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VALIDATION OF THE ALGORITHMS FOR
SECOND DESTINATION
TRANSPORTATION COSTS
FOR
THE COMPONENT SUPPORT COST SYSTEM
(D160B)

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EXECUTIVE SUMMARY

Visibility and Management of Operating and Support Costs is a program initiated by the Office of the Secretary of Defense (OSD) in order to ensure that each Military Department gathers, tracks, and computes operating and support costs by weapon system. VAMOSC II is an Air Force management information system which is responsive to the OSD initiative. It uses information from existing Air Force systems to satisfy both Air Force and OSD needs for certain weapon system operating and support (O&S) costs.

At present, the VAMOSC II system comprises three subsystems:

(1) The Weapon System Support Cost (WSSC) system (D160), which deals with aircraft,

(2) The Communications - Electronics (C-E) system (D160A), which deals with ground communications - electronics equipment,

(3) The Component Support Cost Subsystem (CSCS) (D160B), which deals with subsystems and components for aircraft.

The Component Support Cost System (CSCS) of VAMOSC II gathers and computes support costs by assembly/subassembly and relates those costs back to the end item or weapon system. CSCS replaces the Logistic Support Cost (LSC) model of K051 (AFLCR 400-49) for aircraft and engines.

The CSCS receives inputs from 15 Air Force data systems. On a quarterly basis, the system provides two standard reports each processing cycle and twelve other types of reports as requested by users. It also provides pre-programmed data base extracts on magnetic tape on a one-time basis in response to user requests. Special requests for data in user selected format may also be satisfied on a case by case basis.

At the heart of the CSCS is a set of 30 algorithms for estimation or allocation of costs. Information Spectrum, Inc. (ISI) was awarded a contract to validate these algorithms. This effort included investigations of logic, appropriateness of the algorithms and assumptions inherent in the algorithms. ISI was also to survey published findings, reports of audit, etc. relating to the accuracy to the source data systems. In addition to the algorithm validation, ISI was to perform certain "special tasks," including a user survey.

This report provides the verification and validation of three of the algorithms. All three are concerned with second destination transportation (SDT) costs. SDT costs are defined as:

> "The round trip cost of transporting engines and engine components, ground support equipment and repairable 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."

The CSCS subdivides SDT costs into three categories. The first category is SDT costs for time compliance technical orders (TCTOs) performed at depots for equipment other than engines. TCTOs are "directives issued to provide instructions to Air Force activities for accomplishing one-time changes, modifications, or inspections of equipment or installation of new equipment." The second category is SDT costs for other maintenance for equipment other than engines. The final category is SDT costs for all engine activities.

This report addresses all three algorithms because their methods are similar. Existing data systems do not track shipping costs for individual items. The algorithms are based on Air Force-wide average shipping cost per pound, calculated separately for continental United States (CONUS) and overseas shipments. For each Work Unit Code, each algorithm determines the number of items shipped during the calendar quarter and the item weight. The product of the number of items shipped, the item weight, and the average shipping cost (CONUS or overseas depending on the base location) is taken to be the SDT cost.

In order to verify and validate the CSCS algorithms, a set of analysis procedures applicable to all of the algorithms was established. These procedures were then applied to each algorithm. This report first describes the analysis procedures, without reference to the specific algorithm addressed by this report.

Next, the three transportation cost algorithms are defined and described in detail. This description includes identification of source data systems and files, and the calculation procedures currently implemented by the CSCS.

Finally, a critique of the algorithms is provided as required by the contract. It addresses the following topics:

- Verification of assumptions and approximations for appropriateness and accuracy.
- Validation of accuracy of source data.
- Validation of appropriateness of source data as inputs to CSCS logic.

- Investigation of accuracy and appropriateness of algorithms.
- Consideration of replacement of indirect cost methods with more direct ones.
- Identification of algorithm impact on CSCS output reports.

For each algorithm addressed, ISI is required to affirm the process or procedure and reject any portion that cannot be affirmed. Where the algorithm or portion of the algorithm is rejected, an alternate procedure must be specified.

For the three second destination transportation cost algorithms, Information Spectrum identified several deficiencies. The overseas shipping rates fail to account for the domestic portion of shipping costs. Port handling costs, which should apply to overseas surface shipment, are ignored. Packaging labor and material costs, which are generally more significant than the actual shipping costs, are omitted.

For engines, we found that some shipments to depots are not counted. There is no provision for the cost of shipping engines from base to base (no depot involved). Such shipments are becoming frequent because of evolution of "Queen Bee" engine repair facilities. Engine weights currently stored in the CSCS omit "packaging" (trailer or container) weights, which are quite significant. This flaw is overshadowed by ISI's belief that the "shipping cost per pound" approach is inappropriate for engines.

Appropriate recommendations are provided for resolution of all deficiencies. Some of these entail a change in the data provided by the Comprehensive Engine Management System (D042A). We are advised such changes may be delayed while the D042A system proceeds toward its implementation goals. Information Spectrum recommends a study of actual engine transportation costs applicable to each engine TMS.

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1.0 INTRODUCTION

Visibility and Management of Operating and Support Costs is a program initiated by the Office of the Secretary of Defense (OSD) in order to ensure that each Military Department gathers, tracks, and computes operating and support costs by weapon system (all costs are computed and portrayed in "then year" dollars). VAMOSC II is an Air Force management information system which is responsive to the OSD initiative. It uses information from existing Air Force systems to satisfy both Air Force and OSD needs for certain weapon system operating and support (O&S) costs.

At present, the VAMOSC II system comprises three subsystems:

(1) The Weapon System Support Cost (WSSC) system (D160), which deals with aircraft,

(2) The Communications - Electronics - (C-E) system (D160A), which deals with ground communications - electronics equipment,

(3) The Component Support Cost Subsystem (CSCS) (D160B) which deals with subsystems and components for aircraft.

1.1 The Component Support Cost System

The Component Support Cost System (CSCS) of VAMOSC II gathers and computes support costs by assembly/subassembly and relates those costs back to the end item or weapon system. CSCS replaces the Logistic Support Cost (LSC) model of K051 (AFLCR 400-49) for aircraft and engines.

The objectives of the Component Support Cost System are:

(1) To improve the visibility of aircraft and engine component support costs and to relate those costs to the end item or weapon system.

(2) To improve the Life Cycle Costing capability for the Air Force and the Department of Defense in the acquisition of new weapon systems.

(3) To assist in the design of new weapon systems by providing cost information on existing weapon systems, thereby enhancing design tradeoff studies.

(4) To provide historical cost information at the weapon system level to improve logistic policy decisions.

(5) To identify system component reliability, effectiveness, and costs so that high support cost items may be identified and addressed.

The CSCS is described in detail in references [1], [2], and [3]. It receives inputs from 15 Air Force data systems. On a quarterly basis, the system provides two mandatory reports each processing cycle and twelve other types of reports as requested by users. It also provides pre-programmed data base extracts on magnetic tape on a one-time basis in response to user requests. Special requests for data in user selected format may also be satisfied on a case by case basis.

