to DSCs and are available on the DORAN. In addition, an interface system has been developed on the DORAN, option L.U, which accepts inputs normally made to FRONT and USIMS parameter cards and which then builds the required JCL to submit the job. Please note that any old procedures may not run properly, since some new files are available or mandatory for the execution of the program. Furthermore, because a block data subprogram is used (INIT1), only one policy run can be executed with one execute statement (in the past, USIMS would control the number of times the program would execute and rewind the tape as needed).

To document what is required in the JCL stream, an example of JCL with a number of useful instream procedures is being provided here. These procedures when included in the JCL stream can be executed much like cataloged procedures. The following text with JCL comments explains the JCL being sent:

```
//GOR6009A JOB (6009,OR) 'NAIMON',MSGCLASS=X,CLASS=G
//***** A TYPICAL JOB CARD
//COMPILEU PROC
//***** THE START OF THE PROCEDURE TO COMPILE USIMS
//FORT EXEC PGM=IEYFORT,
//***** NOTE THAT YOUR INSTALLATION MAY HAVE A DIFFERENT
//***** COMPILER
//      PARM=(NOLIST,NOID,EBCIDIC,SOURCE,NOXREF,NOMAP)
//***** YOU MAY WANT TO CHANGE THESE PARAMETERS, BUT THIS
//***** SUPPRESSES MOST OF THE OUTPUT
//SYSPRINT DD SYSOUT=*
//***** THIS CAN BE DUMMIED OUT LATER
//SYSPUNCH DD SYSOUT=B
//SYSLIN DD DSN=*&LOADSET,UNIT=DISK,DISP=(MOD,PASS),
// SPACE=(960,(2000,50),RLSE),DCB=BLKSIZE=960
//SYSIN DD DSN=GOR.USIM1LIB(USIMS1),DISP=SHR
//      DD DSN=GOR.USIM1LIB(INIT1),DISP=SHR
//      DD DSN=GOR.USIM1LIB(STARTX1),DISP=SHR
//***** (ETC.)
//***** THE CONCATENATED LIST OF PROGRAM MODULES REQUIRED
//***** TO COMPILE PROGRAM
```

```

//LKED EXEC PGM=IEWLF440,PARM='LIST,LET,XREF,SIZ=80K',
//***** LINK EDIT STEP OF SYSLIN — NOTE YOU MAY CHOOSE OTHER
//***** PARMS AND CHECK LINK PROGRAM NAME
// COND=(4,LT,FORT)
//SYSLMOD DD DSN=&GOSSET(MAIN1),UNIT=DISK,DISP=(,PASS),
// SPACE=(3072,(90,20,2),RLSE),DCB=BLKSIZE=3072
//SYSLIN DD DSN=&LOADSET,DISP=(OLD,DELETE)
// DD DDNAME=SYSIN
//SYSUT1 DD DSN=&SYSUT1,UNIT=(DISK,SEP=(SYSLIN,SYSLMOD)),
// SPACE=(3072,(50,20),RLSE),DCB=BLKSIZE=3072
//SYSPRINT DD SYSOUT=*
//SYSLIB DD DSN=DGTS.FORTLIB,DIP=SHR
//***** NOTE THAT THE SYSLIB DATA SET NAME IS PROBABLY DIFFERENT
//***** AT YOUR INSTALLATION
//COMPILEU PEND
//COMPILEF PROC
//***** BEGINNING OF PROC TO COMPILE FRONT
//***** THE ONLY DIFFERENCE IS IN THE SYSIN OF THE FORT
//***** STEP AS FOLLOWS AND THE LKED, SYSLMOD AS FOLLOWS
//SYSIN DD DSN=GOR.USIM1LIB(FRONT1),DISP=SHR
// DD DSN=GOR.USIM1LIB(SORT1),DISP=SHR
// DD DSN=GOR.USIM1LIB(REPORT1),DISP=SHR
//***** (ETC.)
//***** MODULES NEEDED TO COMPILE FRONT
//SYSLMOD DD DSN=&GOSSET(MAIN2),UNIT=DISK,DISP=(,PASS),
//***** THE REMAINDER OF THE LKED STEP IS AS BEFORE FOR
//***** THE LKED STEP IN COMPILEU
//COMPILEF PEND
//USIMS PROC
//***** BEGINNING OF PROCEDURE TO EXECUTE LINKED VERSION OF
//***** SIMULATION MAIN
//GO EXEC PGM=*.STEPU.LKED.SYSLMOD
//***** THIS ASSUMES YOU USE STEP1 TO EXEC COMPILEU
//FT05F001 DD DDNAME=SYSIN
//FT06F001 DD SYSOUT=*
//FT09F001 DD DSN=GOR.FRNTG184,UNIT=TAPE,DISP=(OLD,PASS),
// VOL=(,RETAIN,,REF=*.STEP1.GO.FT09F001)
//***** THIS IS THE OUTPUT FROM FRONT FOR WHICH YOU WILL NEED
//***** YOUR OWN DSN AND VOLSER AND MUST OVERRIDE
//***** THE VOL PARM IN STEP1
//FT11F001 DD DSN=GOR.USIM.OUT&NUM,UNIT=TAPE,
// DISP=(NEW,PASS,DELETE),
// VOL=(,RETAIN,,REF=*.STEP1.GO.FT11F001),
// LABEL=(&NUM,SL,EXPDT=85365),
// DCB=(RECFM=FBA,LRECL=133,BLKSIZE=31920)
//***** THIS IS FOR THE TAPE COPY OF THE OUTPUT DETAIL REPORTS
//***** THAT ARE NOT PRINTED OUT; NOTICE THIS IS A MULTI-FILE
//***** TAPE OF WHICH THE FILE NUMBER CORRESPONDS TO THE &NUM
//***** SYMBOLIC NEEDED IN THE PROCEDURE
//***** YOU WILL NEED TO OVERRIDE THIS IN THE FIRST STEP
//FT15F001 DD DSN=GOR.RANDOM.NMBS,UNIT=TAPE,DISP=SHR,
// VOL=(,RETAIN,,REF=*.STEP1.GO.FT15F001)

```

```

//***** THIS IS THE INPUT OF RANDOM NUMBERS READ INTO THE
//***** ARRAYS AT THE BEGINNING OF THE MAIN PROGRAM
//***** YOU WILL NEED TO OVERRIDE THE VOL PARM THE
//***** FIRST TIME THE JOB EXECUTES
//FT16F001 DD DSN=GOR.FRNT184.X1,UNIT=TAPE,
// DISP=(NEW,PASS),LABEL=(1,SL,EXPDT=85365),
// DCB=(RECFM=VSB,BLKSIZE=3800),
// VOL=(,RETAIN)
//***** THIS FILE IS FOR THE EXTENSION OF THE RUN LENGTH
//***** WHICH CAN BE DUMMIED OUT IF NOT USED; NOTE THAT
//***** IF YOU PASS THIS TAPE TO THE NEXT STEP YOU WILL
//***** NEED TO OVERRIDE THE FT09 DSN AND TO FURTHER
//***** EXTEND THE RUN YOU WILL NEED TO OVERRIDE THE DSN
//***** IN THIS DDNAME
//USIMS PEND
//FRONT PROC
//***** THE BEGINNING OF PROCEDURE TO EXECUTE THE COMPILED AND
//***** LINKED VERSION OF FRONT
//GO EXEC PGM=*.STEPF.LKED.SYSLMOD
//***** THIS ASSUMES THE COMPILEF PROC IS EXECUTED AS STEPF
//FT05F001 DD DDNAME=SYSIN
//FT08F001 DD DSN=GOR.COB&ID,UNIT=TAPE,DISP=OLD,
// LABEL=(&NUM,SL,,IN),VOL=SER=&VOL
//***** THIS IS THE USBAEDIT TAPE USED AS INPUT; NOTE THAT THE
//***** SYMBOLICS ARE NOT NECESSARY FOR YOUR PARTICULAR CENTER
//***** AND THAT YOU MAY NEED ANOTHER DSN
//FT09F001 DD DSN=GOR.FRNT.OUT&ID,UNIT=TAPE,DISP=(NEW,PASS),
// LABEL=(1,SL,EXPDT=85365),DCB=(RECFM=VSB,BLKSIZE=3800)
//SYSUDUMP DD SYSOUT=*
//FT06F001 DD SYSOUT=*
//FRONT PEND
//*****
//***** HERE WOULD FOLLOW THE EXECUTE CARDS, FOR INSTANCE:
//STEPF EXEC COMPILEF
//STEPG EXEC FRONT,NUM=1,VOL=050089,ID='G.184'
//***** THE NUM SYMBOLIC IS FOR THE FILE NUMBER AND THE
//***** ID SYMBOLIC FOR THE PART OF THE DSN AND THE VOL
//***** FOR THE SER OF THE VOL/SER OF THE USBAEDIT/
//***** INPUT TAPE YOU DESIRE TO USE
//GO.SYSIN DD *
ZTH
ZTH
ZTH
/*
//***** HERE WOULD COME THE PARAMETER CARDS OR YOU MIGHT USE
//GO.SYSIN DD DSN=GOR.CARDLIB(FRONTG),DISP=SHR
//***** IF YOU HAD LOADED THE PARAMETER CARDS IN A LIBRARY
//*****
//*****
//***** ASSUME WE HAVE RUN FRONT ALREADY AND NOW DESIRE TO
//***** RUN USIMS WITH VOL/SER 050100 AS OUR INPUT
//STEPU EXEC COMPILU

```

```

//**** THIS COMPILES USIMS
//STEP1 EXEC USIMS,NUM=1,ID='G184'
//GO.FT09F001 DD VOL=(,RETAIN,SER=050100)
//GO.FT11F001 DD VOL=(,RETAIN)
//**** THIS ALLOWS YOU TO WRITE ON A NEW TAPE ON FILE 1
//GO.FT15F001 DD VOL=(,RETAIN,SER=050320)
//**** THIS MOUNTS TAPE 050320, THE RANDOM NUMBER
//**** INPUT TAPE
//GO.FT16F001 DD DUMMY
//**** SUPPOSE YOU ONLY WANT 24 MONTHS AND
//**** NO EXTENSION
//GO.SYSIN DD DSN=GOR.CARDLIB(USIMS1),DISP=SHR
//**** AS BEFORE, THESE ARE THE PARAMETER CARDS
//**** THAT ARE FOR ONE RUN AND IN A DATA SET
//STEP2 EXEC USIMS,NUM=2,ID='G184'
//**** SECOND POLICY RUN EXECUTION, RESULTS TO BE WRITTEN
//**** ON FILE 2
//GO.FT16F001 DD DUMMY
//**** DUMMIES OUT FILE 16 AS BEFORE
//GO.SYSIN DD DSN=GOR.CARDLIB(USIMS2),DISP=SHR
//**** SECOND SET OF PARAMETER CARDS
//**** NOW SUPPOSE FOR THE THIRD RUN WE WANT TO
//**** EXTEND THE RUN TO FOUR YEARS; WE NOW NEED
//**** TO WRITE FILE 16
//STEP3 EXEC USIMS,NUM=3,ID='G184'
//GO.SYSIN DD DSN=GOR.CARDLIB(USIMS3),DISP=SHR
//**** NOW WE WANT TO USE THE FILE WRITTEN IN STEP 3
//**** ON FT16 AS THE INPUT TAPE TO THIS NEXT STEP
//**** THE PROCEDURE AUTOMATICALLY WRITES FT16 ON A
//**** NEW TAPE, FILE NUMBER 1
//STEP4 EXEC USIMS,NUM=4,ID='G184.X1'
//GO.FT09F001 DD VOL=(,RETAIN,REF=*.STEP3.GO.FT16F001)
//**** NOTE THAT WE CHOOSE TO RETAIN THIS VOLUME
//GO.FT16F001 DD DUMMY
//**** WE DO NOT WANT TO WRITE ANOTHER FILE 16
//**** SO WE DUMMY OUT THIS FILE
//GO.SYSIN DD DSN=GOR.CARDLIB(USIMS4),DISP=SHR
//**** NOW SUPPOSE WE WANT TO USE THE FILE 16
//**** AGAIN AS INPUT
//STEP5 EXEC USIMS,NUM=5,ID='G184.X1'
//GO.FT09F001 DD VOL=REF=*.STEP3.GO.FT16F001
//**** NOTE THAT WE DO NOT RETAIN THIS VOLUME THIS TIME
//GO.FT16F001 DD DUMMY
//GO.SYSIN DD DSN=GOR.CARDLIB(USIMS5),DISP=SHR
//**** END OF JOB
//**** NOTE THAT EACH TIME YOU WRITE AN OUTPUT TAPE
//**** ON FILE 11; YOU CAN ALSO DUMMY THIS OUT IF
//**** YOU ARE SURE YOU WILL NOT NEED THE OTHER
//**** REPORTS. YOU WILL NEED THE FOLLOWING RESOURCES:
//**** (1) ONE DRIVE FOR INPUT TAPE FROM USBAEDIT
//**** (2) ONE DRIVE TO CREATE OUTPUT IN FRONT

```

//**** (3) ONE DRIVE FOR USIMS FOR INPUT TAPE FROM
//**** FRONT
//**** (4) ONE DRIVE FOR RANDOM NUMBER TAPE (OR PUT ON DISK)
//**** (5) ONE DRIVE FOR COPY OF DETAIL REPORTS
//**** (6) ONE DRIVE FOR NEW OUTPUT FILE, THE
//**** STATUS OF THE ITEMS AT THE END OF THE
//**** FIRST 24 MONTHS OF THE RUN
//**** (7) ONE ADDITIONAL DRIVE IF YOU WANT TO EXTEND
//**** THE RUN ANOTHER 2 YEARS FOR A TOTAL OF 6
//**** YEARS RUN TIME

Appendix K

Lead Time Distributions

The original version of USIMS used a rudimentary lead time distribution. Both the administrative lead time (ALT) and production lead time (PLT) were combined into one distribution. Also, the study used as the basis for this distribution encompassed a small sample of items and was conducted in the 1960s. To enhance the model, the DSCs were asked to analyze recent contracts at their activities and construct distributions similar to the one originally used in USIMS. Below are the values found for the DSCs that conducted such research:

Table 1

LEAD TIMES AT DCSC

<u>DAYS</u> <u>DEVIATION</u>	<u>ALT</u> <u>CUMULATIVE %</u>	<u>PLT</u> <u>CUMULATIVE %</u>
To -40	4.64	6.67
-30	7.71	9.11
-20	13.31	12.86
-10	24.13	19.21
0	42.57	30.69
10	63.01	43.49
20	80.43	56.73
30	91.54	67.42
40	97.09	76.16
50	99.39	83.74
60	99.88	90.51
70	99.93	94.87
Above 70	100.00	100.00

NOTE: this analysis includes approximately 256,000 contracts for fiscal year 1983 and uses either the actual or projected date for the PLT.

Table 2

LEAD TIMES AT DESC

<u>DAYS</u> <u>DEVIATION</u>	<u>ALT</u> <u>CUMULATIVE %</u>	<u>PLT</u> <u>CUMULATIVE %</u>
To -40	3.72	12.78
-30	5.07	15.51
-20	7.60	19.22
-10	13.79	23.88
0	32.78	29.85
10	65.95	36.54
20	81.62	43.49
30	88.45	50.30
40	91.73	56.81
50	93.88	62.88
60	95.73	68.56
70	96.91	73.51
Above 70	100.00	100.00

NOTE: this analysis is based on approximately 80,000 contracts with actual deliveries from February 1982 through February 1984; the PLT is based only on actual receipt date.

Table 3

LEAD TIMES AT DISC

<u>DAYS</u> <u>DEVIATION</u>	<u>ALT</u> <u>CUMULATIVE %</u>	<u>PLT</u> <u>CUMULATIVE %</u>
To -40	6.01	16.86
-30	8.83	20.22
-20	13.17	25.04
-10	20.54	35.22
0	66.63	72.08
10	82.81	86.69
20	88.04	90.69
30	90.87	92.55
40	92.81	93.73
50	94.18	94.65
60	95.28	95.39
70	95.98	95.96
Above 70	100.00	100.00

NOTE: this analysis is based on approximately 216,000 contracts for fiscal year 1983 using both actual and projected delivery dates for the PLT.

The information about these distributions must be entered on USIMS parameter cards five and six for ALT and PLT respectively. Instead of using a multiplier, the model now calculates a deviation in days based on a uniform zero/one random number stream and the observed distribution. Interval extremities are -100 and 200 days respectively. Linear interpolation is used to translate a random number into a time in the proper interval to obtain a deviation from the recorded average value in days.

In contrast to SAMMS processing, this average is not updated when buys are made and stock is received. The smoothed total lead time is used in calculating the reorder point in FORCX.

Appendix L

Maximum Release Quantity

USIMS does not use the SAMMS maximum release quantity (MRQ) policy checks, since requisition sizes are generated by empirical requisition size distributions.

Appendix M

Monthly Aspects

USIMS parameter cards of type nine allow changes to both SAMMS's and simulation policies to be implemented on a monthly basis. To enter a change from the beginning of the simulation, the month of the change is coded as '1'. That is, the change is implemented at the start of month one. Policy changes are made before monthly accumulation and before monthly or quarterly forecasting. Note that a change to the policy values at the beginning of the second quarter of the simulation, which is actually the fourth month of the simulation, requires the use of '4' in the month field.

As in SAMMS processing, month-end accumulations and values reflect those values in the file as of the close of business on the last day of the month. The same applies to the quarterly items. Only after the month is over does the updating of the forecast occur. The month-end values (quarter-end values) were calculated for some variables (EOQ, VSL, QFD) at the beginning of the month (quarter). These values remain constant during the forecast period.

Appendix N

New Users' Introduction to USIMS

The purpose of this appendix is to orient the newcomer to the USIMS package of programs. The programs are available for use at each DSC at DLA Headquarters. There are various levels of knowledge and competence that can be attained in any endeavor, and so it is with the USIMS package. The new user should recall from the Introduction that one purpose of this document is to provide a reference source for knowledge about USIMS. It should be clear that one should not commit the entire contents of this document to memory to become a competent user. A newcomer should first acquaint himself or herself with the basics, which can be found in initial chapters of this guide. After this material has been read, he may wish to review other sources described in Appendix U, Recommended Readings. Before proceeding, a newcomer may wish to deepen his understanding of the three segments of the USIMS package by reading sections III and IV in this guide, which describe each of the three segments in progressively greater detail.

With this overview, a newcomer must next ask the question concerning his or her intentions - do I want to run FRONT or USIMS, do I want to analyze simulation output, or do I want to design an experiment using USIMS. Let us suppose that the new user wants to run both FRONT and USIMS and let us further assume that no change to the extraction process is desired, as is usually the case. In order to run these programs, refer to the section on execution procedures, section V. After reviewing the output reports, the new user can refer to the subsection on running USIMS. Many short cuts are available, especially if the new user can consult with a more senior analyst or can use recent parameter card files or decks in place of creating entirely new files or if the DLA Operations Research Analysis Network (DORAN) can be accessed.

In the area of interpreting the results of the simulation, the newcomer should refer to section VI of the guide for comments and suggestions. Time and experience will be needed to develop expertise in this area.

If the newcomer is interested in exactly how simulation processing functions, more details can be found in section IV on the description of USIMS subprograms. In addition, the source code with general comments has been made available to each DSC and is also on the DORAN to browse under data set DGTS.USIMYYMM.SOURCE, where YY is the year of the release and MM is the month of the release.

While not recommended for the newcomer to the USIMS package, it should be stated that general or DSC specific changes or special programs can be incorporated into USIMS to handle a variety of tasks. A number of approaches are available to accomplish such tasks. Both methods involve creating a specific program version by copying the source code into a separate program library. In one of these two approaches, changes to the FORTRAN source are made, compiled and executed. This

changes to the FORTRAN source are made, compiled and executed. This approach may lead to numerous versions of the entire package or subroutines, all of which may be hard to distinguish at some later date, if all versions are kept. A user could conceivably have numerous versions of various subprograms requiring compilation in certain specific combinations. The second approach involves using the link-editor feature to create a re-executable module. With this approach, changes made to the source code are incorporated into a complete program in load module form ready to execute. In place of recalling which combinations of subprogram versions needed to be compiled, a user might be able to distinguish program versions by some naming convention. In order to become competent in this area, the user is counseled to become familiar with the processing done in each subprogram, to review the source listings, and to consult with more senior analysts.

Appendix O

Optional Demand Data Distribution Input

The sample data preparation program FRONT uses quarterly demand data for one year from the SCF. As a programming expedient in preparing this data for the simulation, this data is randomly divided into monthly increments. Requisitions in USIMS are generated to approximate the monthly average requisition size values except when there were no requisitions in that month; here the yearly average size is used.

Through the use of Option two on FRONT Parameter Card B, the user may substitute the real monthly distributions of quantity and frequency for each item. The optional demand data may be generated for any of the sample items.

