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AN EVALUATION OF THE WSSC (WEAPON SYSTEM SUPPORT COST)
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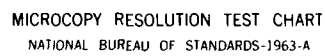
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AN EVALUATION OF THE WSSC COST
ALLOCATION ALGORITHMS VIII: SECOND
DESTINATION TRANSPORTATION

by

Gregory J. Zunic
Patricia H. Weber
Robert L. Gardner

— STATISTICS —

— OPERATIONS RESEARCH —

— MATHEMATICS —

JUN 19 1985

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Applied Research in Statistics - Mathematics - Operations Research

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Prepared under Contract No. F33600-80-C-0554



EXECUTIVE SUMMARY

This report by Desmatics, Inc. is the eighth in a set of volumes which discuss the scope and findings of Desmatics' evaluation of the Weapon System Support Costs (WSSC) subsystem of the Air Force Visibility and Management of Operating and Support Costs (VAMOSC) system. The previous volumes contained evaluations of allocation algorithms, which in general were already included in the WSSC system. This volume addresses an area of cost for which no cost algorithm has been implemented: Second Destination Transportation (SDT).

SDT is defined by the Cost Analysis Improvement Group (CAIG) as "the round-trip cost of transporting engines and engine components, ground support equipment and reparable secondary items to depot maintenance facilities and back to the operational unit or stock points, and the one-way cost of transporting repair parts from stock points to depot and below depot maintenance activities." This definition is the one used by the Air Force VAMOSC system.

At the present time, there is no SDT algorithm in the WSSC system, and the FY81 through FY83 runs of WSSC did not provide cost visibility for SDT. However, the Office of VAMOSC has developed a proposed algorithm for SDT costs. This algorithm is designed to provide these costs to the WSSC and C-E subsystems of VAMOSC. (It should be noted the C-E system provides estimates of these costs under the category "Transportation and Packaging".) The SDT algorithm is currently in the form of a Data Automation Requirement (DAR). Desmatics' evaluation

is based on the methodology contained in the DAR.

The SDT algorithm, as developed by the Office of VAMOSC, is highly complex and resource intensive. For example, implementation of this algorithm would require six new data system interfaces with the VAMOSC system. In Desmatics' opinion, this algorithm can be significantly simplified and still provide the same level of cost detail. Based on this opinion, Desmatics has designed an alternative SDT algorithm which is presented in this volume. Desmatics believes that this alternative algorithm represents a more reasonable approach to the development of SDT costs.

The alternative algorithm is based on costing shipments using AFLC transportation and packaging factors. This obviates the need for several data system interfaces. In addition, the Desmatics algorithm costs several types of shipments which are bypassed by the VAMOSC algorithm. Desmatics' algorithm will be less costly to implement and maintain than the VAMOSC algorithm.

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I. INTRODUCTION

Desmatics, Inc., under Contract No. F33600-80-C-0554, is conducting an evaluation of the cost allocation algorithms employed in the Weapon System Support Cost (WSSC) Subsystem of VAMOSC, the Air Force Visibility and Management of Operating and Support Costs System. The WSSC system is described in three source documents:

- (1) Visibility and Management of Operating and Support Cost Program, Weapon Systems Support Costs (WSSC), Air Force Regulation 400-31, Volume II, [16],
- (2) Subsystem Specification of the Weapon Systems Support Cost System (WSSC), [10],
- and (3) Subsystem Specification of the Preprocessor (VAMOH), [9].

This report is the eighth in a set of volumes which discuss the scope and findings of the Desmatics evaluation efforts. The previous volumes contained Desmatics' evaluations of allocation algorithms, which in general were already a part of the WSSC system. This present volume addresses an area of cost for which no algorithm has as yet been implemented: Second Destination Transportation (SDT).

The Office of VAMOSC has developed a proposed algorithm for SDT costs. Desmatics is tasked with evaluating this proposed SDT algorithm and developing an alternative if necessary.

Although the Desmatics evaluation of SDT is tasked under the WSSC contract, the SDT algorithm proposed by the Office of VAMOSC, as set forth in Data Automation Requirement (DAR) No. LOG-LOC-D82-021, is intended to apply to SDT costs of Communications-Electronics (C-E) equipment as well. Consequently, this evaluation of the SDT algorithm

should be of interest to those concerned with the C-E subsystem as well.

The C-E subsystem currently has an SDT algorithm as an active part of the system. Desmatics is concurrently evaluating the C-E algorithm for SDT, referred to as Transportation and Packaging (T&P) in the C-E system, as a part of its assessment of C-E Depot Non-Maintenance under Contract No. F33600-82-C-0466. Readers who are interested are directed to Volume VI [2] in Desmatics' C-E technical report series.

This volume constitutes the documentation of the Desmatics evaluation effort with respect to the proposed SDT algorithm. Section II presents background information, Section III provides a brief description of the algorithm, Section IV contains the Desmatics evaluation of the algorithm, and Section V describes a suggested alternative algorithm. Section VI contains Desmatics' conclusion and recommendation, as well as the response from the Office of VAMOSC.

II. BACKGROUND

Second Destination Transportation (SDT) is defined in AFM 172-1 in its broadest sense as any transportation other than first destination [14], i.e., the transportation of any Air Force materiel between two points, including household goods of AF personnel. However, as it pertains to the area of operating and support cost, SDT is defined by The Cost Analysis Improvement Group (CAIG) [3] as "the round-trip cost of transporting engines and engine components, ground support equipment and reparable secondary items to depot maintenance facilities and back to the operational unit or stock points, and the one-way cost of transporting repair parts from stock points to depot and below depot maintenance activities." This same definition is found in the WSSC User's Manual [16].

The C-E subsystem of VAMOSC provides visibility of SDT costs in a category referred to as Transportation and Packaging (T&P) Costs. The C-E User's Manual [17] defines T&P cost as "the direct cost associated with the transportation of all [C-E] recoverable assemblies and end items to the depot for service and subsequent return to the user." This definition is generally consistent with those used by WSSC and the CAIG. Although this definition does not explicitly mention one-way transportation costs, the C-E T&P algorithm does account for the transportation to a base of a replacement for an item condemned at that base.

The CAIG definition of SDT mentions only two types of transportation (e.g., round trip between depot maintenance facilities and bases,

and one-way from stock points to depots and bases). However, the picture in reality is considerably more complex as a result of shipments from depot-to-depot and base-to-base. There are also shipments to and from contractor, Army and Navy facilities. In addition, shipments may travel by different modes of transportation for various legs of their journeys. While the majority of these go by LOGAIR (AF contracted service), Military Airlift Command (MAC), Military Sealift Command and commercial facilities, other modes such as local military vehicular transportation, are possible.

III. PROCESS DESCRIPTION

The SDT algorithm proposed by the Office of VAMOSC is documented in DAR LOG-LOC-D82-021, which consists of an eight page description supplemented by eleven data record diagrams and twenty-six pages of flowcharts. This section presents a summarization of the process outlined in that DAR.

In support of the DAR, tables were also developed by the Office of VAMOSC, which were provided to Desmatics. The tables present an extensive list of the types of SDT cost situations that may occur, grouped into 14 types of origins, showing the possible destination categories and transportation modes associated with each. The tables also specify the relative availability of cost data ("yes", "no", "estimated"), and indicates the source of each type of information required for each of over 60 origin/destination/mode combinations considered.

The tables provide an indication of the comprehensiveness of the coverage afforded by the DAR. According to these tables, "costs can be obtained directly from a data system" for the following:

1. Depot-to-depot or depot-to-base shipments by LOGAIR or commercial modes,
2. Depot-to-contractor or depot-to-Army/Navy, shipments by LOGAIR or commercial modes,
3. Depot-to-aerial or water port by LOGAIR,
4. Aerial port-to-aerial port via MAC channel,
5. Water port-to-water port via Military Sealift Command,
- and 6. CONUS port handling costs.

In addition, "costs will be obtained using an estimated cost or algorithm", for the following types of SDT costs:

1. Depot-to-aerial port via commercial transportation,
2. Base-to-depot via LOGAIR or commercial modes,
3. CONUS aerial or water port-to-depot via MAC Special Assignment Airlift (SAA) or commercial transportation,
4. Contractor-to-depot via LOGAIR or commercial,
5. Army/Navy-to-depot via CONUS commercial transportation,
- and 6. Army/Navy-to-aerial port via LOGAIR.

The algorithm is concerned with two types of shipments: round-trip and one-way. Round-trip SDT shipments occur when items are sent to depot level facilities for repair and then returned to the source. One-way shipments involve the shipment of repair parts to repair facilities and replacements for items condemned at base level.