The twelve reports mentioned above are of primary interest to the user community. They are identified by name in Table 1. Descriptions and samples are provided by reference [1].

At the heart of the CSCS is a set of 30 algorithms for estimation or allocation of costs. The algorithms are identified by name in Table 2. Information Spectrum, Inc. (ISI) was awarded a contract to validate these algorithms. This effort includes investigations of logic, appropriateness of the algorithms, and assumptions inherent in the algorithms. ISI was also to survey published findings, reports of audit, etc. relating to the accuracy of the source data systems. In addition to the algorithm validation, ISI was to perform certain "special tasks," including a user survey.

1.2 Overview of the Algorithms

This report provides the verification and validation of algorithms 4, 10, and 11 of Table 2, "TCTO Transportation Costs, Second Destination Transportation Costs, and Second Destination Transportation Costs (Engine)." All three algorithms concern second destination transportation (SDT) costs. SDT costs are defined in reference [46] as

> "The round trip cost of transporting engines and engine components, ground support equipment and repairable 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."

The CSCS subdivides SDT costs into three categories. The first category is SDT costs for time compliance technical orders (TCTOs) performed at depots for equipment other than engines. TCTOs are

Thus there are arguments that the use of two single average shipping rates is an inappropriate, inaccurate approximation. However, there are opposing arguments. First, we address the fact that the approximation obscures actual distances between bases and depots. It should be recognized that CSCS data is intended to provide insights for procurement of new weapon systems. Accordingly, transportation cost estimates corresponding to average, representative shipping distances may be considered more appropriate than costs for actual distances. Similarly, the blending of surface and air military and commercial rates results in a representative rate appropriate for CSCS purposes.

Thus we affirm both the appropriateness and the accuracy of assumptions and approximations used in these algorithms.

3.2.2 Accuracy of Source Data and Congruence of Data Element Definition

Information Spectrum was directed to validate accuracy of source data based on a survey of published findings, reports of audit, etc. No direct sampling of data was to be performed. The Office of VAMOSC has indicated that direct validation of source data is planned for future efforts.

These algorithms receive data from four automated data systems: D002A, 0013, D143F, and D042A. No published criticisms of the accuracy of these systems could be found, and ISI affirms their accuracy. It should be noted that the D042 system is relatively new at the time of this writing. Personnel working with that system have indicated* that they cannot accept a new Memorandum

*Observed by Capt. Michael Howenstine, AFLC/MML(VAMOSC).

3.2.1 Appropriateness and Accuracy of Assumptions and Approximations

Information Spectrum has identified three assumptions and one approximation used in these algorithms. A first assumption is that the weight of a replacement item is the same as the weight of the NRTS or condemned item it replaces. We consider this assumption self-evidently appropriate and accurate.

It is assumed that items are shipped to the depot, and replacements shipped to the base, in the same quarter as action associated with the shipment (kit issue, NRTS, condemnation, or engine receipt) is reported. This may be viewed as not so much an assumption as an analysis convention. Again, we find it self-evidently appropriate and accurate.

The third assumption is that engines are never condemned at base level. In fact, Air Force personnel, notably Mr. Ludwig Coco (AFLC/MMMAE), have confirmed that engine condemnation at any level is so rare that it is negligible.

The approximation lies in the use of one single, Air Force-wide, average shipping cost per pound for CONUS shipments, and one for overseas shipments. Insight into this approximation may be gained by reviewing the source data and explanation of CSCS shipping rate calculations provided in Attachment 1. It will be seen that shipping may be via surface or air, by commercial carrier or military transport. The use of single rates totally obscures the actual distances between the bases and the depots.

CSCS accumulates TCTO transportation costs at the whole aircraft level, consistent with its treatment of TCTO costs in other algorithms. Each kit represents a one-way cost, from depot to base.

The Second Destination Transportation algorithm, applying to everything but TCTO kits and engines, identifies costs at the Work Unit Code level. For items identified as NRTS at the base, a factor of 2 appears. This corresponds to two shipments, one of the NRTS item from base to depot, the other of the replacement item from depot to base. Items condemned at the base are not shipped to the depot, so only the one-way cost of the replacement shipment is counted.

One reason that second destination transportation costs for aircraft engines are treated separately is that a separate data system is devoted to engine management. This sytem is the Comprehensive Engine Management System (CEMS); the Data System Designator is D042. It replaces the D024 system. It is assumed (see Section 3.2.1) that engines are never condemned, so the count of engines received at depots is multiplied by 2 to account for engine shipments back to the base.

3.2 Critique of Algorithm

This section addresses various facets of the algorithm. The discussion is structured to correspond to the contractual requirements. Each aspect is either affirmed or rejected. Rejections lead to recommendations in Section 4.0.

Name: ENG-DEPOT-RCVD

Definition: Number of engines received at the depot from the base for the calendar quarter.

Source System/File: D042A/A503IABO

Name: ENG-WT

Definition: Engine weight

Source System/File: Stored in CSCS tables, having been input manually.

3.1.3 Description of Calculation Procedure

Existing Air Force systems do not develop or track the costs of shipping individual items of equipment. Reference [9] provides cost factors "...which can be used by AFLC decision-makers and analysts to estimate...costs." Chapter 3 of that reference applies to logistics data and provides cost factors in terms of cost per pound.

All three algorithms are based on this average cost per pound approach. Each algorithm determines the number of items shipped to or from a base per quarter. This number is multiplied by the item weight and by a shipping rate per pound. One shipping rate is used for CONUS bases and a second rate for overseas bases. Each rate is intended to be the Air Force-wide average shipping cost for CONUS or overseas shipments, as appropriate. The result is the estimated second destination transportation cost for the specific item and base for the quarter.

There are differences among the algorithms. The algorithm for TCTO transportation costs begins with the number of kits shipped. Note that these are not assigned Work Unit Codes. The

3.1.1 Calculations

For each algorithm addressed in this report, a single formula expresses the calculations.

(1) TCTO-SDT-COST = KITS-NSN-MDS-BASE
x NSN-WT x SHIP-RATE-BASE

(2) NSN-SDT-COST = (2 x NRTS-WUC-MDS-BASE
+ CONDMN-WUC-MDS-BASE) x NSN-WT x SHIP-RATE-BASE

(3) ENG-SDT-COST = 2 x ENG-DEPOT-RCVD
x ENG-WT x SHIP-RATE-BASE

3.1.2 Inputs

Name: KITS-NSN-MDS-BASE

Definition: Number of TCTO kits issued by base supply with a specified NSN for the MDS, base, and calendar quarter.

Source System/File: D002A/F002

Name: NSN-WT

Definition: Weight in pounds of item with specified NSN.

Source System/File: 0013/B794AOU

Name: SHIP-RATE-BASE

Definition: Average shipping cost rate per pound between the base and any depot.

Source System/File: See explanation in Attachment 1.