The optional tape must be in the following format:

<u>Element Name</u>	<u>Position</u>
Federal Supply Group	1-2
Federal Supply Class	3-4
National Item Identification Number (NIIN)	5-13
Recurring Demand Quantity - Month 1	14-20
Recurring Demand Quantity - Month 2	21-27
Recurring Demand Quantity - Month 3	28-34
Recurring Demand Quantity - Month 4	35-41
Recurring Demand Quantity - Month 5	42-48
Recurring Demand Quantity - Month 6	49-55
Recurring Demand Quantity - Month 7	56-62
Recurring Demand Quantity - Month 8	63-69
Recurring Demand Quantity - Month 9	70-76
Recurring Demand Quantity - Month 10	77-83
Recurring Demand Quantity - Month 11	84-90
Recurring Demand Quantity - Month 12	91-97
Recurring Demand Frequency - Month 1	98-104
Recurring Demand Frequency - Month 2	105-111

<u>Element Name</u>	<u>Position</u>
Recurring Demand Frequency - Month 3	112-118
Recurring Demand Frequency - Month 4	119-125
Recurring Demand Frequency - Month 5	126-132
Recurring Demand Frequency - Month 6	133-139
Recurring Demand Frequency - Month 7	140-146
Recurring Demand Frequency - Month 8	147-153
Recurring Demand Frequency - Month 9	154-160
Recurring Demand Frequency - Month 10	161-167
Recurring Demand Frequency - Month 11	168-174
Recurring Demand Frequency - Month 12	175-181
Non-recurring Demand Quantity - Month 1	182-188
Non-recurring Demand Quantity - Month 2	189-195
Non-recurring Demand Quantity - Month 3	196-202
Non-recurring Demand Quantity - Month 4	203-209
Non-recurring Demand Quantity - Month 5	210-216
Non-recurring Demand Quantity - Month 6	217-223
Non-recurring Demand Quantity - Month 7	224-230
Non-recurring Demand Quantity - Month 8	231-237
Non-recurring Demand Quantity - Month 9	238-244
Non-recurring Demand Quantity - Month 10	245-251
Non-recurring Demand Quantity - Month 11	252-258
Non-recurring Demand Quantity - Month 12	259-265
Non-recurring Demand Frequency - Month 1	266-272
Non-recurring Demand Frequency - Month 2	273-279
Non-recurring Demand Frequency - Month 3	280-286

<u>Element Name</u>	<u>Position</u>
Non-recurring Demand Frequency - Month 4	287-293
Non-recurring Demand Frequency - Month 5	294-300
Non-recurring Demand Frequency - Month 6	301-307
Non-recurring Demand Frequency - Month 7	308-314
Non-recurring Demand Frequency - Month 8	315-321
Non-recurring Demand Frequency - Month 9	322-328
Non-recurring Demand Frequency - Month 10	329-335
Non-recurring Demand Frequency - Month 11	336-342
Non-recurring Demand Frequency - Month 12	343-349
Reserved Blank Space	350

Appendix P

Parameter Card Layouts

A. Parameter Card Layouts in Extract

1. USBA50 Parameter Card Number One

<u>FIELD LEGEND</u>	<u>CARD COLUMNS</u>	<u>COBOL FORMAT</u>	<u>EXPLANATION/INSTRUCTIONS</u>
Document Identifier Code	1 - 3	3X	Enter ZTH.
Routing Identifier Code	4 - 6	3X	Enter RIC of DSC (S9X).
Counter	7	9	Enter 1.
National Item Identification Number (NIIN) Selection for ADV \$0 - \$400.00	8 - 13	9(6)	Enter 000 - 999.
Beginning NIIN	8 - 10		Enter last 3 digits of beginning NIIN.
Ending NIIN	11 - 13		Enter last 3 digits of ending NIIN.
NIIN Selection for ADV \$400.01 - \$4500.00	14 - 19	9(6)	Enter 000 - 999.
Beginning NIIN	14 - 16		Enter last 3 digits of beginning NIIN.
Ending NIIN	17 - 19		Enter last 3 digits of ending NIIN.
NIIN Selection for ADV \$4500.01 - 15000.00	20 - 25	9(6)	Enter 000 - 999.
Beginning NIIN	20 - 22		Enter last 3 digits of beginning NIIN.
Ending NIIN	23 - 25		Enter last 3 digits of ending NIIN.

NIIN Selection for
ADV \$15000.01 -
50000.00 26 - 31 9(6)

Enter 000 - 999.

Beginning NIIN 26 - 28

Enter last 3 digits of
beginning NIIN.

Ending NIIN 29 - 31

Enter last 3 digits of
ending NIIN.

NIIN Selection for
ADV \$50000.01 -
\$100000.00 32 - 37 9(6)

Enter 000 - 999.

Beginning NIIN 32 - 34

Enter last 3 digits of
beginning NIIN.

Ending NIIN 35 - 37

Enter last 3 digits of
ending NIIN.

NIIN Selection for
Greater than
\$100000.01 38 - 43 9(6)

Enter 000 - 999.

Beginning NIIN 38 - 40

Enter last 3 digits of
beginning NIIN.

Ending NIIN 41 - 43

Enter last 3 digits of
ending NIIN.

Output Routing
Code 44 - 45 2X

Enter 86.

Blank 46 - 80

Leave blank.

2. USBA50 Parameter Card Number Two

<u>FIELD</u> <u>LEGEND</u>	<u>CARD</u> <u>COLUMNS</u>	<u>COBOL</u> <u>FORMAT</u>	<u>EXPLANATION/INSTRUCTIONS</u>
Document Identifier Code	1 - 3	3X	Enter ZTH.
Routing Identifier Code	4 - 6	3X	Enter RIC of DSC (S9X).
Counter	7	9	Enter 2.
Federal Supply Class	8 - 79		Enter FSCs to be deleted from sample selection.
FSC	8 - 11	9(4)	Enter 0000 - 9999.

FSC	12 - 15	9(4)	Enter 0000 - 9999.
FSC	16 - 19	9(4)	Enter 0000 - 9999.
FSC	20 - 23	9(4)	Enter 0000 - 9999.
FSC	24 - 27	9(4)	Enter 0000 - 9999.
FSC	28 - 31	9(4)	Enter 0000 - 9999.
FSC	32 - 35	9(4)	Enter 0000 - 9999.
FSC	36 - 39	9(4)	Enter 0000 - 9999.
FSC	40 - 43	9(4)	Enter 0000 - 9999.
FSC	44 - 47	9(4)	Enter 0000 - 9999.
FSC	48 - 51	9(4)	Enter 0000 - 9999.
FSC	52 - 55	9(4)	Enter 0000 - 9999.
FSC	56 - 59	9(4)	Enter 0000 - 9999.
FSC	60 - 63	9(4)	Enter 0000 - 9999.
FSC	64 - 67	9(4)	Enter 0000 - 9999.
FSC	68 - 71	9(4)	Enter 0000 - 9999.
FSC	72 - 75	9(4)	Enter 0000 - 9999.
FSC	76 - 79	9(4)	Enter 0000 - 9999.
Blank	80	X	Leave blank.

3. Optional USBA60 Deletion Parameter Card

<u>FIELD</u> <u>LEGEND</u>	<u>CARD</u> <u>COLUMNS</u>	<u>COBOL</u> <u>FORMAT</u>	<u>EXPLANATION/INSTRUCTIONS</u>
Document Identifier Code	1 - 3	3X	Enter ZTH.
Routing Identifier Code	4 - 6	3X	Enter RIC of DSC (S9X).
Blank	7		Leave blank.
National Stock Number	8 - 20	9(13)	Enter NSN of item to be deleted from sample selection.

Date Management Assumed	21 - 25	9(5)	Enter Julian date of management assumed.
Current Date	26 - 30	9(5)	Enter current Julian date.
Blank	31 - 80	X	Leave blank.

B. Parameter Card Layouts in FRONT

1. Card A of FRONT

<u>FIELD</u> <u>LEGEND</u>	<u>CARD</u> <u>COLUMNS</u>	<u>FORTRAN</u> <u>FORMAT</u>	<u>EXPLANATION/INSTRUCTIONS</u>
Document Identifier Code	1 - 3	3X	Enter ZTH.
Routing Identifier Code	4 - 6	3X	Enter RIC of DSC (S9X).
Percent of Issue Priority Group I Requisitions	7 - 9	F3.2	Enter 3 digits ranging from 000 to 100 with an implied decimal between first and second digit.

Note that 025 equates to .25 or 25 %.

Percent of Issue Priority Group I and II Requisitions	10 - 12	F3.2	Enter 3 digits ranging from 000 to 100 with an implied decimal between first and second digit to be the sum of IPG I and IPG II requisitions.
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Note that 025 equates to .25 or 25 %.

Factor for Returns	13 - 18	F6.4	Enter 6 digits with an implied decimal between second and third digit.
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DSC Item Population by Annual Dollar Category

0 - 400	19 - 25	F7.0	Enter values from Fractionation Report for Family Heads
400 - 4500	26 - 32	F7.0	
4500 - 15000	33 - 39	F7.0	
15000 - 50000	40 - 46	F7.0	
50000 - 100000	47 - 53	F7.0	
Over 100000	54 - 60	F7.0	

DSC Total Value
of Annual Demand 61 - 69 F9.0 Enter 9 digit field with
in 000s no decimal point.

DSC Total Number
of Requisitions for Enter 8 digit field with
Past 12 Months 70 - 77 F8.0 no decimal point.
in 000s

Output Routing
Code 78 - 79 2X Enter 86.

Sequence Letter 80 A1 Enter A.

2. Card B of FRONT

<u>FIELD LEGEND</u>	<u>CARD COLUMNS</u>	<u>FORTRAN FORMAT</u>	<u>EXPLANATION/INSTRUCTIONS</u>
Document Identifier Code	1 - 3	3X	Enter ZTH.
Routing Identifier Code	4 - 6	3X	Enter RIC of DSC (S9X).
Julian Date	7 - 11	I5	Enter Julian Date.
Option 1	12	I1	Enter 1 to delete non- weapons items; enter 2 to delete weapons items.
Option 2	13	I1	Enter 1 to exercise option.
Option 3	14 - 21	I8	Enter 8 digits to use.
Option 4	22 - 26	I5	Enter 5 digits to use.
Option 5	27 - 31	I5	Enter 5 digits to use.
Option 6	32 - 36	I5	Enter 5 digits to use.
Option 7	37 - 41	I5	Enter 5 digits to use.
Option 8	42 - 46	I5	Enter 5 digits to use.
Option 9	47 - 51	I5	Enter 5 digits to use.
Option 10	52 - 56	I5	Enter 5 digits to use.
Option 11	57	I1	Enter 1 to delete NSO items; enter 2 to delete non-NSO items.

Option 12	58	I1	Enter 1 to exercise option.
Option 13	59	I1	Enter 1 to exercise option.
Option 14	60	I1	Enter 1 to exercise option.
Option 15	61 - 63	I3	Enter 3 digits from 000 to 999 to use option.
Option 16	64 - 66	I3	Enter 3 digits from 000 to 999 to use option.
Blanks	67 - 77		Leave blank.
Output Routing Code	78 - 79	2X	Enter 86.
Sequence Letter	80	A1	Enter B.

3. Card C of FRONT

<u>FIELD</u> <u>LEGEND</u>	<u>CARD</u> <u>COLUMNS</u>	<u>FORTRAN</u> <u>FORMAT</u>	<u>EXPLANATION/INSTRUCTIONS</u>
Document Identifier Code	1 - 3	3X	Enter ZTH.
Routing Identifier Code	4 - 6	3X	Enter RIC of DSC (S9X).
Federal Supply Group	7 - 74	I2	Enter FSGs to be deleted; up to 34 FSGs can be deleted.
Blank	75 - 77		Leave blank.
Output Routing Code	78 - 79	2X	Enter 86.
Sequence Letter	80	A1	Enter C.

4. Card D of FRONT

<u>FIELD LEGEND</u>	<u>CARD COLUMNS</u>	<u>FORTRAN FORMAT</u>	<u>EXPLANATION/INSTRUCTIONS</u>
Document Identifier Code	1 - 3	3X	Enter ZTH.
Routing Identifier Code	4 - 6	3X	Enter RIC of DSC (S9X).
Federal Supply Class	7 - 74	I4	Enter FSCs to be deleted; up to 17 FSGs can be deleted.
Blank	75 - 77	3X	Leave blank.
Output Routing Code	78 - 79	2X	Enter 86.
Sequence Letter	80	A1	Enter D.

5. Card E of FRONT

<u>FIELD LEGEND</u>	<u>CARD COLUMNS</u>	<u>FORTRAN FORMAT</u>	<u>EXPLANATION/INSTRUCTIONS</u>
Document Identifier Code	1 - 3	3X	Enter ZTH.
Routing Identifier Code	4 - 6	3X	Enter RIC of DSC (S9X).
National Stock Number	7 - 19	I13	Enter NSN to be deleted.
Blank	20 - 77	58X	Leave blank.
Output Routing Code	78 - 79	2X	Enter 86.
Sequence Letter	80	A1	Enter E.

NOTE: Up to 50 NSN deletions are possible. These should be in ascending numeric sequence and the last card must contain all 9's in the NSN field.

D. Parameter Card Layouts in USIMS

1. Card One of USIMS

<u>FIELD LEGEND</u>	<u>CARD COLUMNS</u>	<u>FORTRAN FORMAT</u>	<u>EXPLANATION/INSTRUCTIONS</u>
Document Identifier Code	1 - 3	3X	Enter ZTH.
Routing Identifier Code	4 - 6	A3	Enter RIC of DSC (S9X).
System Constant	7 - 15	F9.0	From RCS 96 Report or F-67.
Random Number Seed	16 - 20	I5	Enter 5 digits.
Number of Policy Runs	21 - 22	I2	Enter 01.
Number of Months	23 - 24	I2	Enter up to 24.
Number of items in Sample	25 - 29	I5	Obtained from F-426 Report.
Backorder Goal	30 - 35	F6.0	Obtained from F-40 or F-67.
Number of Items in Population by Annual Dollar Grouping			
0 - 400	36 - 41	F6.0	Enter values from the Fractionation Report for each ADV group.
400 - 4500	42 - 47	F6.0	
4500 - 15000	48 - 52	F5.0	
15000 - 50000	53 - 57	F5.0	
50000 - 100000	58 - 62	F5.0	
Over 100000	63 - 67	F5.0	
Blank	68 - 77	10X	Leave blank.
Output Routing Code	78 - 79	2X	Enter 86.
Sequence Number	80	I1	Enter 1.

2. Card Two of USIMS

<u>FIELD</u> <u>LEGEND</u>	<u>CARD</u> <u>COLUMNS</u>	<u>FORTRAN</u> <u>FORMAT</u>	<u>EXPLANATION/INSTRUCTIONS</u>
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Document Identifier Code	1 - 3	3X	Enter ZTH.
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Routing Identifier Code	4 - 6	3X	Enter RIC of DSC (S9X).
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Number of Numeric Stockage Objective Items in Population by Annual Dollar Value Group

0 - 400	7 - 12	I6	Enter values from the Fractionation Report for each ADV group.
400 - 4500	13 - 18	I6	
4500 - 15000	19 - 24	I6	
15000 - 50000	25 - 30	I6	
50000 - 100000	31 - 36	I6	
Over 100000	37 - 42	I6	

Number of Numeric Stockage Objective Items in Sample by Annual Dollar Value Group

0 - 400	43 - 48	I6
400 - 4500	49 - 54	I6
4500 - 15000	55 - 60	I6
15000 - 50000	61 - 66	I6
50000 - 100000	67 - 72	I6
Over 100000	73 - 77	I5

Output Routing Code	78 - 79	2X	Enter 86.
------------------------	---------	----	-----------

Sequence Number	80	I1	Enter 2.
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NOTE: Number in sample is obtained from the F-426 Report.
Do not enter zeros in the fields for sample if NSO
items are included in the sample; division by zero will
result.

3. Card Three of USIMS

FIELD LEGEND	CARD COLUMNS	FORTRAN FORMAT	EXPLANATION/INSTRUCTIONS
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Document Identifier Code	1 - 3	3X	Enter ZTH.
-----------------------------	-------	----	------------

Routing Identifier Code	4 - 6	3X	Enter RIC of DSC (S9X).
----------------------------	-------	----	-------------------------

Number of Very Important Program Items in Population by Annual Dollar Value Group

0 - 400	7 - 12	I6	Enter values from the Fractionation Report for each ADV group.
400 - 4500	13 - 18	I6	
4500 - 15000	19 - 24	I6	
15000 - 50000	25 - 30	I6	
50000 - 100000	31 - 36	I6	
Over 100000	37 - 42	I6	

Number of Very Important Program Items in Sample by Annual Dollar Value Group

0 - 400	43 - 48	I6
400 - 4500	49 - 54	I6
4500 - 15000	55 - 60	I6
15000 - 50000	61 - 66	I6
50000 - 100000	67 - 72	I6
Over 100000	73 - 77	I5

Output Routing Code	78 - 79	2X	Enter 86.
------------------------	---------	----	-----------

Sequence Number	80	I1	Enter 3.
-----------------	----	----	----------

NOTE: Number in sample is obtained from the F-426 Report.
Do not enter zeros in the fields for sample if VIP
items are included in the sample; division by zero will
result.

4. Card Four of USIMS

<u>FIELD LEGEND</u>	<u>CARD COLUMNS</u>	<u>FORTRAN FORMAT</u>	<u>EXPLANATION/INSTRUCTIONS</u>
Document Identifier Code	1 - 3	3X	Enter ZTH.
Routing Identifier Code	4 - 6	3X	Enter RIC of DSC (S9X).
Julian Date of Run	7 - 11	I5	Enter julian date of run. (Note: this is not for computational purposes but only a matter of record).
Blank	12 - 14	3X	Leave blank.
Number of Days Between Procurement Consolidations	15 - 17	I3	Enter number of days between consolidation of buys.
Alpha Switch	18	I1	Enter 0 for alpha of record; Enter 1 for use of policy table value.
Disposal Switch	19	I1	Enter 1 for automatic disposal only and counts of reviewed; Enter 2 for automatic and reviewed disposals made.
Returns Switch	20	I1	Enter 0 from normal run; Enter 1 to delete all returns generation.
Continuation Switch	21	I1	Enter 0 for no continuation; Enter 1 to continue beyond simulation by writing output tape.
DUMMYC Value	22 - 26	F5.2	If S9C enter 1.0, else leave blank. This is for use in the determination of requisition interarrivals.
DUMMYM Value	27 - 31	F5.2	If S9M enter 1.0, else leave blank. This is for use in the determination of requisition interarrivals.
Blank	32 - 77	46X	Leave blank.

Output Routing Code	78 - 79	2X	Enter 86.
Sequence Number	80	I1	Enter 4.

5. Card Five of USIMS

<u>FIELD</u> <u>LEGEND</u>	<u>CARD</u> <u>COLUMNS</u>	<u>FORTTRAN</u> <u>FORMAT</u>	<u>EXPLANATION/INSTRUCTIONS</u>
Document Identifier Code	1 - 3	3X	Enter ZTH.
Routing Identifier Code	4 - 6	3X	Enter RIC of DSC (S9X).

Cumulative Probability Distribution for Administrative Lead Time of the DSC

12 Endpoint Probabilities	7 - 66	F5.4	Enter decimal and four digits to express the center-specific cumulative distribution for ALT.
Blank	67 - 77	11X	Leave blank.
Output Routing Code	78 - 79	2X	Enter 86.
Sequence Number	80	I1	Enter 5.

6. Card Six of USIMS

<u>FIELD</u> <u>LEGEND</u>	<u>CARD</u> <u>COLUMNS</u>	<u>FORTTRAN</u> <u>FORMAT</u>	<u>EXPLANATION/INSTRUCTIONS</u>
Document Identifier Code	1 - 3	3X	Enter ZTH.
Routing Identifier Code	4 - 6	3X	Enter RIC of DSC (S9X).

Cumulative Probability Distribution for Production Lead Time of the DSC

12 Endpoint Probabilities	7 - 66	F5.4	Enter decimal and four digits to express the center-specific cumulative distribution for PLT.
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Blank	67 - 77	11X	Leave blank.
Output Routing Code	78 - 79	2X	Enter 86.
Sequence Number	80	I1	Enter 6.

7. Card Seven of USIMS

<u>FIELD</u> <u>LEGEND</u>	<u>CARD</u> <u>COLUMNS</u>	<u>FORTRAN</u> <u>FORMAT</u>	<u>EXPLANATION/INSTRUCTIONS</u>
Document Identifier Code	1 - 3	3X	Enter ZTH.
Routing Identifier Code	4 - 6	3X	Enter RIC of DSC (S9X).

Cumulative Probability Distribution for Requisition
Size of items with Average Requisition Sizes
less than or equal to five

17 Endpoint Probabilities	7 - 74	F4.3	Enter decimal and three digits to express the center-specific cumulative distribution for requisition size.
Blank	75 - 77	3X	Leave blank.
Output Routing Code	78 - 79	2X	Enter 86.
Sequence Number	80	I1	Enter 7.

8. Card Eight of USIMS

<u>FIELD</u> <u>LEGEND</u>	<u>CARD</u> <u>COLUMNS</u>	<u>FORTRAN</u> <u>FORMAT</u>	<u>EXPLANATION/INSTRUCTIONS</u>
Document Identifier Code	1 - 3	3X	Enter ZTH.
Routing Identifier Code	4 - 6	3X	Enter RIC of DSC (S9X).

Cumulative Probability Distribution for Requisition
Size of items with Average Requisition Sizes
greater than five

17 Endpoint Probabilities	7 - 74	F4.3	Enter decimal and four digits to express the center-specific cumulative distribution for requisition size.
Blank	75 - 77	3X	Leave blank.
Output Routing Code	78 - 79	2X	Enter 86.
Sequence Number	80	I1	Enter 8.

9. Card Nine of USIMS

<u>FIELD</u> <u>LEGEND</u>	<u>CARD</u> <u>COLUMNS</u>	<u>FORTRAN</u> <u>FORMAT</u>	<u>EXPLANATION/INSTRUCTIONS</u>
Document Identifier Code	1 - 3	3X	Enter ZTH.
Routing Identifier Code	4 - 6	3X	Enter RIC of DSC (S9X).
USIMS Policy Table Item Number	7 - 9	I3	Enter from USIMS Policy Table.
Effective Month of Change	10 - 11	I2	Enter from 00 to 24 to implement change on the first day of the month designated.
New Value	12 - 20	F9.3	New value in effect until changed.
Policy Title or Comments	21 - 77	57X	Enter up to 57 characters.
Output Routing Code	78 - 79	2X	Enter 86.
Sequence Number	80	I1	Enter 9.

NOTE: Whether or not any type nine cards are entered, all runs submitted must contain a nine card with cc 7 through 20 filled with all nines as the last (if no other type nine cards, the first and last card) of this type. Type nine cards must be submitted in sequence by month of effective date of change and by policy table number within the monthly sequence.

10. Card Ten (Zero) of USIMS

<u>FIELD LEGEND</u>	<u>CARD COLUMNS</u>	<u>FORTRAN FORMAT</u>	<u>EXPLANATION/INSTRUCTIONS</u>
Document Identifier Code	1 - 3	3X	Enter ZTH.
Routing Identifier Code	4 - 6	3X	Enter RIC of DSC (S9X).
Report 0 / 1 Switch	7 - 77	I1	Enter 0 to suppress report; enter 1 to print report out for up to 71 switches.
Output Routing Code	78 - 79	2X	Enter 86.
Sequence Number	80	I1	Enter 0.

NOTE: Two card zeroes are required to account for the 80 detail reports. Seventy one switches are available on one card so that only nine positions in the second card need to be coded.