The SDT algorithm was designed to use data from the Shipment Document Release and Control System (D009) [11] as the major source of information identifying shipments (including engine shipments) from Air Force depots at five Air Logistics Centers (ALCs) and the Wright-Patterson AFB Tire Storage and Distribution Center. (Similar data on shipments to AF bases from the Aerospace Guidance and Metrology Center is provided by the 2803 ABG/DMSP.) Each D009 record provides shipping date, weight, cubage, quantity and destination information, but cost data is not included. Also included is the National Stock Number (NSN) of the item and the Standard Reporting Designator (SRD) of the item's application. The D009 records contain either a Government Bill of Lading (GBL), for shipments by commercial means, or a Transportation Control Number (TCN),

for shipments by military means. The algorithm uses the GBL/TCN to match with records in three AFLC systems which contain shipment cost information. These are the LOGAIR Transportation Management System (0004) [5], the MAC Tonnage and Cost System (0027A) [7], and the Surface Tonnage and Cost System (0027B) [13].

Many of the shipments reported in D009 are consolidated shipments. The algorithm described in the DAR allocates the total cost of each consolidated shipment among the items in the shipment on the basis of the weight or the volume (cubage) of the items. This is computed using item weights and cubage obtained from the Packaging and Transportation Data Maintenance System (0013) [11]. If the shipment is made by Military Sealift Command transportation, the cost of a consolidated shipment is computed on the basis of item cubage ratios. All other types of consolidated shipments use item weight ratios to allocate shipment costs to items.

Based on the previously described processing of shipment cost and weight data, costs of shipments from depots to AF bases and Army, Navy or contractor facilities are obtained. In addition a table of average shipmen. (by NSN) to those destinations is developed, based on single item shipments. It is assumed by this algorithm that the cost to ship an item from a base to a depot is equivalent to the average cost experienced in shipping an identical item from that depot to that base. Also, all shipments from the depot to Army, Navy, or contractor facilities are assumed to be two-way, with equal costs for both legs of the trip, and are costed as such.

shipped in the average cost file. It is assumed that this discrepancy is balanced out over fiscal years.) It is implicitly assumed that it costs as much to send an item in one direction as it does in the reverse direction. This processing computes the one-way cost of a base-to-depot shipment. The return leg was computed earlier from D009. This process also estimates the two-way shipment costs of items sent directly to the Army, Navy, or contractors from a base. These computed costs are appended to the annual SDT cost file. Of course, condemnations on D143F records that match are not costed since the shipment costs for those actions are the already computed depot-to-base costs.

When there is no match, this indicates that there is no data for a corresponding shipment of that item from a depot. It is assumed these NRTS represent a shipment sent directly to a contractor, Army, Navy, or elsewhere, (unmatched condemns represent direct shipment from one of these sources) and the entire shipment cost must be estimated. (Of course, there could be other explanations for a nonmatch such as missing D009 data, but Desmatics is of the opinion that this method of handling such a record is superior to the VAMOSC approach of dropping it.)

In order to estimate the shipment cost for the unmatched shipments, it is first necessary to estimate the item's shipping weight since no weights are given in D143F. The data to allow such estimation is available in 0013 which contains item packaged weight by NSN. Next, based on the SRAN, the disposition of the location (CONUS or overseas) can be determined. The shipment is then costed using the appropriate

GELOC later in processing.

The processing just outlined is the same for both CONUS and overseas destinations. The only difference arises in the cost factors applied. The cost computed thus far (pages A3-A5) is for the depot-to-base leg of one- or two-way shipments. In addition the two-way cost of shipments to contractors, Army, and Navy have been computed. Each of these costs must be further processed in order to achieve the correct level of aggregation. This is described later in this section.

(See page A5)

The next major processing step is to estimate the costs of base-originated shipments to depot, Army, Navy, or contractor. This involves input from D143F (already available in CSCS) and the depot-to-base average cost file mentioned previously in this section. This process will cost direct shipments from a base to a depot, contractor, or other repair facility and vice versa.

NRTS actions and condemnations by component NSN/application SRD/SRAN are available in CSCS from D143F [18]. Each of these actions puts a demand on supply and in essence results in a shipment of a like item (NRTS generate two-way shipments, condemnations one-way, from depot to base). D143F NRTS and condemnations (accumulated to the NSN/SRD/SRAN level) are matched against the previously created average depot-to-base cost file by NSN/SRD/SRAN.

When there is a match between the average cost file and D143F, a cost is computed by multiplying the number of NRTS by the average cost. (It should be noted that the number of NRTS may not match the quantity

FY82 TRANSPORTATION COST FACTOR

Cost per pound

	WITHIN CONUS		OVEROCEAN		
	GBL	LOGAIR	USAFE	PACAF	AAC
Air	\$0.532	\$0.391	\$1.230	\$1.905	\$0.374
Surface	0.098	-	0.124	0.115	0.023
Port Handling:	CONUS		\$0.018		

	FY82
Avg Packaging Cost/Pound	\$1.94
Packaged Weight/Item Weight Factor	1.941

Figure 2: AFLCP 173-10 [1] Packaging Cost and Transportation Cost Factors Suggested for Use in Desmatics' SDT Algorithm

applied for a given shipment can be seen on pages A3-A5. The factors themselves are given in Figure 2.

(See pages A3-A4)

Shipments from depots to contractors (DODAAC EZxxxx in D009) or Army and Navy repair facilities (project code 3AB, 3AC, 3AL in D009) can be identified in the D009 records. These shipment records represent the first leg of a two-way shipment (depot to the repair facility and back), and are the only part of the shipment found in D009. These shipments will be costed by determining the cost with the appropriate factors for the first leg and multiplying this by two. Shipments to other ALCs are costed in a similar manner, but are not multiplied by two, since both legs will appear in D009.

Once computed, the shipment costs are written to several files. Depot-to-base shipment costs are written to an average depot-to-base cost file by NSN of the item shipped, SRAN and GELOC of the destination, application SRD, and quantity shipped. The average cost for a particular NSN/SRD/GELOC is updated by a matching shipment as is the quantity shipped. This average cost file is used in later processing to cost base-originated shipments. Depot-to-base costs are also accumulated to an annual SDT cost file by NSN/SRD/GELOC.

The round-trip costs of the depot-to-repair facility shipments are written to the indirect SDT cost file by NSN/SRD. The reason that these costs are termed indirect is that it is not possible from D009 data to determine the origin of the items shipped (i.e., from what base did they originally come). These costs will be allocated to a

Surface

A	Motor Truckload
B	Motor, Less Than Truckload (LTL)
C	Van (Unpacked, Uncrated, and/or Gov. Property)
D	Driveway, Truckaway, Towaway
E	Busline
G	Surface, Parcel Post
I	Government Truck, including common service
J	Small Package Carrier
K	Rail, Carload
L	Rail, Less Than Carload (LCL)
M	Freight Forwarder
S	Scheduled Truck Service
V	Sea, Van Service
W	Water, River, Lake, Coastal (commercial)
X	Bearer, Walk-thru (customer pick-up)
Z	Military Sealift Command
2	Government Watercraft, Barge/Lighter
3	Roll-on/Roll-off Service
4	Armed Forces Courier Service (ARFCOS)
5	UPS
6	Military Ordinary Mail (MOM)
8	Pipeline
9	Local delivery, Including deliveries to POEs from adjacent Supply Activities

Air

F	MAC
H	Air, Parcel Post
N	LOGAIR
O	Organic Military Air (including aircraft of foreign governments)
P	Through Bill of Lading
Q	Air Freight, Air Express, Air Charter (commercial)
R	Air Express
T	Air Freight Forwarder
U	Quicktrans
Y	Intra-Theater Airlift System
7	Express Mail
0	Pilot Pickup of Foreign Military Sales (FMS) Materiel by Foreign Country Aircraft

Table 1: Mode Codes Classified as Surface or Air [15]

by a D143F record search should be dropped. (See page A3) Once a year, the accumulated D009 records should be processed to drop records which have been superceded by a revised shipment record, which is indicated by a 'G' in the first position of the Document ID field on the record.

(See page A3)

Shipping costs in this algorithm will be computed using transportation cost factors from AFLCP 173-10 [1]. There are factors for CONUS and overseas (USAFE, PACAF, AAC), and both air and surface shipments. These factors are based on data from two systems (0027A and 0027B) which would have to be new interfaces under the VAMOSC SDT algorithm. However, the use of these factors in the Desmatics algorithm makes those interfaces unnecessary. In order to apply these factors correctly, it is necessary to know two facts about a shipment: (1) its destination (CONUS or overseas), and (2) the shipping mode (air or surface). The destination can be determined from the SRAN on the D009 record and the previously-described SRAN table. The mode can be determined by the mode code on the D009 record and a table such as Table 1.