Name: NRTS-WUC-MDS-BASE

Definition: Number of items of the specified MDS and WUC identified as "not repairable this station" (NRTS) at the base for the calendar quarter.

Source System/File: D143F/B21EAO

Name: CONDMN-WUC-MDS-BASE

Definition: Number of items of the specified MDS and WUC condemned at the base for the calendar quarter.

Source System/File: D143F/B21EAO

3.0 ALGORITHM ANALYSIS

The previous section described the general analysis procedures applied to all algorithms. This section presents the results of applying those procedures to the algorithms for TCTO Transportation Costs, Second Destination Transportation Costs, and Second Destination Transportation Costs (Engine).

Section 3.1 provides a detailed description of the algorithms and of the input data they use. Section 3.2 provides a critique, structured to correspond to the contractual requirements. Section 4.0 makes recommendations for solutions of problems.

3.1 Algorithm Description

In the following description COBOL-type data names are used to express the algorithm outputs and their components. The available source documentation does not provide the actual data names used by the CSCS programs. They are presumably different from those used in this report.

The calculation formulas are stated in Section 3.1.1. The input data elements and their sources are provided in Section 3.1.2. The calculation is described verbally in Section 3.1.3. Unless otherwise noted, the descriptions are based on references [1], [2], and [3], and on direct discussion with personnel of the Office of VAMOSC. In case of any discrepancies, information provided by knowledgeable personnel was accepted as most current, hence most definitive.

2.4 Problem Resolution

Whenever a significant deficiency was recognized in one of the algorithms, one or more proposed solutions were developed. This was a creative analytic process for which few guidelines could be proposed in advance. Certainly it depended on familiarity with the various existing Air Force data reporting and processing systems. Proposed solutions were discussed with personnel of the Office of VAMOSC, and revised as appropriate. Recommended solutions were expressed in the form of contributions to a draft Data Automation Requirement (DAR) when these would be applicable.

2.5 Documentation

The documentation of the analysis of each algorithm was a crucial part of the effort. Emphasis was placed on making it thorough, clear, and unambiguous. In the documentation, every assertion was substantiated. This was done by reference to source documentation, by explicitly expressed application of the experience and judgment of the contractor, or by citation of information provided by cognizant Air Force personnel. In the last case, the information was supported by documentation identifying the source, the date, and the information provided.

that for a single reporting period all maintenance labor is overhead and none is direct. Also try the reverse assumption. If an assumption of an extreme input leads to an illogical result, the algorithm is flawed.

Task 4 of Section C-2, c of the contract speaks of appropriate statistical techniques to confirm or repudiate each algorithm. Statistical techniques could confirm or repudiate only statistical hypotheses as assumptions. (Use of an average does not constitute an assumption.) Accordingly, statistical techniques apply to confirmation or repudiation of an algorithm only to the extent that statistical hypotheses can be developed.

(f) As each algorithm is considered, ensure that the costs do not overlap others already accounted for. (In some cases an overlap may be necessary and desirable. Where this occurs, the overlap will be noted.)

(g) In each CSCS output report, identify the data elements incorporating the output of the algorithm, so that a final assessment of report accuracy can be made for each output report.

(h) Consider alternative sources of input data for the algorithm. Also consider more direct cost assignments than those incorporated in the algorithm.

Some explicit techniques which were generally used in concept validation are listed below.

(a) Consider how the cost element would be calculated if there were no constraints on resources. (For example, suppose the CSCS could identify the pay grade and hours worked of each individual involved in a maintenance action.)

(b) Identify assumptions* incorporated into the Algorithm. Generally this procedure will identify the real constraints which affect the approach in (a) above.

(c) Identify approximations incorporated into the algorithm. For instance, one such approximation is the use of an average labor rate for each aircraft.

(d) Study each approximation for possible sources of error. Some examples are biases introduced by editing procedures, obsolete data, or inappropriate application. Whenever feasible, estimate the likelihood of these errors by reviews of the literature and contact with cognizant personnel.

(e) Test the algorithms under conditions of assumed extreme values for the inputs. For instance, in evaluating the algorithm for base maintenance overhead costs, assume

* Note that assumptions, approximations, and allocations are different concepts, although in some cases the boundaries between them are not sharp. ISI has recognized few assumptions in the algorithms, but many approximations and allocations.

input data element and of the system providing it was provided by the User's Manual (reference [1]). This identification was refined by identification of a particular file within the source system and the structure of the file as described in both the CSCS System/Subsystem Specification and in the Memoranda of Agreement. The Memoranda of Agreement have been established between the Office of VAMOSC and the Offices of Primary Responsibility (OPR) for the systems providing the input data. Any inconsistencies or voids were identified and resolved through contact with the Office of VAMOSC and/or implementing personnel.

Whenever appropriate, input data element definitions were further refined by tracing the elements back to their sources through the reference data provided. If these were inadequate, the OPRs were contacted directly for clarifications. In tracing the data back to their origins, possible sources of data contamination were considered. Information on the likelihood and significance of such contamination was collected from cognizant personnel and from published references.

2.3 Concept Validation

The two steps above established exactly what the algorithm does. The third, and most critical step, considered the validity of the procedure. It depends on the ability of the analyst to translate mathematical formulas and data processing techniques into meaningful concepts.

2.0 ANALYSIS PROCEDURES

In order to verify and validate the CSCS algorithms, a set of analysis procedures applicable to all of the algorithms was established. These procedures were then applied to each algorithm. This section describes the analysis procedures, without reference to the specific algorithms addressed by this report.

The algorithm analysis process consists of five portions, described in the following sections.

2.1 Algorithm Description

The algorithms are described in references [1], [2], and [3]. These descriptions are not identical. In general they supplement, rather than contradict each other. The first two describe what the system is to achieve; the third describes the system design to do so.

None of these descriptions provides the combination of level of detail and clarity of concept required for this validation effort. The first step in the analysis methodology was the generation of such a description. The descriptions in the three reference sources just cited were made explicit. When necessary, Air Force personnel involved in implementation of the D160B subsystem were contacted for clarification.

2.2 Input Data Definitions

Closely related to the first step was the clarification of the definitions of the input data. The identification of each "directives issued to provide instructions to Air Force activities for accomplishing one-time changes, modifications, or inspections of equipment or installation of new equipment" (reference [12]). The second category is SDT costs for other maintenance for equipment other than engines. The final category is SDT costs for all engine activities.

This report addresses all three algorithms because their methods are similar. Existing data systems do not track shipping costs for individual items. The algorithms are based on Air Force-wide average shipping cost per pound, calculated separately for continental United States (CONUS) and overseas shipments. For each Work Unit Code, each algorithm determines the number of items shipped during the calendar quarter and the item weight. The product of the number of items shipped, the item weight, and the average shipping cost (CONUS or overseas depending on the base location) is taken to be the SDT cost.