NOTE: Cards must be submitted in ascending order from one through nine and then zero as the tenth type of card.

Appendix Q

Parameter Card Usage in Extract

A. USBA50. This program requires two input cards. The first card, B-296, indicates the beginning and ending range of NIINs to be selected. The second card, B-297, is used to delete any FSCs from the selection. The second card must be present even if there are no deletions.

B. USBA60. This program only requires one type of input card, B-295. It is an optional input used to delete NSNs from the selection process. The program will accept up to 50 NSN deletion cards.

C. USBA70. This program requires no input parameter cards.

Appendix R

Policy Table Adjustments

Two types of adjustments to policy table values are used in the main simulation: (1) value substitution and (2) multipliers. An example of type one is found in policy number 108, minimum return value. The default here is \$7.00. If the value \$25.00 may now be more appropriate, 25.0 would be substituted for the default value of 7.0. In case of type two, the current value of the variable is multiplied by a factor and the multiplier is coded on the parameter card type nine of the main simulation. One example of this is policy 78 which adjusts the recurring demand generator. The line of code in 'MNTHLY' reads as follows:

$$\text{RNRADJ} = \text{RECADJ} * \text{RECUR} (\text{J2})$$

where RNRADJ is the percent of recurring demands for the next month, RECADJ is the adjusting factor (the multiplier), and RECUR (J2) is the percent of recurring demand in a given month. Note that if the original recurring demand for the month was .8 (or 80 %), the use of a factor of 2.0 would make 160 % ($2.0 * .8 = 1.6$) which is treated as 100 % or all demands recurring. To reduce the current value of a policy value with a multiplier, one must use a factor between zero and one. Care must be exercised when adjusting policy table values. First determine which type of change is involved, either substitution or multiplier. Then if the multiplier is used, carefully select the appropriate multiplier to obtain the desired end result.

Appendix S

Policy Table Default Values

<u>POLICY NUMBER</u>	<u>VARIABLE NAME</u>	<u>DEFAULT VALUE</u>	<u>DESCRIPTION & USE</u>
1	BETA	1.0	Adjustment to backorder goal
2	VIPALP	.050	VIP alpha factor used in forecasting
3	UVIPAL	.200	Non-VIP alpha factor used in forecasting
4	CVIPAL	.100	Corrective VIP alpha factor
5	CUVIPA	.100	Corrective non-VIP alpha factor
6			unused
7	DISMIN	50.00	Minimum economic dis- posal under which it is uneconomical to act
8	DISMAX	50.00	Maximum automatic dis- posal below which, if economical, disposal is automatic
9	REVMIN	5000.00	Minimum excess review value above which dis- posal will be reviewed
10			unused
11	NSOMAX	1000.00	Maximum automatic NSO buy without review
12	BUYMAX	1000.00	Maximum automatic buy without review
13	BUYMIN	10.00	Minimum allowed buy dollar value for all
14			unused

<u>POLICY NUMBER</u>	<u>VARIABLE NAME</u>	<u>DEFAULT VALUE</u>	<u>DESCRIPTION & USE</u>
15	VSLR	1.00	Multiplicative safety level adjustment
16	PMRMR	1.00	Multiplicative adjustment to protectable mobilization reserve
17			unused
18	TFAC	74.00	T factor used as a constant multiplier EOQ computation
19	ALPCP1	36.00	Low value procurement cycle value in months (\$0 - \$400)
20	ALPCP2	22.00	Medium value procurement cycle value in months (\$400 - \$4500)
21	ALPCP3	6.00	Procurement cycle value in months for items with \$4500 - \$15000 in demand
22	ALPCP4	3.00	High value procurement cycle months (over \$15000)
23	BM1	38.00	Breakpoint value for M1
24	BM2	1125.00	Breakpoint value for M2
25	BM3	3750.00	Breakpoint value for M3
26	ALVMRQ	1.00	Multiplicative adjustment to low value MRQ
27	AMVMRQ	1.00	Multiplicative adjustment to medium value MRQ
28	AHVMRQ	1.00	Multiplicative adjustment to high value MRQ
29	ANSMRQ	1.00	Multiplicative adjustment to NSO MRQ

NOTE: Policies 26 through 29 are not currently used in USIMS

<u>POLICY NUMBER</u>	<u>VARIABLE NAME</u>	<u>DEFAULT VALUE</u>	<u>DESCRIPTION & USE</u>
30			unused
31			unused
32			unused
33			unused
34			unused
35			unused
36	F1	.05	Multiplicative adjustment to value used in computation of control level for IPG I
37	F2	.10	Multiplicative adjustment to value used in computation of control level for IPG II
38	ROPFAC	1.00	Multiplicative adjustment to normal Reorder Point
39	QFDADJ	1.00	Multiplicative adjustment to QFD used when yearly frequency is less than FRECTR
40	FRECTR	100.00	Frequency counter
41	UPVAR	1.00	Multiplicative adjustment to unit price
42			unused
43			unused

TREND ADJUSTMENTS TO REQUISITION
FREQUENCY

44	PCF(I)	1.00	Multiplicative adjustment factor to all ADV categories
----	--------	------	--

<u>POLICY NUMBER</u>	<u>VARIABLE NAME</u>	<u>DEFAULT VALUE</u>	<u>DESCRIPTION & USE</u>
45	PCF(1)	1.00	Multiplicative adjust- ment factor to category 1 items
46	PCF(2)	1.00	Multiplicative adjust- ment factor to category 2 items
47	PCF(3)	1.00	Multiplicative adjust- ment factor to category 3 items
48	PCF(4)	1.00	Multiplicative adjust- ment factor to category 4 items
49	PCF(5)	1.00	Multiplicative adjust- ment to category 5
50	PCF(6)	1.00	Multiplicative adjust- ment to category 6

NOTE: This will also adjust the quantities so that the yearly quantity requisitioned is constant.

51	unused
52	unused

ADJUSTMENT TO REQUISITION QUANTITY

53	PCQ(I)	1.00	Multiplicative adjust- ment to quantity in all categories
54	PCQ(1)	1.00	Multiplicative adjust- ment to quantity of category 1 items
55	PCQ(2)	1.00	Multiplicative adjust- ment to quantity of category 2 items
56	PCQ(3)	1.00	Multiplicative adjust- ment to quantity of category 3 items
57	PCQ(4)	1.00	Multiplicative adjust- ment to category 4

<u>POLICY NUMBER</u>	<u>VARIABLE NAME</u>	<u>DEFAULT VALUE</u>	<u>DESCRIPTION & USE</u>
58	PCQ(5)	1.00	Multiplicative adjustment to category 5
59	PCQ(6)	1.00	Multiplicative adjustment to category 6
60			unused
61	CUTLPR	25000.00	Large purchase dollar value threshold
62	RATIO(I)	18.00	Value of (sigma/mean) squared applied to all categories in lognormal quantity generator
63	RATIO(1)	18.00	As above but only for category 1 items
64	RATIO(2)	18.00	As above but only for category 2 items
65	RATIO(3)	18.00	As above but only for category 3 items
66	RATIO(4)	18.00	As above but only for category 4 items
67	RATIO(5)	18.00	As above but only for category 5 items
68	RATIO(6)	18.00	As above but only for category 6 items

NOTE: The above parameters have been left in but are not operative for the requisition generation process because of the new empirical requisition size distribution; they are used in the quantity generator for returns.

69			unused
70			unused
71	ALTADJ	1.00	Multiplicative adjustment to administrative lead time
72	PLTADJ	1.00	Multiplicative adjustment to production lead time

<u>POLICY NUMBER</u>	<u>VARIABLE NAME</u>	<u>DEFAULT VALUE</u>	<u>DESCRIPTION & USE</u>
73	SMTFAC	.333	Smoothing factor for updating lead time
74	PIPG1A	1.00	Multiplicative adjust- ment to percent of IPG I requisitions
75	PIPG2A	1.00	Multiplicative adjust- ment to percent of IPG II requisitions
76			unused
77	PNRDAD	1.00	Multiplicative adjust- ment to percent of non-recurring demand
78	RECADJ	1.00	Multiplicative adjust- ment to percent of recurring demand
79			unused
80			unused
81			unused
82			unused
83			unused
84			unused
85			unused
86	DIRDL1	15.00	Due in period in days for IPG I requisitions to place on direct delivery if no due-in within default value; if 99, always backorder
87	DIRDL2	30.00	As above but for IPG II
88	DLT	1.00	Days of administrative lead time for direct delivery after which money is obligated
89			unused

<u>POLICY NUMBER</u>	<u>VARIABLE NAME</u>	<u>DEFAULT VALUE</u>	<u>DESCRIPTION & USE</u>
90			unused
91			unused
92			unused
93			unused
94			unused
95			unused

RETURNS POLICIES

96	RLT	126.00	Return lead time in days; determines arrival and is weighted as average of CONUS and overseas returns
97			unused
98			unused
99			unused
100			unused
101			unused
102			unused
103			unused
104			unused
105			unused
106	RETLVC	.660	Percent of creditable returns that actually arrive
107	RETLVN	.635	Percent of non-creditable returns that actually arrive
108	RETMIN	7.00	Minimum automatic return value

<u>POLICY NUMBER</u>	<u>VARIABLE NAME</u>	<u>DEFAULT VALUE</u>	<u>DESCRIPTION & USE</u>
109	RETMAX	250.00	Maximum automatic return value
110	RPCTAU	.070	Multiplicative percent of all returns that are automatic (times return frequency of item)
111	PCTRF	.416	Percent of late returns that actually arrive
112			unused
113	RPCF(I)	1.00	Multiplicative adjust- ment to return frequen- cies applied to all categories
114	RPCF(1)	1.00	As above but only for category 1 items
115	RPCF(2)	1.00	As above but only for category 2 items
116	RPCF(3)	1.00	As above but only for category 3 items
117	RPCF(4)	1.00	As above but only for category 4 items
118	RPFC(5)	1.00	As above for category 5
119	RPFC(6)	1.00	As above for category 6
120			unused
121	RPCQ(I)	1.00	Multiplicative adjust- ment applied to quantity of return for all categories
122	RPCQ(1)	1.00	As above for only category 1 items
123	RPCQ(2)	1.00	As above for only category 2 items

<u>POLICY NUMBER</u>	<u>VARIABLE NAME</u>	<u>DEFAULT VALUE</u>	<u>DESCRIPTION & USE</u>
124	RPCQ(3)	1.00	As above for only category 3 items
125	RPCQ(4)	1.00	As above for only category 4 items
126	RPCQ(5)	1.00	As above for only category 5 items
127	RPCQ(6)	1.00	As above for only category 6 items
128	QFRADJ	1.00	Multiplicative adjustment to quantity of forecasted returns quantity
129	FRABUY	.500	Fraction level at which recommended buy will be reduced by expected returns

NOTE: This has been eliminated from processing; see Appendix Z on Special Variables in USIMS for more on FRADUE.

130	EOQPR1	12.0	Economic order quantity parameter one used to determine EOQ quantity for low value items so that $EOQ = AQD * EOQPR1$ representing the number of quarters demand in the EOQ
131	EOQPR2	2.0	As above for medium value items
132	EOQPR3	1.0	As above for high value items
133			unused
134			unused
135			unused
136			unused

UNIFORM SAMMS (STANDARD AUTOMATED MATERIEL MANAGEMENT
SYSTEM) INVENTORY M. (U) DEFENSE LOGISTICS AGENCY
ALEXANDRIA VA OPERATIONS RESEARCH AN. S G NATHAN

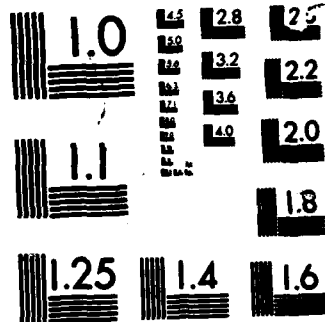
22

JAN 86

S G NAIMON
F/G 15/5

NL

A 10x10 grid of squares, with the top-left square missing.



MICROCOPY

CHART

POLICY
NUMBER

VARIABLE
NAME

DEFAULT
VALUE

DESCRIPTION & USE

137

unused

138

unused

Appendix T

Random Number Generation

A. Introduction

The IBM random number generation process used in GPSS and in IBM hardware is known to be somewhat problematical. In place of this process, the random number generator given in the Averill M. Law and W. David Kelton Simulation Modelling and Analysis (1982) on page 227 is used. The random number program was run to write out 100,000 records onto a tape. The tape was then analyzed using a SAS program which provided strong evidence that the numbers generated were randomly distributed in the interval from zero to one.

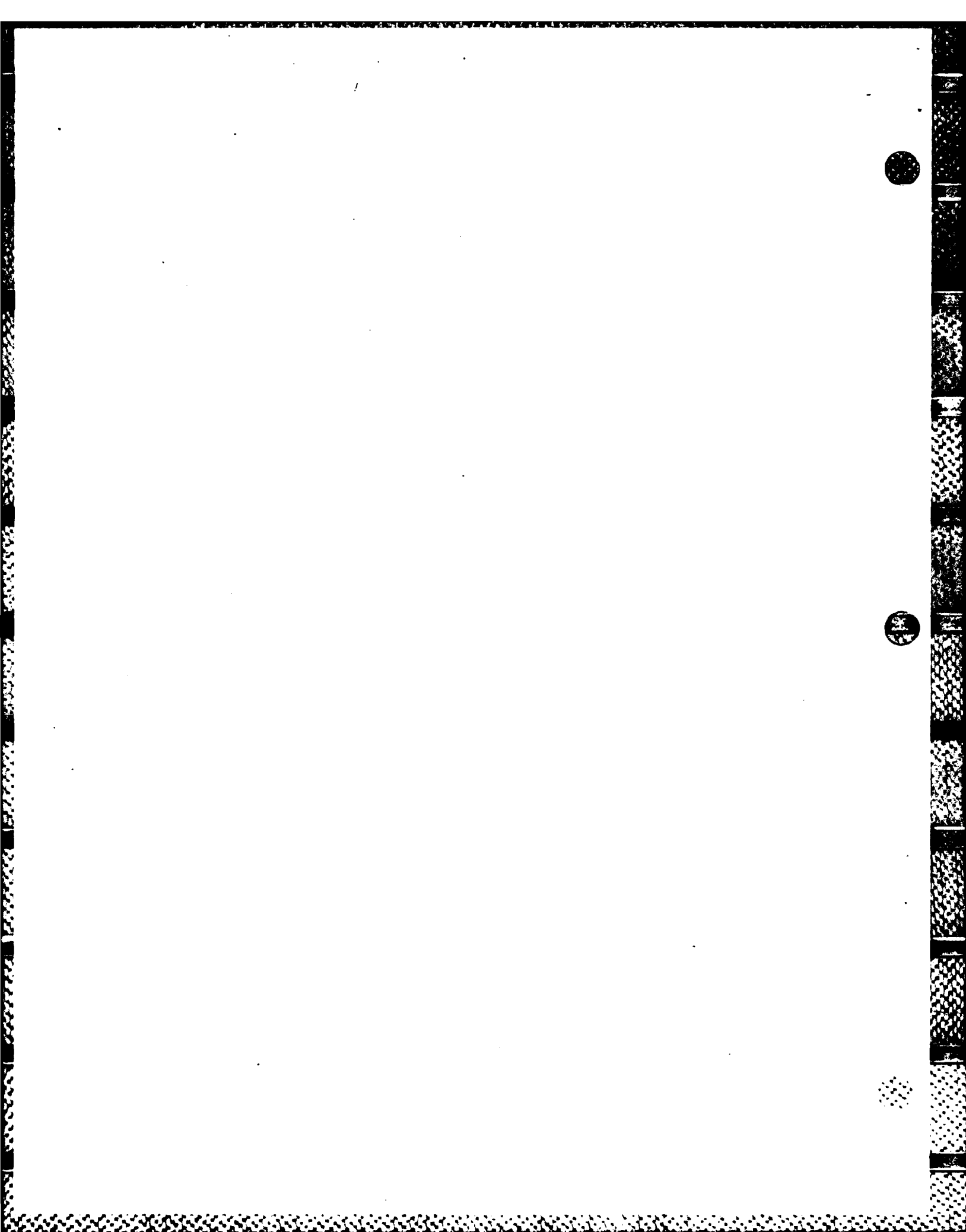
In the main simulation, random values, logs of these random values, and normal variates are required for the operation of the simulation. In the old version, 6000 random numbers were generated, the logs taken of the first 1000, and normal variates derived for the first 500. These values were then used over and over based on incrementing the random number subscripts. The enhanced version uses 6000 random numbers off the tape for the random table, the logs of the subsequent 6000 records off the tape for the log table, and 6000 random variates using another 6000 records from the tape. Variates are generated from a formula given in the George S. Fishman book Principles of Discrete Event Simulation, (1978), pp. 410f on normal generation. A 24 month run was made using approximately 4000 items (including returns) which required about 5,000,000 random numbers (the tape was rewound four times). This means that, on average, about 1250 random numbers are needed for each NSN simulated over 24 months. Note that high frequency items will require many more than this average.

The file of random numbers distributed has 100,000 entries. At most 18,000 different random numbers are needed to initialize the arrays in USIMS.

B. Random Number Indices. The following subscripts or indices are used in the random number process:

<u>CONTROL INDEX</u>	<u>FUNCTION</u>
IS (1)	possible arrival of late return
IS (2)	unused
IS2 (1-6)	requisition quantity by ADV group
IS (3)	unused
IS3 (1-6)	date of next requisition by ADV group
IS (4)	unused
IS4 (1-6)	return quantity by ADV group
IS (5)	unused
IS5 (1-6)	date of next FTE by ADV group
IS (6)	unused
IS6	determines priority of requisition
IS (7)	probability of receipt of a non-creditable return
IS (8)	probability of receipt of a creditable return
IS (9)	recurring vs non-recurring demand
IS (10)	variation in administrative lead time
IS (11)	variation in production lead time
IS (12)	date of next automatic return (based on logs)
IS (13)	probability of random arrival with no credit

C. Random Number Seed. The old random number process used a five digit random number seed to initialize the random number generator. The old process has been replaced by the creation of a random number file of 100,000 random numbers, which is read in to fill the arrays. The seed (NSEED) is used in conjunction with the remaindering process to find a record in the file which will be the starting place for the first random number on the file. NSEED is divided by 1001 and the remainder plus one is the record number of the first record on the file to be used to fill the arrays in the program. Note that 1001, 2002, and 110011 all have a remainder of zero, so that the random number arrays will start using the first record in the file of random numbers.



Appendix U

Recommended Reading

For the first-time user of USIMS, a number of readings are highly recommended as an introduction of the simulation. For newcomers to DLA the article "A new commodity management tool: uniform inventory simulation modeling" by Maj. Gen. Eugene B. Sterling, USAF, in the Defense Management Journal of October 1975, pages 65 through 68, provides a good introduction. Another general overview of the simulation is found in Chapter 36 of DLAM 4140.2, Volume II, Part 1. The chapter outlines the skeleton of processing in USIMS within the 11 pages. The next more detailed description of the USIMS model is found in SAMMS Appendix E-510-P, Part I of DLAM 4140.2, Volume II. More detailed information about the preparation of USIMS inputs, a system description, analysis of output are found in Part II of DLAM 4140.2, Volume II. A subsystem description of USIMS called an ADP manual is found in Part III of the E-510-P.

Appendix V

References

The following are SAMMS references applicable to USIMS:

1. Appendix A-56, Output Routing Codes.
2. Appendix B-296, USIMS Annual Demand Value/NIIN Selection
Card.
3. Appendix B-297, USIMS FSC Omission Card.
4. Appendix B-298, USIMS FORTRAN Front End Input Cards.
5. Appendix B-299, Simulation Card Inputs.
6. Appendix D-283, Sample Item Selection.
7. Appendix D-284, Sample Item Data Extraction/Validation.
8. Appendix D-285, Simulation Front End Program.
9. Appendix D-286, SAMMS Inventory Management Simulation.
10. Appendix F-424, USIMS NSN Selection Summary Report.
11. Appendix F-425, USIMS Sample Item Dropped List.
12. Appendix F-426, USIMS Front End Report.
13. Appendix F-427, USIMS Input Data Card Listing.
14. Appendix F-428, USIMS Summary Report.
15. Appendix F-429, USIMS Detail Report.
16. Appendix E-510, Procedures for Usage of USIMS.

Appendix W

Requisition Processing Problems

A. Introduction

In the past users have noted that the lognormal distribution assumed in the original USIMS did not represent all centers' requisition characteristics. GISMO, the DESC simulation, reads the requisition file and extracts average, minimums, maximums and other data for use in the Weibull distribution. For a separate project, Lt Popken of the DGSC OR office conducted a study of fiscal year 1980 requisitions for all stocked items. He used a Chi-square test to reject the hypothesis that requisitions at DGSC followed the lognormal distribution with a variance to the squared average requisition size ratio of 18 (the default value in USIMS). Lt Hager of the DISC OR office reported on his investigations into the requisition arrival process at the September 1983 Virginia Beach DLA OR/EA Workshop. His study revealed some problems with the assumption of the Poisson process of requisition arrivals especially for low frequency items and noted the problems of same day arrivals.

With these points in mind, DORO, with access to the DLA Information Data Bank (DIDB), began an investigation into these problems. For each commodity a one-tenth sample of all the requisitions (choosing all the requisitions for every tenth stocked NSN) was extracted from the DIDB for fiscal years 1982 and 1983. These samples were examined using the SPSSX statistical package. The USIMS model was used to generate requisitions which were also analyzed using a similar SPSSX program. The results of these analyses indicated that USIMS requisition generation did not reflect the real world and that some enhancements in this area were needed.

B. Requisition Size Analysis

The data extracted from the DIDB uses a yearly basis to determine requisition sizes. Note that while the previous study uses a relatively small sample of about 1700 NSNs and 85,000 requisitions, the extraction from the DIDB captured a substantial number of items (see tables below). For each NSN the total quantity requisitioned in the year is divided by the number of requisitions to obtain the yearly average requisition size. In the SPSSX program a normalized size of the particular requisition is determined by dividing the quantity of the requisition by the average size. Eighteen intervals are used to group this ratio of the actual requisition quantity to the average size. USIMS requisitions were analyzed using both the monthly requisition size average (that which is used as input to the lognormal generator) and on a yearly basis (the sum of all USIMS requisitions that year as in the DIDB extraction). The same eighteen intervals and process of determining in which interval a particular requisition falls applied to USIMS requisitions.