Once the destination and mode have been determined, the appropriate cost factors can be applied. In addition, packaging costs (determined from an AFLCP 173-10 factor) must be computed and added in. Since the packaging factor is based on unpackaged item weight a corresponding packed weight to unpacked weight ratio (also from AFLCP 173-10) must be used to estimated unpackaged weight (this is because the D009 and 0013 weights are packaged weights). The factors which need to be

is a CONUS location or overseas (USAFE, PACAF, AAC). This information should be appended to the D009 fields on the record.

The total weight of a consolidated shipment will be allocated to the individual items (by NSN) in the shipment using packaged weight ratios based on data from the 0013 system. The allocation ratios would look like this for a shipment:

$$\frac{\text{Quantity Shipped x 0013 Weight, This NSN, This Shipment}}{\text{Quantity Shipped x 0013 Weight, All NSNs, This Shipment}}$$

There is an existing interface with 0013 in both the CSCS and C-E subsystems of VAMOSC. It is necessary that weight data be gathered for all applicable WSSC and C-E Federal Supply Classes (FSCs) from all five depots.

The D009 interface shipment records contain an application SRD field for the item shipped. It is necessary to know the SRD in order to identify to which MDS or TMS the SDT costs should be allocated. In those cases when the SRD is not provided, it should be possible to attribute an SRD to the record by searching D143F system NRTS/Condemnation records, which indicate that a supply action has been taken. These D143F records should be searched by NSN and SRAN to match the D009 record, and the SRD present on the D143F record should be appended to the D009 record. There is already a D143F interface established with the CSCS system. For purposes of this algorithm, the D143F data should be accumulated monthly by NSN/SRD/SRAN. Those D009 records which have an SRD not applicable to WSSC or C-E, or which cannot be given an SRD

or other facilities (other ALCs, contractor, Army, Navy) will be obtained monthly from D009. This data will be in the same format that is required for the VAMOSC SDT algorithm DAR. However, it is necessary for the alternate algorithm to have the shipment mode code [15] (i.e., how was an item shipped) provided for each shipment, unlike the interface as designed for the VAMOSC algorithm, which, from the description in the DAR, has mode code only for commercial legs on overseas shipments. This additional mode code information is available in D009 and is needed to estimate shipment costs later in the algorithm. The D009 data should be collected to correspond to the same FY as VAMOSC, not the July-June time frame outlined in the SDT DAR.

In order to cost shipments properly, it is necessary to determine where an item has been shipped. The location is contained in the SRAN portion of the DODAAC (i.e., the last four characters) [12]. A table may be developed which will exclude those D009 records which are for shipments to activities which are not relevant to the current VAMOSC structure. Such activities include Guard and Reserve (SRAN 6xxx), Army, Navy (i.e., those Army and Navy activities other than project code 3AB, 3AC, 3AL), Marines, foreign governments, etc. [15]. The project codes mentioned are for interservice repair of Air Force items. By including only the SRANs of relevant activities, undesired records can be rejected. This SRAN table (to be developed by the Office of VAMOSC) must also include several other pieces of information, which will be used later in the processing. This additional information consists of a GELOC to correspond with each SRAN and whether a SRAN/GELOC

V. AN ALTERNATE SDT ALGORITHM

Desmatics has developed an alternative to the proposed VAMOSC SDT algorithm. It is intended to capture essentially the same costs as the VAMOSC SDT algorithm (plus several others) but with the establishment of one new interface (instead of six) and with less complexity. The algorithm is described below and is presented in detail in accompanying annotated flowcharts (See Appendix).

A. PROCESS DESCRIPTION

This alternate algorithm differs from the VAMOSC algorithm primarily in the way that shipment costs are developed. Instead of developing interfaces with shipment cost data systems, the Desmatics algorithm relies on factors developed from the data in those systems.

The following subsections describe the processing to develop SDT costs for VAMOSC. The processing for each relevant VAMOSC subsystem (VAMOH, WSSC, and C-E) is addressed separately. In addition page references are made to the attached flowcharts.

1. VAMOH

(See page A1)

Data for shipments (including engine shipments) from depots to bases

this discrepancy from Office of VAMOSC personnel. Since the data is available monthly, it seems unnecessary to have such a time lag.

Another concern which Desmatics had in evaluating this algorithm relates to the programming effort which will be required to implement this SDT algorithm (as of August 1984, it had barely been initiated). The level of programming effort required to implement the algorithm has been estimated to be in the neighborhood of 6.4 man-years. This amounts to approximately 25% of the effort which was required to achieve initial operational capability for the remainder of the WSSC system, and close to 50% of the estimated effort for all WSSC DAR refinements [8]. In a relative sense this is excessive, given the relative significance of the costs (about \$400 million per year total, according to the Office of VAMOSC) and the completeness of the anticipated SDT costs captured.

The number of new interfaces required for the SDT algorithm, six, is also excessive. Additional programming effort is required to access and process this data. Considerable effort will also be required to examine these systems to assess their appropriateness as inputs for VAMOSC, and also to evaluate the overall quality of the data.

It is Desmatics' opinion that SDT costs for VAMOSC could be estimated as accurately, or perhaps even more accurately, with a much simpler process than that represented by this proposed algorithm. A simpler process with fewer interfaces would be less expensive to develop, initiate, operate, and maintain. Desmatics has developed such an alternative; it is described in the following sections.

the above-mentioned cost data. For two-way shipments for repairs the algorithm provides estimates of SDT costs for (1) shipments between bases and AF depots or AGMC, and (2) shipments between AF depots and Army, Navy or contractor facilities. For one-way transportation of parts, only those shipments originating at AF depot supply points are costed. What is significant is that this algorithm just provides transportation costs for shipments which at some point are processed at an AF depot or AGMC. For AGMC the shipments only involve AF bases.

No SDT costs are estimated for any shipments originating at a base and destined directly for Army, Navy or contractor repair facilities, or any supply points (for return of excess stock). The costs related to the reverse legs of base originated shipments to these non-AF repair facilities are also not estimated in this algorithm. For one-way parts shipments, it should be noted that there are numerous other stock points besides AF depots: GSA (General Services Administration) and DLA (Defense Logistics Agency) are two notable examples.

Since this SDT algorithm is not yet in place, there is no data available for estimating the proportion of the total of relevant SDT shipments (and therefore, associated costs) which this algorithm fails to capture. It could well be significant.

The base to depot and depot to base SDT costs processed by this algorithm as it is now designed represent a July to June annual time frame. These reported costs will not be for the same period of time (October through September) as the remaining costs in the WSSC and C-E systems. Desmatics was unable to obtain a reasonable explanation for

IV. EVALUATION

In order to satisfy the requirements specified in the CAIG definition of SDT costs, the types of shipments which must be accounted for in the proposed VAMOSC SDT algorithm are:

1. shipments of reparable items from owning activities to repair facilities, and back,
- and 2. shipments of repair parts from supply points to the using activities (either repair facilities or owning activities), and returns of excess materiel from these points.

All packaging (labor and materiel), transportation, and handling charges should be included in the total cost.

The three systems used as sources of cost data, 0027A, 0027B, and 0004, provide shipping costs and some port handling costs. No packaging costs are included in the structure of the proposed algorithm. However, average packaging and transportation cost factors have been developed from actual data by AFLC [1]. For any given item shipped, approximately 51% of the total weight consists of packaging materiel. The average cost of packaging (as of FY82) is \$1.94/unpackaged pound. Transportation costs range from \$1.905/packaged pound (GBL air to PACAF) to \$0.098/packaged pound (CONUS SURFACE, GBL). Depending on destination and transportation mode the VAMOSC SDT algorithm can ignore from 21%-90% of the real total cost of any given SDT shipment by omitting packaging costs.

The algorithm also uses (1) shipment data from the D009 system, (2) NRTS actions from the D143F system, and (3) a listing of shipments from AGMC provided by the 2803 Air Base Group at AGMC in conjunction with

<u>Data System Designator</u>	<u>Data System Name</u>
* D009	Shipment Document Release and Control System
D056A	Edit/Error Analysis Subsystem of the Product Performance System
D143F	Historical Accumulation Subsystem of the Air Force Recoverable Assembly Management System
D160B	Component Support Cost System
G033B	Aerospace Vehicle Inventory Status/Utilization Reporting System (AVISURS)
* 0004	LOGAIR Transportation Management System
* 0013	Packaging and Transportation Data Maintenance System
* 0027A	MAC Tonnage and Cost System
* 0027B	Surface Tonnage and Cost System
* ---	AGMC Shipment Data

*Indicates a new interface with the VAMOS system.

Figure 1: Data System Interfaces Required for the Proposed SDT Algorithm.