TABLE 2. CSCS ALGORITHM NAMES

1. Base TCTO Labor Cost
2. Base TCTO Overhead Cost
3. Base TCTO Material Cost
4. TCTO Transportation Costs
5. Base Inspection Costs
6. Base Other Support General Costs
7. Base Labor Costs
8. Base Direct Material Costs
9. Base Maintenance Overhead Costs
10. Second Destination Transportation Costs
11. Second Destination Transportation Costs (Engine)
12. Base Exchangeable Repair Costs (NSN)
13. Base Exchangeable Repair Costs (Engine)
14. Base Exchangeable Modification Costs (NSN)
15. Base Condemnation Spares Costs/NSN
16. Base Exchangeable Modification Costs (Engine)
17. Base Supply Management Overhead Costs
18. Depot TCTO Labor Costs
19. Depot TCTO Material Costs
20. Depot TCTO Other Costs
21. Depot Support General Costs
22. Depot Labor Costs
23. Depot Direct Material Costs
24. Depot Other Costs
25. Depot Exchangeable Repair Costs (NSN)
26. Depot Exchangeable Repair Costs (Engine)
27. Depot Exchangeable Modification Costs (NSN)
28. Depot Exchangeable Modification Costs (Engine)
29. Depot Condemnation Spares Costs (NSN)
30. Depot Material Management Overhead Cost

TABLE 1. CSCS OUTPUT REPORTS

Number*	Name
8105	Cost Factors
8104	MDS Logistics Support Costs
8106	Base Work Unit Code (WUC) Costs
8107	Total Base Work Unit Code (WUC) Costs
8111	Depot On-Equipment Work Unit Code (WUC) Costs
8108	Total Base and Depot Work Unit Code (WUC) Costs
8109	NSN-MDS-WUC Cross-Reference
8110	MDS-WUC-NSN Cross-Reference
8112	Logistic Support Cost Ranking, Selected Items
8113	Summary of Cost Elements
8114	NSN-WUC Logistics Support Costs
8115	Assembly-Subassembly WUC Costs

* CSCS output reports are assigned Report Control symbol HAF-LEY(AR)nnnn, where nnnn is the number in the table.

of Agreement at this time. This suggests that the D042 system is still being shaken down.

In addition to the periodic inputs cited above, the algorithm for Second Destination Transportation Costs, Engine uses engine weights which were input manually by VAMOSC personnel. ISI has determined that these weights are identical to weights published in the "Engine Handbook" by AFLC/MME. Accordingly, we affirm their accuracy.

All three algorithms use shipping rates derived from reference [9] as described in Attachment 1. No published criticism of the source rates in reference [9] has been found, and their accuracy is also affirmed.

Next, we address the "congruence" question: are the meanings of the inputs provided by the input data systems the same as the meanings implicit in the CSCS algorithms? Here our analysis has revealed several problems. We address the inputs in separate subsections.

3.2.2.1 Kit Counts

The count of TCTO kits issued is identified in Section 3.1.3 as KITS-NSN-MDS-BASE. The definition is perfectly straightforward, and ISI affirms the congruence of this definition as input to the CSCS and as used by it.

3.2.2.2 NSN Weights

Sections 6-3 and 6-4 of reference [44] both show that the item weight in the 0013 data system includes the weight of packaging. ISI affirms the congruence of this definition with the definition implicit in the CSCS use.

3.2.2.3 Shipping Rates

The derivation of average shipping rates for CONUS and overseas shipments from data in reference [9] is reviewed in Attachment 1 to this report. This review provides a basis for affirming the congruence between the CONUS rates as entered and as applied by the algorithms. However, the rates being used by the CSCS for overseas shipments are actually the average cost per packaged pound of the overseas portion of shipments, excluding packaging costs (if applicable). The CSCS algorithms apply these rates as if they also accounted for the CONUS portion of the shipment. ISI rejects this application as not congruent. Appropriate recommendations appear in Section 4.

3.2.2.4 NRTS/Condemnation Counts

The counts of items turned to base supply as NRTS or condemned at the base are straightforward. ISI affirms the congruence of these definitions as used by the input data system with those implicit in the CSCS application.

3.2.2.5 Engine Receipt Counts

Counts are received from the D042 data system in accordance with reference [6.5]. Section 5.g. of that reference begins as follows:

> Processing/Comments: D042A will provide depot level engine repair data. Condition/status codes "JL" and "RL" (Started on engine, reported at Contractor/Depot respectively) will be selected.

Information Spectrum questions the reference to "depot level" data. The D042 system is designed to deal with reports submitted at both base and depot levels. The phrasing of the Memorandum of Agreement suggests that the CSCS only wants reports submitted by depots. ISI believes this is not desirable. Significant numbers of engine shipments take place between Forward Operating Bases and "Queen Bees." In this regard the following definitions from reference [45] are useful:

> Queen Bee. A central (selected) base that is authorized or is designated the intermediate maintenance activity for other operational activities (not authorized intermediate maintenance tools & equipment) not necessarily on the same base or within the same command.
>
> Queen Bee Maintenance. A queen bee activity performs engine intermediate maintenance, component repair or replacement, engine buildup, TCTO and acceptance testing, QEC removal, and preparation of reparable engine shipment to TRC.

Surely engine second destination transportation costs should include shipments between forward operating bases and Queen Bees.

It cannot yet be determined how the words "depot level" in the MOA are interpreted by D042. This is because, according to Mr. Coco (identified above), depots are not yet reporting through D042.

The phrase "condition/status" in the quoted part of the MOA is wrong. The codes are identified in various parts of reference [30] (especially Chapter 9 and Sections 10.d and 10.e) as Transaction/Condition codes. The RL code could identify receipt (R) of an engine at the depot or contractor facility for major overhaul

(L). The same code would be used by a Queen Bee on receipt of an engine to be shipped on to the depot for major overhaul (see reference [30], end of page 9-1).

Section 9-3 of reference [30] shows that depots may also receive engines for minor overhaul (code RK). The MOA does not count such shipments. Section 9-1 of the same reference identifies a panoply of receipt reports corresponding to shipments not covered by the MOA. All of these should be counted in the algorithm.

It is reported by Capt. Michael Howenstine (AFLC/MML(VAMOSC)) that the CSCS does not use the "JL" reports, which correspond to the beginning of major overhaul work on an engine, either initially or after an interruption. The CSCS counts one engine round trip between base and depot for each RL report. As discussed above, not all depot receipts are counted by RL reports. Moreover, it appears that shipments between Forward Operating Bases and Queen Bees are not counted. ISI rejects the congruence of the input data definition with the definition implicit in the CSCS application. Recommendations are provided in Section 4.

3.2.2.6 Engine Weights

Information Spectrum has learned that the engine weights currently stored by the CSCS are identical with weights in a publication identified as the "Engine Handbook", published annually by AFLC/MME. Mr. Joseph Holland (AFLC/MMAC) says these are weights of unpackaged engines without QEC kits. The CSCS is using them as packaged weights. The congruence of these definitions is rejected.