The results can be summarized as follows:

1. Requisition size distributions at each ICP differ; therefore, one distribution will not accurately simulate all centers.
2. The lognormal does not show a good fit for most centers.
3. Special treatment is required for items with small requisition sizes.

The data below is not intended to be complete. Those interested in obtaining complete data for a particular ICP can contact the USIMS System Administrator at DLA-LO(DORO).

To summarize the information presented in the following tables, one can see the high consistency in the year to year distributions either with no differentiation in average size (DESC) and in the DISC data, for which size is differentiated. The other commodities exhibit a similar consistency. One also notices the striking difference between commodities especially in the first two intervals. DISC data for the sample as a whole (not illustrated in DISC table) showed 21.3 % and 23.1 % in the interval from 0 to .1 in FY 1982 and 1983 respectively as compared to DESC values of near 10 % in both years; smaller but substantial differences can be found in other intervals. On the other hand, an analysis of DGSC and DESC requisitions generated by USIMS produced strikingly similar results. Since USIMS uses the same lognormal distribution for each ICP, one would expect a high degree of similarity between commodities.

One idea pursued was that most of the variability in requisition size might be explained by unit price, priorities, and dollar value of demand groupings. Multiple regression analyses were run on the samples of requisitions from DPSC and DGSC. The results completely contradicted this hypothesis, since less than .1% of the variability could be attributed to these factors.

In light of these results, empirical requisition size distributions for each commodity differentiated by average requisition size of five or less as a cutoff were selected to improve the generation of requisition sizes. The empirical analysis shows a considerable difference in requisition sizes based on this breakpoint. The break at the number five was chosen after some experimentation with 10. A process of linear interpolation within the intervals is used to translate the random number into a requisition size. The cumulative probabilities for the remaining four commodities are given in Tables 6 and 7.

Table 4

COMPARISON OF ACTUAL REQUISITION SIZES AND USIMS GENERATED
REQUISITIONS FOR DESC

REQUISITION SIZE INTERVAL (ratio to mean requisition size)	EMPIRICAL DISTRIBUTION		USIMS	
	FY 1982	FY 1983	Monthly	Yearly
0 - .1	10.4	10.4	14.0	30.0
.1 - .2	11.5	12.2	16.9	18.3
.2 - .4	18.5	18.6	26.0	24.9
.4 - .6	12.1	12.4	18.8	6.7
.6 - .8	10.0	10.0	5.9	3.0
.8 - 1.0	11.5	11.5	1.2	1.2
1.0 - 1.25	5.2	4.9	1.4	1.5
1.25 - 1.5	4.5	4.2	1.2	1.2
1.5 - 1.75	3.2	2.9	.8	.9
1.75 - 2.0	2.6	2.4	.7	.7
2.0 - 2.5	3.3	2.9	1.0	1.1
2.5 - 3.0	2.0	1.9	1.0	.9
3.0 - 4.0	2.2	2.2	1.3	1.3
4.0 - 5.0	1.1	1.1	1.0	1.0
5.0 - 6.0	.7	.7	.9	.9
6.0 - 8.0	.7	.7	1.4	1.8
8.0 - 10.0	.3	.3	1.1	1.8
over 10.0	.5	.6	5.4	1.7
TOTAL NSNS	29,833	34,456	4,868	
TOTAL REQUISITIONS	376,476	382,298	496,454	

NOTE: Probability values in table show interval probabilities for requisitions falling within the interval. Also note that even the calibrated version generated about 500,000 requisitions for the sample of 5000 items in the course of one year as compared with the one-tenth sample of about 400,000 requisitions.

Table 5

COMPARISON OF ACTUAL REQUISITION SIZES AT DISC FOR 1982 AND
1983

INTERVAL	REQUISITION SIZE INTERVAL (ratio to mean requisition size)	EMPIRICAL DISTRIBUTION SIZE > 5	EMPIRICAL DISTRIBUTION SIZE <= 5		
		FY 1982	FY 1983	FY 1982	FY 1983
1	0 - .1	25.4	27.7	.0	.0
2	.1 - .2	41.6	43.2	.3	.3
3	.2 - .4	55.8	57.5	24.7	24.4
4	.4 - .6	64.0	65.7	42.8	42.6
5	.6 - .8	70.0	71.6	55.6	55.7
6	.8 - 1.0	75.4	76.7	73.4	74.7
7	1.0 - 1.25	79.5	80.9	79.5	80.4
8	1.25 - 1.5	82.9	84.1	84.7	85.4
9	1.5 - 1.75	85.6	86.6	88.1	88.6
10	1.75 - 2.0	87.8	88.7	90.6	91.0
11	2.0 - 2.5	90.8	91.4	94.1	94.2
12	2.5 - 3.0	92.8	93.3	96.1	96.0
13	3.0 - 4.0	95.4	95.6	98.0	97.8
14	4.0 - 5.0	96.7	96.8	98.8	98.7
15	5.0 - 6.0	97.6	97.6	99.2	99.1
16	6.0 - 8.0	98.5	98.5	99.6	99.6
17	8.0 - 10.0	99.0	98.9	99.8	99.7
18	over 10.	100.0	100.0	100.0	100.0
INTERVAL VARIANCE		16.7	16.3	8.3	8.2
MEAN INTERVAL		4.6	4.5	5.7	5.0
TOTAL NSNS		30,920	32,790		
TOTAL REQUISITIONS		521,028	574,589		

NOTE: Probability values in table body represent cumulative values through the interval. Mean and variance are for intervals (eighteen intervals are present).

Table 6

REQUISITION SIZES DISTRIBUTIONS IN 1983 FOR ITEMS WITH AVERAGE
REQUISITION SIZE GREATER THAN 5

REQUISITION SIZE INTERVAL (ratio to mean requisition size)	FY 1983 EMPIRICAL DISTRIBUTION SIZE > 5			
	DCSC	DESC	DGSC	DPSC
0 - .1	19.0	17.4	23.0	15.8
.1 - .2	39.3	37.7	39.4	30.7
.2 - .4	55.3	53.9	55.6	49.1
.4 - .6	64.4	63.3	65.4	61.9
.6 - .8	70.9	69.9	72.0	69.9
.8 - 1.0	75.8	75.6	77.3	75.8
1.0 - 1.25	80.3	79.9	81.7	81.2
1.25 - 1.5	83.7	83.3	84.9	84.7
1.5 - 1.75	86.4	86.0	87.4	87.3
1.75 - 2.0	88.6	88.4	89.4	89.3
2.0 - 2.5	91.5	91.2	92.0	92.1
2.5 - 3.0	93.4	93.2	93.6	93.9
3.0 - 4.0	95.9	95.7	95.4	96.1
4.0 - 5.0	97.1	96.9	96.5	97.2
5.0 - 6.0	97.9	97.9	97.8	98.0
6.0 - 8.0	98.7	98.6	98.3	98.8
8.0 - 10.0	99.1	99.1	98.9	99.1
over 10.0	100.0	100.0	100.0	100.0
INTERVAL VARIANCE	15.4	15.5	15.6	14.1
MEAN INTERVAL	4.6	4.7	4.5	4.8

Table 7

REQUISITION SIZES DISTRIBUTIONS IN 1983 FOR ITEMS WITH AVERAGE
REQUISITION SIZE LESS THAN 5

REQUISITION SIZE INTERVAL (ratio to mean requisition size)	FY 1983 EMPIRICAL DISTRIBUTION SIZE <= 5			
	DCSC	DESC	DGSC	DPSC
0 - .1	.0	.0	.0	.0
.1 - .2	.2	.4	.1	.0
.2 - .4	24.8	22.6	22.6	31.5
.4 - .6	44.6	39.4	41.5	52.0
.6 - .8	60.0	54.4	58.2	65.5
.8 - 1.0	76.2	74.5	74.6	74.0
1.0 - 1.25	81.5	80.2	80.6	80.6
1.25 - 1.5	86.1	85.7	85.8	85.6
1.5 - 1.75	89.1	88.9	89.2	88.4
1.75 - 2.0	91.2	91.2	91.5	90.2
2.0 - 2.5	94.0	94.2	94.6	92.7
2.5 - 3.0	95.7	96.0	96.2	95.0
3.0 - 4.0	97.6	97.8	97.9	97.0
4.0 - 5.0	98.5	98.7	98.6	97.9
5.0 - 6.0	99.0	99.2	99.0	98.6
6.0 - 8.0	99.4	99.7	99.5	99.2
8.0 - 10.0	99.6	99.8	99.7	99.5
over 10.0	100.0	100.0	100.0	100.0
INTERVAL VARIANCE	8.3	7.9	8.0	9.6
MEAN INTERVAL	5.6	5.8	5.7	4.5
TOTAL NSNS	14,456	34,456	8,984	980
TOTAL REQUISITIONS	317,070	382,298	245,896	127,078

NOTE: To use the distribution for less than or equal to five, one must ensure that the entry on the parameter card is greater than zero and that the difference between intervals is greater than zero to avoid a divide by zero error. To do this choose small values such as .1 and .2 for the first two entries on the card. The applies particularly to the first two intervals for this distribution.

The values in the table for each particular commodity must be input on USIMS parameter cards seven and eight in F4.3 format with decimal point included. The value 100 % is not coded, because it is initialized in INIT1, the block data subprogram, to 1.00. The following table shows the results from the implementation of one empirical distribution for DESC:

Table 8

COMPARISON OF ACTUAL REQUISITION SIZE DISTRIBUTION AND REVISED
USIMS FOR DESC

REQUISITION SIZE INTERVAL (ratio to mean requisition size)	EMPIRICAL DISTRIBUTION		REVISED USIMS	
	FY 1982	FY 1983	Monthly	Yearly
0 - .1	10.4	10.4	9.9	15.7
.1 - .2	11.5	12.2	13.1	13.5
.2 - .4	18.5	18.6	20.4	18.7
.4 - .6	12.1	12.4	14.4	13.2
.6 - .8	10.0	10.0	11.8	8.4
.8 - 1.0	11.5	11.5	7.3	6.3
1.0 - 1.25	5.2	4.9	4.8	5.1
1.25 - 1.5	4.5	4.2	4.4	3.7
1.5 - 1.75	3.2	2.9	2.4	2.6
1.75 - 2.0	2.6	2.4	2.0	2.0
2.0 - 2.5	3.3	2.9	2.6	2.7
2.5 - 3.0	2.0	1.9	1.5	1.7
3.0 - 4.0	2.2	2.2	1.7	2.0
4.0 - 5.0	1.1	1.1	1.1	1.2
5.0 - 6.0	.7	.7	.5	.8
6.0 - 8.0	.7	.7	.9	.9
8.0 - 10.0	.3	.3	.5	.6
over 10.0	.5	.6	.9	1.0
TOTAL NSNS	29,833	34,456	4,868	
TOTAL REQUISITIONS	376,476	382,298	496,454	
INTERVAL VARIANCE		12.7	12.7	14.6
MEAN INTERVAL		5.1	5.0	4.9

Although there are some mismatches between the empirical distribution and the enhanced USIMS results, the closeness of fit is much more pronounced than with the use of the lognormal distribution. Similar tests were run to analyze the two distribution method implemented in the enhanced version of USIMS. Many of the problems can be traced to the switching of intervals due to rounding. When a requisition size of less than one is generated, a minimum size of one is imposed.

C. Information Update on Requisition Sizes. The following information pertains to 1984 requisition sizes for all centers.

Table 9

REQUISITION SIZE DISTRIBUTIONS IN 1984 FOR ITEMS WITH AVERAGE
REQUISITION SIZE GREATER THAN 5

REQUISITION SIZE INTERVAL (ratio to mean requisition size)	FY 1984 EMPIRICAL DISTRIBUTION SIZE > 5				
	DCSC	DESC	DGSC	DISC	DPSC
0 - .1	17.2	16.2	20.0	26.0	16.9
.1 - .2	37.2	35.4	38.0	41.8	30.7
.2 - .4	54.2	52.3	54.2	56.3	48.2
.4 - .6	63.3	61.6	63.7	64.5	61.2
.6 - .8	70.1	68.4	70.3	70.5	68.8
.8 - 1.0	75.2	74.4	75.6	75.8	75.3
1.0 - 1.25	79.7	79.0	80.2	80.0	80.5
1.25 - 1.5	83.2	82.7	83.7	83.3	84.4
1.5 - 1.75	85.8	85.6	86.3	85.8	87.2
1.75 - 2.0	88.1	88.1	88.4	88.1	89.3
2.0 - 2.5	91.0	91.1	91.3	91.0	92.2
2.5 - 3.0	93.1	93.2	93.3	93.0	94.1
3.0 - 4.0	95.6	95.8	95.6	95.4	96.3
4.0 - 5.0	96.9	97.1	97.0	96.8	97.4
5.0 - 6.0	97.7	97.9	97.8	97.6	98.0
6.0 - 8.0	98.7	98.7	98.7	98.5	98.8
8.0 - 10.0	99.1	99.2	99.1	99.0	99.2
over 10.0	100.0	100.0	100.0	100.0	100.0
INTERVAL VARIANCE	15.6	15.4	15.6	16.5	14.1
MEAN INTERVAL	4.7	4.8	4.7	4.6	4.8

Table 10

REQUISITION SIZE DISTRIBUTIONS IN 1984 FOR ITEMS WITH AVERAGE
REQUISITION SIZE LESS THAN 5

REQUISITION SIZE INTERVAL (ratio to mean requisition size)	FY 1984 EMPIRICAL DISTRIBUTION SIZE <= 5				
	DCSC	DESC	DGSC	DISC	DPSC
0 - .1	.0	.0	.0	.0	.0
.1 - .2	.1	.3	.2	.4	.0
.2 - .4	23.0	20.5	23.3	25.0	30.3
.4 - .6	43.9	38.3	41.7	42.7	50.6
.6 - .8	59.6	53.7	58.1	56.4	62.7
.8 - 1.0	73.5	72.0	73.4	74.4	72.6
1.0 - 1.25	79.7	78.7	79.6	80.4	79.3
1.25 - 1.5	85.1	84.9	85.1	85.3	84.0
1.5 - 1.75	88.6	88.6	88.6	88.6	87.1
1.75 - 2.0	91.0	91.3	90.9	91.0	89.6
2.0 - 2.5	94.2	94.6	94.2	94.1	92.6
2.5 - 3.0	95.9	96.4	96.1	95.9	94.8
3.0 - 4.0	97.7	98.2	97.9	97.8	97.2
4.0 - 5.0	98.6	99.0	98.8	98.7	98.1
5.0 - 6.0	99.1	99.4	99.2	99.1	98.8
6.0 - 8.0	99.5	99.7	99.6	99.6	99.4
8.0 - 10.0	99.7	99.9	99.7	99.7	99.6
over 10.0	100.0	100.0	100.0	100.0	100.0
INTERVAL VARIANCE	8.3	7.8	8.1	8.3	9.7
MEAN INTERVAL	5.7	5.8	5.7	5.7	5.6
TOTAL NSNS	14,667	30,801	9,114	35,614	1,032
TOTAL REQUISITIONS	312,702	364,658	268,957	599,434	139,417

NOTE: To use the distribution for less than or equal to five, one must ensure that the entry on the parameter card is greater than zero and that the difference between intervals is greater than zero to avoid a divide by zero error. To do this, choose small values such as .1 and .2 for the first two entries on card number seven.

D. Requisition Interarrival Analysis

One of the areas of research during phase one of the enhancement of USIMS concerned the time between requisitions arrivals. The purpose of the research was to develop a simulation algorithm that reasonably reflected actual experience at the supply centers. The same extract from the DIDB used to obtain requisition sizes served as the sample for this research.

An SPSSX program was written to calculate the time between requisitions, that is the interarrival time, for the requisitions of each NSN in the sample. The program then merged all interarrivals by NSNs that had the same number of requisitions ("hits") per year, generated histogram plots of requisition interarrivals measured in days. An example of this is shown below:

Figure 5

EXAMPLE OF HISTOGRAM PLOT OF INTERARRIVALS

COUNT	MIDPOINT	ONE SYMBOL EQUALS APPROX 16 OCCURRENCES
762	2.00	*****
509	6.00	*****
269	10.00	*****
194	14.00	*****
128	18.00	*****
102	22.00	*****
58	26.00	****
55	30.00	***
30	34.00	**
16	38.00	*
13	42.00	*
11	46.00	*
9	50.00	*
4	54.00	
3	58.00	

This histogram plot shows the actual distribution of requisition interarrivals for DESC during 1983 for all NSNs that experienced 36 hits during that year. Similar histograms were generated for all combinations of:

1. General, Electronic, Construction, Industrial, and Medical items; and
2. 4, 12, 24, 36, 48, 60, and 72 hits per year; and
3. 1982 and 1983 experience.

An analysis of the various statistics generated by the histogram plots and their associated samples as well as attempts to fit various theoretical probability distributions followed. This approach implicitly assumes that the NSNs with the same number of hits per year behave similarly in regards to requisition interarrivals. Observation of all of the generated histograms revealed the same characteristic, namely a skewed shape. In addition, the mode of each distribution of interarrival was usually zero days and a coefficient of variation (the ratio of the standard deviation to the mean) was slightly higher than one. Because of these observations the only theoretical distributions considered were the gamma and Weibull. For all of the histogram-samples, the shape (alpha) and scale (beta) parameters were estimated from the data for both the gamma and Weibull. Statistical analyses using ANOVA and regression revealed two important aspects of these shape parameter values. First, the shape parameters of the construction and the medical commodities were found to be significantly different from those of the other centers. Second, the shape parameters were found to decrease slightly with increases in the annual frequency of requisitions. A general expression for the shape parameter was then developed by a regression equation which could be used to estimate the shape parameter as a function of the number of hits per year. Dummy variables were added to account for the differences for the construction and medical items. These regression equations (for both the gamma and Weibull distributions) were necessary to smooth out the noise in the raw data and to provide an interpolation technique for estimating the shape parameter for any value of requisition hits per year. Once the shape parameter is estimated for a given mean interarrival, the scale parameter is uniquely determined.

The next step of the research involved a comparison of the theoretical distribution to the actual requisition interarrivals. A sample of such a comparison is shown in Figure 6 below. Note that this is the same histogram plot shown earlier.

Comparisons like this were made for all histogram-samples. Although other measures of goodness-of-fit are possible, the mean absolute deviation was chosen as the method of evaluation. With the mean absolute deviation, the Weibull distribution was found to have a better fit than the gamma distribution in the majority of cases. The Weibull distribution was, therefore, selected as the best choice for the remainder of this investigation.

To correct this deficiency the simulation algorithm was modified to include an empirical adjustment to the Weibull distribution to reflect the high number of same day requisition arrivals. This was accomplished by subtracting the theoretical fraction of same day requisitions from the actual experience for each of the centers for both 1982 and 1983. These ten data points were used in a second regression equation to estimate the "extra" probability of having a same day requisition. This probability decreases with increasing requisition frequency and eventually tapers off to zero at around 72

hits per year. In the actual simulation algorithm, a random number determines whether or not the next requisition falls on the same day as the last requisition. If not, the time until the next requisition is simulated from the Weibull distribution.

Figure 6

PLOT OF INTERARRIVALS WITH SAMPLE DISTRIBUTIONS

COUNT	MIDPOINT	ONE SYMBOL EQUALS APPROX 16 OCCURRENCES	
762	2.00	*****+\$	
509	6.00	*****x**	
269	10.00	***** X	
194	14.00	*****x\$	
128	18.00	*****x\$	
102	22.00	***x*\$	
58	26.00	***x\$	
55	30.00	**x\$	
30	34.00	*x\$	* ACTUAL
16	38.00	x \$	+ WEIBULL
13	42.00	*	\$ GAMMA
11	46.00	*	X more than one of above
9	50.00	*	
4	54.00		
3	58.00		

Additional analysis revealed that, although the Weibull distribution gave a good approximation to the overall behavior of actual requisition arrivals, it had a deficiency on the far left "tail" for lower requisition frequency items. Specifically, the actual experience showed a relatively high percentage of requisition arrivals on the same day compared to the theoretical Weibull distribution. This observation is substantiated by the values in Table 11 below.

A new subprogram, WEIBUL, was written and USIMS MAIN, STARTX, and POLICY were modified to implement the new simulation algorithm. For each NSN, demand over the one year history is summed to obtain the annual requisition frequency (hits per year). This serves as the input into the regression equations described earlier to estimate the Weibull shape parameter and the "extra" probability of experiencing an arrival on the same day as the last requisition (interarrival of zero days).

Table 11

BENCHMARK FRACTION OF REQUISITION ARRIVALS ON THE SAME DAY FOR
1983 FOR DCSC DATA

HITS/YEAR	GENERAL	MEDICAL	CONSTRUCTION	ELECTRONIC	INDUSTRIAL
4 ACTUAL	0.05	0.12	0.05	0.05	0.06
4 WEIBULL	0.01	0.01	0.01	0.01	0.01
12 ACTUAL	0.08	0.01	0.07	0.07	0.07
12 WEIBULL	0.03	0.02	0.03	0.03	0.03
24 ACTUAL	0.08	0.02	0.10	0.09	0.10
24 WEIBULL	0.05	0.04	0.06	0.05	0.05
36 ACTUAL	0.10	0.09	0.12	0.10	0.11
36 WEIBULL	0.08	0.06	0.09	0.08	0.08
48 ACTUAL	0.12	0.09	0.13	0.12	0.12
48 WEIBULL	0.10	0.08	0.12	0.10	0.12
60 ACTUAL	0.12	0.14	0.13	0.15	0.16
60 WEIBULL	0.12	0.10	0.14	0.12	0.12
72 ACTUAL	0.15	0.13	0.17	0.16	0.21
72 WEIBULL	0.14	0.12	0.16	0.14	0.14

The last step of the research and analysis was the testing of the new version of USIMS. This was accomplished by comparing the actual requisition experience to the USIMS simulated experience for two supply centers in the following cases:

1. DESC, 4 through 72 hits per year;
2. DCSC, 4 through 72 hits per year;
3. DESC, 100 through 500 hits per year.

The remainder of this section provides detailed results for these three cases.

