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ROUTINE ECONOMIC AIRLIFT FOR REPARABLE
ITEMS SUPPORTED ONLY FROM CONUS DEPOT
OVERHAUL FACILITIES

Ray M. Clarke, et al

Research Analysis Corporation

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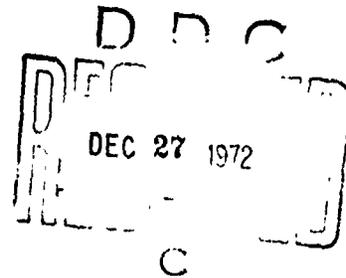
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Routine Economic Airlift

For Repairable Items

Supported Only from CONUS Depot Overhaul Facilities

by Ray M. Clarke
Martha E. Breon



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13. ABSTRACT This report provides a methodology for computing the most economical mode of shipment (surface vs air), when considering the total distribution system costs, for repairable items that are coded for CONUS depot overhaul in those instances where 100 percent of the annual requirement is being met from depot overhaul of unserviceable items. The basic rationale for the development of the formulas and concepts contained herein is in large part developed in Refs 1 and 2, to which the reader is referred. This document is an extension and further refinement of techniques developed initially in the above references.		

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Supported Only from CONUS Depot

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FOREWORD

This paper, prepared as a result of an Institutional Research effort, is an extension of RAC-R-146, "Routine Economic Airlift," October 1972. The problem of the retrograde movement of military cargo was mentioned in the above referred-to report. A formula was included for retrograde computations in RAC-R-116, "Selection of Items for Air Shipment on an Economic Basis," January 1971. Neither of the above documents, however, addresses specifically techniques for use in determining the cost of overhaul of reparable items, and the impact on the economics of a surface versus an air pipeline in the transportation segment of the distribution system. This problem is unique to those reparables that are supplied totally by production from Army CONUS depot overhaul facilities rather than from new procurement. Although the results of this study are predicated upon reparable Army aviation components, the techniques developed should apply to reparable items managed by all Army National Inventory Control Points.

Lee S. Stoneback
Director
Logistics Department

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ROUTINE ECONOMIC AIRLIFT

For Repairable Items Supported only from CONUS
Depot Overhaul Facilities

ABBREVIATIONS

AAD	average annual demand
ALR	air linehaul rate
AMC	US Army Materiel Command
AMDF	Army Master Data File
APOD	aerial port of debarkation
APOE	aerial port of embarkation
AVSCOM	US Army Aviation Systems Command
REP	Break-even Point
CONUS	continental United States
COP	Cross-over Point
FSN	Federal stock number
MAC	Military Airlift Command
NM	nautical mile
OST	order-ship time
POD	port of debarkation
POE	port of embarkation
RAC	Research Analysis Corporation
REAL	routine economic airlift
SAAM	special assignment airlift movement
ST-NM	short ton-nautical mile

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Chapter 1

INTRODUCTION

PROBLEM

To determine the economics of overhauling a requisite quantity of unserviceable components coded for continental United States (CONUS) depot repair to fill a surface pipeline versus overhauling only those required to maintain an air pipeline.

BACKGROUND

With a reduction in the flying hour program, due in large part to the reduction in US Army activity in South Vietnam, the US Army Aviation Systems Command (AVSCOM) has had an increase in the number of unserviceable aircraft components that have been returned from overseas areas for CONUS depot overhaul that are in excess of its needs to support an air pipeline. This raises the question of whether it is more economical to overhaul a sufficient number of these unserviceable items to fill a surface pipeline, or whether it is more economical to continue to overhaul only those that are required to maintain an air pipeline. These items are not in a procurement status as annual requirements are being provided by production from the depot overhaul facilities. AVSCOM requested that RAC undertake a review of the problem and develop a methodology to determine whether it would be more economical to continue the air pipeline or to fill a surface pipeline.

DISCUSSION

Approach

In approaching this problem it was determined that item cost calculations, reflecting the economics of unserviceable overhaul required to fill a surface pipeline versus the overhaul of a requisite number

of items to maintain an air pipeline, could be accomplished by modifying the Routine Economic Airlift (REAL) formulas¹ to account for the overhaul costs. The modifications to the formulas were accomplished, and together with standard input values furnished by AVSCOM, calculations were made for 280 individual Federal stock numbers (FSNs) that AVSCOM wished to be studied. The 280 FSNs are items that are coded in the Army Master Data File (AMDF) for CONUS depot overhaul ("T"-coded). The modified formula consists of five basic equations as follows:

- a. A computation of the differential between surface and air transport modes in the item overhaul costs required for supporting an outbound pipeline and overseas stock levels.
- b. A computation of the differential value between surface and air transport modes for supporting a retrograde pipeline.
- c. The cost of surface transportation for the annual demand.
- d. The differential in packaging costs between the two transport modes for the annual demand.
- e. The cost of air transportation for the annual demand.

Computations were made at three different air linehaul rates (ALRs): the Military Airlift Command (MAC) channel rate, C-141 Special Assignment Airlift Movement (SAAM) MAC rates, and C-5A SAAM MAC rates. It will be noted that a computation for the holding cost differential was not made as it was assumed the cost of holding unserviceable items would be essentially the same as holding serviceable items.

Summary Results

The 280 FSN data bank included 23 FSNs that had no demands forecasted for the succeeding 12-month period, leaving 257 FSNs for which cost calculations could be made. Using the MAC channel ALR of \$0.12146 per short ton-nautical mile (ST-NM), 88.3 percent of the items (227) were calculated as being more economical to overhaul only the annual demands and maintain an air pipeline both outbound and retrograde; 87.5 percent of the items (225) were more economical by air than by surface using the MAC C-141 SAAM ALR of \$0.12337 per ST-NM; and 97.7 percent of the items (251) were more economical by air than by surface using the MAC C-5A SAAM ALR of \$0.07211 per ST-NM. The cost savings, air over surface, were approximately \$36 million each for the MAC channel and C-141 SAAM flights, and \$55 million for the C-5A. The above results were obtained by use of a two-year computational period.

For the 23 FSNs which had no demands forecasted for the succeeding 12 months, Break-Even Point (BEP) and Cross-Over Point (COP) calculations were made. For the MAC channel ALR and the C-141 SAAM ALR, 95.7 percent were air eligible, and 100 percent were air eligible using the C-5A SAAM ALR. Percentages air eligible for the 280 FSNs were 88.9 percent for the MAC channel ALR, 88.2 percent for the MAC C-141 SAAM ALR, and 97.9 percent for the MAC C-5A SAAM ALR. Thirty-two percent of the items had a COP between 2.0 and 5.9 years, 57 percent of the items had COPs of 6 years and over.

Report Contents

The modifications made to the REAL formulas are contained in Chap. 2 together with an explanation of the rationale used in such modifications; the input values provided by AVSCOM and used in the calculations are documented in Chap. 3; analyses of computational results are contained in Chap. 4; and the computer program is documented in Chap. 5.

CONCLUSIONS

1. The cost calculations, based on a two-year time period, exhibited a very high degree of air eligibility for the AVSCOM items coded in the AMDF for CONUS depot overhaul.
2. Candidate item selection for the REAL program should include those high value repairable items, coded in the AMDF for CONUS depot overhaul, in those instances where the annual demand is being met solely from the production lines of the CONUS depot overhaul facilities.
3. Items with COPs between 2.0 and 5.9 years should be reviewed in relation to the expected remaining service life of the items for possible modification of the results of the FSN cost calculations.

Chapter 2

MODIFICATION OF REAL PROGRAM FORMULAS

FSN COST FORMULA

General

The problem to be addressed in modifying the REAL program formulas contained in references 1 and 2, was to determine the cost of overhaul of unserviceable items that were available at Army depot overhaul facilities in sufficient quantities to fill initially an outbound and retrograde surface pipeline, together with requisite overseas stock levels, and to compare that cost with the cost of maintaining an outbound and retrograde air pipeline for the same items. Since the problem being addressed was to determine whether the items being studied were to be transferred from an air pipeline to a surface pipeline, the formulas had to be adjusted to reflect the cost of pipeline expansion using overhaul costs rather than the cost savings accruing in pipeline compression using the unit price of the items.

Formula Modification for FSN Cost Program

Five cost equations were developed for the FSN cost formula, which differed slightly from the original cost equations, as follows:

- a. The differential cost of overhaul in expanding the outbound pipeline from air to surface transport mode, and the increased overseas stock levels required.
- b. The differential cost of overhaul in expanding the retrograde pipeline from the air to surface transport mode.
- c. The cost of surface transportation, outbound and retrograde.
- d. The differential packaging costs both outbound and retrograde between air and surface shipment, if any, and
- e. The cost of air transportation, outbound and retrograde.

The five equations developed are as follows:

Differential outbound pipeline and stock level costs. The equation for computing the differential costs of expanding the outbound pipeline and increasing the stock levels is reflected below.

$$\Delta \bar{C}_{INV}(i,j) = \overline{MF}(i) \bar{A}(i,j) \left[(\bar{t}_s(j) - \bar{t}_a(j)) + \frac{(\bar{I}_{\text{surface}}(i,j) - \bar{I}_{\text{air}}(i,j))}{\bar{\lambda}_y(i,j)} \right]$$

- where: $\Delta \bar{C}_{INV}(i,j)$ = The additional investment required in the outbound pipeline and overseas stock levels to switch from the air transport mode to the surface mode for the i^{th} item in the j^{th} distribution system.
- $\overline{MF}(i)$ = The ratio of the cost of overhaul of the i^{th} item to the unit price.
- $\bar{A}(i,j)$ = Dollar value of the average annual demand (AAD) of the j^{th} item in the j^{th} distribution system based on the unit price of the i^{th} item.
- $\bar{t}_s(j)$ = Average outbound pipeline time when materiel is transported in the j^{th} distribution system by surface transportation (fraction of year).
- $\bar{t}_a(j)$ = Average outbound pipeline time when materiel is transported in the j^{th} distribution system by air transportation (fraction of year).
- $\bar{I}_{\text{surface}}(i,j)$ = The average number of days of materiel required in on shelf inventory when the i^{th} item is shipped by the surface mode in the j^{th} distribution system.
- $\bar{I}_{\text{air}}(i,j)$ = The average number of days of materiel required in on shelf inventory when the i^{th} item is shipped by the air mode in the j^{th} distribution system.
- $\bar{\lambda}_y(i,j)$ = The number of days in a year which when divided into $\bar{I}_{\text{surface}}(i,j) - \bar{I}_{\text{air}}(i,j)$ converts the stock level differentials into a fraction of a year.

Differential in the retrograde pipeline costs. The differential costs in the retrograde pipeline is a function of the ratio of the overhaul costs to the unit value, the annual demand in dollars and the surface retrograde pipeline time and the air retrograde pipeline

expressed in a fraction of a year. This equation is as follows:

$$\Delta \bar{C}_{INV}^{\text{Retro}} = \overline{MF}(i) \bar{A}(i,j) \left[\frac{\bar{t}_s^{\text{Retro}}(j) - \bar{t}_a^{\text{Retro}}(j)}{\bar{\lambda}_y(i,j)} \right]$$

where: $\Delta \bar{C}_{INV}^{\text{Retro}}$ = Differential between the costs of the retrograde pipeline when shipping by the surface and air transportation modes.

$\overline{MF}(i)$ = As previously defined.

$\bar{A}(i,j)$ = Dollar value of the average annual retrograde shipments of the i^{th} item in the j^{th} distribution system based on the unit price of the i^{th} item.

$\bar{t}_s^{\text{Retro}}(j)$ = Average retrograde pipeline time when materiel is transported in the j^{th} distribution system by the surface transportation mode.

$\bar{t}_a^{\text{Retro}}(j)$ = Average retrograde pipeline time when materiel is transported in the j^{th} distribution system by the air transportation mode.

$\bar{\lambda}_y(i,j)$ = As previously defined.

Surface transportation costs. There are two equations to determine the cost of surface transportation, one for outbound movement and one for retrograde movement as follows:

$$\bar{C}t_s^{\text{Out}}(i,j) = [\Sigma \{ \bar{M}_s(j) W(i,j) \bar{K}_e \bar{\beta}_2 \bar{C}t_s(i,j) \}]$$

$$\bar{C}t_s^{\text{Retro}}(i,j) = [\Sigma \{ \bar{M}_s(j) W(i,j) \bar{K}_e \bar{\beta}_2 \bar{C}t_s^{\text{Retro}}(i,j) \}]$$

When all values of the factors in the two equations are identical (as in the situation being examined) the equations can be combined and expressed as:

$$\bar{C}t_s(i,j) = 2 [\Sigma \{ \bar{M}_s(j) W(i,j) \bar{K}_e \bar{\beta}_2 \bar{C}t_s(i,j) \}]$$

where

$\bar{C}t_s(i,j)$ = Total costs associated with the outbound and retrograde surface movements of the i^{th} item in the j^{th} distribution system.

\sum^N = Summation of the costs over "N" years, the time period of the computations.

$\bar{M}_s(j)$ = Average distance in nautical miles, that the i^{th} item is shipped in the j^{th} distribution system by the surface mode.

$W(i,j)$ = The annual weight, in short tons, that the i^{th} item is shipped in the j^{th} distribution system.

\bar{K}_2 = The average tare weight packaging factor associated with the i^{th} item for surface movement.

$\bar{\beta}_2$ = The price change factor which reflects the average inflation/deflation of costs for surface transportation over "N" years, the time period of computation.

$\bar{C}_{t_s}(i,j)$ = The average cost rate(s) associated with movement by the surface mode for the i^{th} item in the j^{th} distribution system. It includes: (a) cost in dollars/ST-NM from origin to POE, POE to POD, POD to destination and return; and (b) port handling costs at the CONUS ports and overseas ports.

Differential packaging costs, air/surface. There are two equations to determine the total packaging cost differentials, one for outbound and one for retrograde as follows:

$$\bar{\Delta TC}_{Pkg(i)}^{Out} = [\sum^N \{\bar{\beta}_3 W(i,j) \bar{\Delta C}_{Pkg(i)}\}]$$

$$\bar{\Delta TC}_{Pkg(i)}^{Retro} = [\sum^N \{\bar{\beta}_3 W^{Retro}(i,j) \bar{\Delta C}_{Pkg(i)}^{Retro}\}]$$

As in the previous equation, if all values of the factors in the two equations are identical (as in the situation being examined) the equations can be combined and expressed as:

$$\bar{\Delta TC}_{Pkg(i)}^{OR} = 2[\sum^N \{\bar{\beta}_3 W(i,j) \bar{\Delta C}_{Pkg(i)}\}]$$

where:

$\bar{\Delta TC}_{Pkg(i)}^{OR}$ (i) = Differential in total packaging costs between the air and surface transport modes, both outbound and retrograde.