The D009 system provides information solely on depot out-bound shipments. It does not provide visibility for base-originated shipments, so the SDT algorithm estimates the number of base-originated shipments destined for AF depots using NRTS (Not Repairable This Station) data obtained from the Historical Accumulation Subsystem of the Recoverable Assembly Management System (D143F) [4]. These shipments are costed via the previously mentioned average cost table based on the NSN and location on the D143F records.

Since SRDs are provided on the D009 shipment records, shipment costs may be attributed to a particular Mission Design Series (MDS) or Type Model Series (TMS) [6]. In the case of depot-to-base shipments (and the corresponding reverse legs on two-way shipments), the costs can also be identified to a particular geographic location (GELOC) which is essential in WSSC processing. This is achieved with the Stock Record Account Number (SRAN), which is contained in the DoD Activity Address Code (DODAAC) [15] on the D009 record,

The costs of depot-to-Army, Navy, and contractor shipments of aircraft items are allocated to the CMD/GELOC/MDS by aircraft possession data from G033B and maintenance data from D056. This is necessary since it is impossible to determine the ultimate origin of the part (i.e., the point from which it was originally shipped to the depot).

A complete listing of the data system interfaces necessary to implement the SDT algorithm is given in Figure 1. This is based on the information given in the DAR. As can be seen, six new interfaces are required.

cost factors, as before. However an assumption must be made as to the transportation mode. It seems reasonable to use LOGAIR rates for CONUS locations, and MAC rates for overseas locations, based on information from AFLCP 173-10 [1]. For non-matching NRTS, the computed cost must be multiplied by two to represent round trip, whereas for non-matching condemnations only the computed cost is used as it is a one-way shipment. These costs are then also appended to the annual SDT cost file. (See page A6)

Several other processes are still needed before the costs are passed to WSSC and C-E. Recall those costs written to the indirect SDT cost file. These represent the costs of depot-originated round-trip shipments to Army, Navy, and contractor facilities and one-way shipments to other ALCs. As mentioned previously the costs must be allocated to the SRAN level. This can be accomplished once again with D143F. Once the indirect costs have been accumulated to the NSN/SRD level they may be allocated by a ratio of the D143F NRTS by NSN/SRD/SRAN to total D143F NRTS for that NSN/SRD over all records. These allocated costs may then be appended to the annual SDT cost file. (See page A7)

Once the annual SDT cost file has been built by the aforementioned processing, the individual records can be sent to the appropriate system, C-E or WSSC, according to the SRD, based on SRD information in TO 00-20-2 [6]. The processing those systems must then effect is outlined in the next two subsections.

2. WSSC Process Description

(See page A8)

Once the WSSC system receives the SDT cost records, the SRD must be converted to MDS. A table to accomplish this can be built from TO 00-20-2 [6] information. It is then necessary to allocate the costs to the CMD/GELOC/MDS level.

In order to accomplish this it is necessary to construct a table from AVISURS records (VAMOH VC-48 format), which contains aircraft possession data for all commands [9]. SDT records in the WSSC SDT file will be matched against this table by GELOC/MDS to determine if the MDS from the SDT record is assigned to that base. If it is, it must be determined if more than one command at that base owns such an MDS (this is a relatively frequent occurrence). If that is the case it is necessary to allocate the SDT costs to the two commands. This may be accomplished with the D056 data currently available in VAMOH. However, data for both relevant and non-relevant commands must be used. The VAMOH system currently discards non-relevant command records [9]. The NRTS and condemnations figures in the D056 data should be accumulated by CMD/GELOC/MDS and used as the allocation basis:

$$\frac{\text{NRTS+Condemnations, This CMD/GELOC/MDS}}{\text{NRTS+Condemnations, This GELOC/MDS}}$$

If the aircraft is owned by only one command at that base, it is a simple matter to assign those costs to that CMD/GELOC/MDS.

In those cases where there is no match between the SDT cost record and the MDS table, the costs should be accumulated to the worldwide level by MDS. These costs can be allocated to the CMD/GELOC/MDS level via NRTS-condemnation ratios for all commands with the D056 data:

$$\frac{\text{NRTS+Condemnations, This CMD/GELOC/MDS}}{\text{NRTS+Condemnations, This MDS, all CMD/all GELOC}}$$

The costs can then be displayed on the WSSC output products, and appended to the existing cost field in the WSSC history files.

3. C-E Process Description

(See page A9)

The processing of SDT costs in C-E will be straightforward. The SRD on the SDT cost record from VAMOH can be converted to TMS. This can be accomplished with the TMS-NSN table which contains SRD [17]. These costs can then be accumulated to the worldwide level for a TMS. These costs can then be displayed on output products.

B. COMMENTS

At this point it is appropriate to compare and contrast the VAMOSC SDT algorithm and the Desmatics SDT algorithm. From early in its evaluation Desmatics was of the opinion that the costs captured by the VAMOSC

algorithm could be arrived at in a simpler and more economical manner. With that in mind, the goal became to construct an algorithm to provide at least the same level of cost detail as the VAMOSC algorithm with less complexity and cost. In fact, the revised algorithm proposed by Desmatics not only will provide that cost detail, but also will yield estimates of additional costs not covered by the VAMOSC SDT algorithm. Some advantages of the Desmatics algorithm over the VAMOSC SDT algorithm are:

- (1) The Desmatics algorithm requires establishment of one new interface (D009), whereas the VAMOSC algorithm requires six new interfaces.
- (2) The Desmatics algorithm includes estimates of packaging costs, which the VAMOSC algorithm does not.
- (3) The Desmatics algorithm includes estimates of the cost of base-originated shipments to points other than ALCs (e.g., contractor, Army, Navy), which are not provided in the VAMOSC algorithm.
- (4) The Desmatics algorithm will require fewer computer resources than the VAMOSC algorithm.
- (5) The Desmatics algorithm should be much easier to implement than the VAMOSC algorithm.
- (6) The Desmatics algorithm is designed to collect costs over the same FY cycle as the remainder of the VAMOSC system, not the July-June time frame of the VAMOSC SDT algorithm.

It should be noted that there are still relevant costs which are not captured by either of the SDT algorithms. According to cognizant Office of VAMOSC personnel, for example, shipment costs associated with lateral support will not be captured. Lateral support is the shipment of repair parts base-to-base to meet critical needs. These ship-

ments will not appear in D009 and no NRTS appear in D143F. As such they will not be costed by either algorithm. In addition, new logistics support facilities such as the AFLC Logistics Support Center-Europe at RAF Kemble, UK or so-called "Queen Bee" centralized engine repair facilities, present additional transportation situations which must be investigated. It should be noted, however, that the Desmatics algorithm will implicitly provide cost estimates for shipments to and from these facilities. When a base NRTSs an item to these facilities, there may be no corresponding shipment found in D009 (if a like item was never sent from an ALC to that base). The Desmatics algorithm is designed to estimate two-way shipment costs in such a case, which the VAMOSC algorithm is incapable of doing. This allows for an estimate of the shipment costs to/from these alternate logistics support facilities. It is hoped that if the alternative SDT algorithm is used, the resulting resource savings over the VAMOSC algorithm could be applied towards obtaining missing (or better estimated) costs.

VI. CONCLUSIONS, RECOMMENDATIONS AND OFFICE OF VAMOSC COMMENTS

This volume has presented an evaluation by Desmatics of the VAMOSC system's proposed cost allocation algorithm for Second Destination Transportation (SDT) cost. This algorithm is designed to provide these costs to the WSSC and C-E subsystems of VAMOSC. The SDT algorithm is currently in the form of a Data Automation Requirement (DAR), and as such, has not been implemented. Desmatics' evaluation is based on the methodology contained in the DAR.

A. SUMMARY

The SDT algorithm, as developed by the Office of VAMOSC, is highly complex and resource intensive. For example, implementation of this algorithm would require six new data system interfaces with the VAMOSC system. In Desmatics' opinion, this algorithm can be significantly simplified and still provide the same level of cost detail. Based on this opinion, Desmatics has designed an alternative SDT algorithm which is presented in this volume. Desmatics believes that this alternative algorithm represents a reasonable approach to the development of SDT costs.

B. RECOMMENDATIONS AND REPLIES

What follows is Desmatics' conclusion and recommendation regarding

the VAMOSC SDT algorithm. The response of the Office of VAMOSC is appended to this recommendation.

1. The SDT Algorithm (DAR LOG-LOC-D82-021)

Conclusion: The SDT algorithm developed by the Office of VAMOSC for inclusion in the VAMOSC system is excessively complex and costly to implement. In Desmatics' opinion, this algorithm can be simplified and still achieve at least the same level of cost detail.