In the first case, USIMS was used to simulate requisitions for a sample of DESC items. The same SPSSX program described earlier was then used to plot histograms of the simulated requisition interarrivals for all NSNs having 4, 12, 24, and so on hits per year. These histograms of USIMS requisitions were then compared to those obtained from actual 1983 experience at DESC. This comparison was accomplished using the mean absolute deviation (MAD) as a measure of error. For each comparison, the absolute value of the difference between actual experience and USIMS requisitions was calculated for each histogram interval. The average of the absolute differences (or deviations) of

the first ten histogram intervals was then calculated and used as a figure-of-merit indicating how good the fit was. These MAD values have no significance in any absolute sense, but only in a relative one (compared to something else). For this reason, histograms for 1982 at DESC were also generated and compared to 1983 data. This was done to provide a benchmark of how low the MAD should be to achieve a good fit. In other words, there will always be some noise in the data, and it is not realistic to expect a MAD of zero. The MAD between 1982 and 1983 experience was also compared to the both the old version of USIMS and the new version of USIMS. The results are shown in Table 12.

Table 12

COMPARISON OF OLD AND NEW USIMS USING HISTOGRAM OF INTERARRIVAL
FREQUENCY MEAN ABSOLUTE DEVIATION (OVER 10 INTERVALS) FOR DESC
LOW FREQUENCY ITEMS

HITS/YEAR	1982 DATA	OLD USIMS "knobbed"	OLD USIMS "unknobbed"	NEW USIMS "unknobbed"
4	0.4	5.8	7.6	1.5
12	0.6	2.4	4.6	0.8
24	0.9	2.9	2.4	0.8
36	0.5	2.7	1.2	1.2
48	0.8	2.7	1.2	1.2
60	0.7	3.4	1.0	1.0
72	0.7	3.6	0.9	0.8

The new version of USIMS, with the modified Weibull simulation algorithm, had consistently lower MADs than the old version of USIMS (run without adjusting requisition frequencies and dollar values to obtain real-world expected values for the particular DSC, called "knobbing"; the difference between the "knobbed" and "unknobbed" will be explained in more detail at the end of this section; see also Appendix Y on scaling for additional remarks on "knobbing"). Also, the new version of USIMS displayed MADs reasonably close to the 1982 data, so it was concluded that the new version of USIMS performed adequately.

Similar results were obtained on comparing 1983 DCSC actual requisition arrivals to the requisitions generated in USIMS for DCSC. Construction items were selected in the second case to test the use of dummy variables on the Weibull shape parameter regression equation. Again, MAD was used as the figure-of-merit for goodness-of-fit. As can be seen from the Table 13, the new version of USIMS had consistently better results than the old version of USIMS, and was again reasonably close to the 1982 data at DCSC.

Table 13

COMPARISON OF OLD AND NEW USIMS USING HISTOGRAM OF INTERARRIVAL
FREQUENCY MEAN ABSOLUTE DEVIATION (OVER 10 INTERVALS) FOR DCSC
DATA

HITS/YEAR	1982 DATA	OLD USIMS	NEW USIMS
4	0.7	2.3	1.0
12	0.9	2.0	0.4
24	1.3	1.8	0.8
36	0.7	1.3	0.9
48	0.7	1.7	1.3
60	2.4	1.5	1.0
72	0.4	1.5	1.1

NOTE: No "knobbing" in either version of USIMS.

A third test was performed for DESC items in the high requisition frequency (100, 200, 300, 400, and 500 hits per year) range. This was done to test the new version of USIMS for high frequency items outside of the range of the regression data base. The results are shown in Table 14. The high frequency items were no problem, and, once again, the new version of USIMS provided results consistently superior to the old version of USIMS and reasonably close to 1982 empirical data.

Table 14

COMPARISON OF OLD AND NEW USIMS USING HISTOGRAM OF INTERARRIVAL
FREQUENCY MEAN ABSOLUTE DEVIATION (OVER 10 INTERVALS) FOR DESC
HIGH FREQUENCY ITEMS

HITS/YEAR	1982 DATA	OLD USIMS "knobbed"	OLD USIMS "unknobbed"	NEW USIMS "unknobbed"
100	0.1	2.7	1.5	0.6
200	0.8	4.4	1.8	0.9
300	0.5	4.6	1.5	0.6
400	0.3	4.6	1.5	0.7
500	0.5	4.5	1.5	0.6

During the testing phase a side issue emerged concerning the use of "knobbing" of the requisition frequency. In the actual usage of USIMS, the model often generates too many requisitions (in total) compared to the actual experience at a particular center. In practice, the model is adjusted or "knobbed" back by globally (or for each dollar demand

category) reducing the requisition frequencies so that the model provides a realistic total number of requisitions. However, in performing this "knobbing", a distortion is produced in the simulation of requisition interarrivals. In general, the "knobbed" versions of USIMS outputs had a poorer fit than the "unknobbed" versions, especially for higher requisition frequencies. Work still needs to be done to manipulate the total number of requisitions without distorting the interval simulation process.

Appendix X

Sampling Method in the Simulation

This description assumes a basic knowledge of statistics and sampling procedures. While it is not the intent to provide a course in these subjects, the following definitions are provided for those who may be interested:

CONFIDENCE INTERVAL - A range of values, which contain a population parameter with a given probability.

STANDARD DEVIATION - A measure of dispersion of the values of a distribution. The standard deviation is the positive square root of the variance.

STRATIFIED SAMPLE - A sample selected from a population which has been stratified, part of the sample coming from each stratum.

VARIANCE - The quadratic mean of the difference between sample values and the sample mean.

A uniform random sample of NSNs from the total population is not an efficient way to sample a skewed distribution. For skewed distributions, a few NSNs can contribute a large portion of the system totals. Intuition suggests heavy sampling of certain groups and minimum sampling from the remaining population. This rationale is the basis for "stratified sampling." For example, if system obligations are of interest, then a variable sample rate based upon NSN annual demand value will be more efficient than a single constant sampling rate for all annual demand value categories. The use of stratified samples reduces the sampling error for a given sample size.

One procedure for developing a stratified sample is:

1. Categorize the population by NSN ADV;
2. Identify the number of NSNs, requisitions, and other data of interest within the individual strata by count or estimation;
3. Compute or estimate the standard deviation of the variable of interest (in this case, ADV) and the mean for each stratum;
4. Determine the sample size for each stratum with consideration of the desired total statistical system precision and confidence level;
5. The sum of the individual stratum samples is the total sample size.

The desired sampling error in point four above may result in sample sizes that must be reduced due to practical considerations, that is, ADP running time.

The formula for computation of the stratum sample size for a given system precision and confidence level is:

$$n_i = \frac{N_i s_i \sum_{j=1}^k (N_j s_j)}{N \left(\frac{SE}{t} \right)^2 + \sum_{j=1}^k (N_j s_j^2)} \quad (1)$$

where:

n_i = Number of sample NSNs in the i^{th} stratum.

N_i = Number of NSN in the i^{th} stratum.

s_i = Standard deviation of the variable concerned in the i^{th} stratum of the sample.

N = Total number of NSNs.

SE = Desired sampling precision in units of variable concerned.

t = Normal variate. If $t = 1.96$, the confidence level is 95%.

k = Number of stratum.

A source for this formula is the Handbook of Sampling for Auditing and Accounting, Volume I - Methods, by Herbert Arkin, (McGraw-Hill, 1963), p. 192 to identify the number of sample items for each stratum for 1/1.96 or the 95 % confidence level.

If the total sample size is fixed at size $n = \sum_{i=1}^k n_i$ where

there are k stratum, then the optimal stratum sample sizes $n_1, n_2, n_3, \dots$, if the criterion is minimum variance for the estimate of the mean is:

$$n_i = \frac{n N_i s_i}{\sum_{i=1}^k N_i s_i} \quad (2)$$

A source for this formula is the Handbook of Sampling for Auditing and Accounting, Volume I - Methods, by Herbert Arkin, (McGraw-Hill, 1963), p. 190 to find the optimum proportion of sampled items in each strata.

Hence, for a given precision and confidence level, equation (1) may be used to compute stratum sample sizes. Conversely, given a total sample size, the optimal stratum sample sizes is given by equation (2). The ratio of the precision and confidence level may then be determined by:

$$\frac{SE}{t} = \frac{1}{N} \sqrt{\frac{N_i s_i \sum N_i s_i - N_i s_i^2}{n_i}} \quad (3)$$

This formula can be derived from equation (1). For a given precision, the confidence is then known or for a given confidence, the precision is specified.

The equations above will be applied to two key variables, demand value and requisition frequency. The first is required for financial projections and the second for customer support projections. The fractionation report can be used to obtain data on NSN annual demand value. Other sources may be needed to extract information on requisition frequency. Refer to Figure 7 for the standard breakdown by ADV used in the subsequent tables.

Figure 7

ADV STRATA

STRATUM	ADV
1	0-400
2	400-4500
3	4500-1500
4	15000-5000
5	50000-10000
6	over 100000

It is assumed data exist to construct a table of the form of Table 15, a hypothetical inventory system.

Table 15

HYPOTHETICAL INVENTORY (ILLUSTRATION ONE)

STRATUM	NSNs		ADV		REQN/YR	
	NUMBER	ACCUM %	\$	ACCUM %	NUMBER	ACCUM %
1	195,000	78.00	27.18 x 10 ⁶	7.44	2,000,000	40
2	45,000	96.00	96.06 x 10 ⁶	33.73	1,700,000	74
3	6,000	98.40	71.83 x 10 ⁶	53.39	550,000	85
4	2,825	99.53	73.18 x 10 ⁶	73.42	450,000	94
5	775	99.84	39.97 x 10 ⁶	84.36	100,000	96
6	<u>400</u>	<u>100.00</u>	<u>57.15 x 10⁶</u>	<u>100.00</u>	<u>200,000</u>	<u>100</u>
	250,000		\$365.37 x 10 ⁶		5,000,000	

$$\text{Mean ADV/NSN} = 365.37 * 10^6 / 25 * 10^4 = 14.614. * 10^2$$

$$\text{Mean Number Reqn/NSN} = 5 * 10^6 / 2.5 * 10^5 = 20$$

The computation of the stratum sample sizes and proportions requires the standard deviations of the ADV/NSN and the requisitions/NSN by stratum. These standard deviations can be estimated by preliminary sampling or by consideration of system characteristics.

If preliminary sampling is used, equation, (4) below, may be used to estimate the sample standard deviation.

$$s = \sqrt{\frac{\left(\sum_{i=1}^n X_i^2 \right) - nx^2}{n-1}} \quad (4)$$

where:

s = standard deviation.

X_i = individual observed value.

n = number of observations

$$\bar{x} = \text{mean} = \frac{\sum_{i=1}^n X_i}{n}$$

In a preliminary sample, it is recommended that a minimum of 50 observations be made for each stratum for the computation of the s for that stratum.

Another method of obtaining an estimated standard deviation is through observation of system characteristics. This method was used to derive the standard deviations portrayed in Table 16.

Table 16

HYPOTHETICAL INVENTORY (ILLUSTRATION TWO)

STRATUM	NUMBER		STD DEVIATION (s_i)	
	NSNS/YR	REON/YR	ADV/NSN	REON/NSN
1	195,000	2,000,000	89.84	13.35
2	45,000	1,700,000	987.55	47.90
3	6,000	550,000	2,824.4	102.48
4	2,825	450,000	9,258.4	172.53
5	775	100,000	13,950.0	263.60
6	<u>400</u>	<u>200,000</u>	515,613.0	536.07
	250,000	5,000,000		

Sample sizes based on the ADV of the NSNs will be computed first. Table 17 is computed as shown using data from Table 16.

Table 17

ADV CHARACTERISTICS - HYPOTHETICAL INVENTORY

STRATUM	NO. OF NSNs	$N_i s_i$	$N_i s_i^2$	EQUATION 2 SAMPLE RATIO
				$(N_i s_i / \Sigma N_i s_i) \%$
1	195,000	17,518,800	1.57×10^9	5.43
2	45,000	44,439,750	43.89×10^9	13.80
3	6,000	16,946,400	47.86×10^9	5.26
4	2,825	26,154,980	242.2×10^9	8.12
5	775	10,811,250	150.8×10^9	3.36
6	<u>400</u>	<u>206,245,200</u>	<u>$106,343 \times 10^9$</u>	<u>64.03</u>
	250,000	322,116,380	$106,829 \times 10^9$	100.00

The last column gives the proportion of the total sample in each category independent of the precision and confidence level desired. The ratio of these parameters establishes the size of the sample. If a sampling error of 2% with 95% confidence is desired, compute elements in equation (1).

$$\begin{aligned}
 SE &= .02 \text{ [Avg ADV per NSN]} \\
 &= .02 \frac{365.27 * 10^6}{250,000} = 29.2296
 \end{aligned}$$

$$t = 1.96$$

$$SE/t = 14.913$$

$$N^2(SE/t)^2 = (250,000)^2 * (14.913)^2 = 13,900 * 10^9$$

$$\sum_{i=1}^6 (N_i s_i) = .3221 * 10^9$$

$$\sum_{i=1}^6 (N_i s_i^2) = 106829 * 10^9$$

Substituting in equation (1) yields:

$$n_1 = \frac{N_1 s_1 [.3221 * 10^9]}{13900 * 10^9 + 106829 * 10^9} = .2668 * 10^{-5} N_1 s_1$$

If a sampling error of 5% with 95% confidence is specified:

$$SE = \frac{.05 \ 365.37 * 10^6}{250,000} = 73.074$$

$$t = 1.96$$

$$SE/t = 37.283$$

$$N^2 (SE/t)^2 = (250,000)^2 * (37.283)^2 = 86875 * 10^9$$

The remaining parameters are unchanged. Thus:

$$n_1 = \frac{N_1 s_1 [.3221 * 10^9]}{86875 * 10^9 + 106829 * 10^9} = .1663 * 10^{-5} N_1 s_1$$

Both sample plans are shown in Table 18.

Table 18

ADV SAMPLE PLANS

STRATUM	SAMPLE SIZE		SAMPLE SIZE	
	$= (.2668 \times 10^{-5})N_1s_1$		$= (.1663 \times 10^{-5})N_1s_1$	
	<u>N_1s_1</u>	<u>2% ERROR</u> <u>95% CONFIDENCE</u>	<u>5% ERROR</u> <u>95% CONFIDENCE</u>	
1	17,518,800	47	29	
2	44,439,750	119	74	
3	16,946,400	45	28	
4	26,154,980	70	43	
5	10,811,250	29	18	
6	206,245,200	<u>*550</u> 860	<u>343</u> 535	

*Exceeds category size (use 100% sample).

Inspection of Table 19 shows a very heavy sampling rate for the higher ADV categories. This is to be expected due to their contribution of the system ADV. The top category (above \$100,000) sample size exceeds the category size for the first sampling plan. Consideration may be given to inclusion of additional categories at this end of the inventory.

The same procedure is used to compute the stratum sample size based on the standard deviation of the number of requisitions for NSNs in an ADV category. This is not obvious from Table 16 that much larger samples are required. Table 19 is computed using Table 16 data.

Table 19

REQUISITION CHARACTERISTICS - HYPOTHETICAL INVENTORY

STRATUM	NO. OF NSNs	$N_1 s_1$	$N_1 s_1^2$	EQUATION 2 SAMPLE RATIO
				$(N_1 s_1 / \Sigma N_1 s_1) \%$
1	195,000	2,603,445	34,758,555	41.46
2	45,000	2,155,635	103,262,310	34.33
3	6,000	614,862	63,009,270	9.79
4	2,825	487,406	84,093,498	7.76
5	775	204,287	53,849,164	3.25
6	<u>400</u>	<u>214,429</u>	<u>114,949,198</u>	<u>3.41</u>
	250,000	6,280,064	453,921,995	100.00

With a 2% sampling error and a 95% confidence as before:

$$SE = .02 \text{ [Ave Reqs per NSN]}$$

$$= .02 \frac{5 \times 10^6}{250,000} = .4$$

$$t = 1.96$$

$$SE/t = .2041$$

$$N^2 \frac{SE}{t}^2 = (250,000)^2 * (.2041)^2 = 2.603 * 10^9$$

$$\sum_{i=1}^6 N_1 s_1 = 6.28 * 10^6$$

$$\sum_{i=1}^6 N_1 s_1^2 = 453.92 * 10^6$$

Again, substituting in Equation (1):

$$n_1 = \frac{N_1 s_1 [6.28 * 10^6]}{2.603 * 10^9 + 453.92 * 10^6}$$

$$= .2054 * 10^{-2} N_1 s_1$$

If a 5% sampling error is used:

$$n_1 = .3755 * 10^{-3} N_1 s_1$$

The resulting sample plans are displayed in Table 20.

Table 20

REQUISITION SAMPLE PLANS - HYPOTHETICAL INVENTORY

STRATUM	$N_1 s_1$	SAMPLE SIZE	SAMPLE SIZE
		= .002054 $N_1 s_1$	= .0003755 $N_1 s_1$
		2% ERROR	5% ERROR
		<u>95% CONFIDENCE</u>	<u>95% CONFIDENCE</u>
1	2,603,445	5,348	978
2	2,155,635	4,428	810
3	614,862	1,263	231
4	487,406	1,001	183
5	204,287	420	77
6	<u>214,429</u>	<u>*441</u>	<u>81</u>
		12,901	2,360

*Exceeds category size (use 100% sample).

Table 21 consolidates the sample plans in Tables 18 and 20. Comparison of the columns shows that the requisition characteristics dominate the sampling plans. For this inventory system, a practical choice would be an approximation of the 5% Error, 95% Confidence, requisition plan modified by 100% sampling of the top ADV category. This results in a total sample of 2679 NSNs. A more direct method would be as follows:

1. Determine a reasonable sample size based on additional factors such as ADP running time and simulation output stability.

2. Delete the top ADV category from the system since it should be sampled at 100%. Allocate the remaining portion of the sample according to Equation (2) and take requisition characteristics of Table 19.

Table 21

SAMPLE SIZES - HYPOTHETICAL INVENTORY

STRATUM	NO. OF NSNs	2% ERROR		5% ERROR	
		95% CONFIDENCE		95% CONFIDENCE	
		ADV	REON	ADV	REON
1	195,000	47	5,348	29	978
2	45,000	119	4,428	74	810
3	6,000	45	1,263	28	231
4	2,825	70	1,001	43	183
5	775	29	420	18	77
6	400	<u>*550</u>	<u>*441</u>	<u>343</u>	<u>81</u>
		860	12,901	535	2,360

*Exceeds stratum size - size 100% sample.

Following the direct method discussed above, suppose a limit of 3600 items was set for the total sample size. Deleting the top ADV category, since it should normally be sampled at 100%, leaves 3200 items to be allocated IAW Equation (2). Tables 22 and 23 show the sample sizes by stratum IAW Equation (2) for ADV characteristics and requisition characteristics respectively. To determine the precision and confidence for the ADV characteristics, use Equation (3):

$$N_1 s_1 = 17,518,800 - \text{Table 22} = a$$

$$\sum_{j=1}^5 N_j s_j = 115,871,180 - \text{Table 22} = b$$

$$a \times b / n_1 = 4194.06 \times 10^9 = c$$

$$c - \sum_{j=1}^5 N_j s_j^2 = 3707.74 \times 10^9$$

$$\sum_{j=1}^5 N_j s_j^2 - \text{Table 22} = d$$

$$\sqrt{d} = 192.55 \times 10^4 = e$$

$$e/N = 7.7 \quad N = 249,600 - \text{Table 22} = \frac{SE}{t}$$

Table 22

SAMPLE SIZES - HYPOTHETICAL INVENTORY

ADV CHARACTERISTICS

STRATUM	NUMBER OF NSNs	$N_1 s_1^2$	$N_1 s_1$	$(N_1 s_1) / (\sum N_1 s_1)$	n_1
1	195,000	1.57×10^9	17,518,800	.1512	484
2	45,000	43.89×10^9	44,439,750	.3835	1,227
3	6,000	47.86×10^9	16,946,400	.1463	468
4	2,825	242.2×10^9	26,154,980	.2257	722
5	<u>775</u>	<u>150.8×10^9</u>	<u>10,811,250</u>	<u>.0933</u>	<u>299</u>
	249,600	486.32×10^9	115,871,180	1.0	3,200

NOTE: $n_1 = (n \cdot N_1 s_1) / (\sum N_1 s_1)$

Table 23

SAMPLE SIZES - HYPOTHETICAL INVENTORY

REQUISITION CHARACTERISTICS

<u>STRATUM</u>	<u>NUMBER OF NSNs</u>	<u>$N_i s_i^2$</u>	<u>$N_i s_i$</u>	<u>$(N_i s_i) / (\sum N_i s_i)$</u>	<u>n_i</u>
1	195,000	34,758,555	2,603,445	.4292	1,373
2	45,000	103,262,310	2,155,635	.3554	1,137
3	6,000	63,009,270	614,862	.1014	324
4	2,825	84,093,498	487,406	.0803	257
5	<u>775</u>	<u>53,849,164</u>	<u>204,287</u>	<u>.0337</u>	<u>109</u>
	249,600	338,972,797	6,065,635	1.0	3,200

NOTE: $n_i = (n * N_i s_i) / (\sum N_i s_i)$

From Table 15, the mean ADV/NSN adjusted due to 100% sampling of the sixth stratum is:

$$\frac{365.37 \times 10^6 - 57.15 \times 10^6}{250,000 - 400} = 12.35 \times 10^2$$

For confidence levels of 90, 95, and 99 percents, the precision is:

$$\text{Precision} = t * \frac{7.7}{12.35 \times 10^2} = t * 6.2348 \times 10^{-3}$$

<u>CONF</u>	<u>t</u>	<u>PRECISION (%)</u>
90.0	1.645	1.02
95.0	1.96	1.22
99.0	2.575	1.61

It should be noted, however, that some error will occur if care is not taken to prevent rounding errors in the process of utilizing scientific notation.

Going through a similar process for requisition characteristics, the following table is constructed:

<u>CONF</u>	<u>t</u>	<u>PRECISION (%)</u>
90.0	1.645	3.60
95.0	1.96	4.29
99.0	2.573	5.64

It should be emphasized that we have established the confidence and precision of the sample of items. This does not necessarily carry over to output results of the simulation model itself. This is a totally different area. Briefly stated, best confidence in results is obtained with a good sample and multiple simulation runs based upon different random numbers.