\sum^N = As previously defined

$\bar{\beta}_3$ = The price change factor which reflects the average inflation/deflation of costs for packaging over "N" years, the time period of the computation.

$W(i,j)$ = As previously defined.

$\Delta \bar{C}_{Pkg}(i)$ = The average difference in packaging costs in dollars per short ton for the i^{th} item between the air and surface transport modes.

Air Transportation Costs. There are two equations to determine the cost of air transportation, one for outbound movement and one for retrograde movement, as follows:

$$\bar{C}_{t_a}(i,j)^{Out} = [\sum^N \{ \bar{M}_a(i) W(i,j) \bar{K}_3 \bar{\beta}_4 \bar{C}_{t_a}(i,j) \}]$$

$$\bar{C}_{t_a}(i,j)^{Retro} = [\sum^N \{ \bar{M}_a(j) W(i,j) \bar{K}_3 \bar{\beta}_4 \bar{C}_{t_a}(i,j) \}]$$

As in the previous two equations, if all values of the factors in the two equations are identical (as in the situation being examined) the equations can be combined and expressed as:

$$\bar{C}_{t_a}(i,j)^{OR} = 2[\sum^N \{ \bar{M}_a(j) W(i,j) \bar{K}_3 \bar{\beta}_4 \bar{C}_{t_a}(i,j) \}]$$

where:

$\bar{C}_{t_a}(i,j)^{OR}$ = Total costs associated with the outbound and retrograde air movements of the i^{th} item in the j^{th} distribution system.

\sum^N = As previously defined

$\bar{M}_a(j)$ = Average distance, in nautical miles, that the i^{th} item is shipped in the j^{th} distribution system by the air transport mode.

where:

$W(i,j)$ = As previously defined.

\bar{K}_3 = The average tare weight packaging factor associated with the i^{th} item for air movement.

$\bar{\beta}_4$ = The price change factor which reflects the average inflation/deflation of costs for air shipments over "N" years, the time period of computation.

$\bar{Ct}_a(i,j)$ = The average cost rate(s) associated with movement by the air mode for the i^{th} item in the j^{th} distribution system. It includes: (a) cost in dollars/ST-NM from point of origin to nearest APOE, APOE to APOD, and APOD to destination and return; and (b) handling costs for air transportation which are included in the MAC ALRs.

FSN Cost Formula - Economics of Overhaul, Surface vs Air Pipeline

To summarize, since the outbound and retrograde input values provided by AVSCOM were identical for outbound and retrograde movements (see Chap. 3), the formula used for this study is as follows:

$$\begin{aligned} \Delta \bar{C}(i,j)_{\text{Total}} = & \overline{MF}(i) \bar{A}(i,j) \left[\left(\bar{t}_s(j) - \bar{t}_a(j) \right) + \left(\frac{\bar{I}_o(i,j) - \bar{I}_d(i,j)}{\bar{\lambda}_y(i,j)} \right) \right] \\ & + \overline{MF}(i) \bar{A}(i,j) \left[\frac{\bar{t}_s(j)_{\text{Retro}} - \bar{t}_a(j)_{\text{Retro}}}{\bar{\lambda}_y} \right] \\ & + 2 \left[\sum^N \{ \bar{M}_s(j) W(i,j) \bar{K}_2 \bar{\beta}_2 \bar{Ct}_a(i,j) \} \right] \\ & + 2 \left[\sum^N \{ \bar{\beta}_3 W(i,j) \Delta \bar{C}_{\text{Pkg}}(i) \} \right] \\ & + 2 \left[\sum^N \{ \bar{M}(i,j) W(i,j) \bar{K}_3 \bar{\beta}_4 \bar{Ct}_a(i,j) \} \right] \end{aligned}$$

It is emphasized once again that the holding cost equation used in the formulas used in Refs 1 and 2 has not been used in this problem, as it was determined that there would be very little difference, if any, between the cost of holding serviceable and unserviceable items.

BREAK-EVEN POINT (BEP) FORMULA

The basic rationale used in developing the BEP formula is contained in Ref 1, to which the reader is referred if more detail on

the BEP concept is desired. Suffice to say here is that the purpose of the BEP computation is to determine the ALR at which the total distribution costs, whether shipping by air or surface transport modes, are exactly equal, i.e., the cost avoidance would be zero. The BEP formula used in this study, as is the case for the FSN cost formula, is a slight modification of the basic BEP formula to account for the cost of overhauling an item at CONUS depot overhaul facilities. Since the elements of the BEP formula are, with minor exceptions, the same as the elements of the FSN cost formula documented in the previous section of this chapter, a detailed explanation of the individual equations is not believed necessary. Where there is a difference in terms, such terms will be defined. The BEP formula, for determining the ALR at which the total distribution costs are exactly equal when overhauling a sufficient number of unserviceable items to fill a surface pipeline versus overhauling only the annual demand to maintain an air pipeline, is expressed as follows:

$$\begin{aligned}
 \bar{C}t_a(i,x) = & \overline{MF}(i)\bar{A}(i,j)\left[\left(\bar{t}_s(j) - \bar{t}_a(j)\right) + \left(\frac{\bar{I}(i,j) - \bar{I}_0(i,j)}{\bar{\lambda}_y(i,j)}\right)\right] \\
 & + \overline{MF}(i)\bar{A}(i,j)\left[\frac{\bar{t}_s^{\text{Retro}}(j) - \bar{t}_a^{\text{Retro}}(j)}{\bar{\lambda}_y(i,j)}\right] \\
 & + 2\left[\sum^N \{\bar{M}_a(j)W(i,j)\bar{K}_2\bar{\beta}_2\bar{C}t_a(i,j)\}\right] \\
 & + 2\left[\sum^N \{\bar{\beta}_3W(i,j)\Delta\bar{C}_{\text{Pkg}}(i)\}\right] \\
 & - 2\left[\sum^N \{\bar{\beta}_4\bar{K}_3W(i,1)\bar{M}_a(1)\bar{C}t_a(i,1)\}\right] \\
 & - 2\left[\sum^N \{\bar{\beta}_4\bar{K}_3W(i,4)\bar{M}_a(4)\bar{C}t_a(i,4)\}\right] \\
 & \underline{\hspace{10em}} \\
 & 2\left[\sum^N \{\bar{\beta}_4\bar{K}_3W(i,x)\bar{M}_a(x)\}\right]
 \end{aligned}$$

where: $\bar{C}t_a(i,x)$ = The ALR-BEP, from the APOE to APOD

$\bar{M}_a(1)$ = The distance in nautical miles from the point of origin to the nearest APOE when moving by the air mode.

$\overline{Ct}_a(i,1)$ = The linehaul costs in dollars/ST-NM in the movement of the i^{th} item from the point of origin to the nearest APOE.

$\overline{M}_a(4)$ = The distance in nautical miles from the APOD to the destination when moving by the air mode.

$\overline{Ct}_a(i,4)$ = The cost in dollars/ST-NM in the movement of the i^{th} item from the APOD to the destination.

$W(i,x)$ = The short tons of the i^{th} item moved from the APOE to the APOD.

$\overline{M}_a(x)$ = The distance in NM between the APOE and APOD. All other terms are previously described.

CROSS-OVER POINT (COP) FORMULA

As in the case of the BEP formula, the basic rationale used in developing the COP formula is contained in Ref 1, to which the reader is referred if more detail on the COP concept is desired. In this case, the COP computation is made to determine the number of years in the future that the additional cost of filling the surface pipeline is offset by the differential costs between shipping by air and surface transport modes. All terms used in the COP formula have been defined in the section on the FSN Cost Formula and will not be repeated here, except for one term - "N years." "N years" in the COP formula as used herein as defined as that point in time when the additional cost of air transportation equals the dollar value of the differential between an air and surface pipeline when filling the surface pipeline by overhauling unserviceable items. The formula is expressed as:

$$\begin{aligned}
 & - \overline{MF}(i,j) \overline{A}(i,j) \left[\overline{t}_s(j) - \overline{t}_a(j) \right] + \frac{\left[\overline{I}_{\text{O.S.}}(i,j) - \overline{I}_{\text{S.S.}}(i,j) \right]}{\overline{\lambda}_y(i,j)} \\
 & - \overline{MF}(i,j) \overline{A}^{\text{Retro}}(i,j) \left[\frac{\overline{t}_s^{\text{Retro}}(j) - \overline{t}_a^{\text{Retro}}(j)}{\overline{\lambda}_y(i,j)} \right]
 \end{aligned}$$

N years = _____

$$\begin{aligned}
& 2[\bar{M}_a(j)W(i,j)\bar{K}_2\bar{\beta}_2\bar{C}t_a(i,j)] \\
& + 2[\bar{\beta}_3W(i,j)\bar{\Delta C}_{\text{Pkg}}(i)] \\
& - 2[\bar{\beta}_4\bar{K}_4\bar{M}_a(j)W(i,j)\bar{C}t_a(i,j)]
\end{aligned}$$

GENERAL

The preceding formulas do not provide for application of the 10%/year discount technique being used currently by AMC for the REAL program. Application of the discount technique to this problem tends to distort the computational results as is noted in Chap. 4. In Ref 1, RAC stated in some detail the reasons for not recommending the use of the discount technique.

Chapter 3

INPUT VALUES

INTRODUCTION

This chapter contains the various input values used in the computations. All input values used were provided by the US Army AVSCOM. Most of such inputs are identical with inputs used in Refs 1 and 2 and are currently being used by the Army Materiel Command (AMC) in the REAL computations. There have been some modifications which will be noted as they are addressed. The rationale and method of application for those that are the same as explained in Refs 1 and 2 will not be repeated here. For those input values for which modifications or variations to the values or their application have been made, an explanation of the differences will be given.

FSN DATA REQUIREMENTS

Certain FSN data are a prerequisite for FSN Cost, BEP, and COP calculations. These data were provided by AVSCOM for the 280 individual items which they wished to be examined. The data consisted of the following for each FSN:

- a. Unit price
- b. Unit weight
- c. Unit cube
- d. Ratio of the overhaul cost to the unit price
- e. Average annual demand (AAD) from overseas areas

Table 1 contains a listing of these input values for each of the 280 individual FSNs. The unit weight and cube are used in the same manner as in Refs 1 and 2. The ratio of the overhaul cost to the unit

Table 1

INDIVIDUAL ITEM INPUT VALUES

FSN	NOUN	PRICE (\$-.00)	WEIGHT (lbs-.00)	CUBE (ft ³ -.000)	AAD (Qty)	RATIO (%)
15601814784	POOM,PO	553600	110800	536000	168	25
15606724827	STAR AS	551100	19600	7900	0	25
15638678992	PLANE S	229900	35600	37900	48	43
16101336840	CONTROL	1061500	9000	6200	18	25
16101796275	PROPPELL	1450200	67200	30200	35	25
16105297806	PROPPELL	399300	9540	1600	142	26
16105939133	BARREL	225500	4070	1200	1	25
16106179735	PROPPELL	1095200	67200	30200	127	10
16106711092	CONTROL	1051000	11500	5500	152	11
16150195174	SHAFT A	847200	94700	60300	113	26
16150195174	SHAFT A	899900	94700	60300	113	35
16150646525	CLUTCH	356800	16600	10400	0	25
16150725799	BLADE, P	323900	54800	78800	5387	40
16150749932	SHAFT, T	48300	4110	2500	145	51
16150836217	CLUTCH	332600	11600	8000	194	24
16150965337	BLADE A	210600	36300	48400	20	43
16151067911	SWASHPL	533400	22600	14300	42	33
16151154758	PLANE, P	357100	10300	15800	55	36
16151216543	TRANSMI	703500	17500	10400	149	25
16151254051	HEAD,PO	221900	18000	19100	172	25
16151336974	HEAD,PO	7835700	370800	230000	22	29
16151343087	OUTLL A	148500	7950	3500	1466	26
16151514240	PEEWHE	119800	1200	0926	282	25
1615166504	TRANSMI	727700	15000	10200	361	25
16151678290	PLADE, R	277700	48000	75000	175	62
16151685934	TRANSMI	895000	144900	110000	245	25
16151685994	TRANSMI	4006400	158500	110000	256	25
16151719210	HEAD,RO	2592800	113000	122000	100	13
16151762106	PLADE, P	1141800	65900	95800	507	40
16151762111	PLADE, P	1141800	65900	95800	634	40
16151762628	TRANSMI	2032500	65900	43900	121	21
16151788345	PLADE, R	783000	79400	131000	98	25
16151789680	PLADE, P	340800	51800	82700	1748	25
16151790818	PLADE, P	1095900	69900	120000	440	39
16151793063	HUP ASS	480300	7560	15000	270	60
16151799209	HEAD,RO	2777800	161700	122000	119	13

Table 1 (Cont'd)

FSN	NOUN	PRICE (\$-.00)	WEIGHT (lbs-.00)	CUBE (ft ³ -.000)	AAD (Qty)	RATIO (%)
16151799210	HEAD, R0	2618700	161700	122000	100	25
16151815154	PLANE, R	1250000	93800	150000	28	25
16151815273	HEAD, R0	1200000	51800	76100	5	25
16151815495	PLANE, R	1113400	65900	95300	636	35
16151830834	TRANSMI	1162000	60400	68100	2125	25
16152339241	TRANSMI	111100	3560	1200	588	54
16152433663	MAIN PO	10000000	760300	677000	10	25
16153012240	GEARBOX	124500	5900	4200	11	48
16153170584	GEAR RO	90000	1000	0463	14	65
16153499243	GEARBOX	2100300	46600	42400	16	22
16154072823	TRANSMI	3573000	156900	142000	292	25
16154132641	TRANSMI	1465300	60400	68100	30	19
16154207845	SWASHPL	1020100	31900	13300	5	25
16154322492	GEARBOX	122800	4700	2900	293	25
16154498227	GEAR RO	12300000	418200	356000	19	22
16154579825	HEAD AS	1063400	30100	29200	4	25
16154713325	HUB AND	115600	5220	5600	838	25
16154826243	GEARBOX	16500000	457700	352000	8	13
16154905877	GEAR RO	157500	7560	6000	300	25
16155636712	PLANE, R	166500	10500	15000	0	57
16155709770	HUB ASS	423800	35600	12500	102	44
16155933310	PLANE, R	359400	35600	41800	18	26
16156097801	PLANE, A	30100	1400	1500	130	63
16156113886	HEAD, R0	1390300	122300	78800	85	61
16156228918	GEARBOX	492400	9540	9700	54	18
16156273914	TRANSMI	342900	13500	4000	20	65
16156534336	PLANE A	294700	39400	49100	89	37
16156589520	GEARBOX	1322000	122300	106000	37	42
16156711773	GEARBOX	115300	6010	4600	47	65
16156724828	TAIL RO	970900	44400	18200	0	25
16156737729	SERVO U	1045000	52800	46100	0	25
16156762266	STAR AS	174300	6370	3000	37	43
16157392580	SHAFT A	58000	7010	7600	297	49
16157569140	PLANE, R	310000	50800	71500	540	36
16157645851	TRANSMI	841600	32500	28300	102	25
16157665908	PLANE A	196900	34900	39800	173	34