Recommendation: The Office of VAMOSC should halt further development efforts on the SDT algorithm outlined in the DAR. The Desmatics SDT algorithm outlined in this volume (or one very much like it) should replace the algorithm proposed by the Office of VAMOSC.

Office of VAMOSC Comments: "We concur with Desmatics' assessment of the current SDT DAR and with the proposed changes. The current DAR will be revised to reflect the changes recommended in this report. We estimate final coordination of the revision by 30 April 1985."

VII. REFERENCES

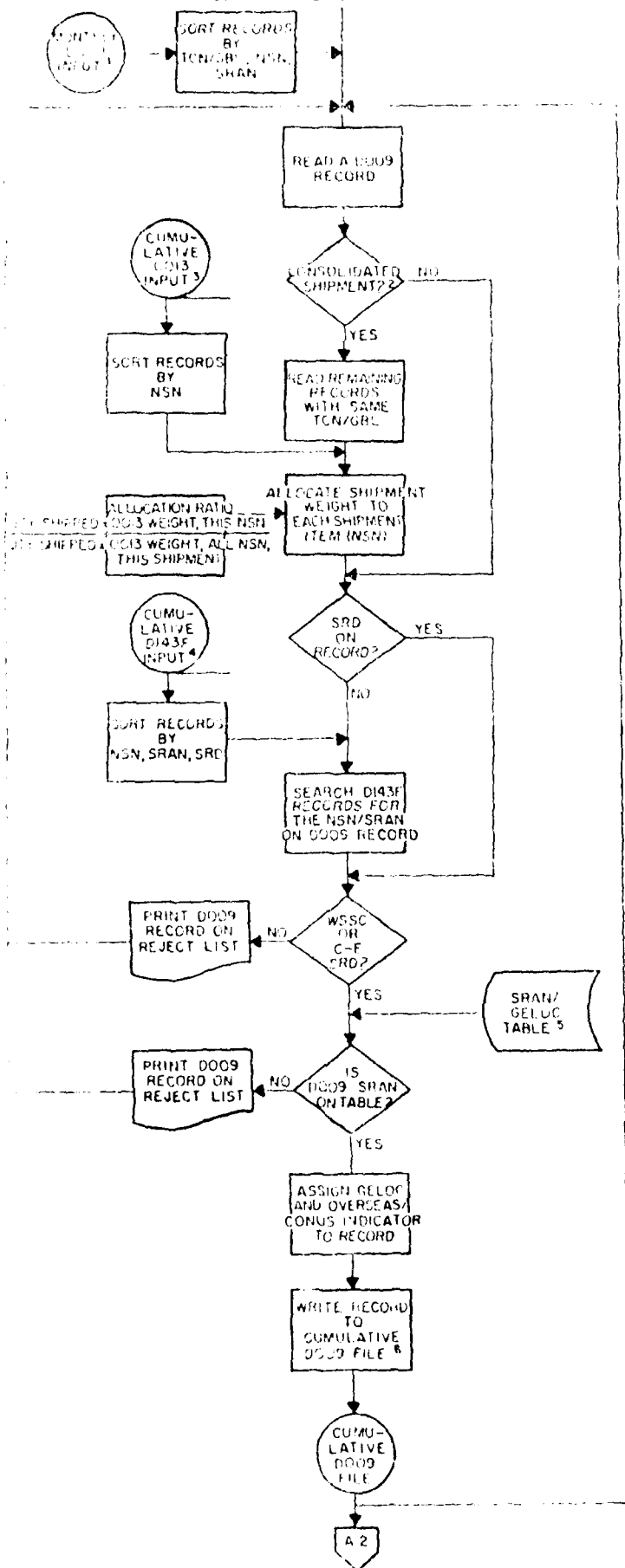
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APPENDIX

The following pages are annotated flowcharts describing the SDT algorithm proposed by Desmatics, Inc. These flowcharts correspond to the text in Section IV.

MONTHLY D009 PROCESSING



Source: This is the source of the information used to determine the shipment to class, and history, since repair to the ship. This is also the source of the information used to determine the ship's status in the D009 file.

This is the source of the information used to determine the ship's status in the D009 file. This is also the source of the information used to determine the ship's status in the D009 file.

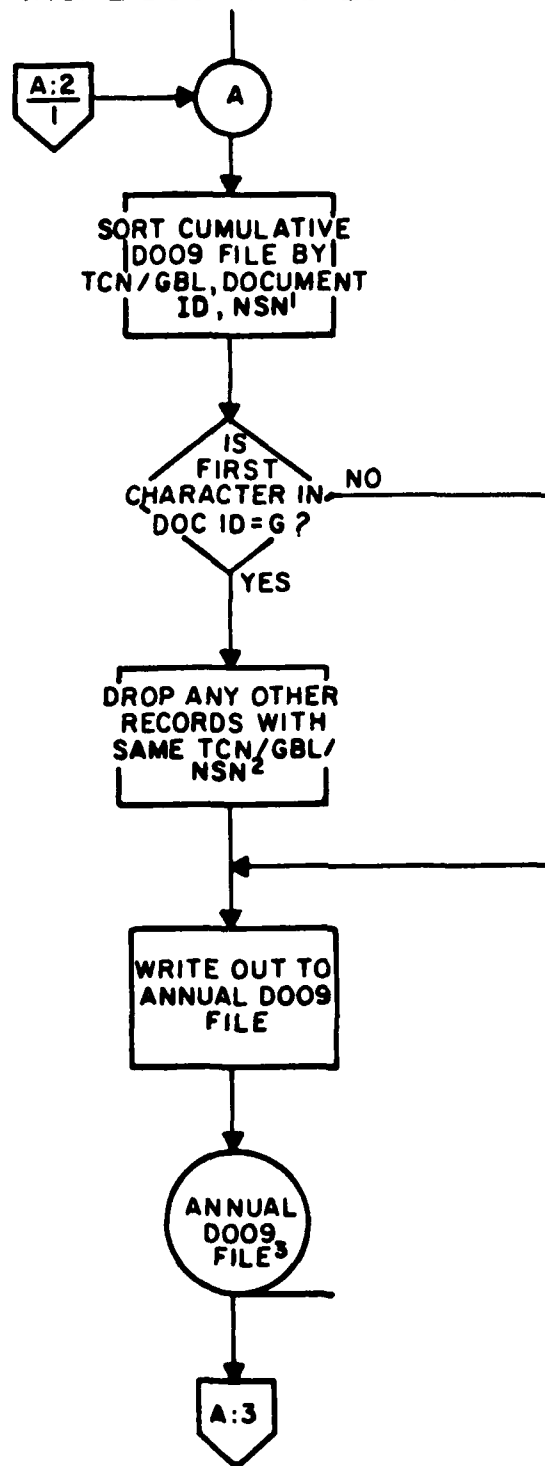
This is the source of the information used to determine the ship's status in the D009 file. This is also the source of the information used to determine the ship's status in the D009 file.

This is the source of the information used to determine the ship's status in the D009 file. This is also the source of the information used to determine the ship's status in the D009 file.

This table would be developed by the Office of TAMPSC, and would be used to select desired SRANs, and permit conversion to D009. This table would also contain an overseas (AAC, ALE, PACAF) or CONUS indicator for each SRAN. SRAN would be carried along for later processing.

This is the source of the information used to determine the ship's status in the D009 file.