Appendix Y

Scaling

A. Scaling Factors. Sample results are scaled up to expected population statistics based upon the input of the USIMS parameter card one. The only source of population by ADV categories is the Fractionation Report. This report is based upon actual demands of items during the past 12 months. It includes items of SSCs 1, 4, 5, 6, 7, 8, and A; the sample omits terminal items (i.e., SSC 6); however, this should not materially affect results. The simulation reports are designed to be similar to stratification report results; hence, items are categorized by forecasted demands for demand type items. Scaling factors then use forecasted demand categories for the sample and actual demand categories for the population.

B. Scaling and Knobbing Problems

The USIMS model uses scaling factors by annual dollar value groupings for all items, for NSO items, and for VIP items to scale the results of the items sampled in the simulation back to values for the entire population. However, USIMS does not necessarily yield results that are indicative of population values. Specifically, both the number of requisitions generated and the dollar value of demand are usually too high and safety level values calculated by the simulation are not accurate.

To correct for these problems, one can adjust various factors and rerun the baseline a number of times to make the results conform to expected ICP values. This process has been called "knobbing". It has become common practice to "knob" the three values cited above and assume that the other simulation values would be correct. This assumption needs to be tested and verified in the future.

To adjust the requisition frequency downward, one can utilize USIMS parameter card number nine for policies 44 through 50 and factors of less than 1.0. Note that certain distortions arise when this is done; (refer to the end of the section on requisition interarrival analysis in the Appendix W, Requisition Processing Problems). To adjust the requisition quantities, one can utilize USIMS parameter card number nine for policies 53 through 59 and factors of less than 1.0. The safety level, often used to define the dollar value parameters of requirements, can be adjusted by the inclusion of USIMS parameter card nine for policy number 15. Another approach to the safety level adjustment uses the system constant (read in from USIMS parameter card one) and the beta factor (read in from the same parameter card or changed by parameter card nine for policy number one), since these are two components of the safety level formula to derive R1. In the calculation for the variable safety level, if R1 is small, the safety level is large; if R1 is large, the safety level is small. Larger BETA values will cause R1 values to become larger and the safety level to be lower; smaller BETA values will cause R1 to become smaller and the

safety level to increase. Larger system constant values will cause the R1 value to fall and the safety level to rise, whereas smaller values for the system constant will cause an increase in R1 and a decrease in the safety level.

Appendix Z

Special USIMS Variables

A. FRADUE

The handling of reductions in buy quantities to compensate for returns has been changed. The original USIMS assumed that a certain fixed percentage (50%) limit existed for the reduction of a buy (FRABUY). In SAMMS, a portion of the dues-in expected from returns is applied towards the procurement cycle requirements. In other words, the buy is reduced by some quantity to allow for returns. However, the F-67 SAMMS Appendix does not mention a fixed limit.

At one point the USIMS code involving FRADUE was changed to remove the artificial limit by setting that limit to 100 % of the buy quantity, as in SAMMS (no limit on buy reduction). The results, however, showed that numerous automated small purchases were generated for high dollar value items. These small purchases of less than \$1000 came about because the normal buy, which would have been of a substantial dollar value, was being reduced almost entirely by the amount of dues-in from returns. As a result of this anomaly, FRABUY was reinitialized at .50 or 50%. To eliminate consideration of all returns as applied in the procurement cycle (note: this is not what SAMMS does), the lines involved were deactivated.

B. ICAT. ICAT is the name of the variable in USIMS for the annual dollar value groupings of demand for the various items in the sample. It is used as a subscript in various arrays including the random number generators and is first defined for each item in STARTX. Counts of the total items in each ADV grouping are used in scaling results of the simulation back to the population as a whole. ICAT is broken down into the six dollar value groupings listed on the detail reports across the top of the page.

C. KLESIS. KLESIS is the name of the variable in USIMS for the type of item, VIP, NSO and non-VIP-replenishment. KLESIS is either 7,8, or 9 (these represent also the column on the detail page in which report values appear for VIP and NSO items; column nine of the detail report is for the population as a whole). Like ICAT, KLESIS is used as a subscript for arrays and is determined first in STARTX for each item.

D. NERCTR. NERCTR is an array that handles overflow requisitions, backorders, returns, and dues-in. It is used throughout USIMS to prevent erroneous values from entering the common block when limits of the array in question are exceeded. The net effect of this type of handling is that the particular requisition (or other item of concern) is lost. The requisition is counted, but no stock is issued as the program arrays could not hold the quantity. Processing still

continues without decrementing stock on hand. The NSNs and the type of error involved are written out by an error message in main without counting how many times the particular error occurred.

Appendix AA

System Constant

USIMS parameter card instructions indicate that the system constant used in the DoD variable safety level can be obtained from the DLA RCS 96. This number can be used as the initial value, recognizing that until the DLA and SAMMS system is programmed to include the DoD time-weighted essentiality weighted variable safety level, it is based upon the Efficient Surface Safety Level Model. Hence, it is the sums of the dollar mean absolute deviations of medium and high dollar items only. The DoD model will include low value items as well.

Appendix BB

Timing

Table 24

DATE ARRAY TABLE

EVENT	TIME	TIME	SUBSCRIPT	SUBROUTINE
	IN ORIGINAL	IN USIMS II		PERFORMED IN
REQUISITIONING	XXX.1	XXX.1	1	MAIN
RECEIPT/BUY	XXX.0	XXX.0	2	DUEINX
OBLIGATION	XXX.0	XXX.0	3	OBLX
MONTH	MMM.5	MMM.5	4	MAIN
FTE PROCESS	XXX.3	XXX.3	5	FTERDD
AUTO RETURN	XXX.0	XXX.0	6	DUEINX
RECEIPT/RETURN	XXX.0	XXX.0	7	DUEINX
INITIALIZATION	ZZZ.6	ZZZ.6	8	STARTX
POLICY CHANGES	ZMM.55	ZMM.55	9	POLICY
DISPOSALS	QQQ.7	QQQ.7	10	MAIN
MONTHLY TOTALS	MMM.8	MMM.6	11	MNTHLY
FORECASTING	MQQ.60	MQQ.65	12	FORCX

MMM means event can occur monthly

MQQ means event can occur monthly or quarterly

QQQ means event can occur quarterly

XXX means event can occur any day

ZMM means event can occur at the start of the simulation or monthly

ZZZ means event can occur at the start of the simulation

Note that in the enhanced version of USIMS, monthly accumulation now precedes forecasting and disposals are made after the quarterly forecast update. Previously, USIMS assumed that the input data had already been updated. In fact, the data was a snapshot of the month-end status. The enhanced version thus calls FORCX from the start routine to complete the forecasting at the outset of the run. Since disposal is done in MAIN after a normal quarterly update, the disposal routine is activated only in the second quarter. Therefore, the disposal routine was also added to STARTX to take care of the first month's disposals.

Appendix CC

Validation Criteria in Extract

Table 25 gives the validation criteria and data modifications of the extract segment of the USIMS package.

Table 25

EXTRACT AND VALIDATE THE FOLLOWING DATA ELEMENTS

FILE NO.	DATA ELEMENT NAME	SWMS SOURCE FILE	SWMS SOURCE CONFIG	SWMS OUTPUT CONFIG	VALIDATION CRITERIA	ELSE CONNECTIVE ACTION
01	FEDERAL SUPPLY CLASS	SFTT	24	4.0	MATCH SWMS FILES	DELETE NSN FROM SAMPLE
02	NUMERIC ITEM ID NUMBER	SFTT	27	7.0	MATCH SWMS FILES	DELETE NSN FROM SAMPLE
03	DATE MANAGEMENT ASSIGNED	FTF	P3	5.0	OVER 2-YRS IN SYS	DELETE NSN FROM SAMPLE
04	UNIT PRICE	SCF	P5	9.2	NUMERIC NON-ZERO	DELETE NSN FROM SAMPLE
05	SUPPLY STATUS CODE	SCF	21	1.0	UNEQUAL 2,3,6, or 9	DELETE NSN SET A = TWO
06	DEMAND VALUE CODE	SCF	21	1.0	SET LOW=1, MEDIUM=2, HIGH=3	
07	TOT ON HAND ISS ASSETS QTY	MEAF	P5	9.0	NUMERIC	DELETE NSN FROM SAMPLE
08	DEPT BACKORDERS QTY	MEAF	P5	9.0	NUMERIC	SET = ALL 9's
09	AGE OF ITEM INDICATOR	SCF	B1	1.0	MUST EQUAL 1	DELETE NSN FROM SAMPLE
10	VIP ITEM INDICATOR	SCF	B1	1.0	SET VIP=1, NONVIP=0	
11	PROCUREMENT CYCLE INDICATOR	SCF	B1	1.0	SET 0-9; 1=1	E,P
12	ITEM CATEGORY CODE	SCF	B2	1.0	SET 00-9,01-1,10-2,11-3	P,B,2,1
13	SAFETY LEVEL CODE	SCF	B2	1.0	SET 00-9,01-1,10-2,11-3	N,E,V,P
14	MONROE FILL QUANTITY	SCF	B32	9.0	NUMERIC	DELETE NSN FROM SAMPLE
15	OKLAND FILL QUANTITY	SCF	B32	9.0	NUMERIC	DELETE NSN FROM SAMPLE
16	QUARTERLY FORECAST OF DEMANDS	SCF	B32	9.0	NUMERIC	SET = 0.0
17	QTD NEW ITEMS QUANTITY	SCF	B32	9.0	NUMERIC	SET = 0.0
18	SYSTEM SINGLE SMOOTED QTY	SCF	B32	9.1	NUMERIC	DELETE NSN FROM SAMPLE

Table 25

FILE NO.	DATA ELEMENT NAME	SWAGS SOURCE FILE	SWAGS SOURCE CONFID	SWAGS OUTPUT CONFID	VALIDATION CRITERIA	ELSE CORRECTIVE ACTION
19	SYSTEM DOUBLE SPOOLED QTY	SCF	R32	9.1	NUMERIC	DELETE MEN FROM SAMPLE
20	NUMERIC STORAGE OBJECTIVE	SCF	R32	9.9	NUMERIC IF ELEMENT 012 EQUAL 01 OR 10, ELSE DELETE NO CHECK IF ELEMENT 012 UNEQUAL 01 OR 10	
21	QUARTERLY RETURNS FORECAST	SCF	R32	9.9	NUMERIC	SET = 0
22	ALGEBRAIC SUM OF FORECAST ERR	SCF	R32	10	NUMERIC	SET = 0.0 HIGH ORDER SIGN
23	MEAN AVERAGE DEVIATION	SCF	R32	9.1	NUMERIC	DELETE MEN FROM SAMPLE
24	ADDITIONAL RETENTION QTY	SCF	R32	9.9	NUMERIC	SET = 0
25	MODIUM PRODUCEMENT QTY	SCF	R32	9.9	NUMERIC	SET = 0
26	TRACK SIGNAL CORR CTR	SCF	06	1.0	SET 00-0, 01-1, 12-2	
27	ADMINISTRATIVE LEADTIME	SCF	P2	3.0	NUMERIC	SET = 00
28	PRODUCTION LEADTIME	SCF	P2	3.0	NUMERIC	SET = 00
29	PRODUCEMENT CYCLE MONTHS	SCF	P2	2.0	NUMERIC NON-ZERO	DELETE MEN FROM SAMPLE
30	FIXED SAFETY LEVEL MONTHS	SCF	P2	3.1	NUMERIC IF ELEMENT 013 EQUAL 3, ELSE DELETE MEN SET EQUAL ALL 9'S IF ELEMENT 013 UNEQUAL 3	
31	OPERATING LEVEL MONTHS	SCF	P2	2.0	NUMERIC	SET = ELEMENT 029
32	APPLIC MONITOR DEND PERCENT	SCF	P2	3.0	NUMERIC	IF 0-100 .12, 1125 SET = 1.00, ELSE SET = .5
33	ESSENTIAL ITEM CODE	SCF	01	1.0	NUMERIC NON-ZERO	SET = 1
34	FORECAST BASIS CODE	SCF	01	1.0	QUARTERLY AND NON-QUARTERLY ITEM, MONTHLY AND VTP ITEM	DELETE MEN

Table 25

FILE NO.	DATA ELEMENT NAME	SWMS SOURCE FILE	SWMS SOURCE CONFIG	SWMS OUTPUT CONFIG	VALIDATION CRITERIA	BASE CONNECTIVE ACTION
35	PMNR QUANTITY	SCF	B32	9.9	SET = β	
36	GRNO QUANTITY	SCF	B32	9.9	NUMERIC	SET = β
37	T P C01 RECUR DND QTT*	SCF	B32	9.9	NUMERIC	DELETE NEN FROM SAMPLE
38	T P C02 RECUR DND QTT*	SCF	B32	9.9	NUMERIC	DELETE NEN FROM SAMPLE
39	T P C03 RECUR DND QTT*	SCF	B32	9.9	NUMERIC	DELETE NEN FROM SAMPLE
40	T P C04 RECUR DND QTT*	SCF	B32	9.9	NUMERIC	SET = AVE 1ST 3 QUANTERS
41	T P C01 RECUR DND FREQ*	SCF	B16	5.9	NUMERIC	DELETE NEN FROM SAMPLE
42	T P C02 RECUR DND FREQ*	SCF	B16	5.9	NUMERIC	DELETE NEN FROM SAMPLE
43	T P C03 RECUR DND FREQ*	SCF	B16	5.9	NUMERIC	DELETE NEN FROM SAMPLE
44	T P C04 RECUR DND FREQ*	SCF	B16	5.9	NUMERIC	SET = AVE 1ST 3 QUANTERS
45	T P C01 NONRECUR DND QTT*	SCF	B32	9.9	NUMERIC	DELETE NEN FROM SAMPLE
46	T P C02 NONRECUR DND QTT*	SCF	B32	9.9	NUMERIC	DELETE NEN FROM SAMPLE
47	T P C03 NONRECUR DND QTT*	SCF	B32	9.9	NUMERIC	DELETE NEN FROM SAMPLE
48	T P C04 NONRECUR DND QTT*	SCF	B32	9.9	NUMERIC	SET = AVE 1ST 3 QUANTERS
49	T P C01 NONRECUR DND FREQ*	SCF	B16	5.9	NUMERIC	DELETE NEN FROM SAMPLE
50	T P C02 NONRECUR DND FREQ*	SCF	B16	5.9	NUMERIC	DELETE NEN FROM SAMPLE
51	T P C03 NONRECUR DND FREQ*	SCF	B16	5.9	NUMERIC	DELETE NEN FROM SAMPLE
52	T P C04 NONRECUR DND FREQ*	SCF	B16	5.9	NUMERIC	SET = AVE 1ST 3 QUANTERS
53	CUT-OF-TRACK INDICATOR	SCF	21	1.9	SET BLANK = β , PLUS = 1, MINUS = 2	

Table 25

FILE NO.	DATA ELEMENT NAME	SOURCE FILE	SOURCE CONFIG	SINGLE OUTPUT CONFIG	VALIDATION CRITERIA	BASE CORRECTIVE ACTION
70	PRIORITY CODE*	EDF	32		FOR CODES 1 TO 3 SET R/O CODE = 1 FOR CODES 4 TO 8 SET R/O CODE = 2 ALL OTHERS SET R/O CODE = 3	
71	BACKORDER ADVISE CODE	EDF	32		UNEQUAL BA, BF, BK, BL, BM, BN, BO, BR, BS, BU, BV, BW, BX, BY, BZ, C, N NOTE: DIRECT DELIVERY DESIGNATED BY AS BF, BV	DELETE BACKORDER RECORD
72	DUB-IN DATE PROCUREMENT	DIF	P3	5.5	NUMERIC	DELETE DUB-IN RECORD
73	DUB-IN QTY PROCUREMENT	DIF	P5	9.5	NUMERIC	DELETE DUB-IN RECORD
74	DUB-IN TYPE CODE*	DIF	23		EQUALS ZUS, ZDU, ZDV, ZOE ASSET GRP 24A	DELETE DUB-IN RECORD
75	DUB-IN CONDITION CODE*				EQUAL A	DELETE DUB-IN RECORD
76	DUB-IN DATE RETURNS*			5.5	NUMERIC	DELETE DUB-IN RECORD
77	DUB-IN QUANTITY RETURNS*			9.5	NUMERIC	DELETE DUB-IN RECORD
78	DUB-IN RETURNS CREDIT IND*			1.5	SET CREDIT = 5, NO CREDIT = 1	

Appendix DD

Variable Cross References

A. Variable Cross Reference for FRONT

VARIABLE	DIMENSION	LOCAL	COMMON	MAIN	INIT	REPORT	SORT
A		X		X			
variable used to check for character "a"							
AERQ		X		X			
additional economic retention quantity read in							
ALPHX		X		X			
alpha value read in							
ALT		X		X			
administrative lead time read in							
AMAD		X		X			
mean absolute deviation read in							
ANORQT		X		X			
Norfolk FILL quantity read in							
AOAKQT		X		X			
Oakland FILL quantity read in							
APNRD		X		X			
applicable percentage of non-recurring demand read in							
AQD		X		X			
quarterly forecast of demand read in							
AQDM		X		X			
quarterly forecast of demand for new items read in							
ARRAY	MAX,N	X					X
array used in SORT routine							
AVEDMD		X		X			
average demand size							
B		X		X			
variable used to check for character "b"							
BUYMIN		X		X			
minimum buy read in							
C		X		X			
variable used to check for character "c"							

VARIABLE	DIMENSION	LOCAL	COMMON	MAIN	INIT	REPORT	SORT
CCC		X		X			
category change code read in							
CLVL1		X		X			
control level 1 read in							
CLVL2		X		X			
control level 2 read in							
CNT		X		X			
the subscript used for each value of MCOUNT							
CODES	18		X	X	X		
peculiar item management codes read in							
CONF	5		X	X	X	X	
level of confidence							
D		X		X			
variable used to represent character "d"							
DAYSBO	6,9		X	X	X	X	
number of items with backorder for output report							
DAYSDD	6,9		X	X	X	X	
number of items with direct deliveries for output report							
DBQ		X		X			
depot backorder quantity read in							
DEMMNR	12		X	X	X		
monthly non-recurring demand quantity output simulated by a uniform zero - one distribution							
DEMMR	12		X	X	X		
monthly recurring demand quantity output simulated by a uniform zero - one distribution							
DFIIN		X		X			
last 9 digits of NSN on optional demand input tape							
DFSC		X		X			
last 2 digits of FSC on NSN of optional demand input tape							
DFSG		X		X			
FSG of NSN of optional demand input tape							
DNATO		X		X			
NATO code of NSN on optional demand input tape							
DNR	4		X	X	X		
quarterly non-recurring demand read in							

VARIABLE	DIMENSION	LOCAL	COMMON	MAIN	INIT	REPORT	SORT
DR	4		X	X	X		
quarterly recurring demands read in							
DSUM	6		X	X	X		
value of annual demand for all items in a particular dollar value grouping							
DSUM2	6		X	X	X		
sum of squared of the DSUM values							
DUE	150,4		X	X	X		
due in file output							
DUIN	5,9		X	X	X	X	
number of items with due-ins for output report							
E			X		X		
variable for representation of character "e"							
END10			X	X	X		
logical variable for end of file on optional requisition tape							
ERROR			X		X		
forecasting error read in							
FILLER			X		X		
filler portion of header record read in							
FIX			X		X		
fixed safety level months							
FNR	4		X	X	X		
quarterly frequency of non-recurring demands							
FR	4		X	X	X		
quarterly frequency of recurring demands							
FRECNT	11,7		X	X	X	X	
count of items in frequency ranges for output report							
FREMNR	12		X	X	X		
monthly frequency of non-recurring demands simulated by uniform zero - one distribution							
FREMR	12		X	X	X		
monthly frequency of recurring demands simulated by uniform zero - one distribution							
FSSC			X		X		
future supply status code read in							

VARIABLE	DIMENSION	LOCAL	COMMON	MAIN	INIT	REPORT	SORT
GMRAO		X		X			
general mobilization reserve acquisition objective read in							
I		X		X		X	X
index on do loop							
ICAT		X		X			
demand value category							
IDAY		X		X			
variable used as array subscript on backorder and due-in output reports							
IFSC	17		X	X	X		
last 2 digits of FSC on D parameter card read in							
IFSG	17		X	X	X		
FSG on D parameter card read in							
INDAY		X		X			
used for subscript for due-in							
INSO		X		X			
NSO code read in on item data							
IS		X		X			
used in random number generation process							
IPAGE		X				X	
report page number							
ITMTYP	6,7		X	X	X	X	
type of item used in output report							
I15CTR			X	X	X		
counter for option 15							
I16CTR			X	X	X		
counter for option 16							
J		X		X		X	X
index on do loop							
JEND		X		X			
subscript used to detect end of trailer inputs for item (MTRAIL)							
JFIIN	50	X		X	X		
last 9 digits of NSN for up to 50 items to be deleted from sample							

VARIABLE	DIMENSION	LOCAL	COMMON	MAIN	INIT	REPORT	SORT
JFSC	50	X		X	X		
last 2 digits of FSC of NSN for up to 50 items to be deleted from sample							
JFSG	50	X		X	X		
FSG of NSN for up to 50 items to be deleted from sample							
JULDAT			X	X	X	X	
julian date of the run							
K		X		X			X
index on do loop							
L		X					X
index on do loop							
LDAY		X		X			
days that a due-in is late							
LD1		X		X			
number of dues-in from procurement							
LD3		X		X			
number of dues-in from returns							
LROW		X		X			
row from 1 to 10 used as subscript on output reports							
L1		X					X
index on ARRAY							
M		X					X
number of records to be sorted							
MAX		X					X
maximum possible elements in file, varies with type of file being sorted							
MAXLD1			X	X	X	X	
value of highest number of dues-in from procurement for an item							
MAXLD3			X	X	X	X	
value of highest number of dues-in from returns for an item							
MAXNBO			X	X	X	X	
value of highest number of backorders for an item							
MAXNDD			X	X	X	X	
value of highest number of direct deliveries for an item							