Table 1 (Cont'd)

FSN	NOUN	PRICE (\$-.00)	WEIGHT (lbs-.00)	CURE (ft ³ -.000)	AAD (Qty)	RATIO (%)
16157668580	OUTILL A	50200	1770	1000	1	65
16157711634	SWASHPL	337800	48400	45300	494	43
16157718295	TPANSMI	590900	26500	24400	1	64
16157816613	TPANSMI	922000	16900	11400	494	29
16157926390	OUTILL A	151100	7290	2600	5	25
16157944728	GEAR RO	3800000	271800	242000	0	25
16157960760	PLANE R	574000	77900	148000	0	25
16158064317	PLADF R	324500	24200	41800	18	25
16158166954	SHAFT A	33700	7560	11500	58	65
16158206845	OUTILL A	69300	3950	2400	116	18
16158331556	MUR, POT	360900	50800	25700	2223	46
16158390690	TRANSMI	2038800	65300	56000	40	32
16158396886	OUTILL A	50800	480	1000	360	12
16158426277	PLADF, R	783000	80200	110000	23	32
16158562420	GEAR RO	384500	28500	20100	0	25
16158717300	HEAD, RO	2447100	161700	118000	136	10
16158717303	HEAD, RO	2443000	161700	118000	117	14
16158721212	SHAFT A	59600	8010	8200	121	65
16158721213	SHAFT A	70500	5520	7800	522	39
16158737420	SWASHPL	462100	43200	45300	50	42
16158737421	SWASHPL	447300	47500	45300	65	47
16158737424	SWASHPL	514100	20200	18200	28	42
16158737425	SWASHPL	433400	20200	18200	28	50
16158764316	ROTOP A	4000000	277300	142000	0	61
16158861778	MUR, MAT	284200	50800	25700	352	54
16158934955	GEAR RO	57300	1000	0512	160	50
16159074870	PLANE, R	336600	37000	53300	75	28
16159182676	GEAR RO	114400	2180	2200	2158	27
16159182677	GEAR RO	153800	3310	2800	3280	29
16159560971	ADAPTER	20200	900	0635	4	65
16159603930	TRANSMI	302200	13200	4000	254	65
16159747726	OUTILL A	64600	3010	6200	18	65
16159758355	SEPVU U	157200	11600	13700	43	65
16159763113	GEAR RO	155900	3310	2800	29	29
16159830512	GEAR AS	140500	5170	3300	143	50
16159866169	GEAR RO	1032700	22800	20100	5	19

Table 1 (Cont'd)

FSN	NOUN	PRICE (\$-.00)	WEIGHT (lbs-.00)	CUBF (ft ³ -.000)	AAD (Qty)	RATIO (%)
161598751520	UILL A	128400	5520	2600	241	19
16159903093	FAN ASS	50300	7010	7200	18	40
1620860241	ASHOCK S	146700	3250	1300	16	58
1620956996	RCYLINDF	296800	5000	3300	40	25
162097731274	SHOCK S	463300	12300	9500	4	25
16500119022	SFRVOCY	105200	4000	1800	540	65
1650016288	PUMP, AX	166300	2800	1100	443	38
1650021908	FMTORPU	99300	2310	0636	325	37
16500343674	MOTOR, H	135900	2000	1300	190	22
16501172986	SFRVOCY	218900	10700	11800	149	19
1650128742	OPUMP, AX	126800	1300	0706	388	51
16501336262	SFRVOCY	201000	10700	11800	30	47
16501336265	SFRVOCY	201000	10700	11800	40	47
16501336266	SFRVOCY	231400	10300	11200	70	25
16501336270	SFRVOCY	241900	9410	3300	122	25
16501336962	SFRVOCY	278100	10700	11800	78	25
16501341057	SFRVOCY	284700	10700	11800	142	25
16501522784	SFRVOCY	590000	15000	16000	5	25
16501685525	SFRVOCY	243100	10700	11800	138	17
16501794264	SFRVOCY	243800	10700	11800	70	25
16501813544	DAMPENE	152800	2000	4100	416	22
16502210462	DAMPENE	152800	5520	4000	628	49
16504426211	SFRVOCY	240100	10700	11800	73	25
16504426217	SFRVOCY	279400	13500	11800	74	40
16504426219	SFRVOCY	271500	13500	11800	85	40
16506007615	SFRVOCY	815700	6010	4100	0	25
16506010560	SFRVOCY	38800	1000	0636	0	65
16506272035	SFRVOCY	273200	6250	4800	0	25
16506278104	SFRVOCY	146400	1350	2600	0	41
16506541457	SFRVOCY	554800	3630	2200	24	28
16506724820	SFRVOCY	35300	1800	1900	146	65
16506730280	SFRVOCY	273200	5520	2500	8	25
16507061046	SFRVOCY	174400	5900	4100	1	25
16507561046	MOTOR, H	38800	1000	4100	8	24
16509480968	MOTOR, H	51000	1600	0463	348	31
16500107448	VALVE, T	150000	420	0347	1	25

Table 1 (Cont'd)

FSN	NOUN	PRICE (\$-.00)	WEIGHT (lbs-.00)	CURF (ft ³ -.000)	AAD (Qty)	RATIO (%)
16601110024	TURBINE	329900	4300	4100	1	25
1660111293A	REFRIG	1020000	6540	5400	1	25
16601761343	CONTROL	314300	4030	18200	576	25
16601791390	TURBINE	112300	1900	1800	108	25
16605672921	REGULAT	23400	570	0405	526	65
16608686547	VALVE, P	125000	480	0405	1	25
16800195277	CARLE A	434300	22400	8000	48	49
16801690752	CARLE A	434300	23600	10400	8	25
16806732961	WINDCH, A	431600	11000	8300	12	25
16808586807	RELEASE	38400	560	0405	106	48
16808594841	PROPAGUE	18500	1650	1800	30	65
16808718736	OUTLL A	137800	900	1400	61	23
16809067919	WINDCH, A	920100	17200	11400	0	25
28101004577	ENGINE,	661100	110800	78800	46	47
28101004578	ENGINE,	627500	110800	78800	114	49
28101254173	CYLINDR	139300	7150	4600	115	27
28101796985	CYLINDR	139400	7010	7800	153	26
28103488690	CYLINDR	44400	7560	3400	4	62
28103488691	CYLINDR	42200	7950	4100	14	53
28106004650	ENGINE,	3978000	414000	209000	2	23
28106004663	ENGINE,	339500	106500	75000	4	25
28106248648	ENGINE,	1734000	135200	78800	130	59
28106246705	CYLINDR	22100	3700	1300	1540	65
28106714460	ENGINE,	978500	98500	75000	2	25
28106714463	ENGINE,	1107400	108600	78800	1	43
28106714464	ENGINE,	1385300	110800	78800	0	43
28106780392	ENGINE,	2000000	207300	106000	3	58
28108573272	ENGINE,	400000	96600	75000	65	25
28108935588	ENGINE,	583900	100400	74500	22	65
28109104514	ENGINE,	391400	89300	75000	64	25
28109190188	ENGINE,	559500	101400	74500	0	65
28109498268	ENGINE,	598400	96600	75000	184	65
28109539495	ENGINE,	3610000	171600	148000	36	25
28109543965	CYLINDR	23000	3730	1700	276	46
28350158633	PIPE A	495200	3370	0925	1	25
28351569785	ENGINE,	856900	38100	14700	12	25

Table 1 (Cont'd)

FSN	NOUN	PRICE (\$-.00)	WEIGHT (lbs-.00)	CUBE (ft ³ -.000)	AAD (Qty)	RATIO (%)
28354577327	DUCT I	102800	3010	3400	0	25
28358098316	ENGINE,	907000	35600	7100	326	49
28400207488	CARRIER	216900	2600	0706	1	25
28400543608	TURBINE	259500	1990	0706	77	65
28400566922	GEAR BOX	89400	480	0174	1	65
28400729690	CASE AS	218400	4560	9800	0	25
28400750089	HOUSING	67100	16000	567000	13	65
28400785056	NOZZLE,	236800	4230	2900	58	37
28400853880	NOZZLE,	84100	2000	1100	65	29
28401023966	ENGINE,	4475000	123500	75000	126	25
28401023968	ENGINE,	5316600	122300	75000	734	22
28401185707	PARTS K	161700	2100	1000	54	24
28401230682	ENGINE,	20552500	122300	75000	1	25
28401340015	NOZZLE,	238700	3100	2700	124	43
28401344803	ENGINE,	6851000	122300	75000	3133	15
28401507434	PLATE, T	250000	1175	1700	0	25
28401530129	TURBINE	1489700	18400	13700	0	17
28401763380	DUCT, EX	421200	5000	44400	4	25
28401763449	TURBINE	1262500	18600	13700	20	22
28401768753	TURBINE	220400	1200	0087	60	18
28401769128	ENGINE,	6363000	122300	75000	78	16
28401769132	ENGINE,	7599700	137800	74500	5	14
28401795536	ENGINE,	1767500	51800	43400	626	42
28402424477	COMPRES	382700	3400	1200	161	25
28402512550	GEAR AS	1321700	21800	5000	10	25
28404286382	ENGINE,	11788900	116500	74000	4	25
28404447653	GEARBOX	712600	13100	9700	4	25
28404447654	GEARBOX	705600	13100	9700	1	25
28405873936	GEARBOX	193400	3700	2300	24	32
28406107026	GEAR BOX	317500	3490	1500	7	50
28406547870	CARRIER	151300	420	0289	0	25
28406577998	GEAR AS	290200	2650	1100	17	20
28406703093	TURBINE	202200	2500	0845	1	65
28407274663	GEARBOX	199500	3700	2300	32	29
28407394612	TURBINE	243200	2300	2400	0	25
28407666401	ENGINE,	5800000	113000	74500	7	30

Table 1 (Cont'd)

FSN	NOUN	PRICE (\$-.00)	WFIGHT (lbs-.00)	CURF (ft ³ -.000)	AAD (Qty)	RATIO (%)
28407821772	TURBINE	994800	18600	16500	10	28
28408007120	GEAR AS	826200	13500	5000	60	10
28408007120	GEAR AS	620000	16300	9700	60	25
28408328373	NOZZLE,	157100	1500	1200	8	24
28408556100	ENGINE,	3237400	41400	63300	156	27
28408624855	NOZZLE,	73200	1175	0706	13	36
28408737618	NOZZLE,	266500	1500	1300	18	35
28408750983	CHAMBER	50000	125	0926	1	31
28408768713	SHAFT A	181400	1700	1100	46	25
28408866018	CAPPIER	462500	7420	1900	4	44
28409042461	ENGINE,	20417200	231400	265000	31	33
28409228282	TURBINE	181600	3010	2000	42	44
28409236023	ENGINE,	1533700	51800	43400	487	52
28409248647	TURBINE	281700	2220	0706	74	23
28409255813	TURBINE	203900	1400	0463	22	23
28409273588	HOUSING	314100	4820	2700	11	33
28409370480	ENGINE,	6960600	116500	74000	454	20
28409410536	DIFFUSE	169900	3250	2400	188	25
28409432375	LINER A	98300	2100	3300	68	20
28409432381	TURBINE	300700	2200	1800	119	25
28409506860	LINER A	115900	1710	3600	79	17
28409506875	ENGINE,	7172400	115300	74000	132	26
28409577064	DUCT AS	489500	13200	32200	12	10
28409600174	MANIFOL	140900	1600	1500	136	25
28409716279	NOZZLE,	152200	1070	1800	238	22
29101796986	FUEL CO	99700	1500	1000	47	65
29102202076	CONTROL	116700	1400	0845	20	25
29150206541	FUEL CO	629700	5070	2600	11	42
29150548861	FUEL CO	583800	5520	2800	44	51
29151560941	PUMP, FU	67300	640	0405	154	36
29151572308	FUEL CO	153900	860	32200	8	25
29151572313	FUEL CO	140000	860	32200	155	32
29151988724	REGULAT	548900	3950	1600	13	56
29154313648	FUEL CO	1150000	9000	5200	54	22
29154623228	FUEL CO	1120400	6750	4200	12	25
29157610002	FUEL CO	973300	7010	4600	36	25

Table 1 (Cont'd)

FSN	NOUN	PRICE (\$-.00)	WEIGHT (lbs-.00)	CURF (ft ³ -.000)	AAD (Qty)	RATIO (%)
29157817917	FUEL GN	505000	5730	4400	580	55
29157817925	FUEL GN	447100	5070	2600	286	57
29157817926	FUEL GN	446900	5070	2600	30	25
29157817928	FUEL GN	570700	5070	2600	89	31
29158973996	GOVERNOR	42700	350	0115	22	60
29159283906	FUEL GN	988500	6820	4400	35	25
29159368547	FUEL GN	863000	6250	4400	94	29
29159641716	MANIFOL	122500	1560	1100	1	25
29159642185	MANIFOL	122200	1560	1100	2	25
29159670818	FUEL GN	647200	7010	2800	94	25
29159921140	GOVERNOR	72100	600	0174	23	62
29159942016	GOVERNOR	80400	1250	1200	427	58
29501682870	TURBOSU	42300	1530	1300	196	46
29508160733	TURBOSU	52200	1500	1500	276	65
29951344682	STARTER	140900	1100	0945	542	32
29951505914	QUADPAN	245400	460	0463	120	25
29951505915	BOX ASS	285000	1050	0463	24	25
29951590002	ACTUATOR	127700	1000	0289	288	25
29959669367	GEARBOX	185100	4070	3500	55	65
41400425790	FAN, VAN	160000	900	1000	1	25
43201230691	PUMP, PN	168800	620	0289	0	25
43201682060	PUMP, PN	15600	150	0069	220	65
49207693376	PILEP A	195700	100400	128000	2	65
49209548853	TORQUE	696900	16000	6400	2	25
58210752425	CONTROL	56400	460	0231	218	55
66151812497	SERVOCY	2000000	13500	15800	5	65
66158298443	SERVOCY	1522200	13500	16000	20	25
66204982510	INDICAT	550000	600	1000	8	25

price was used to determine the overhaul cost of an item by applying the ratio to the unit price. The overhaul cost thus derived was then applied to the annual demand to develop the cost of meeting such demand from production by the depot overhaul facilities. The demand data were combined figures for all overseas areas.