ANNUAL D009 PROCESSING

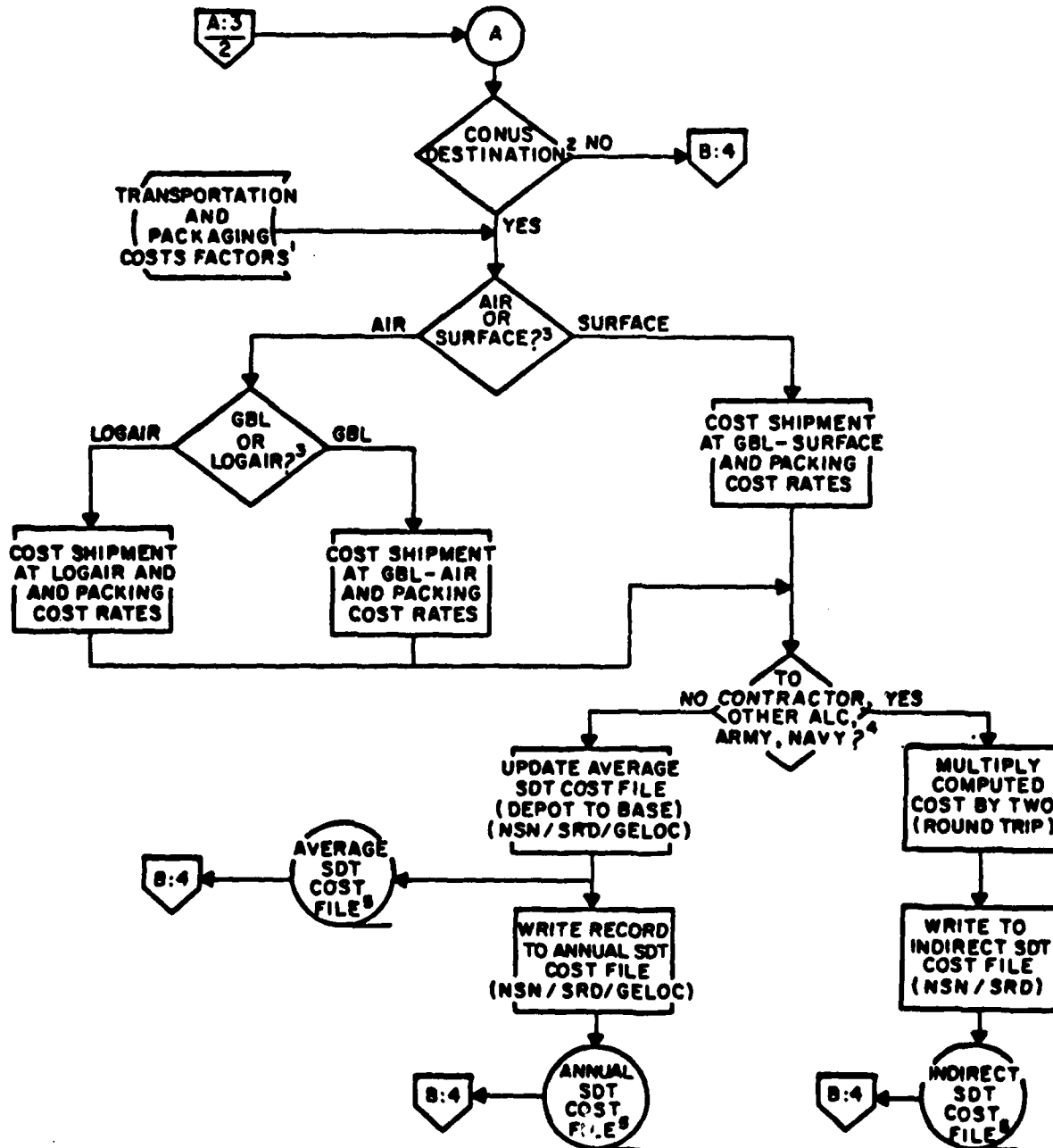


¹ Sort in ascending order by TCN/GBL, and in descending order by Document ID.

² A Document ID of 'G' indicates a revised record for a particular shipment, and the record which is superceded should be dropped.

³ This is a new file to the system.

CONUS DESTINATION DEPOT-ORIGINATED SHIPMENTS



¹ These factors are available in AFLCP 173-10, AFLC Cost and Planning Factors.

2 CONUS or overseas destination can be determined based on GELOC.

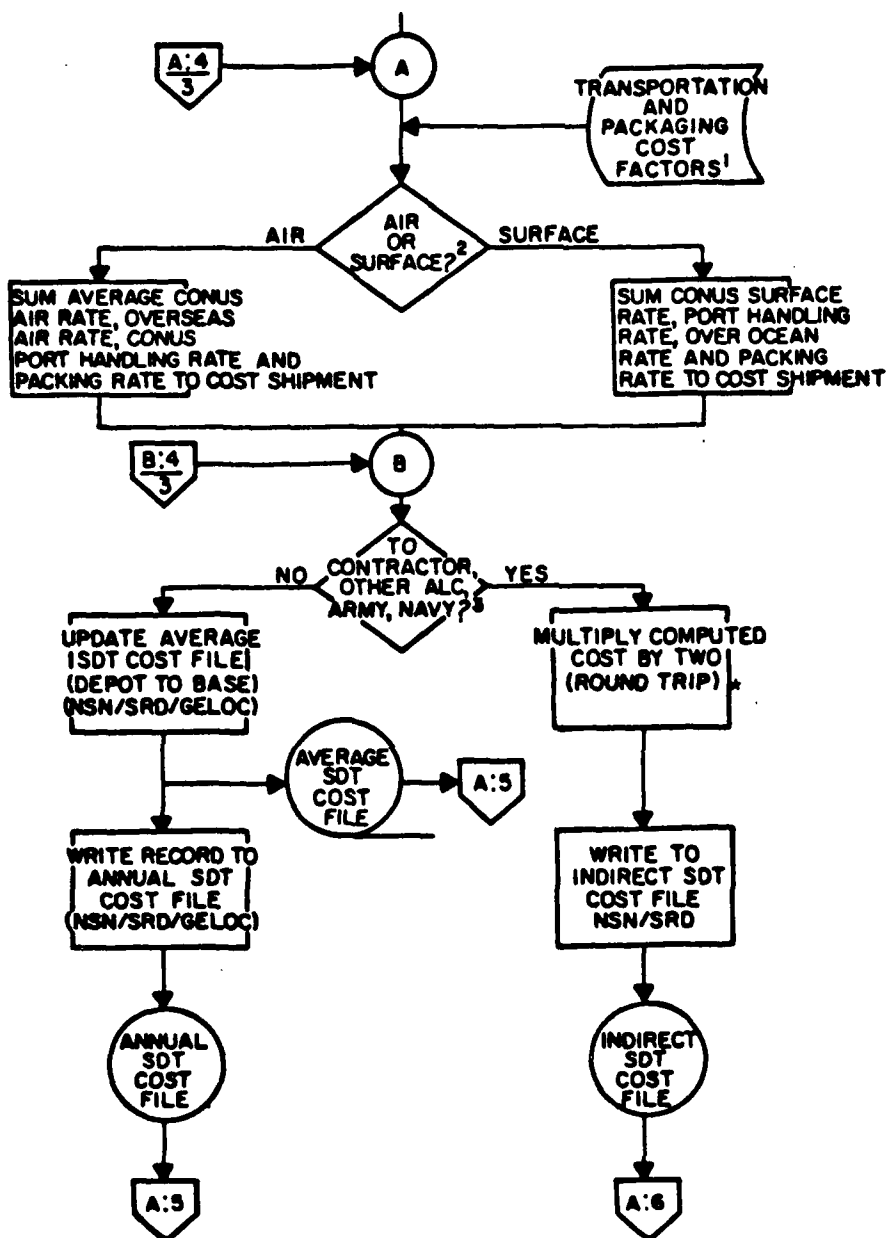
³Air or surface, commercial (GBL) or LOGAIR determined by mode code on record.

4 Shipments to contractors determined by ship-to-DODAAC (EZxxxx) on record. Shipments to Army, Navy repair facilities are determined by project codes 3AB, 3AC, 3AL on record. Shipments to other ALCs determined by SRAN.