VARIABLE	DIMENSION	LOCAL	COMMON	MAIN	INIT	REPORT	SORT
MCOUNT	6		X	X	X		
count of number of items in a dollar value of demand category							
MM		X					X
index on do loop in SORT							
MRQ		X		X			
maximum release quantity read in							
MTRAIL	81		X	X	X		
trailers read in from file							
N		X					X
index on do loop in SORT							
NAII		X		X			
age of item code read in							
NATO		X		X			
NATO code of item read in							
NBO		X		X			
number of backorders for an item							
NBOF1B		X		X			
number of backorders on file for priority I							
NBOF1V		X		X			
number of direct delivery backorders for priority II							
NBOF2B		X		X			
number of backorders on file for priority II							
NBOF2V		X		X			
number of direct delivery backorders for priority II							
NBOF3B		X		X			
number of backorders on file for priority III							
NCODE		X		X			
code on trailer read in to distinguish priority and type of backorder							
NCTR		X		X			
number of periods item is out of track read in							
NDATDU		X		X			
date a procurement is due in							
NDATE		X		X			
date established read in from trailer							

VARIABLE	DIMENSION	LOCAL	COMMON	MAIN	INIT	REPORT	SORT
NDATE1		X	X	X			
hold variable added to check for same date established to consolidate dues-in							
NDO		X		X			
number of backorders							
NDI		X		X			
number of due in							
NDMA		X		X			
date management assumed read in							
NDVC		X		X			
dollar value of demand code read in							
NE		X		X			
essentiality code of item read in							
NFBC		X		X			
forecast basis code read in							
NFIIN		X		X			
last nine digits of NSN read in							
NFSC		X		X			
last 2 digits of federal stock class of NSN read in							
NFSG		X		X			
federal stock group of NSN read in							
NOP	16	X	X	X	X	X	X
number of option read in							
NOPT10		X	X	X	X	X	X
value of option 10 read in							
NOPT11		X	X	X	X	X	X
value of option 11 read in							
NOPT12		X	X	X	X	X	X
value of option 12 read in							
NOPT13		X	X	X	X	X	X
value of option 13 read in							
NOPT14		X	X	X	X	X	X
value of option 14 read in							
NOPT15		X	X	X	X	X	X
value of option 15 read in							

VARIABLE	DIMENSION	LOCAL	COMMON	MAIN	INIT	REPORT	SORT
NOPT16		X		X	X	X	
value of option 16 read in							
NOPT1		X		X	X	X	
value of option 1 read in							
NOPT2		X		X	X	X	
value of option 2 read in							
NOPT3		X		X	X	X	
value of option 3 read in							
NOPT4		X		X	X	X	
value of option 4 read in							
NOPT5		X		X	X	X	
value of option 5 read in							
NOPT6		X		X	X	X	
value of option 6 read in							
NOPT7		X		X	X	X	
value of option 7 read in							
NOPT8		X		X	X	X	
value of option 8 read in							
NOPT9		X		X	X	X	
value of option 9 read in							
NOTI		X		X			
out of track periods indicator read in							
NPIC		X		X			
procurement cycle code read in							
NSEED		X		X			
random number seed							
NSG	34	X		X	X	X	
FSG of items on parameter card C read in							
NSHELF		X		X			
shelf life months used for option 10							
NSNDLT		X		X			
number of NSNs deleted from sample							
NSO		X		X			
numeric stockage objective for output file							

VARIABLE	DIMENSION	LOCAL	COMMON	MAIN	INIT	REPORT	SORT
NSSC		X		X			
supply status code read in							
NVIP		X		X			
VIP indicator read in							
NWSI		X		X			
weapons system application indicator							
OBLD1	250,4		X	X	X		
obligation file for direct deliveries priority I							
OBLD2	400,4		X	X	X		
obligation file for direct deliveries priority II							
OL		X		X			
operating level read in							
PCP		X		X			
procurement cycle period read in							
PIG1I		X		X			
percent of priority I requisitions							
PIG2I		X		X			
percent of priority II requisitions							
PIPG1			X	X	X	X	
percent read in from parameter card A							
PIPG2			X	X	X	X	
percent of priority I and priority II requisitions read in from parameter card A							
PLT		X		X			
production lead time read in							
PMRMR		X		X			
protectable material reserve material requirement read in							
POP		X		X			
total number of items in population computed by summing POPNR							
POPNR	6		X	X	X	X	
items in population by annual dollar value categories							
PREC	3		X	X	X		
precision used in statistical analyses							

VARIABLE	DIMENSION	LOCAL	COMMON	MAIN	INIT	REPORT	SORT
PRECD	5,7		X	X	X	X	
used for output report for precision by annual demand value							
PREC	5,7		X	X	X	X	
used for output report for precision by annual requisition frequency							
PROC	8,9		X	X	X	X	
array used for reporting number of procurements							
Q			X		X		
stock for issue							
QFR	4		X		X		
quarterly forecast of returns							
QUN01B	250,2		X	X	X		
file of backorders for priority I							
QUN02B	400,2		X	X	X		
file of backorders for priority II							
QUN03B	950,2		X	X	X		
file of backorders for priority III							
RANDOM			X		X		
random number used for arrival of returns							
RET	200,3		X	X	X		
file of returns							
RETDUE	8,9		X	X	X	X	
used to report on returns							
RETFAC			X	X	X	X	
factor used for returns read in from parameter card							
RETFRQ			X		X		
return frequency written out							
RETLIM			X		X		
return limit							
RETQTY			X		X		
return quantity written out							
RETURN	5,9		X	X	X	X	
used to write reports on returns							
RIC			X	X	X	X	
routing identifier of center read in							

VARIABLE	DIMENSION	LOCAL	COMMON	MAIN	INIT	REPORT	SORT
ROBJ		X			X		
requisition objective (NSO quantity) for NSO items							
RP		X			X		
reorder point							
SEQ		X			X		
sequence letter of parameter cards							
SHELIF		X			X		
shelf life code read in							
SLC		X			X		
safety level code							
SMRQ	6		X	X	X		
frequency of requisitions for all items in the dollar categories in the sample							
SOH		X			X		
stock on hand read in							
SQUARD	6	X			X		
PREC (K) * SYSAVD / Z (J)							
SQUARR	6	X			X		
PREC (K) * SYSAVR / Z (J)							
STDVD	6		X	X	X		
square root of VARAD for each dollar category							
STDVR	6		X	X	X		
square root of VADAR for each dollar category							
SUMD		X			X		
dollar value of demand for the item based on monthly demand							
SUMDEM		X			X		
dollar value of the annual demand for an item (quarters)							
SUMREQ		X			X		
annual demand frequency for the item (quarters)							
SUMRQ	6	X			X		
sum of the number of requisition quantity for the item by each ADV group based on monthly demands							
SUMRQ2	6		X	X	X		
SUMRQ squared in each ADV group							

VARIABLE	DIMENSION	LOCAL	COMMON	MAIN	INIT	REPORT	SORT
SUMX	6		X	X	X		
sum of requisition frequency (SUMREQ) for the item by each ADV group							
SUMX2	6		X	X	X		
sum of SUMREQ squared in each ADV group							
SUMY	6		X	X	X		
sum of the demand dollars (SUMDEM) for each item by ADV group							
SUMY2	6		X	X	X		
sum of SUMDEM squared in each ADV group							
SYSAVD			X		X		
system annual value of demand							
SYSAVR			X		X		
system annual value of requisitions							
S1			X		X		
single smooth value read in							
S2			X		X		
double smooth value read in							
TEMP			X				X
temporary storage for lowest value being sorted							
TOTREQ			X		X		X
total number of requisitions							
TOTVAD			X		X		X
total value of annual demand							
TYPE			X		X		
type record read in, A is return, B is procurement due-in, C is backorder, D is end of trailer record							
UPI			X		X		
unit price read in							

NOTE: the following variables through VARDR refer to the SAMMS E-510 Appendix and Appendix X in this document on Sampling Methods in the Simulation.

VARAD		X		X
variance of the <u>dollar</u> value of demand for each of the ADV groups				
VARAR		X		X
variance of the number of <u>requisitions</u> for each of the ADV groups				

VARIABLE	DIMENSION	LOCAL	COMMON	MAIN	INIT	REPORT	SORT
----------	-----------	-------	--------	------	------	--------	------

VARBD		X		X			
right term of denominator in equation (1) on X-3 for dollars							

$$\sum_{j=1}^k (N_j s_j^2)$$

VARBR		X		X			
as VARBD for frequency of requisitions							

VARCD		X		X			
numerator of equation (1) on X-3 for dollars							

$$\sum_{j=1}^k (N_j s_j)$$

VARCR		X		X			
as VARCD for frequency of requisitions							

VARDD		X		X			
the argument of the square root in equation (3) on X-3 for dollars							

$$\frac{N_1 s_1 \sum N_j s_j}{n_1} - \sum N_1 s_1^2$$

VARDR		X		X			
as VARDD for requisition frequency							

VSL		X		X			
variable safety level read in							

XMONY1	8,9		X	X	X	X	
dollar value due-in from procurement							

XMONY2	5,9		X	X	X	X	
dollar value due-in from procurement stratified by days							

XMONY3	8,9		X	X	X	X	
dollar value due-in from returns							

XMONY4	5,9		X	X	X	X	
dollar value due-in from returns stratified by days							

XMONY5	6,9		X	X	X	X	
dollar value of backorders							

XMONY6	6,9		X	X	X	X	
dollar value of direct delivery backorders							

VARIABLE	DIMENSION	LOCAL	COMMON	MAIN	INIT	REPORT	SORT
XNQTY		X			X		
quantity read in from trailer							
XNQTYB			X		X		X
quantity due-in total							
XNUM	7,5,3		X		X		X
optimum sample size for each dollar grouping and total based on requisition frequency							
X16QTY			X		X		X
quantity involved in option 16							
YNUM	7,5,3		X		X		X
optimum sample size for each dollar grouping and total based on demand value							
Z	5		X		X		X
probability for various confidence intervals in the normal distribution (used as t in equations (3) on P-84)							

B. Variable Cross Reference for USIMS

KEY: L is local	MN is MNTHLY
C is common block	OB is OBLX
MA is MAIN	OU is OUTPUT
B is BOREL	P is POLICY
D is DUEINX	R is ROPX
FO is FORCX	SO is SORT
FT is FTERDD	ST is STARTX
IN is INIT	W is WEIBULL

VARIABLE DIMENSIONS L C MA B D FO FT IN MN OB OU P R SO ST W

ADAYS L MA
threshold to check for putting requisition on direct delivery

ADBSBC C MA IN R ST
number of days between consolidation for procurements

ADJOLD L MN
hold variable for RNRADJ

AERQ C MA FO IN ST
additional economic retention quantity

AII C MA IN ST
age of item code

ALPCP1 C MA IN P R
low value procurement cycle period

ALPCP2 C MA IN P R
medium value procurement cycle period

ALPCP3 C MA IN P R
high value 1 procurement cycle period

ALPCP4 C MA IN P R
high value 2 procurement cycle period

ALPHA C MA FO IN ST
smoothing factor for forecast

ALPHAW 12 C MA IN ST W
alpha factor used in weibull distribution of arrivals

ALPHX C MA IN ST
smoothing factor read in for forecast of demand

ALT C MA IN P ST
administrative lead time read in

VARIABLE DIMENSIONS L C MA B D FO FT IN MN OB OU P R SO ST W

ALTADJ C MA IN P ST
administrative lead time adjustment factor

ALTDIF 14 C MA IN
probabilities of each interval in time of administrative lead time

ALTPRB 14 C MA IN R
cumulative probability distribution read in of administrative lead time

AM C FO ST
used as multiplication factor for computing AQD

AMAD C MA FO IN ST
smoothed absolute error of forecast

AMADLT 26,10 C MA FO IN MN OU
mean absolute deviation of lead time

ANBFV1 26,10 C MA IN MN OB OU
average number of BV priority I backorders on file

ANBFV2 26,10 C MA IN MN OB OU
average number of BV priority II backorders on file

ANBF1 26,10 C MA B IN MN OU
average number of BB priority I backorders on file per day

ANBF2 26,10 C MA B IN MN OU
average number of BB priority II backorders on file per day

ANBF3 26,10 C MA B IN MN OU
average number of BB priority III backorders on file per day

ANBOR1 26,10 C B IN OU
number of BB and BV priority I backorders released in the month

ANBOR2 26,10 C B IN OU
number of BB and BV priority II backorders released in the month

ANBOR3 26,10 C B IN OU
number of backorders priority III released during the month

ANB1 26,10 C B IN OU
average number of days priority I backorders are on file

ANB2 26,10 C B IN OU
average number of days priority II backorders are on file

VARIABLE DIMENSIONS L C MA B D FO FT IN MN OB OU P R SO ST W

ANB3 26,10 C B IN OU
average number of days priority III backorders are on file

ANORQT C MA IN R ST
Norfolk FILL quantity read in

ANRDEM L FO
non-recurring demand

AOAKQT C MA IN P ST
Oakland FILL quantity read in

APNRD C FO IN P ST
applicable percent of non-recurring demand to forecast

APNRDI C MA IN P ST
applicable percent of non-recurring demand read in

AQD C MA D FO IN MN R ST
quarterly forecast of demand

AQDMIN L MA ST
threshold for determining if disposal is economic

AQDN C MA IN ST
quarterly forecast of demand for new items

ARRAY (MAX,N) L SO
array used for sorting in SORT subroutine

ARS L FO
average requisition size

ASSET L D
net assets not including returns

AUTOFR C D IN P ST
frequency of automatic returns

AUT1 C D IN ST
quantity of automatic return

AX 3 C IN MN ST
factor used in generation of lognormal distribution for returns

AZ L ST
factor used in computing quarterly returns

BETA C MA FO IN P ST
adjusted number of backorders on file for use in safety level computations

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VARIABLE DIMENSIONS L C MA B D FO FT IN MN OB OU P R SO ST W

BETAW 12 C MA IN ST W
 beta factor used in computation of weibull distribution for requisition interarrivals

BLT L FO
 lead time in months or quarters for use in safety level computation

BM1 C MA FO IN P
 monetary breakpoint for procurement cycle computations

BM2 C MA FO IN P
 monetary breakpoint for procurement cycle computations

BM3 C MA FO IN P
 monetary breakpoint for procurement cycle computations

BOFPOP C MA IN P
 number of backorders on file in population read in

BOQ L MA
 quantity on backorder for the requisition

BUYMAX C MA IN P R
 maximum automatic buy without review

BUYMIN C MA IN P R
 minimum system buy allowed

CCC C MA IN ST
 category change code

CLVL 3 C MA B FO IN MN ST
 control level quantities for each priority group

CMRQ C IN
 maximum release quantity edit

COMENT 57 C MA IN
 comments read in and written out for that policy

CRELVL C D FO FT IN
 credit level for returns

VARIABLE DIMENSIONS L C MA B D FO FT IN MN OB OU P R SO ST W

CUTLPR C MA IN P R
value for large procurement threshold

CUVIPA C MA FO IN P ST
corrective non-VIP alpha factor

CVIPAL C MA FO IN P ST
corrective VIP alpha factor

DATE 12 C MA D FO FT IN MN OB P R ST
date for next event of each of 12 types for each function

DAZPNT 14 C MA IN R
endpoint values of intervals in days used in both lead time distributions

DBQ C MA IN ST
depot backorder quantity read in

DBUY L R
value of buy quantity

DBUY1 L R
value of previous buy for consolidation purposes

DBUY2 L R
value of new buy when consolidated

DEMLT L D FO
demand lead time

DEMMR 12 C MA IN P ST
recurring demand quantity by month

DEMNR 12 C MA IN P ST
non-recurring demand quantity by month

DEMS 3 C FO IN ST
quantity requisitioned by priority group

DIRDL1 C MA IN P
maximum days until a procurement is due-in for determination in putting priority I backorder on direct delivery

DIRDL2 C MA IN P
maximum days until a procurement is due-in for determination in putting priority II backorder on direct delivery

DISMAX C MA IN P ST
maximum automatic disposal value

VARIABLE DIMENSIONS L C MA B D FO FT IN MN OB OU P R SO ST W

DISMIN C MA IN P ST
minimum economic disposal value allowed

DISP L MA ST
dollar value of disposal

DLT C MA IN P
direct delivery administrative lead time

DPGRP 2 C FO IN ST
percentage quantity demanded by priority group for I and II

DUE 150,4 C MA FO IN OB R ST
file for dues-in from procurement

DUEQTY L R
procurement quantity

DUM L MA
value of backorder

DUMYC C MA IN W
input of parameter for requisition interarrivals for DCSC

DUMYM C MA IN W
input of parameter for requisition interarrivals for DPSC-M

DVQD L FO
dollar value of quarterly demand

E C MA FO IN
essentiality used in safety level computations

EAX 3 C D FT IN MN ST
exponentiated variable AX

EEOQ L R
economic order quantity computed by procurement cycle

EOQ C FO IN MN R
economic order quantity

EOQPR1 C MA FO IN P
first parameter for economic order quantity

EOQPR2 C MA FO IN P
second parameter for economic order quantity

EOQPR3 C MA FO IN P
third parameter for economic order quantity

VARIABLE DIMENSIONS L C MA B D FO FT IN MN OB OU P R SO ST W

ER		C	MA		FO		IN									ST	
forecast error																	
ERETQT			C	MA		FO										ST	
economic retention quantity used for maximum allowable stock on hand																	
ERROR			L			FO											
forecast less adjust quantity demanded																	
FILLER			C					IN									
extra space in the input read header portion																	
FIX			C	MA				IN								ST	
fixed safety level months																	
FLQTPT			C			FO		IN			P					ST	
total Norfolk and Oakland FILL quantity																	
FRABUY			C	MA				IN			P						
fractional portion of buy used to calculate due-in assets when returns are considered																	
FRANK				L						MN							
AMADLT times UP																	
FRECTR			C	MA		FO		IN			P						
frequency counter used for adjustment of forecast of demand																	
FREMNR	12		C	MA				IN								ST	
non-recurring requisition frequency by month																	
FREMR	12		C	MA				IN								ST	
recurring requisition frequency by month																	
FREQ	12		C					IN			P					ST	
total requisition frequency by month																	
FSSC			C					IN								ST	
future supply status code																	
FTE				L					FT								
quantity of an FTE																	
F1			C	MA		FO		IN			P						
factor used in control level 1 computation																	
F2			C	MA		FO		IN			P						
factor used in control level 2 computation																	
GMRAO			C	MA		FO		IN								ST	
general mobilization reserve acquisition objective																	

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VARIABLE DIMENSIONS L C MA B D FO FT IN MN OB OU P R SO ST W

HITSPY C IN P ST W
 yearly requisition frequency used in interarrival computation

HOLDVA C IN
 used for computation in requisition interarrival process

I L MA B D FO MN OB OU P R SO ST
 index on loops

IC L MA
 index on management policy table change values and periods

ICAT C MA B D FT IN MN OB P R ST
 annual dollar value category 1 through 6 on an item

ICTR1 L B
 counter for priority group I releases

ICTR2 L B
 counter for priority group II releases

ICTR3 L B
 counter for priority group III releases

IDATE C MA B D IN MN OB ST
 integer portion of the current date

IDSPSW L MA
 disposal switch

II L MA FO
 index on loop

IMONTH C MA B D FO FT IN MN OB P R ST
 current month on scale 1 to 24

IMORE L MA
 switch to indicate whether run is to be continued by outputting file at
 end of run

IND L MA FO
 factor used in computing forecast

VARIABLE DIMENSIONS L C MA B D FO FT IN MN OB OU P R SO ST W

INTREQ C IN
used in determining next requisition date

IPAGE L OU
page number on output reports

IPG L MA B D IN
index of do loop to process requisitions

IPOLICY L MA
former number of policy runs, now inoperative

IPRMNTH L R
month of previous procurement for purposes of consolidation

IQTR C D FO IN OU
current quarter

IRCPSW C MA D IN
receipt switch

IRPSWT 142 L OU
switch for printing output reports, one for each report

IREQ L MA
integer portion of requisition interarrival variable

IS 13 C MA D IN P R
random number generator substream

ISCALE C MA FT IN MN R ST
scaling variable

IS2 6 C MA IN
random number generator substream

IS3 6 C MA IN ST
random number generator substream

VARIABLE DIMENSIONS L C MA B D FO FT IN MN OB OU P R SO ST W

IS4 6 C MA FT IN
random number generator substream

IS5 6 C FT IN
random number generator substream

IS6 L MA
random number generator substream

ITEM L MA
control on item loop

ITEM1 L MA
current number of items in simulation

I1 L MA
index on do loop

J L D FO FT OB OU R SO ST
index on loop

JJ L MA
index on do loop

JULDAT C MA IN OU
julian date of the run

J1 L FO
current month

J2 C MA FO IN MN ST
next month on scale from 1 to 12

J4 L FO
current quarter on scale 1 - 4

J5 L MN
previous month on scale 1 - 12

K L MA FO FT OB OU SO
counter and index on do loop in SORT

KILLER L MA
read in value on header portion of record

KLESIS C MA B D FT IN MN OB R ST
item type: VIP - 7, NSO - 8, other - 9, VIP and NSO 10

KP 3 C MA IN
number of requisition on a day by priority group

VARIABLE DIMENSIONS L C MA B D FO FT IN MN OB OU P R SO ST W

K1 L FO
current month on scale 1 - 12

L L D OB OU SO
index on do loop

LDATE C MA D IN MN ST

LDAY1B C MA B IN MN ST
date used to compute backorder days for priority I backorders last day
on which average stock on hand was updated

LDAY1V C MA IN MN OB ST
date used to compute backorder days for priority I direct deliveries

LDAY2B C MA B IN MN ST
date used to compute backorder days for priority II backorders

LDAY2V C MA IN MN OB ST
date used to compute backorder days for priority II direct deliveries

LDAY3B C MA B IN MN ST
date used to compute backorder days for priority III backorders

LDD L D
index on do loop

LDIDTE L MA
last due in arrival date

LD1 C MA D IN OB R ST
number of dues-in from procurement sources

LD3 C MA D FT IN ST
number of returns due in (FTE documents only)

L1 L MA SO
index on DATE(3) loop and in SORT

M L MA SO
number of items to be sorted

MAX L SO
first dimension of ARRAY in SORT

MICAT L FO
migration dollar value category

VARIABLE DIMENSIONS L C MA B D FO FT IN MN OB OU P R SO ST W

MIGRAT 26,10 C FO IN OU
array to store migrations from one dollar grouping category to the next