DISTANCES AND COST OF SHIPPING/ST-NM

Because of reduced South Vietnam requirements, AVSCOM preferred to have the computations made for an average overseas distance which would be more typical of the overseas distances that materiel would be shipped. It was decided that the distances used in Refs 1 and 2 for other Pacific areas (excluding South Vietnam) would provide the best basis for this average overseas distance.

Distances, AVSCOM Depots to Korea

There was a slight modification made in the percent shipped from each depot in computing the average weighted distances from the AVSCOM depots to the surface and aerial ports of embarkation to those contained in Refs 1 and 2. The distances used are reflected in the following tabulation.

<u>Depot</u>	<u>Percent shipped</u>	<u>CONUS DISTANCES</u>		
		<u>NM to Oakland</u>	<u>NM to APOE</u>	<u>NM APOE to Travis AFB</u>
Atlanta	4.00	2182	734	1161
New Cumberland	23.98	2425	104	2133
Red River	33.10	1646	259	1161
Sharpe	22.17	63	56	0
ARAIMAC	16.75	1640	125	1250
Average weighted distance		1502.30	173.39	1151.60

OVERSEAS DISTANCES (NM)

Surface

Oakland - Inchon 5552
 Inchon - Depot 4

Air

Travis AFB - Kimpo 5146
 Kimpo - Depot 23

The above distances were used in both outbound and retrograde calculations.

Shipping Costs/ST-NM

The costs of shipping materiel for each segment of the movement links used in this study effort were the same as used in Ref 1 except for the MAC ALRs. These costs in ST-NMs are reflected in the following tabulation.

SURFACE MOVEMENT

<u>Segment</u>	<u>Cost/ST-NM</u>
Depot to POE	\$0.0810
POE to POD	\$0.0150
POD to Depot	\$0.0598

AIR MOVEMENT

Depot to APOE	\$0.1110
APOE to APOD	
MAC Channel	\$0.12146
MAC SAAM(C-141)	\$0.12337
MAC SAAM(C-5A)	\$0.07211
APOD to Depot	\$0.0598

The above costs were used in both outbound and retrograde calculations. There is one possible variation from the MAC ALRs on the return leg. That is the use of "opportune airlift" on a space available basis identified by MAC as the TP-9 ALR which is calculated at 12% of the MAC channel ALR. In this case it would be \$0.0146/ST-NM, which is less than the surface rate of \$0.0150/ST-NM used. While TP-9 shipments may not be the most prudent method of shipping high value aircraft components back to CONUS, it could be pursued for less expensive reparable items that do not qualify for airlift at the MAC channel ALR, since the unused MAC retrograde airlift capacity in past years has averaged 39%.

TIME AND PORT HANDLING COST DIFFERENTIALS

Time Differentials

The time differentials provided by AVSCOM reflect the basic differential between use of the faster air transport mode versus the

surface transport mode, and the resulting days of inventory required in the pipeline and on-hand in overseas stocks. The time factors provided are identical with those being used currently in the REAL program by AMC and documented in Ref 1, with the exception of the retrograde part of the formula. The values used in the outbound computations include an on-shelf inventory reduction in overseas stocks of 18 days and an order-ship time (OST) differential of 66 days. The retrograde time differential used includes movement of the cargo from the point of origin to the appropriate port (POE/APOE), POE and APOE holding times, time intransit from the POE/APOE to the POD/APOD, unload time at the POE/APOE, port holding times at the POE/APOE, and delivery times from the POE/APOE to the destination. This differential was specified as equaling a total of 84 days between the two shipping modes. The computation time period requested for both outbound and retrograde movements was two years, in order to relate the computations to the budget cycle.

Port Handling Costs

Port handling costs used are identical to those used in the REAL program and in Ref 1. These costs only apply to surface movements, both outbound and retrograde, and are as follows:

CONUS Port Handling Costs	\$25.10/ST
Overseas Port Handling Costs	\$ 8.13/ST

TARE WEIGHT AND PACKAGING COST DIFFERENTIALS

Tare weight and packaging cost differentials specified are identical to those used in Ref 1.

SUMMARY

The input values provided by AVSCOM for use in this problem are essentially the same as those used in the REAL program by AMC, with minor exceptions. Obviously, the output of the calculations is heavily influenced by the input values. As suggested in Ref 1, the input values should receive constant scrutiny to ensure the validity of the values being used.

Chapter 4

ANALYSIS OF COMPUTATIONS

INTRODUCTION

This chapter presents an analysis and review of the results of the FSN cost computations, the BEP computations and the COP computations using the formulas described in Chap. 2 and the input values described in Chap. 3. FSN cost computations were made for 257 of the 280 items studied, as 23 of the items had forecast of demands equalling zero. BEP and COP calculations were made for all of the 280 items.

FSN COST COMPUTATIONS

Individual Item Computation

As stated in Chap. 2, FSN cost calculations were made using three different MAC ALRs; the MAC channel rate, the MAC SAAM C-141 rate, and the MAC SAAM C-5A rate. An example of the output for one item is reflected in the following tabulation:

		MAC		
Item:	Turbine	Channel	C-141 SAAM	C-5A SAAM
FSN:	2840-176-3449 Pipe Inv Cost	\$25,554.22	\$25,554.22	\$25,554.22
Annual Demand:	20 Holding Cost	0.00	0.00	0.00
Price:	\$12,625.00 Surf. Transp. Cost	2,802.86	2,802.86	2,802.86
Weight:	186.00 lbs Diff. Pkg. Cost	1,135.34	1,135.34	1,135.34
Cube:	13.70 ft ³ Air Transp. Cost	-8,006.73	-8,129.34	-4,845.37
Maint. Ratio:	.22			
Total Cost Avoid		\$21,485.69	\$21,363.08	\$24,647.05
BEP-ALR		\$0.46	\$0.46	\$0.46
COP (years)		12.56	12.19	56.34

The individual item input values shown in the first column, together with the general input values documented in Chap. 3, formed the basis for this calculation. The \$25,554.22 reflected for "Pipe Inv Cost" represents the cost of filling both the outbound and retrograde surface pipelines and overseas stock levels for this item. No holding cost factors were used as shown by the zero dollars for this element. The cost of surface transportation of \$2,802.86 reflects a two-year cost both for outbound and retrograde surface shipments from points of origin to the POE, POE to the POD, and POD to destination. There is a packaging cost differential for this item over the two-year period of \$1,135.34, again for both outbound and retrograde shipments. There are three separate costs for air transportation for the two-year period—outbound and retrograde—of \$8,006.73 for MAC channel flights at \$0.12146/ST-NM, \$8,129.34 for MAC C-141 SAAM flights at \$0.12337/ST-NM and \$4,845.37 for MAC C-5A SAAM flights at \$0.07211/ST-NM. The line "Total Cost Avoid" reflects the net additional cost of filling a surface pipeline, outbound and retrograde, increased overseas stock levels, and supporting the annual demand to overseas areas over a two-year period, based on overhauling the requisite number of unserviceable items for this purpose rather than maintaining the existent air pipeline. It will be noted that the BEP-ALR for all three flight categories is \$0.46/ST-NM, considerably above the MAC ALRs for all three. The COPs for the three flight categories are over 12 years for the MAC channel and C-141 SAAM flights and over 56 years for the C-5A SAAM flights. It should be noted that the MAC channel rate of \$0.12146 is the current average for all such flights; however, the costs associated with the two SAAM flights are based on full utilization of those aircraft both outbound and retrograde. If not fully utilized, the cost/ST-NM will increase for the SAAM flights.

The above calculations did not include the 10 percent discount factor being used by AMC in its selection of candidate items for the REAL program, as was seen in the formulas developed for this program in Chap. 2. A calculation was made using the discount, which only applies to the surface transportation cost, the packaging cost differential, and the air transportation cost. The effect of using

the discount technique was to increase the total cost avoidance from \$21,485.69 to \$22,258.71 for MAC channel flights to \$22,159.40 for MAC C-141 SAAM flights, and to \$24,819.71 for MAC C-5A SAAM flights. The BEPs increased from \$0.46/ST-NM to \$0.55/ST-NM for all three MAC flight categories. The COPs increased to 15.51, 15.05 and 69.55 years for the three flight categories respectively.

For this item it appears to be more economical to continue to overhaul only those unserviceable items required to maintain the air pipeline.

Summary of FSN Cost Computations

Using the MAC channel ALR of \$0.12146 (See Table 2), of the 257 individual items that AVSCOM had forecasted an overseas demand, 227 items reflected a cost to the Army of \$54,718,283.33 for the increased requirements for the surface pipeline and the requisite increase in stock level requirements overseas. The cost of air transportation for the two-year period exceeded the cost of surface transportation plus the packaging cost differential by \$18,433,977.27, resulting in a net increase in cost for a surface pipeline for these items of \$36,284,306.06. If the 10% discount technique had been used, the cost of expanded requirements for the surface pipeline and overseas stock levels increases to \$55,002,358.20, and the difference in transportation costs would be reduced to \$15,191,926.45, with the net cost of changing to a surface pipeline increasing to \$39,810,431.75. The number of items involved would increase from 227 to 236. The increase in the pipeline/inventory requirement in shifting from the surface to the air transport mode is due to the additional 9 items that become air eligible using the discount technique. The decrease in the transportation cost differential is due to the fact that the air costs being higher, a percentage reduction by use of the discount technique reduces the absolute air costs by a greater value than it does the surface costs. As an example, the FOE-POD surface transportation costs are reduced by \$0.002/ST-NM, and the ALR at the MAC channel rate is reduced by \$0.024/ST-NM. It also has the effect of reducing the distances traveled and the weight carried which favors the air mode over surface. As stated in Ref 1, RAC does not recommend the use of the discount technique.

Table 2
SUMMARY OF FSN COST COMPUTATIONS
(Air Eligible Items)

Normal Formula	MAC Flights		
	Channel	C-141 SAAM	C-5A SAAM
Number of Items	227	225	251
Total Tonnage (2 years)	11,859	11,776	16,930
Pipeline Inventory Cost	\$54,718,283.33	\$54,578,010.64	\$60,173,209.30
Transportation Cost Diff.	<u>-18,433,977.27</u>	<u>-18,863,522.18</u>	<u>-5,267,617.91</u>
Net Cost Avoidance	\$36,284,306.06	\$35,714,488.46	\$54,905,591.39
Discount Technique (10%/year)			
Number of Items	236	235	252
Total Tonnage (2 years)	12,071	11,977	16,932
Pipeline Inventory Cost	\$55,002,358.20	\$54,887,855.36	\$60,175,911.47
Transportation Cost Diff.	<u>-15,191,926.45</u>	<u>-15,546,662.68</u>	<u>-4,269,131.80</u>
Net Cost Avoidance	\$39,810,431.75	\$39,341,192.68	\$55,906,779.67

(Surface Eligible Items)

Normal Formula			
Number of Items	30	32	6
Total Tonnage (2 years)	5,278	5,356	176
Pipeline Inventory Cost	\$5,601,726.34	\$5,741,999.03	\$146,800.37
Transportation Cost Diff.	<u>-9,588,397.97</u>	<u>-10,004,486.85</u>	<u>-949,802.24</u>
Net Cost Avoidance	\$-3,986,671.63	\$-4,262,487.82	\$-803,001.87
Discount Technique (10%/year)			
Number of Items	21	22	5
Total Tonnage (2 years)	5,060	5,158	174
Pipeline Inventory Cost	\$5,317,651.47	\$5,432,154.31	\$144,098.20
Transportation Cost Diff.	<u>-7,506,197.50</u>	<u>-7,836,424.63</u>	<u>-766,978.52</u>
Net Cost Avoidance	\$-2,188,546.03	\$-2,404,270.32	\$-622,880.32

In summary, it appears that 227 items, using the MAC channel flights, can be shipped by the air transport mode at a savings of approximately \$36 million, while 30 items can be transferred to the surface transport mode at a savings over air of approximately \$4 million. Under the discount technique the respective figures are 236 items for air at a savings of approximately \$40 million, with 21 appearing to be surface eligible at a savings of approximately \$2 million. Including all 257 under the air mode would result in net savings of approximately \$32 million under the normal formula and \$38 million under the discount technique. Sending all 257 items by air has the advantage of having only one transportation mode used in support of the supply system for T-coded reparable. Similar analyses can be made for the other two MAC flight categories.

BREAK-EVEN POINT (BEP) COMPUTATIONS

The BEP formula, described in Chap. 2, was used to make BEP-AIR computations for all 280 items on the AVSCOM list. The results of these computations are reflected in Fig. 1. Using the normal formula described in Chap. 2, 89 percent of the items had a BEP of \$0.12146/ST-NM (the current MAC channel rate) or greater, 83 percent had a BEP of \$0.14 or greater, 64 percent had a BEP of \$0.20 or greater, 28 percent had a BEP of \$0.50 or greater, and 13 percent had a BEP of \$1.00 or over. Comparable figures using the discount technique increased these percentages to 92, 89, 72, 32, and 16, respectively. Again one can see that reducing the differential between the air and surface transportation costs results in a higher degree of air eligibility for the items studied. Under the normal formula, only 11 percent of the 280 items are surface eligible, using the current MAC channel rate as the criterion. Using the discount technique, the surface eligible items are reduced to 8 percent of the 280 items. From these calculations, the 280 items on the AVSCOM list exhibited a very high degree of air eligibility for a two-year calculation.