ISI has located packaged engine weights in Air Force Technical Manual TO 00-85-20, Engine Shipping Instructions, 1 December 1978, updated to 1 October 1983. However, Section 3.2.4 will explain that we feel that the CSCS approach to engine shipping costs based on weight should be replaced.

3.2.3 Appropriateness of Source Data as Inputs

The counts of TCTO kits in D002A, and of NSNs NRTS or condemned in D143F are routinely maintained by those systems. Provision of shipping weights for NSN items by system 0013 is appropriate since that system is devoted to shipment management (reference [44]).

The shipping rates, it has been shown, are weighted averages of rates published annually for analysis and planning purposes in reference [9]. The D042 system is devoted to engine management, and is therefore ideal as a source for reports of engine shipments.

Information Spectrum affirms the appropriateness of the above input data systems.

In one case we demur. Section 3.2.2.6 shows that the engine weights input to the CSCS exclude packaging, while the algorithm implicitly assumes its inclusion. Packaged weights for other items are derived from the 0013 data system. Section 4 provides a suitable recommendation for engines.

3.2.4 Accuracy and Appropriateness of Algorithms

The concepts of the three algorithms may be summarized as follows:

- Count the number of items shipped.
- Multiply by item weight.
- Multiply by the appropriate (CONUS or overseas) average shipping cost per pound.

Since actual shipping costs for each item are not available, ISI finds the concept appropriate for NSNs, as far as it goes. However, it does not go far enough. Figure A1-3 of Attachment 1 indicates that the average packaging cost per pound in FY 82 was $2.38.[1] This includes labor and materials. This is more than the transportation cost. Information Spectrum considers it inappropriate to ignore packaging cost. An appropriate recommendation is provided in Section 4.

Section 3.2.2.5 of this report provided definitions of Queen Bee activities. Mr. Ludwig Coco (AFLC/MMMAE) has estimated that at present some 30% of engine transactions involve a Queen Bee. The present algorithm for Second Destination Transportation Costs, Engine consider only transportation between bases and depots. A recommendation incorporating transportation between bases and Queen Bees is provided in Section 4.

Information Spectrum feels that the current procedure for converting shipment counts to shipment costs based on costs per pound is inappropriate for engines. This conclusion is based on discussions with Mr. Ludwig Coco (AFLC/MMMAE), Mr. Marvin Martin (AFLC/MMMAC),

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(1) As written on the figure, this value was provided by Mr. J. B. McGill (AFLC/ACMCI) as a correction.

and Mr. Cecil Dodrill (OCALC Base Engine Manager), as well as from TO 00-85-20 referenced above. Some concepts developed from these sources are highlighted as follows.

An engine may be shipped mounted on a trailer with an adapter, or in a container. For air shipment there is a slight preference for the trailer. Shipment by truck would be packaged either way. Containers may be phased out for non-modular engines; they are heavy and awkward, and require maintenance. Overseas shipments are usually, but not necessarily, by air. Shipments within CONUS could be either way. For each engine shipment the mode (air or surface) is determined by the engine manager. His decision may depend on urgency, cost, mode availability, weather, expected traffic, and other factors.

The weight of the combined trailer and adapter varies from engine to engine and may be one of several values for a single engine. It is generally close to 1000 pounds, except for the TF-39 engine, for which the possible values are 16,440 or 19,300 pounds. Engine container weights are generally close to the engine weights.

Some engines require particular care. The F-100, if shipped by truck, requires an "air-cushion" ride. A single truck is reported to rent for $5,000 (essentially irrespective of distance). The additional cost of shipping another engine on the same truck is negligible.

A major objective of the CSCS is to provide a basis for predicting the life cycle cost for a new aircraft design. Some engines may require significantly more transportation cost per pound than others. These differences should be revealed by the CSCS, not obscured by using average shipping rates.

The foregoing discussion has addressed the appropriateness of the algorithms. With respect to accuracy, it is recognized that the use of one single average cost per pound within CONUS, and another for overseas, appears to be a gross distortion. When reported for individual bases, the resulting transportation costs ignore the actual distances from the bases to the depots. Nevertheless, ISI feels that the accuracy is satisfactory. The argument is that the transportation cost is representative rather than actual. Each analyst using CSCS results should be made aware that the reported second destination transportation costs represent "average" costs if that base were in an "average" location.

3.2.5 Directness of Costing

Costing is not direct because actual costs of transporting equipment items are not available. The fact that average shipping cost rates do not involve shipping distances make the costing even less direct.(1) However, ISI sees no possibility of any more direct method for developing second destination transportation costs. Hence we affirm the directness of costing in these algorithms.

3.2.6 Application to CSCS Output Reports

Second destination transportation costs are components of CSCS reports as described by Table 3. The accuracy of the algorithm

TABLE 3

CONTRIBUTION OF SECOND DESTINATION TRANSPORTATION COSTS ALGORITHMS TO CSCS OUTPUT REPORTS

OUTPUT REPORT[1]	COST ELEMENTS CONTRIBUTED TO BY THE ALGORITHMS[2]
1. MDS Logistic Support Costs/8104	1. By MDS for all bases: TCTO COSTS: BASE TRANSPORTATION COSTS
2. Cost Factors/8105	2. For all MDS, all bases: STANDARD SHIPPING RATE a. CONUS b. OVERSEAS
3. Base Work Unit Code (WUC) Cost/8106	3. By MDS and base: a. TOTAL BASE COSTS (1) COMPONENT (2) TCTO b. By five digit WUC: WUC COSTS (1) 2ND DEST TRANS (2) TOTAL WUC
4. Total Base Work Unit Code (WUC) Costs/8107	4. By MDS for all bases: a. TOTAL BASE COSTS (1) COMPONENT (2) TCTO b. By five digit WUC: WUC COSTS (1) 2ND DEST TRANS (2) TOTAL WUC
5. Total Base and Depot Work Unit Code (WUC) Costs/8108	5. By MDS for all bases: a. TOTAL COSTS (1) COMPONENT (2) TCTO b. By five digit WUC (1) BASE 2ND DEST COST (2) BASE & DEPOT WUC TOTAL

(1) CSCS output reports are assigned Report Control Symbol HAF-LEY (AR) nnnn, where nnnn is the number indicated in the output report title in Table 3.

(2) Identified by the title printed in the report.

TABLE 3 (Continued)

6. Summary of Cost Elements/8113	6. By MDS for all bases: DEPOT NON-MAINTENANCE TRANSPORTATION COSTS a. TCTO b. 2ND DEST
7. NSN-WUC Logistics Support Cost/8114	7. By NSN, MDS, and WUC for all bases: BASE COSTS, 2ND DEST TRANS
8. Assembly-Subassembly WUC Costs/8115	8. By MDS and WUC for all bases: BASE 2ND DEST COST

outputs will impact the accuracy of the reports as a whole. However, the total report accuracy cannot be addressed until all algorithms are reviewed. This will occur in the final report of this effort. Evaluation of the usefulness of the reports will also be provided in the final report of this effort and after ISI conducts a survey of users.