MM L SO
index on do loop in SORT

MONCHG 250 C MA IN
effective month for a management policy change

MRQ C MA IN ST
maximum release quantity read in

NALPSW C MA IN ST
alpha switch

N L SO
index for ARRAY in SORT

C MA IN ST
date management assumed read in

NBOF1B C MA B IN MN ST
number of priority I backorders on file

NBOF1V C MA IN MN OB ST
number of priority I direct deliveries on file

NBOF2B C MA B IN MN ST
number of priority II backorders on file

NBOF2V C MA IN MN OB ST
number of priority II direct deliveries on file

NBOF3B C MA B IN MN ST
number of priority group III backorders on file

NBOQB1 C MA B IN MN ST
quantity on backorder priority I

NBOQB2 C MA B IN MN ST
quantity on backorder priority II

NBOQB3 C MA B IN MN ST
quantity on backorder priority III

NBOQV1 C MA IN MN OB ST
quantity on direct delivery backorder priority I

NBOQV2 C MA IN MN OB ST
quantity on direct delivery backorder priority II

KEY: L is local	MN is MNTHLY
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VARIABLE DIMENSIONS L C MA B D FO FT IN MN OB OU P R SO ST W

NCAL	C					IN MN		P		ST
initialized to 0 in STARTX										
NCALSW	C					IN MN		P		ST
calculation switch										
NCTR	C MA			FO		IN				ST
number of periods out of track										
NDAYS	C MA					IN		OB		
number of days the simulation is to run										
NDBSBC	L MA									
number of days between procurements for consolidation of stock buys										
NDI	C MA		D		FT IN			R		ST
total quantity due in from procurement										
NDIRT	C MA		D		FT IN					ST
total quantity due in from returns										
NDO	C MA B D			FO FT IN MN				R		ST
total quantity on backorder and due-out										
NDVC	C MA				IN					ST
demand value code										
ND6	C MA				IN		OB	R		ST
control used in obligation subroutine										
NE	C MA				IN					ST
essential item code										
NERCTR	16 C MA		D		FT IN		OB	R		
simulation error message array										
NFBC	C MA				IN					ST
forecast basis code										
NFREQ	12 C MA			FO	IN MN					ST
recurring requisition frequency by month										

VARIABLE DIMENSIONS L C MA B D FO FT IN MN OB OU P R SO ST W

NGO L D
index on computed go to statement

NITEMS L MA
number of items in simulation read in

NITPNS 6 C MA IN ST
number of NSO items in population

NITPVS 6 C MA IN ST
number of VIP items in population

NITSNS 6 C MA IN ST
number of NSO items in sample

NITSVS 6 C MA IN ST
number of VIP items in sample

NMONTH C MA IN OU
number of months in simulation read in

NMPCHG 250 C MA IN
management policy change indicator

NN L MA
index on do loop

NPAST L MA
used to control policy changes

NPIC C MA IN ST
procurement cycle indicator

NPOLCY C MA IN OU
number of policy

NPRES L MA
used as present value of policy to control policy changes

NRETSW L MA ST
returns switch read in

NRFREQ 12 C MA FO IN MN ST
monthly non-recurring frequency

NRIC L MA
routing identifier of the DSC

NRQ L MA
number of requisitions

VARIABLE DIMENSIONS L C MA B D FO FT IN MN OB OU P R SO ST W

NRSW		L			FT														
switch																			
NSEED		L		MA															
seed for random number																			
NSEQ		L		MA					OU										
sequence number on USIMS parameter card																			
NSN	4		C	MA			IN											ST	
national stock number																			
NSO			C	MA	D	FO	IN	MN		R								ST	
numeric stockage objective item code: > 0 is no; =< 0 is yes																			
NSOMAX			C	MA			IN			P	R								
maximum automatic procurement for NSO items without review																			
NSSC			C	MA			IN											ST	
supply status code																			
NSWIT1			C			FO	IN											ST	
set to NSO value in START and used to detect migrations																			
NSWIT2			C			FO	IN											ST	
set to ICAT in STARTX and used to detect migrations																			
NTS			C	MA			IN											ST	
out of track indicator																			
NUMBER		L								P									
number of policy being changed																			
NUMPOL		L		MA															
number of the policy read in																			
NVIP			C	MA														ST	
VIP item indicator read in and written out																			
NWSI			C	MA			IN											ST	
weapons system indicator																			
OBLD1	250,4		C	MA			IN		OB									ST	
direct delivery file for priority I																			
OBLD2	400,4		C	MA			IN		OB									ST	
direct delivery file for priority II																			
OPLVL			C	MA			IN											ST	
operating level months																			

VARIABLE DIMENSIONS L C MA B D FO FT IN MN OB OU P R SO ST W

OR 26,10,90 L OU
equivalenced array for output reports

PALT C IN P R ST
administrative lead time after adjustments

PCF 6 C MA IN P ST
requisition frequency adjustment factor by dollar grouping

PCP L R
value of procurement cycle period

PCPX C MA IN ST
procurement cycle months

PCQ 6 C MA IN P ST
requisition quantity adjustment factor by dollar grouping

PCTRF C MA D IN P
percent of late returns that actually arrive

PDATE C MA B D FT IN OB P R
current date in simulation

PE L MA
point estimate used to determine requisition size

PERGT5 19 C MA IN
cumulative distribution for requisition sizes when average size is greater than 5

PERLE5 19 C MA IN
cumulative distribution for requisition sizes when average size is less than or equal to 5

PIPG1 C MA IN P ST
percent of priority I requisitions

PIPG1A C IN
unused at this time

PIPG1I C MA IN P ST
input percent for priority I requisitions

PIPG2 C MA IN P ST
percent of priority II requisitions

PIPG2A C IN
unused at this time

VARIABLE DIMENSIONS L C MA B D FO FT IN MN OB OU P R SO ST W

PIPG2I C MA IN P ST
input percent for priority II requisitions

PLT C MA IN P ST
production lead time read in

PLTADJ C MA IN P ST
procurement lead time adjustment factor

PLTDIF 14 C MA IN
difference in for interval probabilities for production lead time distribution

PLTPRB 14 C MA IN R
cumulative probability endpoints read in for production lead time distribution

PMRMR C MA IN P ST
protectable mobilization reserve material requirement

PNRDAD C MA FO IN P ST
percent of non-recurring demand adjustment factor

PNTINT 18 C MA IN
difference in the intervals of the average requisition size used in determining the actual size of requisitions

POPITM 6 C MA IN OU
values for the population totals of items by dollar value grouping

PPLT C MA IN P R ST
production lead time after adjustment

PPMRMR C MA D FO IN P ST
protectable mobilization reserve material requirement adjustment factor

PRBGT5 19 C MA IN
cumulative probability distribution for items with an average size greater than 5

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VARIABLE DIMENSIONS L C MA B D FO FT IN MN OB OU P R SO ST W

PRBLE5 19 C MA IN
cumulative probability distribution used for requisition size when average size is less than or equal to 5

PROBSD C MA IN ST W
probability addition to account for skewness to same day arrival

PROMAX L R
maximum automatic procurement

PUKCOD 18 C MA IN ST
peculiar management codes

QDEM L FO
adjusted demand quantity

QDM L FO
recurring demand quantity for the period under considerations

QFD C FO IN ST
quarterly forecast of demand read in

QFDADJ C MA FO IN P
adjustment factor for quarterly forecast of demand

QFR C MA FO IN R ST
quarterly forecast of returns

QFRADJ C MA FO IN P
adjustment factor for quarterly forecast of returns

QNDM L FO
quantity of non-recurring demand for the period under consideration

QNRDEM 12 C MA FO IN MN ST
quantity of non-recurring demand by month

QNRDM 12 C FO IN
quantity of recurring demand by month

VARIABLE DIMENSIONS L C MA B D FO FT IN MN OB OU P R SO ST W

QRDEM 12 C MA FO IN MN ST
quantity of recurring demand on monthly basis

QT L MA
quantity of a requisition

QTY L MA D
quantity

QTYDAY L MA MN
due-out x days

QTYMIN C MA IN
minimum buy quantity

QTYNC L FT
non-creditable return quantity

QTYP 3,30 C MA IN
quantity of a requisition

QTYPC L FT
creditable return quantity

QTYPNC L FT
quantity on FTE partial no credit accepted

QTYREJ L FT
quantity on FTE rejected

QUNO1B 400,2 C MA B IN ST
file of priority I backorders

QUNO2B 800,2 C MA B IN ST
file of priority II backorders

QUNO3B 4000,2 C MA B IN ST
file of priority III backorders

R L R
random number

RAIQUAU C MA IN MN P ST
average quantity of an automatic return

RATGT5 18 C MA IN
ratio of requisition size for those requisitions with average size greater than 5

RATIO 6 C MA IN P ST
ratio of variance for the mean square in the log normal quantity generator

VARIABLE DIMENSIONS L C MA B D FO FT IN MN OB OU P R SO ST W

RATLE5 18 C MA IN
ratio of requisition size for those requisitions with average size less than or equal to 5

RECADJ C MA IN MN P ST
adjustment for percent of recurring demands

RECUR 12 C IN MN ST
percent of recurring demand by month

REDUCE C MA IN
number of days by which to reduce dates when file is written to extend run length

REQINT C MA IN ST
used in computation of next requisition arrival

RET 200,3 C MA D FT IN ST
file for dues-in from returns (FTE only): quantity, date, credit code

RETFAD C IN
unused variable

RETFR 4 C D IN ST
frequency by quarter of returns

RETFRQ C MA IN P ST
yearly frequency of returns

RETLIM C MA FO FT IN ST
returns limit

RETLVC C MA D IN P
percent of creditable returns that actually arrive

RETLVN C MA D IN P
percent of non-credit returns that actually arrive

RETMAX C MA D IN P
maximum value of automatic return

RETMIN C MA D IN P
minimum value for automatic return

RETQTY C MA IN P ST
yearly returns quantity read in

REVMIN C MA IN P ST
minimum excess review value

VARIABLE DIMENSIONS L C MA B D FO FT IN MN OB OU P R SO ST W

RLT		C	MA		FT	IN		P				
returns lead time in days												
RLTAB	6000	C	MA	D	FT	IN		P				
random number table for logarithms												
RNARR	3,30	C	MA			IN						
array used for determining whether requisition is recurring or non-recurring												
RNFILE		L	MA									
random number read in from file												
RNRADJ		C	MA			IN	MN				ST	
adjusted percent of recurring demand												
RNTAB	6000	C	MA	D		IN			R		ST	
random number table of uniform 0-1 numbers												
ROBJ		C	MA		FO	IN			R		ST	
requisition objective for NSO items												
ROPFAC		C	MA	D	FO	IN		P			ST	
reorder point adjustment factor												
RP		C	MA	D	FO	IN						
reorder point quantity												
RPCF	6	C	MA			IN		P			ST	
adjustment factor by dollar grouping for returns frequency												
RPCQ	6	C	MA			IN		P			ST	
adjustment factor by dollar grouping for returns quantity												
RPCTAU		C	MA		FO	IN		P			ST	
fraction of returns that are automatic												
RPLT		C	MA	D		IN			R		ST	
smoothed production lead time												
RPT58	26,10	C				IN			OU			
report array for total number of requisitions												
RPT59	26,10	C				IN			OU			
report array for procurements initiated												
RPT60	26,10	C				IN			OU			
report array for total supply availability												
RPT61	26,10	C				IN			OU			
report array for priority I availability												

KEY: L is local	MN is MNTHLY
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MA is MAIN	OU is OUTPUT
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D is DUEINX	R is ROPX
FO is FORCX	SO is SORT
FT is FTERDD	ST is STARTX
IN is INIT	W is WEIBULL

VARIABLE DIMENSIONS L C MA B D FO FT IN MN OB OU P R SO ST W

RPT62	26,10	C				IN		OU
report array for priority II availability								
RPT63	26,10	C				IN		OU
report array for priority III availability								
RPT64	26,10	C				IN		OU
report array for average number of backorders								
RPT65	26,10	C				IN		OU
report array for total value of backorders established								
RPT66	26,10	C				IN		OU
report array for total commitment value								
RPT67	26,10	C				IN		OU
report array for total obligation value								
RPT68	26,10	C				IN		OU
report array for net investment change								
RPT69	26,10	C				IN		OU
report array for number of FTEs with credit								
RPT70	26,10	C				IN		OU
report array for value of FTEs with credit								
RPT71	26,10	C				IN		OU
report array for number of FTEs with partial credit								
RPT72	26,10	C				IN		OU
report array for value of FTEs with partial credit								
RPT73	26,10	C				IN		OU
report array for number of FTEs with no credit								
RPT74	26,10	C				IN		OU
report array for value of FTEs with no credit								
RPT75	26,10	C				IN		OU
filler array for equivalences								

VARIABLE DIMENSIONS L C MA B D FO FT IN MN OB OU P R SO ST W

RPT76	26,10	C				IN		OU									
filler array for equivalences																	
RPT77	26,10	C				IN		OU									
filler array for equivalences																	
RPT78	26,10	C				IN		OU									
filler array for equivalences																	
RPT79	26,10	C				IN		OU									
filler array for equivalences																	
RPT80	26,10	C				IN		OU									
filler array for equivalences																	
RPT81	26,10	C				IN		OU									
filler array for equivalences																	
RPT82	26,10	C				IN		OU									
filler array for equivalences																	
RRATIA		C				IN	MN		P							ST	
variance to mean square ratio for automatic returns																	
RRATIO		C				IN	MN		P								ST
Variance to mean square ratio for returns (FTE documents)																	
RSCALE			C	MA	B	D		FT	IN	MN	OB			R			ST
scaling factor																	
RTURN	4		C			D	FO		IN								ST
quarterly returns quantity																	
RVTAB	6000		C	MA		D		FT	IN								
random number table for normal variates																	
R1			L				FO										
used in VSL computation																	
R2			L				FO										
used in VSL computation																	
SAX	3		C			D		FT	IN	MN							ST
square root of variable AX																	
SC				C	MA			FO		IN							
system constant																	
SCAMAT	8			C	MA				IN		OU						ST
scaling matrix																	

VARIABLE DIMENSIONS L C MA B D FO FT IN MN OB OU P R SO ST W

SFI L MA
stock available for issue

SHELIF C MA IN ST
shelf life in months

SIZPNT 19 C MA IN
point intervals for requisition sizes

SLC C MA IN ST
shelf life code

SMTFAC C MA D IN P
smoothing factor for administrative and production lead time

SOH C MA B D FO FT IN MN R ST
stock on hand

SUM1 L FO
dummy computation variable

SUM2 L FO
dummy computation variable

SUM3 L FO
dummy computation variable

SUM4 L FO
dummy computation variable

SUM5 L FO
dummy computation variable

SUM6 L FO
dummy computation variable

SUM7 L FO
dummy computation variable

SZMULT 6 C MA IN
currently unused

S1 C MA FO IN ST
single smooth quantity

S2 C MA FO IN ST
double smoothed quantity

T L MA
temporary variable used to write output file for run extension

VARIABLE DIMENSIONS L C MA B D FO FT IN MN OB OU P R SO ST W

TAST1 L FT
net assets with FTE quantity

TAST2 L FT
net assets without FTE quantity

TAUTO L D
current date

TEMP 5 L OB
temporary array for dates

TEMP L SO
temporary for sorting

TEMP1 L FO
dummy variable used to compute APNRD

TFACT C MA FO IN P
multiplication factor used in EOQ computations

TFTE L FT
next date or dates

TITLES 6,82 L OU
used for output of report titles

TITLE1 6,17 L OU
used for output of report titles

TITLE2 6,17 L OU
used for output of report titles

TITLE3 6,17 L OU
used for output of report titles

TITLE4 6,17 L OU
used for output of report titles

TITLE5 6,14 L OU
used for output of report titles

TREQ L MA
real portion of continuous requisition interarrival time

TS L FO
tracking signal

TSLIM L FO
tracking signal limit

VARIABLE DIMENSIONS L C MA B D FO FT IN MN OB OU P R SO ST W

TS1 C FO IN ST
tracking signal product

TVDO 26,10 C MA B IN MN OB OU
average total backorder value per day

U L MA
temporary variable for use in writing out trailers for extending the run length

UAIQ 12 C MA IN MN P ST
average issue quantity for requisitions by month

UFREQ 12 C IN
monthly frequency of requisitions

UFTEFQ C FT IN P ST
interarrival time for returns (FTE documents)

UP C MA B D FO FT IN MN OB P R ST
unit price

UPI C MA IN P ST
unit price read in

UPVAR C MA IN P ST
unit price adjustment factor

URAIQ C IN MN P ST
adjusted average returns frequency (FTE documents)

UVIPAL C MA FO IN P ST
non-VIP alpha factor

V L MA
temporary variable for use in writing out trailers for extending the run length

VAD C FO IN R ST
value of annual demand

VADI 26,10 C MA IN OU
value of average due in

VADISP 26,10 C MA IN OU ST
value of automatic disposals

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VARIABLE DIMENSIONS L C MA B D FO FT IN MN OB OU P R SO ST W

VALCHG	250	C MA	IN		
value of management policy change					
VALMAD	26,10	C	IN MN	OU	
value of mean absolute deviation of lead time for report					
VALUE		L		P	
value of the management policy change					
VANB1	26,10	C MA	IN	OU	
value of backorders established priority I					
VANB2	26,10	C MA	IN	OU	
value of backorders established priority II					
VANB3	26,10	C MA	IN	OU	
value of backorders established priority III					
VASOH	26,10	C MA D	IN MN	OU	
average value of stock on hand					
VAUT1		L D			
value of automatic return					
VCLV1	26,10	C	IN MN	OU	
value of control level for priority I					
VCLV2	26,10	C	IN MN	OU	
value of control level for priority II					
VDSCM	26,10	C MA	IN	OU	
value of commitments for direct deliveries					
VDSOB	26,10	C	IN	OB OU	
value of obligation for direct deliveries					
VEOQ	26,10	C	IN MN	OU	
value of economic order quantity					
VFTEC	26,10	C	FT IN	OU	
value of FTEs accepted with credit					

VARIABLE DIMENSIONS L C MA B D FO FT IN MN OB OU P R SO ST W

VFTENC	26,10	C				FT	IN		OU								
value of FTEs accepted without credit																	
VFTEPC	26,10	C				FT	IN		OU								
value of FTEs accepted partial credit																	
VFTER	26,10	C				FT	IN		OU								
value of FTEs rejected																	
VGRSL	26,10	C	MA	B	D		IN		OU								
value of net sales, issues less returns																	
VIP		C	MA			FO		IN	MN							ST	
VIP item code indicator, yes is > or = 1; no is < 1																	
VIPAL			L														
VIP alpha factor written out to extend run length																	
VIPALP		C	MA			FO		IN		P						ST	
alpha factor for VIP items																	
VNRDM	26,10	C	MA				IN		OU								
value of non-recurring demand																	
VQFD	26,10	C					IN	MN	OU								
value of quarterly forecast of demand																	
VRCOM	26,10	C					IN		OU		R						
value of commitments																	
VRDEM	26,10	C	MA				IN		OU								
value of recurring demand																	
VRDISP	26,10	C	MA				IN		OU							ST	
value of reviewed disposals																	
VREC	26,10	C		D			IN		OU								
value of receipts from procurement																	
VRETC	26,10	C		D			IN		OU								
value of receipts from returns																	
VROBL	26,10	C					IN		OB	OU							
value of obligations																	
VSL		C	MA		D	FO		IN	MN							ST	
variable safety level																	
VSLR		C	MA			FO		IN	MN		P						
variable safety level adjustment factor																	

VARIABLE DIMENSIONS L C MA B D FO FT IN MN OB OU P R SO ST W

VSOH 26,10 C IN MN OU
value of stock on hand at end of month

VVSL 26,10 C IN MN OU
value of variable safety level

WEIPCF L W
frequency adjustment factor for use in weibull distribution

X L FO
used in computing safety level

XADISP 26,10 C MA IN OU ST
number of automatic disposals

XBO1 26,10 C MA IN OU
number of backorders for priority I

XBO2 26,10 C MA IN OU
number of backorders for priority II

XBO3 26,10 C MA IN OU
number of backorders for priority III

XBV1 26,10 C MA IN OU
number of backorders for priority I direct deliveries

XBV2 26,10 C MA IN OU
number of backorders for priority II direct deliveries

XDODS 26,10 C MA IN OU
total number of direct delivery backorders established

XDOR 26,10 C MA IN OU
number of backorders for stock established

XFSDD 26,10 C IN MN OU
number of NSNs with direct deliveries

XFTEC 26,10 C FT IN OU
number of FTEs accepted with credit

XFTENC 26,10 C FT IN OU
number of FTEs accepted with no credit

XFTEPC 26,10 C FT IN OU
number of FTEs accepted with partial credit

XFTEPN 26,10 C FT IN OU
number of FTEs accepted with partial no credit

VARIABLE DIMENSIONS L C MA B D FO FT IN MN OB OU P R SO ST W

XFTER 26,10 C
number of FTEs rejected

FT IN OU

XINTAR 12 C IN ST
interarrivals as expressed by 365 days divided by HITSPY

XK L FO
used in computing safety level

XNRRQ 26,10 C MA IN OU
number of non-recurring requisitions

XPRBP 26,10 C IN OU R
number of procurements that bypass review in supply

XPRGT 26,10 C MA IN OU R
number of large procurements

XPRLT 26,10 C MA IN OU P
number if small value procurements

XPRRP 26,10 C IN OU P
number of procurements reviewed in supply

XRDISP 26,10 C MA IN OU ST
number of disposals reviewed

XREQ1 26,10 C MA IN OU
number of priority I requisitions

XREQ2 26,10 C MA IN OU
number of priority II requisitions

XREQ3 26,10 C MA IN OU
number of priority III requisitions

XRREQ 26,10 C MA IN OU
number of recurring requisitions

XSND0 26,10 C IN MN OU
number of stock numbers with backorders

YRAVSZ C IN O ST
yearly average requisition size

Y6 L MA
used for random number value

ZLTA L R
administrative lead time calculated by distribution and random number process

VARIABLE DIMENSIONS L C MA B D FO FT IN MN OB OU P R SO ST W

ZLTP

L

R

production lead time calculated by distribution and random
number process

END
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