CROSS-OVER POINT (COP) COMPUTATIONS

The COP formula, described in Chap. 2, was used to compute the COP in years for all 280 items on the AVSCOM list. The results of

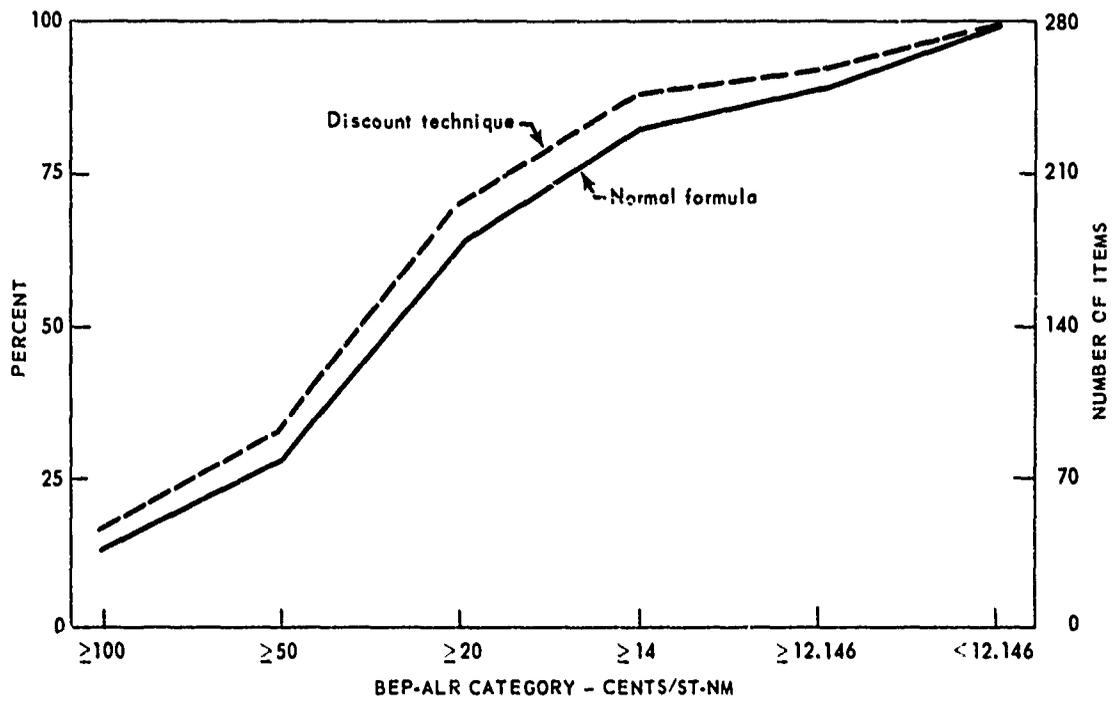


Fig. 1—Summary of BEP Calculations.

Table 3

SUMMARY OF COP COMPUTATIONS

<u>Normal Formula</u>	MAC					
	<u>Channel</u>		<u>C-141 SAAM</u>		<u>C-5A SAAM</u>	
	<u>No.</u> <u>items</u>	<u>%</u>	<u>No.</u> <u>items</u>	<u>%</u>	<u>No.</u> <u>items</u>	<u>%</u>
<u>Years</u>						
< 2	31	11	33	12	6	2
2 - 2.9	25	9	25	9	3	1
3 - 3.9	30	11	31	11	3	1
4 - 4.9	25	9	25	9	3	1
5 - 5.9	9	3	8	3	1	0.4
≥ 6	<u>160</u>	<u>57</u>	<u>158</u>	<u>56</u>	<u>264</u>	<u>94</u>
Total	280	100	280	100	280	100
 <u>Discount Technique</u>						
< 2	22	8	23	8	5	2
2 - 2.9	27	10	27	10	3	1
3 - 3.9	14	5	17	6	2	1
4 - 4.9	23	8	22	8	2	1
5 - 5.9	22	8	22	8	3	1
≥ 6	<u>172</u>	<u>61</u>	<u>169</u>	<u>60</u>	<u>265</u>	<u>94</u>
Total	280	100	280	100	280	100

these computations are shown in Table 3. Table 3 shows that 57 percent of the 280 items had a COP of six years or greater when using the normal formula for the MAC channel flights, 56 percent for the C-141 SAAM flights and 94 percent for the C-5A SAAM flights. Under the discount technique, the figures were 61%, 60% and 94%, respectively. COPs of two years or greater are reflected for 89% of the items for MAC channel flights using the normal formula, 88% for the C-141 SAAM flights, and 98% for the C-5A SAAM flights. Comparable figures using the discount technique were 92%, 92% and 98%, respectively. Under either method of calculation, the 280 item list reflected COPs well in excess of the two-year criteria used by AVSCOM. This held true despite the fact that no holding cost differentials were considered in the formulas. The average COP under the normal formula for the MAC channel flight is 15 years.

As mentioned previously, the basic time value used in these computations for AVSCOM was two years. As demonstrated in the summary statistics, a two-year criterion generates a large percentage of air eligible items. From the COP computations it can be seen that a substantial part, although not a majority, of the 280 items have COPs between 2.0 and 5.9 years (32%). AMC, in selecting Army items for the REAL program, has been using a six-year COP as one of the criteria. The six-year COP as an average for all Army items appears to be reasonable when considering the probable age distribution of all items in the Army supply system as a function of an average total life of 15 years prior to replacement by a new item. For AVSCOM items, the six years may be a little high as the product life of aircraft components and parts tends to be less than the 15-year average for all Army materiel. In using the computational results which have been furnished, AVSCOM may find it appropriate to examine the COP of each item separately in relation to its forecast life remaining in the supply system. For example, one item may be due for replacement within 12 months, another within three years, and another within eight years. If this knowledge is available, then selection of items to be supported by an air pipeline can be made directly from the COP computations rather than using an average two-year criterion as reflected in the

FSN cost calculations. Adjustments to the total cost avoidances can be made by establishing the ratio of the remaining life of the item to the two years used; multiplying the "Difference Xport-Pack Cost" in the print-out by this ratio; and subtracting the result from the "Pipeline Inventory Cost." A sample of the print-out is contained in Chap. 5. A negative result would indicate surface transportation, and a positive result would indicate a savings by use of air transportation. An aggregation of the positive results will give an estimate of the total cost avoidances to be achieved by use of air, and an aggregation of the negative results an estimate of the total cost avoidances by use of the surface mode.

CONCLUSIONS

The results of the various computations made show rather conclusively that it is more economical to maintain an air pipeline for an overwhelming majority of the 280 items, rather than to overhaul a sufficient number of unserviceable items to fill a surface pipeline using the two-year criterion. The FSN cost calculations reflect that including all of the items in an air pipeline, even those that were indicated as being more economical to overhaul the requisite number of unserviceable items to fill the surface pipeline, would still result in a substantial net cost savings and not require separate transportation systems for items coded for CONUS depot overhaul. In addition, the computation results point up the need to consider items, when the annual demand is being supported by production of CONUS depot overhaul facilities, for the REAL program even though the items may not be in a procurement status. The distribution of items in the COP calculations suggests that caution may be necessary in the use of the two-year FSN cost computations. It may be advisable to modify these calculations by the expected remaining life of the individual items in relation to the individual item COP.

Chapter 5

THE COMPUTER PROGRAM

GENERAL

The computer program used to make the cost calculations based on the formula described in Chap. 2 is called AVSCOST. The computations made by this program are similar to some extent to those made by the FSNCOST program for the REAL program as explained in detail in reference 1. The input value elements too are very similar with the exception of the holding costs, which have been excluded.

In this program, the cost avoidance, break-even point, and cross-over point calculations have been combined. The break-even and cross-over points are printed out at the same time as the individual element costs and the total cost avoidances for each item.

The output formats for AVSCOST are radically different from those for the FSNCOST formats reflected in Ref 1, even though most of the information is very much alike for both programs.

THE PROGRAM

Figure 2 is a listing of the AVSCOST program; Fig. 3 is a flowchart of it; and Fig. 4 depicts the make-up of the program deck. AVSCOST uses only one subroutine (PCOST) and one set of BLOCK DATA. Figure 5 is a listing of PCOST, and Fig. 6 is a listing of BLOCK DATA. Figure 7 shows the packaging cost table output by PCOST.

INPUTS

Table 4 lists the inputs to be used with this program. The cards listed there must be followed by a card containing a "9" in each column. This designates the end-of-file and switches the program to the summary section.

Figure 8 shows the input cards required for this program.
No other inputs are required.

OUTPUTS

The outputs from this program consist of: (a) a printout of the input values; (b) a printout of distances used in the computations; (c) a printout of the comparative costs, cost avoidance, break-even point, and cross-over point for each item considered; and (d) summaries of the number of items examined, the number of items eligible by air and by surface for each rate used, the items stratified by BEP, and the items stratified by COP.

Figures 9 through 12 are examples of these outputs.

```

PROGRAM AVSCOST (INPUT,OUTPUT)
COMMON /COSTS/ COST(4,16),KGROUP(90)
COMMON /TITLE/ TITLE(8),KNICP,LINE1,LINE5,LINE6,IOATE
REAL K1,K2,K3,K4,K5
REAL N
5 FORMAT(A10)
11 FORMAT(3F10.2)
11 FORMAT(5F10.4)
12 FORMAT(4F10.2)
13 FORMAT(2F10.4)
14 FORMAT(3F10.5)
15 FORMAT(2F10.2)
16 FORMAT(F10.2)
101 FORMAT(1H1,2(//////////))
1.1 FORMAT(1H,31X,1H*,7X,1H*,11X,1H*,2X,6H***** ,4X,
* 6(1H*),4X,6(1H*),3X,1H*, 7X,1H*)
1.2 FORMAT(1H,7X,3H* *,7X,1H*,9X,1H*,2X,1H*,6X,1H*,2X,1H*,6X,
* 1H*,2X,1H*,6X,1H*,2X,2H** ,5X,2H**)
1.3 FORMAT(1H,29X,1H*,3X,1H*,7X,1H*,7X,1H*,3X,1H*,9X,1H*,9X,
* 1H*,6X,1H*,2X,3H* *,3X,3H* *)
1.4 FORMAT(1H,28X,1H*,5X,1H*,7X,1H*,5X,1H*,5X,6(1H*),3X,1H*,9X,1H*,
* 6X,1H*,2X,1H*,2X,1H*,1X,1H*,2X,1H*)
1.5 FORMAT(1H,27X,9(1H*),7X,1H*,3X,1H*,12X,4H* *,9X,1H*,6X,4H* *,
* 2(3X,1H*))
1.6 FORMAT(1H,26X,1H*,9X,1H*,7X,3H* *,2(6X,1H*),2X,1H*,2(6X,4H* *),
* 7X,1H*)
1.7 FORMAT(1H,25X,1H*,11X,1H*,7X,1H*,8X,2(6H***** ,4X),
* 6(1H*),3X,1H*,7X,1H*)
11. FORMAT(1H1,13X,*INPUTS*,22X,*ELEMENTS OF FORMULA*,17X,*DOLLARS*,
* 11X,*COMPUTATION RESULTS*)
111 FORMAT(1H,3X,4HITEM,10X, A10,15X,*RATIO USED*,10X,F10.2,
* 21X,*DATE*,5X,A10)
112 FORMAT(1H0,3X,3HESH,17X,I10,A1,5X,23HPIPELINE INVENTORY COST,8X,
* F13.2)
113 FORMAT(1H,3X,13HANNUAL DEMAND,7X,I11,5X,21HPIPE-INV HOLDING COST,
* 11X,F13.2,5X,16HBREAK-EVEN POINT,9X,F10.2,6X,*ALR*)
114 FORMAT(1H,3X,10HUNIT PRICE,10X,F11.2,5X,27HSURFACE TRANSPORTATION
* COST,4X,F13.2)
115 FORMAT(1H,3X,11HUNIT WEIGHT,9X,F11.2,5X,25HDIFFERENCE PACKAGING C
*OST,6X,F13.2,5X,16HCROSS-OVER POINT,9X,F10.2,4X,*YEARS*)
116 FORMAT(1H,3X,9HUNIT CUBE,11X,F11.3,5X,18HAIR TRANSPORT COST,13X,
* F13.2)
117 FORMAT(1H,3X,13HCUBE-OUT ITEM,8X,A10,5X,
* 26HDIFFERENCE XPORT-PACK COST,5X,F13.2,5X,26HTOTAL COST AVOIDANCE
*,F15.2,2X,*DOLLARS*)
118 FORMAT(1H,39X,13HCUBE-OUT ITEM,19X,A10)
119 FORMAT(1H1)
121 FORMAT(1H0,42X,*DISTANCES FROM AVSCOM DEPOTS FOR PACIFIC THEATER*)
121 FORMAT(1H0,///)
122 FORMAT(1H0,40X,*PER CENT*,12X,*NAUTICAL MILES*,11X,
* *NAUTICAL MILES*,11X,*NAUTICAL MILES*)
123 FORMAT(1H,40X,*SHIPPED*,15X,*TO OAKLAND*,16X,*TC AFOE*,14X,
* *AFOE TO TRAVIS*)
124 FORMAT(1H0,11X,*ATLANTA*,23X,*04.63*,19X,*2182*,21X,*734*,
* 21X,*1161*)
125 FORMAT(1H0,11X,*NEW CUMBERLAND*,16X,*23.98*,19X,*2425*,21X,*104*,
* 21X,*2133*)