4.0 RECOMMENDATIONS

Section 3.2 of this report has identified several deficiencies in the algorithms. These are addressed by the following recommendations.

4.1 Shipping Rates Computations

Information Spectrum recommends that VAMOSC shipping rate calculations be modified to provide the following improvements per AFLCP 173-10, Sections 3-10 and 3-11:

- Include packaging costs.
- Include port handling costs for overseas surface shipments.
- Add CONUS to overseas rates for overseas shipments.

These changes may be implemented by providing suitable sample instructions in revised versions of VAMOSC Operating Instructions. Figure 1 provides a recommended version. In that figure, we have used FY83 values copied from reference [43] for most of the data. FY82 values were used for average packaging cost per pound and for packaged weight/item weight. This was done for illustration purposes, since FY83 values are not available.

4.1a Office of VAMOSC Comments

Concur. These elements will be added to CSCS shipping rates before processing for the first quarter of FY 85 begins.

Transportation Rates Computations

CONUS and overseas transportation rates are computed for CSCS using data obtained from AFLC/DSXR and AFLC/ACMC. This attachment shows computations for FY 1984.

In the calculations, column (1) is tons shipped in FY83 and column (2) is shipping cost per ton in FY83. These figures were provided by AFLC/DSXR. Column (3) is average shipping cost per pound. Column (4) is transportation cost per pound, including port handling charges of $0.021 (provided by AFLC/ACMC), which apply only to overseas surface shipping.

The packaging cost of $1.22617 is per packaged pound. It is the result of dividing the average packaging cost of $2.38 per item pound by the packaged weight/item weight factor of 1.941. Both of these factors were provided by AFLC/ACMC.

The inflation factor was obtained from AFR 173-13, Table 5-1, O&M Non POL column.

a. CONUS

	(1) Tons	(2) SCPT	(3) SCPP	$[(1)/\Sigma(1)] \times (3)$
Surface	215,973	174.54	.08727	.05395
Comm Air	3,225	798.14	.39907	.00368
LOGAIR	130,146	825.86	.41293	.15383
Total	349,344			

Average shipping cost per pound	.21146
Plus packaging cost	1.22617
	1.43763
Times inflation factor	1.053
VAMOSC CONUS shipping rate	$1.51382

Figure 1. Transportation Rate Explanation for VAMOSC Operating Instruction

b. Overseas

MAC

	(1) Tons	(2) SCPT	(3) SCPP	(4) *	[(1)/Σ(1)] x (3 or 4)
USAFE	34,861	2,498	1.249		.14276
PACAF	24,640	3,789	1.8945		.15306
AAC	10,911	787	.3935		.01408

MSC & MTMC

USAFE	152,035	241.81	.120905	.141905	.07074
PACAF	74,097	245.86	.12293	.14393	.03497
AAC	8,445	159.62	.07981	.10081	.00279
	304,989				.41840

Average overseas shipping cost per pound	.41840
Plus CONUS shipping cost per pound	.21146
Plus packaging cost	1.22617
	1.85603
Times inflation factor	1.053
VAMOSC Overseas shipping rate	1.9544

*Shipping plus port handling cost per pound

Figure 1. (Continued)

ATTACHMENT 3-2
Shipping Rates Computations

CONUS and overseas shipping rates are computed for CSCS using data obtained from AFLC/DSXR. This attachment shows computations for FY 1984.

a. General cargo to overseas areas:

	(1) S/T*	(2) AVCPT*	(3) AVCPP	[(1)/Σ(1)] X (3)
MAC				
USAFE	34,861	2,498	1.249	.1427638
PACAF	24,640	3,789	1.8945	.1530563
AAC	10,911	787	.3935	.0140775
MSC & MTMC				
USAFE	152,035	241.81	.120905	.0602703
PACAF	74,097	245.86	.12293	.0298658
AAC	8,445	159.62	.07981	.0022099
Total	304,989			.4022436
				X 1.053**
				.42356

b. CONUS transportation:

	(1) S/T*	(2) AVCPT*	(3) AVCPP	[(1)/Σ(1)] X (3)
Surface	215,973	174.54	.08727	.0539524
Comm Air	3,225	798.14	.39907	.003684
LOGAIR	130,146	825.86	.41293	.1538346
Total	349,344			.211471
				X 1.053**
				.22268

*Denotes data obtained from DSXR.
**Inflation factors obtained from AFR 173-13, Table 5-1, O&M Non POL column.

NOTE: AVCPT and AVCPP refer to Average Cost Per Ton and Average Cost Per Pound respectively (AVCPP = AVCPT/2000). Overall shipping rates for CSCS are obtained by finding the weighted average of the AVCPP for CONUS and overseas shipments.

Figure A1-2 Extract From VAMOSC OI 7 of 28 December 1983

Table A1-1 Transportation Costs Per Pound

		Air					Surface			
		CONUS		Overseas			CONUS	Overseas		
Source of Data	Valid	GBL	LOGAIR	USAFE	PACAF	AAC	GBL	USAFE	PACAF	AAC
J. B. McGill AFLC/ACMCI	FY 81	$0.427	0.349	1.026	1.546	0.309	0.081	0.107	0.092	0.036
AFLCP 173-10	FY 82	0.532	0.391	1.230	1.905	0.374	0.098	0.124	0.115	0.023
VAMOSC OI 7	FY 84	0.399	0.413	1.249	1.894	0.394	0.0873	0.121	0.123	0.080

(1) Material Management Overhead Rate. AFLCP 173-10 is usually published in December. Review the pamphlet and determine what percentage is stated. If nothing is entered, contact ACMC to see if the 21.7% is still considered an adequate number.

(2) Second Destination Transportation. Obtain the tonnage from LOZX and prepare calculation as shown:

SECOND DESTINATION COSTS 1982
DERIVATION OF COMPOSITE RATES FOR D160B

1981 Transportation to Europe (Short Tons)

	Air	Surface	Total	
USAFE	37,685	515,156	552,841	
PACAF	25,987	316,531	342,518	
AAC	11,457	39,419	50,876	
Total	75,129	871,106	946,235	Grand Total

% of Grand Total

	Air	Surface
USAFE	3.98%	54.44%
PACAF	2.74%	33.45%
AAC	1.21%	4.17%

Calculation of Composite Rate

	Air		Surface		
USAFE	3.98% x $1.026/pound	+	54.44% x $.107	=	$.09912
PACAF	2.74% x $1.546	+	33.45% x $.092	=	.07323
AAC	1.21% x $ .309	+	4.17% x $.036	=	.00524
					$.177/pound overseas 1982

1981 Transportation CONUS (Short Tons)

		% of Total
SURFACE	164,440	60.22%
COMM AIR	3,060	1.12%
LOGAIR	105,549	38.66%
Total	273,049	

Calculation of Composite Rate

SURFACE	60.22%	x	$.081/pound	=	$.0487
LOGAIR	38.66%	x	.349	=	.1349
COMM AIR	1.12%	x	.427	=	.0048
					$.188/pound CONUS 1982

Figure A1-1 Extract From VAMOSC OI 7 of 9 April 1982

Attachment 1: Analysis of CSCS Procedure for Developing Shipping Rates

Figure A1-1, extracted from reference [38], provides the computation procedures used by personnel of the Office of VAMOSC to develop average overseas and CONUS shipping rates in dollars per pound for 1982. It will be seen that the "calculation of composite rate" develops a weighted average of individual rates. The weights are observed tonnages for 1981. ISI investigated the source of the individual rates (for instance, $1.026/pound for air shipments to USAFE).