5. These are new files to the system.

***Do not multiply shipments to other ALCs by two.**

OVERSEAS DESTINATION DEPOT-ORIGINATED SHIPMENTS



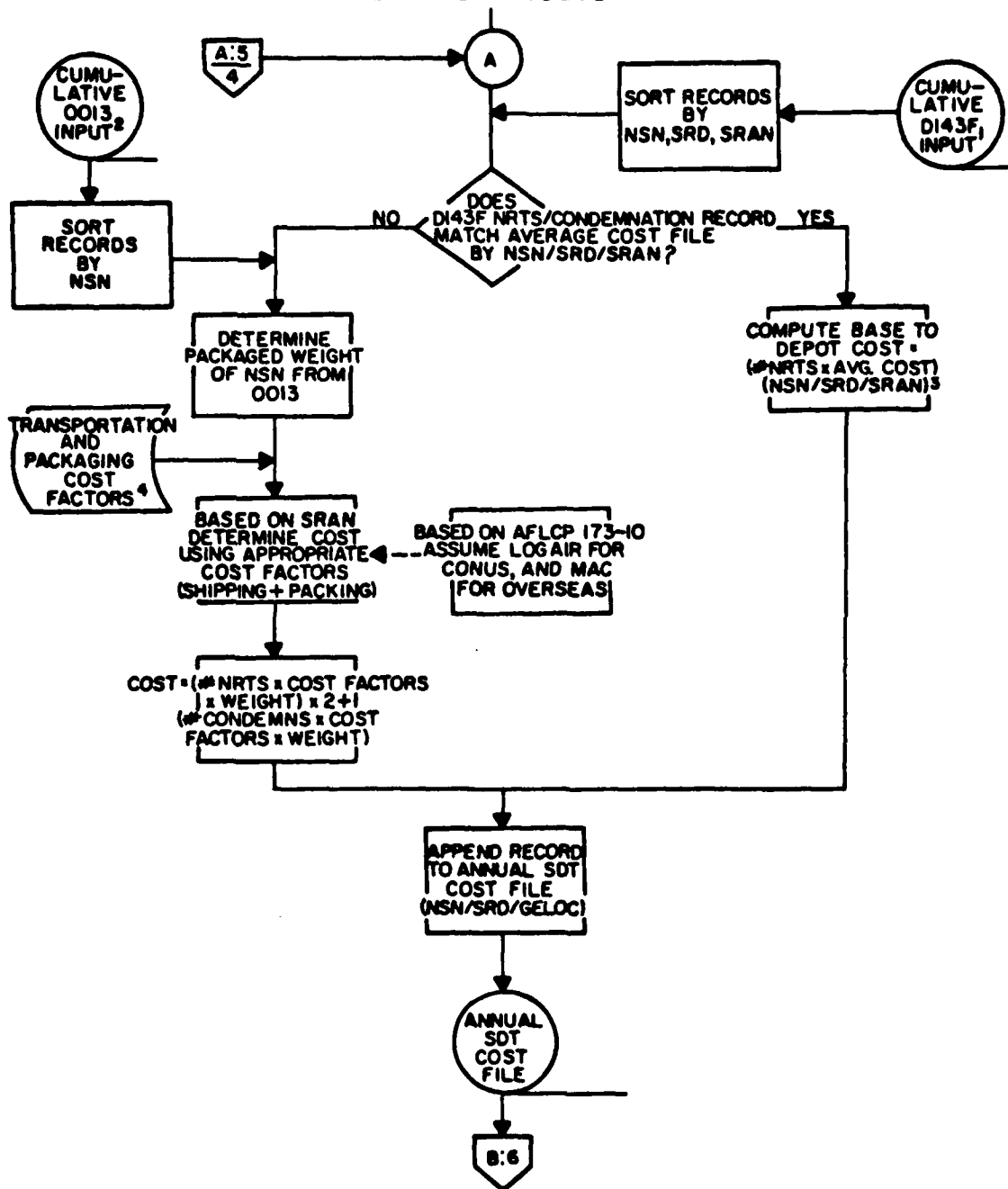
¹These factors are available in AFLCP 173-10.

²Air or Surface can be determined based on mode code on record.

³Shipments to contractors determined by ship-to-DODAAC (EZxxxx) on record. Shipments to Army, Navy repair facilities are determined by project codes 3AB, 3AC, 3AL on record. Shipments to other ALCs determined by SRAN.

*Do not multiply shipments to other ALCs by two. Cost as one-way.

ESTIMATING BASE-ORIGINATED SHIPMENT COSTS



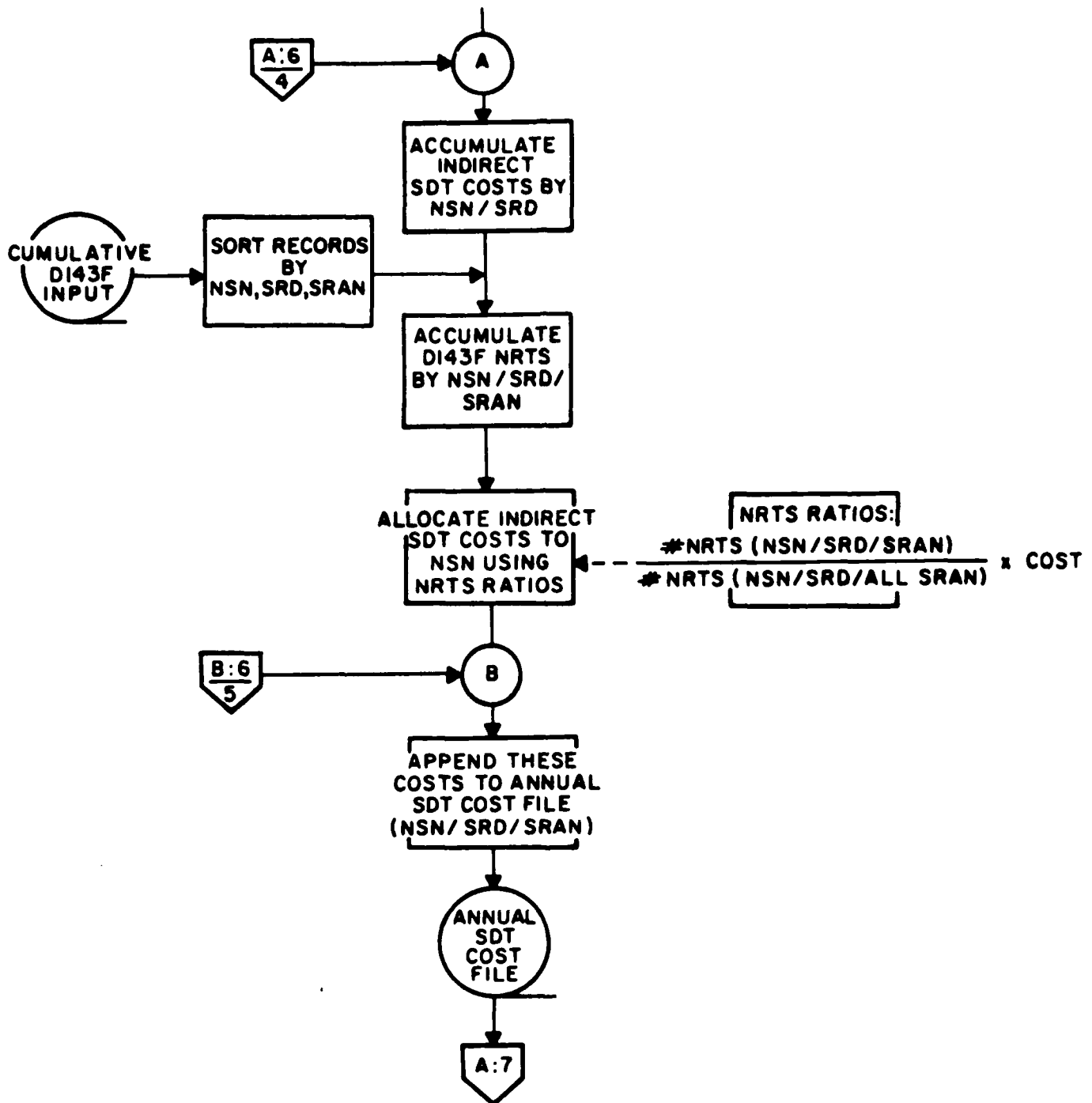
¹ D143F is source of NRTS and condemnation information by NSN/SRD/SRAN. This is an existing interface with VAMOSC.

² 0013 is source of packaged weights by NSN. In order to estimate packing costs this weight must be altered with an AFLCP 173-10 factor (see text).

³ Base to depot shipments are costed at same average rate as depot to base shipments.

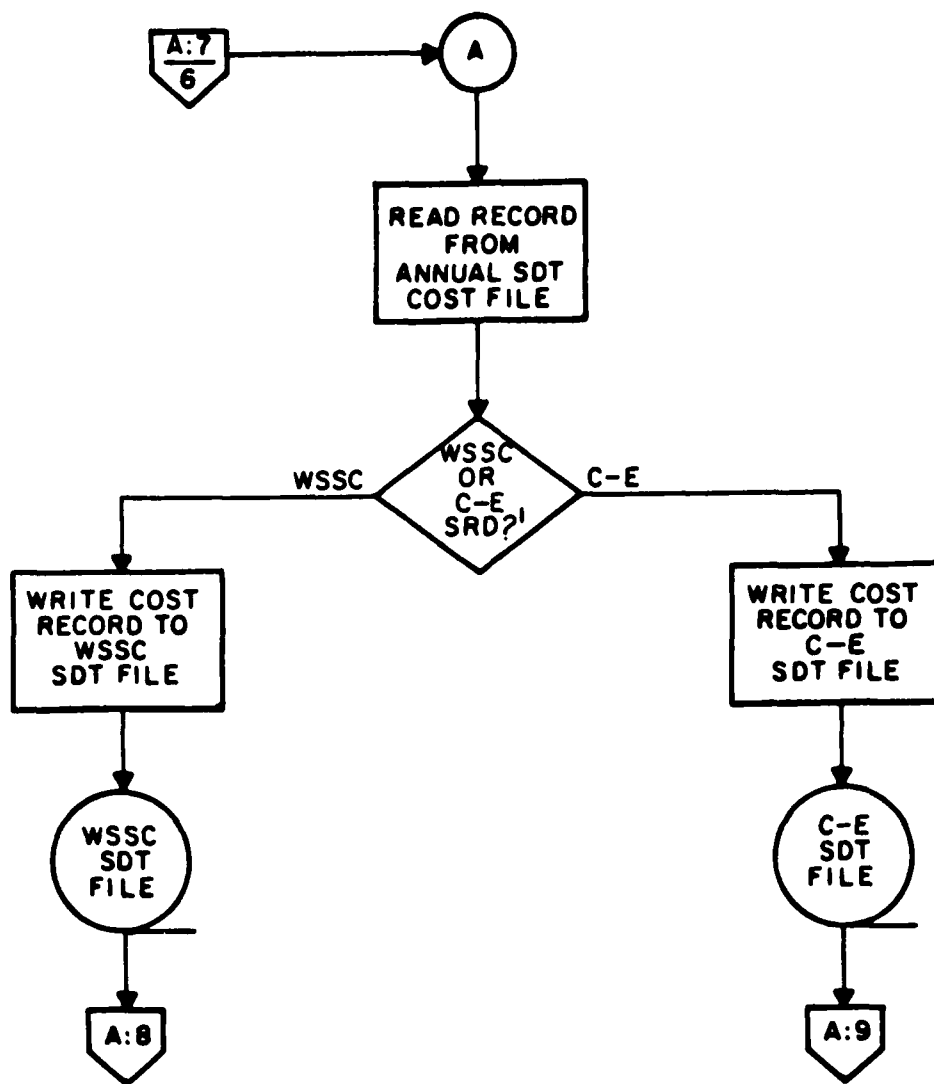
⁴ These factors are available in AFLCP 173-10.