```

Fig. 2—Listings of AVSCOST Program

```

126 FORMAT(1H0,11X,*RED RIVER*,21X,*33.10*,19X,*1646*,21X,*259*,
* 20X,*1161*)
127 FORMAT(1H0,11X,*SHARPE*,24X,*22.17*,21X,*63*,22X,*56*,23X,*J*)
128 FORMAT(1H0,11X,*ARADMAC*,23X,*16.75*,19X,*1646*,21X,*125*,
* 20X,*1250*,///)
129 FORMAT(1H0,11X,*AVERAGE*)
130 FORMAT(1H ,11X,*WEIGHTED*)
131 FORMAT(1H ,11X,*DISTANCES*,43X,*1502.30*,18X,*173.39*,17X,
* *1151.60*,///)
132 FORMAT(1H0,30X,*NAUTICAL MILES*)
133 FORMAT(1H0,18X,*OAKLAND TO INCHON*,9X,*5552*)
134 FORMAT(1H0,18X,*INCHON TO DEPOT*,14X,*4*)
135 FORMAT(1H0,18X,*TRAVIS TO KIMPO*,11X,*5146*)
136 FORMAT(1H0,18X,*KIMPO TO DEPOT*,14X,*23*)
137 FORMAT(1H0,1X,*MAC CHANNEL*,5X,*12.146 ALR*)
138 FORMAT(1H0,1X,*MAC SAAM C-141*,3X,*12.337 ALR*)
139 FORMAT(1H0,1X,*MAC SAAM C-5A*,5X,*7.211 ALR*)
140 FORMAT(1H0,A1,A9,2F10.2,F10.3,I10,F5.2)
148 FORMAT(1H0)
149 FORMAT(1H0,9(///))
150 FORMAT(1H1,*RECORDS READ*,15X,I10)
155 FORMAT(1H ,*RECORDS WITH NO DEMANDS*,I10)
160 FORMAT(1H0,*THIS ITEM HAD NO DEMANDS*)
161 FORMAT(1H0,14X,*BREAK-EVEN POINT*,F13.2)
162 FORMAT(1H0,17X,3(* CROSS-OVER POINT*,F13.2,10X))
171 FORMAT(1H ,3X,11HUNIT WEIGHT,9X,F11.2,5X,25HDIFFERENCE PACKAGING C
*OST,6X,F13.2,5X,16HCROSS-OVER POINT,9X,A10,4X,*YEARS*)
180 FORMAT(1H0,20X,*SUMMARIES*///)
181 FORMAT(1H0,28X,*NUMBER OF ITEMS AIR ELIGIBLE*,12X,I10)
182 FORMAT(1H0,22X,*TOTAL WEIGHT OF AIR ELIGIBLE ITEMS*,12X,F10.2)
183 FORMAT(1H0,14X,*TOTAL COST AVOIDANCE OF AIR ELIGIBLE ITEMS*,
* 6X,F16.2/)
184 FORMAT(1H0,24X,*NUMBER OF ITEMS SURFACE ELIGIBLE*,12X,I10)
185 FORMAT(1H0,18X,*TOTAL WEIGHT OF SURFACE ELIGIBLE ITEMS*,
* 12X,F11.2)
186 FORMAT(1H0,10X,*TOTAL COST AVOIDANCE OF SURFACE ELIGIBLE ITEMS*,
* 6X,F16.2/)
187 FORMAT(1H0,7X,*MAC CHANNEL COPS*)
188 FORMAT(1H0,7X,*MAC SAAM C-141 COPS*)
189 FORMAT(1H0,7X,*MAC SAAM C-5A COPS*)
190 FORMAT(1H0,10X,*COPS LESS THAN 1 YEAR*,17X,I10)
191 FORMAT(1H ,10X,*COPS 1 YEAR AND LESS THAN 2 YEARS*,5X,I10)
192 FORMAT(1H ,10X,*COPS 2 YEARS AND LESS THAN 3 YEARS*,4X,I10)
193 FORMAT(1H ,10X,*COPS 3 YEARS AND LESS THAN 4 YEARS*,4X,I10)
194 FORMAT(1H ,10X,*COPS 4 YEARS AND LESS THAN 5 YEARS*,4X,I10)
195 FORMAT(1H ,10X,*COPS 5 YEARS AND LESS THAN 6 YEARS*,4X,I10)
196 FORMAT(1H ,10X,*COPS 6 YEARS AND MORE*,17X,I10)
197 FORMAT(1H0,5X,*COP SUMMARY*)
200 FORMAT(1H1,12X,*INPUT VALUES USED IN COMPUTATIONS*///)
202 FORMAT(1H0,90X,A10)
205 FORMAT(1H0,6X,*SURFACE*,14X,*MILEAGE*,7X,*COST*,15X,*AIR*,19X,
* *MILEAGE*,7X,*COST*)
210 FORMAT(1H0,8X,*DEPOT TO POE*,4X,2F12.4,12X,*DEPCT TO AP*
* 7X,2F12.4)
215 FORMAT(1H ,8X,*POE TO POD*,6X,2F12.4,12X,*AP TO AFCE*,
* 8X,F12.4)
220 FORMAT(1H ,8X,*POD TO DEPOT*,4X,2F12.4,12X,*APOE TO APOC*,
* 6X,F12.4,3X)

```

Fig. 2—(Continued)

```

225 FORMAT(1H,6X,*APCD TO DEPOT*,5X,2F12.4//)
233 FORMAT(1HC,6X,*CONUS PORT HANDLING COST*,6X,F10.2)
235 FORMAT(1HC,6X,*OVERSEA PORT HANDLING COST*,4X,F10.2)
242 FORMAT(1HC,6X,*B1*,F8.2,2X,*B2*,F8.2,2X,*B3*,F8.2,2X,*B4*,F8.2)
245 FORMAT(1HC,6X,*ON SHELF INVENTORY REDUCTION*,F15.2)
255 FORMAT(1HC,6X,*FIRST FACTOR*,F8.2,6X,*SECCND FACTOR*,F8.2)
267 FORMAT(1HC,6X,*SURFACE SHIP TIME*,F9.2,16X,*AIR SHIP TIME*,F9.2)
264 FORMAT(1HC,6X,*RETROGRADE SURFACE SHIP TIME*,F9.2,5X,
* *RETROGRADE AIR SHIP TIME*,F9.2)
265 FORMAT(1HC,6X,*NUMEER OF YEARS*,I10)
273 FORMAT(1HC,6X,*K1 VALUE USED*,F10.3)
280 FORMAT(1H1,/,*, RECORDS WITH BEPS LESS THAN $0.10*,I10)
281 FORMAT(1HC,*RECORDS WITH BEPS LESS THAN $0.13*,I10)
282 FORMAT(1HC,*RECORDS WITH BEPS LESS THAN $1.14*,I10)
283 FORMAT(1HC,*RECORDS WITH BEPS LFSS THAN $0.20*,I10)
284 FORMAT(1HC,*RECORDS WITH BEPS LESS THAN $1.00*,I10)
285 FORMAT(1HC,*RECORDS WITH BEPS MORE THAN $1.00*,I10)
912 FORMAT(1HC,3X,3HESN,17X,I10,A1)
DIMENSION COP(3)
DIMENSION U(3),RNC(3),CTA(3),CX(3),DTNV(3),CTOT(3)
DIMENSION CA2(3)
DIMENSION AVCID(3),SAVOID(3),TAWGT(3),TSWGT(3)
INTEGER C1(3),C2(3),C3(3),C4(3),C5(3),C6(3),C7(3)
INTEGER ACT(3),SCT(3)
DIMENSION KSW(3)
NRCT = 0
300 IF(NRCT,GE,1) GO TO 2050
ICT = 1
I1 = 0
I2 = 0
I3 = 0
I4 = 0
I5 = 0
I6 = 0
KCT = 0
IESG = 0
LCT = 0
COPCUT = -1.00
DO 1 I = 1,3
SAVOID(I) = 0.0
TSWGT(I) = 0.0
SCT(I) = 0
AVOID(I) = 0.0
TAWGT(I) = 0.0
ACT(I) = 0
C1(I) = 0
C2(I) = 0
C3(I) = 0
C4(I) = 0
C5(I) = 0
C6(I) = 0
C7(I) = 0
1 CONTINUE
DO 999 I = 1,2
PRINT 100
PRINT 101
PRINT 102
PRINT 103

```

Fig. 2—(Continued)

```

PRINT 104
PRINT 105
PRINT 106
PRINT 107
999 CONTINUE
READ 5, IDATE
READ 10, SM1, SM2, SM3
READ 11, CS1, CS2, CS3, CS4, CS5
READ 12, AM1, AM2, AM3, AM4
READ 13, CA1, CA3
READ 12, B1, B2, B3, B4
READ 15, TS, TA
READ 15, TSRET, TARET
READ 16, CSIR
READ 15, K1, N
READ 15, F1, F2
READ 14, CA2(1), CA2(2), CA2(3)
T = (TS-TA)/365.2
RETRO = (TSRET - TARET)/365.2
CALL PCOST
PRINT 200
PRINT 202, IDATE
PRINT 205
PRINT 210, SM1, CS1, AM1, CA1
PRINT 215, SM2, CS2, AM2
PRINT 220, SM3, CS3, AM3
PRINT 225, AM4, CA3
PRINT 230, CS4
PRINT 235, CS5
PRINT 240, B1, B2, B3, B4
PRINT 245, CSIR
PRINT 255, F1, F2
PRINT 260, TS, TA
PRINT 261, TSRET, TARET
M = N
PRINT 265, M
PRINT 270, K1
PRINT 119
PRINT 120
PRINT 121
PRINT 122
PRINT 123
PRINT 124
PRINT 125
PRINT 126
PRINT 127
PRINT 128
PRINT 129
PRINT 130
PRINT 131
PRINT 132
PRINT 133
PRINT 134
PRINT 135
PRINT 136
IYES = 10H      YES
IHO = 10H      NO
IFSG = 0

```

Fig. 2—(Continued)

```

LCT = 7
1.00 READ 140, IFSN, JFSN, NAM1, TPR, UWT, UCU, IDEM, RATIO
UPR = TPR * RATIO
DO 1005 J = 1,3
KSW(J) = 0
1005 CONTINUE
IF(IFSUN.EC.9999999999) GO TO 2000
ICT = ICT + 1
IF(IDEM.NE.0) GO TO 1010
IDCT = 100
IDEM = 1
1.1. IFSG = IFSN/100000000
PRICE = UPR * IDEM
WGT = UWT * IDEM
EPRICE = PRICE
EWGT = WGT/2000.0
IFSG = IFSG - 9
INDEX = KGROUP(IFSG)
K2 = COST(1,INDEX)
K3 = COST(2,INDEX)
DCOST = (COST(3,INDEX) - COST(4,INDEX)) * 20.0
AWGT = EWGT
SWGT = EWGT
CUWT = UCU * 12.5
K5 = K3 * UWT
IF(CUWT.LE.K5) GO TO 1020
CUWT = CUWT/2000.0
AWGT = CUWT * IDEM * F2
ICUBE = IYES
GO TO 1030
1.20 AWGT = AWGT * F2 * K3
ICUBE = INO
1030 SWGT = SWGT * F2 * K2
DCOST = DCOST * EWGT * B2 * N * F2
DCOST = DCOST * 2.0
R = (1 + (OSIR/365.2))
CINV = (EPRICE * R) + (EPRICE * RETRO)
CHINV = 0
V = (CS1*SM1) + (CS2 * SM2) + (CS3 * SM3) + CS4 + CS5
CTS = (V * SWGT) * B2 * N
CTS = CTS * 2.0
DO 1050 JL = 1,3
U(JL) = (CA1*AM1)+(CA2(JL)*AM2)+(CA2(JL)*AM3)+(CA3*AM4)
CTA(JL) = (U(JL) * AWGT) * B4 * N
CTA(JL) = CTA(JL) * 2.0
CX(JL) = CTS + DCOST - CTA(JL)
CTOT(JL) = CINV + CHINV + CX(JL)
DINV(JL) = CX(JL) + CHINV
IF(DINV(JL).GE.0.0) GO TO 1040
COP(JL) = (CTNV/DINV(JL)) * N
COP(JL) = COP(JL) * COPOUT
GO TO 1050
1040 COP(JL) = 1CHINFINITY
C1(JL) = C1(JL) - 1
C7(JL) = C7(JL) + 1
KSW(JL) = 1
1050 CONTINUE
AA = N * B4 * AWGT

```

Fig. 2--(Continued)

```

BB1 = AA * AM1 * CA1
BB1 = BB1 * 2.0
BB2 = AA * AM4 * CA3
BB2 = BB2 * 2.0
CC = CINV + CHINV + CTS + DCOST
DD = CC - BB1 - BB2
EE = AA * (AM2 + AM3)
EE = EE * 2.0
BEP = DD/EE
IF(LCT.LT.6) GO TO 1360
PRINT 10
PRINT 110
LCT = 0
1060 PRINT 111, NAM1,RATTC,TDATF
IF(IDCT.EQ.100) GO TO 1200
DC 11.0 JM = 1,3
GO TO (1080,1085,1090) JM
1080 PRINT 137
GO TO 1095
1085 PRINT 138
GO TO 1095
1090 PRINT 139
GO TO 1095
1095 PRINT 112, IFSN,JFSN,CINV
PRINT 113, IDEM,CHINV,REP
PRINT 114, TFR,CTS
IF(KSW(JM).NE.1) GO TO 1098
PRINT 171, UMT,DCOST,COP(JM)
KSW(JM) = 1
GO TO 1099
1098 PRINT 115, UMT,DCOST,COP(JM)
1099 PRINT 116, UCU,CTA(JM)
PRINT 117, ICUBE,CX(JM),CTOT(JM)
1100 CONTINUE
LCT = LCT + 3
PRINT 148
GO TO 1220
1200 PRINT 160
PRINT 912, IFSN,JFSN
PRINT 161, REP
PRINT 162, CCP
PRINT 149
KCT = KCT + 1
IDCT = 0
LCT = LCT + 3
GO TO 1060
1220 DO 1300 I = 1,3
IF(CTOT(I).GE.0.0) GO TO 1230
SAVOID(I) = SAVOID(I) + CTOT(I)
TSWGT(I) = TSWGT(I) + SWGT
SCT(I) = SCT(I) + 1
GO TO 1300
1230 AVOID(I) = AVOID(I) + CTOT(I)
TAWGT(I) = TAWGT(I) + SWGT
ACT(I) = ACT(I) + 1
1300 CONTINUE
IF(REP.LT.0.10) I1 = I1 + 1
IF(REP.LT.0.13) I2 = I2 + 1

```

Fig. 2—(Continued)

```

IF(BEP.LT.0.14) I3 = I3 + 1
IF(BEP.LT.0.2) I4 = I4 + 1
IF(BEP.LT.1.00) I5 = I5 + 1
IF(BEP.GT.1.0) I6 = I6 + 1
DC 14(J) JK = 1,3
IF(COP(JK).LT.1.0)GO TO 1310
IF(COP(JK).LT.2.0)GO TO 1320
IF(COP(JK).LT.3.0)GO TO 1330
IF(COP(JK).LT.4.0) GO TO 1340
IF(COP(JK).LT.5.0)GO TO 1350
IF(COP(JK).LT.6.0)GO TO 1360
IF(COP(JK).GE.6.0)GO TO 1370
1310 C1(JK) = C1(JK) + 1
GO TO 1400
1320 C2(JK) = C2(JK) + 1
GO TO 1400
1330 C3(JK) = C3(JK) + 1
GO TO 1400
1340 C4(JK) = C4(JK) + 1
GO TO 1400
1350 C5(JK) = C5(JK) + 1
GO TO 1400
1360 C6(JK) = C6(JK) + 1
GO TO 1400
1370 C7(JK) = C7(JK) + 1
1400 CONTINUE
GO TO 1000
2.14 PRINT 150, ICT
PRINT 155, KCT
PRINT 180
PRINT 137
PRINT 181,ACT(1)
PRINT 182, TAWGT(1)
PRINT 183, AVOID(1)
PRINT 184, SCT(1)
PRINT 185, TSWG(1)
PRINT 186, SAVOID(1)
PRINT 138
PRINT 181,ACT(2)
PRINT 182, TAWGT(2)
PRINT 183, AVOID(2)
PRINT 184, SCT(2)
PRINT 185, TSWG(2)
PRINT 186, SAVOID(2)
PRINT 139
PRINT 181,ACT(3)
PRINT 182, TAWGT(3)
PRINT 183, AVOID(3)
PRINT 184, SCT(3)
PRINT 185, TSWG(3)
PRINT 186, SAVOID(3)
PRINT 280, I1
PRINT 281, I2
PRINT 282, I3
PRINT 283, I4
PRINT 284, I5
PRINT 285, I6
PRINT 121