Mr. J. B. McGill (AFLC/ACMCI) provided the data in the first line of Table A1-1. These are identical to those used in Figure A1-1. The data provided by Mr. McGill are the 1981 version of rates published annually in AFLCP 173-10. A newer set of data from AFLCP 173-10 (reference [9]) appears in the second line of Table A1-1.

VAMOSC Operating Instruction 7 was updated by reference [43]. Figure A1-2, extracted from that reference, provides the new instructions for calculating average shipping rates. Although rearranged, it is clear that the method is identical to that of Figure A1-1, except that an inflation factor is applied to escalate the shipping rates from FY83 to FY84.

The individual shipping rates of Figure A1-2 appear in the third line of Table A1-1. Comparing this line with those above convinces us that the definitions of the individual shipping rates remain the same as used in AFLCP 173-10.

MEMORANDA OF AGREEMENT
FOR SYSTEM INTERFACES (Continued)

Ref. No.	Memorandum No.	Date
[6.24]	H036B/RC/D160B-A	10 Feb 1981
[6.25]	H069R/M024B/D160B-B	19 Jan 1981
[6.26]	0013/BDN/D160B	22 Jul 1982

MEMORANDA OF AGREEMENT
FOR SYSTEM INTERFACES

Ref. No.	Memorandum No.	Date
[6.1]	D002A/M024B/D160B-A	9 Jun 1980
[6.2]	D002A/M024B/D160B-B	9 Jun 1980
[6.3]	D024A/D160B-A	30 Jun 1980
[6.4]	D033./ARC/D160B	14 Jun 1980
[6.5]	D042A/DNB/D160B	4 Nov 1983
[6.6]	D046/M024/D160B	9 Apr 1981
[6.7]	D046/D160B	23 Jun 1982
[6.8]	D056A/BDN/D160B-A	23 Jan 1981
[6.9]	D056A/D160B-C	13 Oct 1981
[6.10]	D056A/D160B-D	29 Jan 1981
[6.11]	D056A F005	25 Apr 1979
[6.12]	D056B/BDN/D160B-A	22 Dec 1980
[6.13]	D056C/D160B-A	4 Mar 1981
[6.14]	D071/D160B	17 Jun 1982
[6.15]	D143B/D002A 9159	3 Aug 1979
[6.16]	D143F/ARC/D160B-A	5 Feb 1981
[6.17]	D160/D160B	11 Jun 1982
[6.18]	G004L/M024B/D160B-A	30 May 1980
[6.19]	G004L/M024B/D160B-B	30 May 1980
[6.20]	G004L/M024B/D160B-C	5 Nov 1981
[6.21]	G019F/D160B	8 Sep 1982
[6.22]	G033B/D160B	12 Jul 1982
[6.23]	G072D/BDN/D160B-A	19 Apr 1982

[42] VAMOSC Operating Instruction 7, Component Support System (CSCS), Mission Support of the CSCS (D160B), 9 April 1982

[43] VAMOSC OI7, 28 December 1983

[44] AFLC Regulation 75-1, Shipment Processing and Documentation, 15 October 1975, updated to 21 December 1977

[45] AFM 400-1, Volume I, Selective Management of Propulsion Units, Policy and Guidance, 21 June 1976

[46] Aircraft Operating and Support Cost Development Guide, Office of the Secretary of Defense, Cost Analysis Improvement Group, 15 April 1980

[47] Letter from ACM to ALMAJCOM-SOA/ACM/ACC/ACR, Subject: Commercial/Industrial Type Activities (CITA) Factor Development Procedures (RCS: HAF-ACM(AR)8004) (AF/MPMX Msg, 251445Z Jul 80), signed by Donald G. Kane, Colonel, USAF, Director of Cost and Management Analysis

[48] AFLC Regulation 65-12, Management of Items Subject to Repair (MISTR). 2 August 1978

[49] AFLC Regulation 66-61, Operational Planning, 27 October 1983

[50] "Validation of the Algorithms for Depot Support General, Labor, Direct Material, and Other Costs for the Component Support Cost System (D160B)," Information Spectrum, Inc., Report No. V-84-31859-15, 12 April 1984

[51] AF Manual 177-206, Automated Material System Interfaced with Supply System at Base Level, Users Manual, 1 August 1979, updated to 1 February 1983.

[52] AF Regulation 66-1, Maintenance Management, Volume 3, Squadron Maintenance, 2 January 1980

[53] "Validation of the Algorithm for Base Inspection Costs for the Component Support Cost System (D160B)," Information Spectrum, Inc., Report No. V-83-31859-04, 15 August 1983

[29] DoD Handbook 7220.29-H, Department of Defense Depot Maintenance and Maintenance Support Cost Accounting and Production Handbook, updated through 13 September 1979

[30] AF Manual 400-1, Volume II, Comprehensive Engine Management System (D042) Engine Status, Configuration and TCTO Reporting Procedures, 1 October 1983

[31] "Validation of the Algorithms for Base Exchangeable Repair Costs (Engine) and Base Exchangeable Modification Costs (Engine) for the Component Support Cost System (D160B)," Information Spectrum, Inc., Report No. V-84-31859-10, 11 February 1984

[32] TO-00-5-15, Technical Manual: Air Force Time Compliance Technical Order System, 15 April 1983

[33] "Validation of the Algorithm for Depot TCTO Labor Costs for the Component Support Cost System (D160B)," Information Spectrum, Inc., Report No. V-84-31859-12, 12 April 1984

[34] "Validation of the Algorithm for Depot TCTO Material Costs for the Component Support Cost System (D160B)," Information Spectrum, Inc., Report No. V-84-31859-13, 12 April 1984

[35] "Validation of the Algorithm for Depot TCTO Other Costs for the Component Support Cost System (D160B)," Information Spectrum, Inc., Report No. V-84-31859-14, 12 April 1984

[36] AFLC Regulation 170-10, "Depot Maintenance Service Air Force Industrial Fund (DMS, AFIF) Financial Procedures, 28 June 1979, updated to 16 February 1982

[37] "Validation of the Algorithms for Base Exchangeable Repair Costs (NSN) and Base Exchangeable Modification Costs (NSN) for the Component Support Cost System (D160B)," Information Spectrum, Inc., Report No. V-84-31859-09, 11 February 1984