DEPOT SHIPMENTS TO DEPOT, CONTRACTOR, ARMY AND NAVY¹



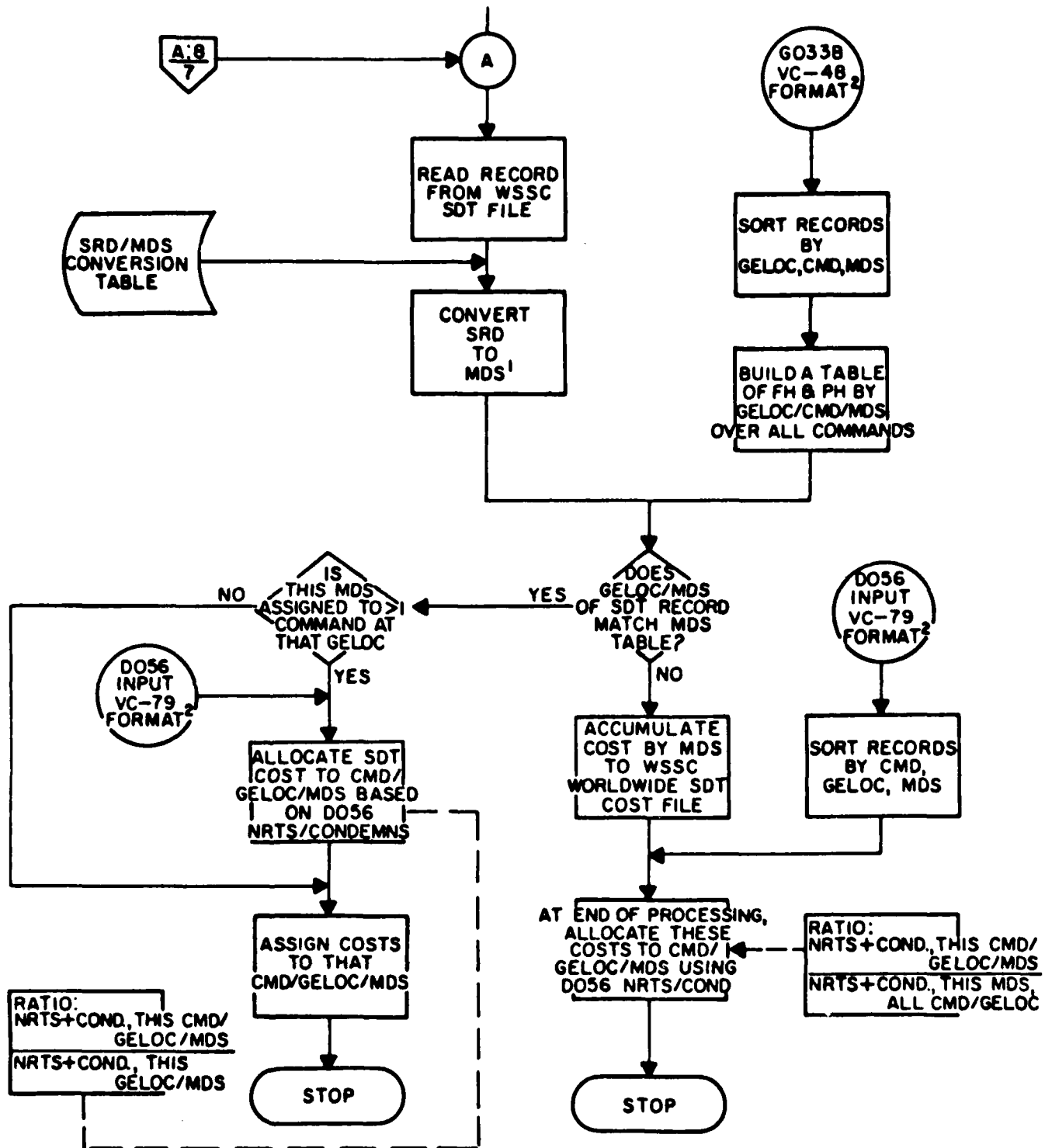
¹This process is to allocate the cost of these shipments to the NSN/SRD/SRAN level. This can be done with NRTS counts, which is a measure of shipment activity to the depot. These shipments to Army, Navy, etc. lose their identity as to which is the base of origin. This process is an attempt to link these shipments to a base.

WSSC/C-E SELECTION



¹ Based on first character of SRD, with information from TO 00-20-2, The Maintenance Data Collection System.

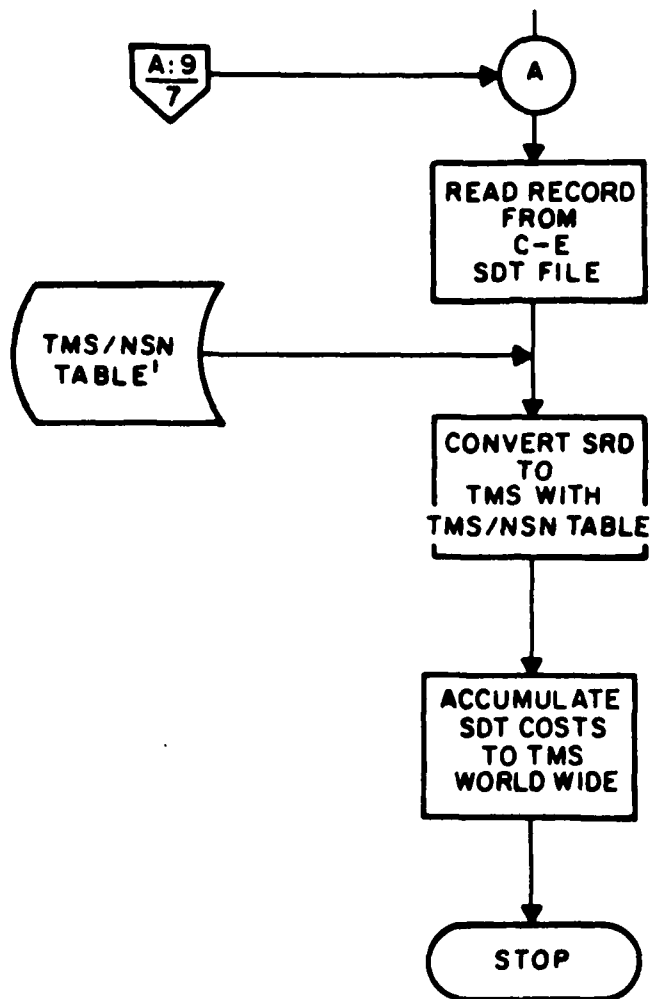
ANNUAL WSSC PROCESSING OF SDT COSTS



¹ This data is available in TO 00-20-2.

² This data is currently available in VAMOS, and all commands (relevant and non-relevant) must be considered.

ANNUAL C-E PROCESSING OF SDT COSTS



¹Already available in the C-E system.

Unclassified

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This report presents the results of an evaluation of an algorithm designed to be used to collect and report Second Destination Transportation (SDT) costs for the Weapon System Support Cost (WSSC) and Communications-Electronics (C-E) subsystems of AF VAMOSC. This report also includes an alternative SDT algorithm, which is presented as a replacement for the VAMOSC SDT algorithm. Conclusions, recommendations, and algorithm flowcharts are included.		

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