```

Fig. 2—(Continued)

```
PRINT 197
PRINT 187
PRINT 190, C1(1)
PRINT 191, C2(1)
PRINT 192, C3(1)
PRINT 193, C4(1)
PRINT 194, C5(1)
PRINT 195, C6(1)
PRINT 196, C7(1)
PRINT 188
PRINT 190, C1(2)
PRINT 191, C2(2)
PRINT 192, C3(2)
PRINT 193, C4(2)
PRINT 194, C5(2)
PRINT 195, C6(2)
PRINT 196, C7(2)
PRINT 189
PRINT 190, C1(3)
PRINT 191, C2(3)
PRINT 192, C3(3)
PRINT 193, C4(3)
PRINT 194, C5(3)
PRINT 195, C6(3)
PRINT 196, C7(3)
NRCT = NRCT + 1
GO TO 3000
2.50 STOP
END
```

Fig. 2--(Continued)



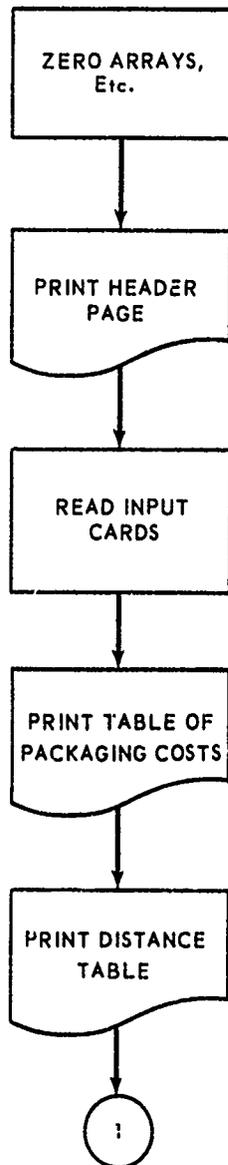


Fig. 3—Flow Chart - AVSCOST Program

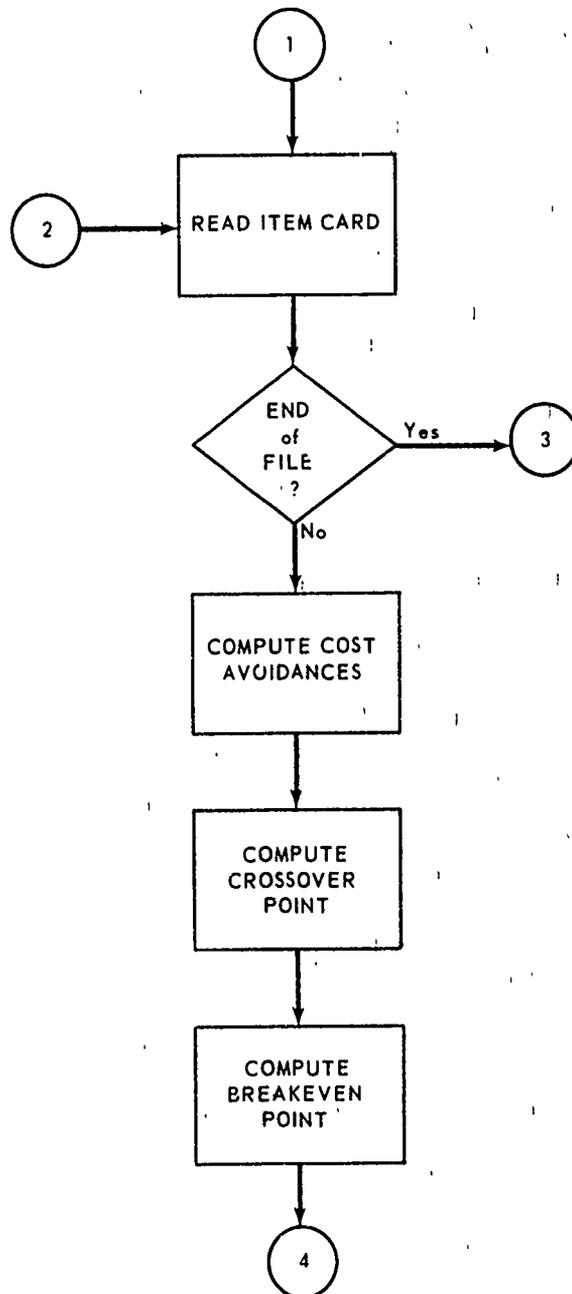


Fig. 3 (Continued)

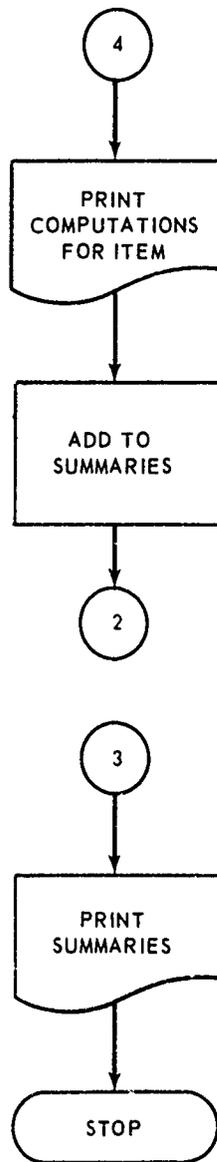


Fig. 3 (Continued)

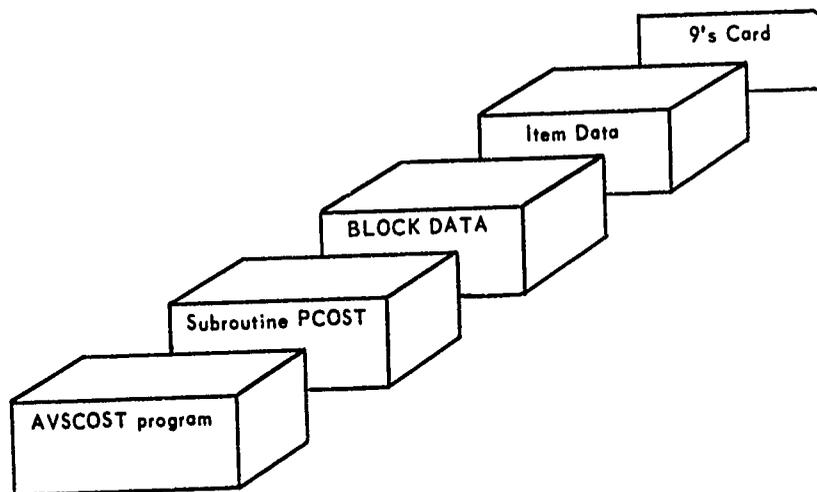


Fig. 4—Arrangement of Program Deck

```

SUBROUTINE PCOST
C
C           THIS SUBROUTINE IS USED TO PRINT OUT THE REFERENCE DATA
C           ON THE PACKAGING COSTS.
COMMON /TITLE/ TITLE(8), KNICE,LINE1,LINE5,LINE6,IDATE
COMMON /COSTS/ COST(4,16),KGROUP(90)
DIMENSION IREF(12)
C
C           DATA (IREF(I),I=1,12) / 3REFERENCE FOR PACKAGING COSTS,
1 60H USAMC -- RAC MEETING APRIL 14, 1970
2 30H /
C
C           PRINT 3000, IDATE
C           PRINT 3010, IREF
C           PRINT 3020
C           PRINT 3021
C           PRINT 3022
C
C           PRINT THE PACKAGING COSTS TABLE.
C
DO 40 J = 1,45
K = J + 9
L = J + 54
IFSG1 = KGROUP(J)
IFSG2 = KGROUP(J+45)
PRINT 3031, K, 1
C
IF (IFSG1.EQ.C) GO TO 20
PPRINT 3032, (COST(I,IFSG1),I=1,4)
C
20 IF (IFSG2.EQ.C) GO TO 40
PRINT 3033, (COST(I,IFSG2),I=1,4)
C
40 CONTINUE
C
C           PRINT 3040
C           PRINT 3041
C           PRINT 3042
C           RETURN
C
1001 FORMAT (1H0)
3000 FORMAT (1H1,7X,A10,4)X,16HPACKAGING COSTS)
3010 FORMAT (1H0,12A10/)
3020 FORMAT (1X,2(7HFEDERAL,11X,11HTARE WEIGHT,12X,
* 17H$ COST OF PACKING,9X))
3021 FORMAT (1X,2(6HSUPPLY,8X,2)H(PACKAGING) FACTORS*,10X,
* 16HPER 100 LBS ***,7X))
3022 FORMAT (1X,2(5HGROUP,10X,7HSURFACE,7X,3HAIR,9X,
* 7HSURFACE,7X,3HAIR,9X))
3031 FORMAT (1H ,15,62X,15)
3032 FORMAT (1H+, 6X, 2(10X,F6.2,4X,F6.2))
3033 FORMAT (1H+,73X, 2(10X,F6.2,4X,F6.2))
3040 FORMAT (1H0,1H*,*FACTOR IS BASED ON NET WEIGHT OF ITEM. THUS AN*,
1 * ITEM OF GROUP 59 WEIGHING 100 POUNDS BARE * /
2 * WOULD WEIGH 100 X 1.78 = 178 POUNDS PACKED FOR SURFACE OR*,
4 * 100 X 1.33 = 133 POUNDS PACKED FOR AIR.*)
3041 FORMAT (1H ,3H***,*COST OF PACKAGING IS DETERMINED BY APPLYING*,
1 * THE COST OF PACKING TO THE SHELF WEIGHT OF THE ITEM.*)

```

Fig. 5--Listing of PCOST Program

3042 FORMAT (1H ,*EXCEPTIONS: 5821 AND 5841 ARE IN MATERIAL GROUP 4.*,
1 * SAME AS FEDERAL SUPPLY CLASS 12.*)

C

END

Fig. 5—(Continued)

```

BLOCK DATA
C
C      THIS BLOCK DATA SUBPROGRAM STORES THE DATA OF THE
C      TAPE WEIGHT FACTORS AND THE COST OF PACKAGE.
C      THE DATA IS STORED BY MATERIAL GROUPS.
C
COMMON /CCSTS/ COST(4,16), KGRGUP(90)
C
C
C
C      DATA (COST(I),I=1,64) /
C      TARE WEIGHT FACTORS    $ COST OF PACK/100 LBS
C      SURFACE      AIR      SURFACE      AIR
C
C      1      1.83,      1.75,      96.90,      82.30,
C
C      2      1.58,      1.37,      32.36,      24.73,
C
C      3      1.78,      1.33,      38.40,      7.10,
C
C      4      1.35,      1.31,      23.71,      19.59,
C
C      5      1.39,      1.14,      3.60,      2.28,
C
C      6      1.44,      1.44,      19.17,      19.07,
C
C      7      1.48,      1.16,      14.26,      3.70,
C
C      8      1.25,      1.16,      9.67,      6.53,
C
C      9      1.63,      1.26,      23.60,      15.43,
C
C      *      1.25,      1.16,      9.90,      6.56,
C
C      1      1.27,      1.27,      9.13,      9.13,
C
C      2      1.12,      1.12,      5.62,      4.53,
C
C      3      1.10,      1.10,      .60,      .60,
C
C      4      1.17,      1.03,      2.82,      .60,
C
C      5      1.15,      1.15,      5.93,      5.93,
C
C      6      1.59,      1.26,      12.86,      9.30/
C
C
C
C      THIS COMMON PUT FSGS INTO MATERIAL GROUPS.
C      DATA (KGRGUP(I),I=1,90) /
C      X0  X1  X2  X3  X4  X5  X6  X7  X8  X9
C
C      1      6,  6,  4, 15,  1,  1,  1,  7,  0, 16,
C
C      2      16,  0, 16,  7,  7,  2, 14,  0,  2,  2,
C

```

Fig. 6—Listing of Block Data

C	3	2,	2,	8,	0,	8,	8,	8,	7,	7,	7,
C	4	11,	8,	7,	8,	8,	10,	16,	10,	10,	8,
C	5	8,	8,	8,	8,	10,	10,	10,	0,	3,	3,
C	6	0,	11,	11,	3,	4,	5,	5,	5,	12,	5,
C	7	0,	9,	9,	9,	9,	9,	9,	9,	9,	12,
C	8	12,	9,	3,	9,	9,	9,	9,	16,	16,	16,
C	9	4,	12,	0,	9,	9,	13,	13,	0,	0,	16/
		END									

Fig. 6—(Continued)

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PACKAGING COSTS											
REFERENCE FOR PACKAGING COSTS: USAMC -- RAC MEETING				APRIL 14, 1970							
FEDERAL SUPPLY GROUP	TARE WEIGHT (PACKAGING) FACTORS*		% COST OF PACKING PER 100 LBS ***		FEDERAL SUPPLY GROUP	TARE WEIGHT (PACKAGING) FACTORS*		% COST OF PACKING PER 100 LBS ***			
	SURFACE	AIR	SURFACE	AIR		SURFACE	AIR	SURFACE	AIR		
10	1.44	1.44	19.37	19.07	55	1.25	1.16	9.95	6.56		
11	1.44	1.44	19.77	19.07	56	1.25	1.16	9.90	6.56		
12	1.35	1.31	23.71	19.59	57						
13	1.15	1.15	5.93	5.93	58	1.78	1.33	38.40	7.10		
14	1.87	1.75	96.90	82.31	59	1.73	1.33	38.40	7.10		
15	1.83	1.75	96.90	82.31	61						
16	1.83	1.75	96.90	82.31	61	1.27	1.27	9.03	9.03		
17	1.48	1.16	14.26	3.77	62	1.27	1.27	9.03	9.03		
18					63	1.73	1.33	38.40	7.10		
19	1.59	1.26	12.96	9.30	64						
20	1.59	1.26	12.96	9.30	65	1.39	1.14	3.60	2.28		
21					66	1.39	1.14	3.60	2.28		
22	1.59	1.26	12.96	9.30	67	1.39	1.14	3.60	2.28		
23	1.48	1.16	14.26	3.77	68	1.12	1.12	5.62	4.53		
24	1.48	1.16	14.26	3.77	69	1.39	1.14	3.60	2.28		
25	1.58	1.37	32.36	24.73	71						
26	1.37	1.37	2.52	.61	71	1.63	1.26	23.60	15.43		
27					72	1.63	1.26	23.60	15.43		
28	1.58	1.37	32.36	24.73	73	1.63	1.26	23.60	15.43		
29	1.58	1.37	32.36	24.73	74	1.63	1.26	23.60	15.43		
30	1.58	1.37	32.36	24.73	75	1.63	1.26	23.60	15.43		
31	1.58	1.37	32.36	24.73	76	1.63	1.26	23.60	15.43		
32	1.25	1.16	9.67	6.53	77	1.63	1.26	23.60	15.43		
33					78	1.63	1.26	23.60	15.43		
34	1.25	1.16	9.67	6.53	79	1.12	1.12	5.62	4.53		
35	1.25	1.16	9.67	6.53	80	1.12	1.12	5.62	4.53		
36	1.25	1.16	9.67	6.53	81	1.63	1.26	23.60	15.43		
37	1.48	1.16	14.26	3.77	82						
38	1.48	1.16	14.26	3.77	83	1.63	1.26	23.60	15.43		
39	1.48	1.16	14.26	3.77	84	1.63	1.26	23.60	15.43		
40	1.27	1.27	9.03	9.03	85	1.63	1.26	23.60	15.43		
41	1.25	1.16	9.67	6.53	86						
42	1.48	1.16	14.26	3.77	87	1.59	1.26	12.86	9.30		
43	1.25	1.16	9.67	6.53	88	1.59	1.26	12.86	9.30		
44	1.25	1.16	9.67	6.53	89	1.59	1.26	12.86	9.30		
45	1.25	1.16	9.67	6.53	90						
46	1.59	1.26	12.96	9.30	91	1.12	1.12	5.62	4.53		
47	1.25	1.16	9.67	6.53	92						
48	1.25	1.16	9.67	6.53	93	1.63	1.26	23.60	15.43		
49	1.25	1.16	9.67	6.53	94	1.63	1.26	23.60	15.43		
50					95	1.10	1.10	.60	.60		
51	1.25	1.16	9.67	6.53	96	1.10	1.10	.60	.60		
52	1.25	1.16	9.67	6.53	97						
53	1.25	1.16	9.67	6.53	98						
54	1.25	1.16	9.67	6.53	99	1.59	1.26	12.86	9.30		

*FACTOR IS BASED ON NET WEIGHT OF ITEM, THUS AN ITEM OF GROUP 59 WEIGHING 100 POUNDS BARE WOULD WEIGH 100 X 1.73 = 173 POUNDS PACKED FOR SURFACE OR 100 X 1.33 = 133 POUNDS PACKED FOR AIR.
 ***COST OF PACKAGING IS DETERMINED BY APPLYING THE COST OF PACKING TO THE SHELF WEIGHT OF THE ITEM.
 EXCEPTIONS: 5921 AND 5941 ARE IN MATERIAL GROUP 4, SAME AS FEDERAL SUPPLY CLASS 12.

Fig. 7—Packaging Cost Data



Table 4

INPUTS TO AVSCOST PROGRAM

Input	Mnemonic	Format	Explanation
Card 1			
Date of Run	Idate	A10	
Card 2			
Surface Mileages			
	SM1	F10.2	Surface mileage from NICP to CONUS port
	SM2	F10.2	Surface mileage from CONUS port to overseas port
	SM3	F10.2	Surface mileage from overseas port to overseas depot
Card 3			
Surface Costs			
	CS1	F10.4	Cost/mile from NICP to CONUS port
	CS2	F10.4	Cost/mile from CONUS port to overseas port
	CS3	F10.4	Cost/mile from overseas port to overseas depot
	CS4	F10.4	Port handling costs/ton CONUS port
	CS5	F10.4	Port handling costs/ton overseas port
Card 4			
Air Mileages			
	AM1	F10.2	Air mileage from NICP to nearest airport
	AM2	F10.2	Air mileage from airport to APOE
	AM3	F10.2	Air mileage from APOE to APOD
	AM4	F10.2	Air mileage from APOD to overseas depot
Card 5			
Air Costs			
	CA1	F10.4	Cost/air mile from NICP to APOE
	CA3	F10.4	Cost/air mile from APOD to depot

Table 4 (continued)

Card 6

Price Change Factors

B1	F10.2	Applied against pipeline inventory
B2	F10.2	Applied against total surface cost
B3	F10.2	Applied against packaging cost
B4	F10.2	Applied against total air cost

Card 7

Shipping Times

TS	F10.2	Order/ship time by surface
TA	F10.2	Order/ship time by air

Card 8

Retrograde Shipping Times

TSRET	F10.2	Shipping time retrograde by surface
TARET	F10.2	Shipping time retrograde by air

Card 9

Onshelf Inventory Reduction

OSIR	F10.2	
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Card 10

Obsolescence Factor and Time Period

K1	F10.2	Obsolescence factor
N	F10.2	Time period

Card 11

Forecast Factors

F1	F10.2	Used to forecast dollar changes
F2	F10.2	Used to forecast tonnage changes

Card 12

Variable air cost - APOE - APOD

CA2(1)	F10.5	MAC Channel air cost/mile
CA2(2)	F10.5	MAC SAAM C-141 air cost/mile
CA2(3)	F10.5	MAC SAAM C-5A air cost/mile

Remainder of Input Cards

Date for Item to be shipped (one card for each item)

IFSN	A10	First 10 digits of FSN
JFSN	A1	Last digit of FSN
NAM1	A9	Alphabetic name of item
TPR	F10.2	Unit price of item
UWT	F10.2	Unit weight of item
UCU	F10.3	Unit cube of item
IDEM	I10	Annual demand for item
RATIO	F5.2	Percentage of original cost incurred when repairing item

INPUT VALUES USED IN COMPUTATIONS

25 MAY 72

SURFACE	MILEAGE	COST	AIP	MILEAGE	COST
DEPT TO POE	152.3000	.0810	DEFT TO AF	173.3900	.1110
PCE TO POD	552.4000	.0150	AE TO AEDD	1151.4000	
POD TO DEPOT	4.0000	.0598	APCE TO APOD	5146.1900	
			APDD IC DEENT	23.0000	.3598

COMUS PORT HANDLING COST 25.10

OVERSEA PORT HANDLING COST 9.13

R1 1.00 R2 1.00 R3 1.00 R4 1.00

ON-SHELF INVENTORY REDUCTION 18.00

FIRST FACTOR 1.00 SECOND FACTOR 1.00

SURFACE SHIP TIME 42.00 AIR SHIP TIME 16.20

RETROGRADE SURFACE SHIP TIME 94.21 RETROGRADE AIR SHIP TIME 10.20

NUMBER OF YEARS 2

K1 VALUE USED .250

Fig. 9—Input Values Printout



DISTANCES FROM AVSCOM DEPOTS FOR PACIFIC THEATER

	PER CENT SHIPPED	NAUTICAL MILES TO OAKLAND	NAUTICAL MILES TO APOE	NAUTICAL MILES APOE TO TRAVIS
ATLANTA	04.00	2182	734	1161
NEW CUMBERLAND	23.98	2425	104	2133
RED RIVER	35.16	1646	259	1161
SHARPE	22.17	63	56	0
ARADMAC	16.75	1647	125	1250

AVERAGE WEIGHTED DISTANCES 1502.34 173.39 1151.62

NAUTICAL MILES

OAKLAND TO INCHON	5552
INCHON TO DEPOT	4
TRAVIS TO KIMPO	5146
KIMPO TO DEPOT	23

Fig. 10—Printout of Distances

INPUTS		ELEMENTS OF FORMULA		DOLLARS		COMPUTATION RESULTS	
ITEM	PROPELL	RATIO USED	.25	DATE	25 MAY 72		
MAC CHANNEL 12.146 ALR							
FSN	1611796275	PIPELINE INVENTORY COST	56373.33				
ANNUAL DEMAND	15	PIPE-INV HOLDING COST	0.00				.10 ALR
UNIT PRICE	14502.00	SURFACE TRANSPORTATION COST	20525.29				
UNIT WEIGHT	672.00	DIFFERENCE PACKAGING COST	13735.68				3.04 YEARS
UNIT CUBE	3.000	AIR TRANSPORT COST	64654.60				
CUBE-CUT ITEM	NC	DIFFERENCE XPORT-PACK COST	-30433.71				27969.62 DOLLARS
MAC SAAM C-141 12.337 ALR							
FSN	16101796275	PIPELINE INVENTORY COST	56373.33				
ANNUAL DEMAND	35	PIPE-INV HOLDING COST	0.00				.10 ALR
UNIT PRICE	14502.00	SURFACE TRANSPORTATION COST	20525.29				
UNIT WEIGHT	672.00	DIFFERENCE PACKAGING COST	13735.68				3.72 YEAR
UNIT CUBE	3.000	AIR TRANSPORT COST	65654.08				
CUBE-CUT ITEM	NC	DIFFERENCE XPORT-PACK COST	-31393.09				26979.44 DOLLARS
MAC SAAM C-5A 7.211 ALR							
FSN	16101796275	PIPELINE INVENTORY COST	56373.33				
ANNUAL DEMAND	35	PIPE-INV HOLDING COST	0.00				.10 ALR
UNIT PRICE	14502.00	SURFACE TRANSPORTATION COST	20525.29				
UNIT WEIGHT	672.00	DIFFERENCE PACKAGING COST	13735.68				23.96 YEARS
UNIT CUBE	3.000	AIR TRANSPORT COST	39132.57				
CUBE-CUT ITEM	NC	DIFFERENCE XPORT-PACK COST	-4021.60				53501.73 DOLLARS
ITEM PROPELL 12.146 ALR							
RATIO USED .25 DATE 25 MAY 72							
MAC CHANNEL 12.146 ALR							
FSN	16115297406	PIPELINE INVENTORY COST	67817.15				
ANNUAL DEMAND	142	PIPE-INV HOLDING COST	0.00				.29 ALR
UNIT PRICE	3993.00	SURFACE TRANSPORTATION COST	11821.94				
UNIT WEIGHT	95.40	DIFFERENCE PACKAGING COST	7911.33				7.75 YEARS
UNIT CUBE	1.600	AIR TRANSPORT COST	37244.88				
CUBE-CUT ITEM	NC	DIFFERENCE XPORT-PACK COST	-17511.61				50305.54 DOLLARS
MAC SAAM C-141 12.337 ALR							
FSN	16105297406	PIPELINE INVENTORY COST	67817.15				
ANNUAL DEMAND	142	PIPE-INV HOLDING COST	0.00				.29 ALR
UNIT PRICE	3993.00	SURFACE TRANSPORTATION COST	11821.94				
UNIT WEIGHT	95.40	DIFFERENCE PACKAGING COST	7911.33				7.50 YEARS
UNIT CUBE	1.600	AIR TRANSPORT COST	37815.19				
CUBE-CUT ITEM	NC	DIFFERENCE XPORT-PACK COST	-10081.92				49735.23 DOLLARS
MAC SAAM C-5A 7.211 ALR							
FSN	16105297406	PIPELINE INVENTORY COST	67817.15				
ANNUAL DEMAND	142	PIPE-INV HOLDING COST	0.00				.29 ALR
UNIT PRICE	3993.00	SURFACE TRANSPORTATION COST	11821.94				
UNIT WEIGHT	95.40	DIFFERENCE PACKAGING COST	7911.33				40.34 YEARS
UNIT CUBE	1.600	AIR TRANSPORT COST	22539.16				
CUBE-CUT ITEM	NC	DIFFERENCE XPORT-PACK COST	-2805.09				65911.25 DOLLARS

Fig. 11--Sample Item Printout

RECORDS READ	287	
RECORDS WITH NO DEMANDS	23	
SUMMARIES		
MAC CHANNEL	12.146	ALR
	NUMBER OF ITEMS AIR ELIGIBLE	227
	TOTAL WEIGHT OF AIR ELIGIBLE ITEMS	11859.73
	TOTAL COST AVOIDANCE OF AIR ELIGIBLE ITEMS	36284305.96
	NUMBER OF ITEMS SURFACE ELIGIBLE	30
	TOTAL WEIGHT OF SURFACE ELIGIBLE ITEMS	5278.35
	TOTAL COST AVOIDANCE OF SURFACE ELIGIBLE ITEMS	-3986771.63
MAC SAAM C-141	12.337	ALR
	NUMBER OF ITEMS AIR ELIGIBLE	225
	TOTAL WEIGHT OF AIR ELIGIBLE ITEMS	11775.59
	TOTAL COST AVOIDANCE OF AIR ELIGIBLE ITEMS	35714489.46
	NUMBER OF ITEMS SURFACE ELIGIBLE	32
	TOTAL WEIGHT OF SURFACE ELIGIBLE ITEMS	5356.37
	TOTAL COST AVOIDANCE OF SURFACE ELIGIBLE ITEMS	-4262487.82
MAC SAAM C-5A	7.211	ALR
	NUMBER OF ITEMS AIR ELIGIBLE	251
	TOTAL WEIGHT OF AIR ELIGIBLE ITEMS	16937.06
	TOTAL COST AVOIDANCE OF AIR ELIGIBLE ITEMS	54905591.39
	NUMBER OF ITEMS SURFACE ELIGIBLE	5
	TOTAL WEIGHT OF SURFACE ELIGIBLE ITEMS	179.58
	TOTAL COST AVOIDANCE OF SURFACE ELIGIBLE ITEMS	-807091.87

Fig 12--Item Summaries

RECORDS WITH BEPS LESS THAN \$0.10	5
RECORDS WITH BEPS LESS THAN \$0.13	12
RECORDS WITH BEPS LESS THAN \$0.14	12
RECORDS WITH BEPS LESS THAN \$0.20	41
RECORDS WITH BEPS LESS THAN \$1.00	183
RECORDS WITH BEPS MORE THAN \$1.00	74

COP SUMMARY

MAC CHANNEL COPS

COPS LESS THAN 1 YEAR	10
COPS 1 YEAR AND LESS THAN 2 YEARS	20
COPS 2 YEARS AND LESS THAN 3 YEARS	23
COPS 3 YEARS AND LESS THAN 4 YEARS	25
COPS 4 YEARS AND LESS THAN 5 YEARS	24
COPS 5 YEARS AND LESS THAN 6 YEARS	8
COPS 6 YEARS AND MORE	147

MAC SAAM C-141 COPS

COPS LESS THAN 1 YEAR	10
COPS 1 YEAR AND LESS THAN 2 YEARS	22
COPS 2 YEARS AND LESS THAN 3 YEARS	22
COPS 3 YEARS AND LESS THAN 4 YEARS	27
COPS 4 YEARS AND LESS THAN 5 YEARS	23
COPS 5 YEARS AND LESS THAN 6 YEARS	8
COPS 6 YEARS AND MORE	145

MAC SAAM C-5A COPS

COPS LESS THAN 1 YEAR	3
COPS 1 YEAR AND LESS THAN 2 YEARS	3
COPS 2 YEARS AND LESS THAN 3 YEARS	2
COPS 3 YEARS AND LESS THAN 4 YEARS	3
COPS 4 YEARS AND LESS THAN 5 YEARS	3
COPS 5 YEARS AND LESS THAN 6 YEARS	1
COPS 6 YEARS AND MORE	242

Fig. 12—(Continued)

REFERENCES

1. Ray M. Clarke, et al, "Routine Economic Airlift," RAC-R-146, October 1972.
2. Ray M. Clarke, et al, "Selection of Items for Air Shipment on an Economic Basis," RAC-R-116, January 1971.