[38] AF Manual 67-1, "USAF Supply Manual," Vol. II (Ph IV) Part II, 1 February 1984

[39] "Validation of the Algorithm for Base Maintenance Overhead Costs for the Component Support Cost System (D160B)," Information Spectrum, Inc., Report No. V-83-31859-08, 13 December 1983

[40] "Aircraft Operating and Support Cost Development Guide," Office of the Secretary of Defense, Cost Analysis Improvement Group, 15 April 1980

[41] DoD 7220.29H, "DoD Depot Maintenance and Maintenance Support Cost Accounting and Production Reporting Handbook," updated through 28 October 1981

[16] HQ USAF/ACF (AFAFC) Denver, Co ltr (undated), Subject: Direct Labor Rates for VAMOSC (your 21 Apr 83 ltr)

[17] "Validation of the Algorithm for Base TCTO Labor Cost for the Component Support System (D160B)," Information Spectrum, Inc., Report No. V-83-31859-01, 15 August 1983

[18] AF Regulation 300-4, Vol. III, Unclassified Data Elements and Codes, 1 May 1982

[19] AF Manual 177-674, USAF Standard Base Level Accounting and Distribution System (AFDS): H069R/XQ (H6000), 1 April 1980, updated to 18 June 1982

[20] AF Manual 177-370, USAF Standard Base-Level Accounting and Finance System (B3500), 1 December 1979

[21] TO-00-20-2-2, Technical Manual: On-Equipment Maintenance Documentation for Aircraft; Air-Launched Missiles; Ground-Launched Missiles; Except ICBMS; Drones; and Related Training Equipment, 1 August 1976, updated to 15 October 1982

[22] TO-00-20-2-10, Technical Manual: Off-Equipment Maintenance Documentation for Shopwork, Conventional Munitions, and Precision Measuring Equipment, 1 January 1978, updated to 1 August 1982

[23] AF Manual 66-267, Maintenance Data Collection System (MDC), DSDC: G001BD, Users Manual, 1 October 1979, updated to 1 January 1983

[24] Letter from Chief, Material Systems Division, Directorate of Comptroller Systems, Air Force Data Systems Design Center, to HQ AFLC/MM(VAMOSC), dated 15 September 1983, Subject: "D002A, Daily Consumable Material Cost Data Interface with D160B, Component Support Cost System (CSCS) (your ltr, 15 Aug 83)."

[25] AF Manual 67-1, USAF Supply Manual, Vol. II, Part I, Base Procedures, updated to 18 April 1983

[26] AFLC Regulation 72-2, Cataloging and Standardization, 3 March 1980, updated to 29 May 1982

[27] "Validation of the Algorithm for Base TCTO Overhead Costs for the Component Support Cost System (D160B)," Information Spectrum, Inc., Report No. V-83-31859-02, 15 August 1983

[28] "Validation of the Algorithm for Base Labor Costs for the Component Support Cost System (D160B)," Information Spectrum, Inc., Report No. V-83-31859-06, 13 December 1983

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[2] FD-K-14010C, *Functional Description* (for the Component Support Cost System (CSCS), Data System Designator D160B, undated draft)

[3] SS-K-15010B, *Component Support Cost System/Subsystem Specification*, 1 June 1983

[4] TO-00-20-2, *Technical Manual: The Maintenance Data Collection System*, 1 November 1981

[5] TO-00-20-2-45-2, *Operational Supplement to Technical Order: Maintenance Documentation for In-Shop Engine Maintenance*, 1 October 1982

[6] Memoranda of Agreement (listed separately)

[7] Letter from Chief, Material, Cost & International Accounting Systems Division, Directorate of Plans & System, HQ USAF, dated 27 Feb 1981, Subject: Direct Labor Rates

[8] *Air Force Magazine*, May 1983 (Almanac Issue)

[9] AFLC Pamphlet 173-10, *AFLC Cost and Planning Factors*, 31 December 1981

[10] "A Statistical Evaluation of the Accuracy of Maintenance Direct Labor Data Used in Support of Operating and Support Costs." Desmatics, Inc. Final Report No. 111-1, by Dennis E. Smith, Robert L. Gardner, and Terry L. King, April 1979

[11] "The Air Force Can Improve Its Maintenance Information System," U.S. General Accounting Office Report No. GAO/GGD-83-20, 25 January 1983

[12] *Compendium of Authenticated Systems and Logistics Terms, Definitions and Acronyms*, School of Systems and Logistics, Air Force Institute of Technology, 1 April 1981

[13] AF Regulation 177-101, *General Accounting and Finance Systems at Base Level*, 17 March 1980 updated to 1 June 1982

[14] AF Manual 177-380, *USAF Standard Base Level Maintenance Cost System (B3500)*, 19 October 1976 updated to 31 July 1981

[15] AF Regulation 173-13, *USAF Cost and Planning Factors*, 1 February 1982

For engine SDT costs, the current algorithm would be replaced by one which multiplies each shipment count by the sum of the appropriate average shipping cost and preparation labor cost. The tables should be updated annually by application of transportation inflation and military pay increase factors. However, they should be more accurately revised every few years by reiterated study efforts, to account for changes in transportation modes.

Appropriate DAR entries for the CSCS should be developed as a final phase of the study.

4.2.3a <u>Office of VAMOSC Comments</u>

Concur. We have been in contact with transportation personnel at OC-ALC and SA-ALC and are preparing a letter to them detailing our data needs. Our intent is to develop shipping rates, by TMS, for CONUS, overseas, and overseas-to-Queen Bee shipments.

The study should address each engine TMS covered by the CSCS. Each appropriate engine manager should be consulted, as well as transportation managers at SAALC and OCALC. For each engine or module TMS, the study should address the following questions:

(1) What was the actual average cost of one-way transportation between CONUS bases and the depot for the latest year for which data are available?

(2) Same question for overseas bases.

(3) Same question for transportation between base and Queen Bee (where applicable) separately for CONUS and overseas.

(4) Is there any reason to consider the data not representative? If so, what adjustments should be made?

(5) Can the average labor cost of preparing the engine or module for shipment be estimated?

If data are not available for some TMS, it should be possible to estimate them based on comparable TMS.

Results of this study would be used by the CSCS in calculating engine SDT costs as follows. The CSCS would store a table which provides, for each engine or module, the average shipping cost between base and depot, and (where applicable) the average shipping cost between base and Queen Bee. These data would be provided separately for CONUS and overseas bases. Finally, the table would provide the average labor cost of preparing the engine or module for shipment.

that we intend to negotiate a new MOA as soon as possible.

4.2.2 Engine Shipments Involving Queen Bees

Reports of receipts of engines by one base from another are assumed to indicate shipment between a base and a Queen Bee. Both shipper and receiver are indicated. Reports of receipts of serviceable engines ("RB" and "RR" reports) should be associated with the receiving base. Other reports should be associated with the shipping base.

In accordance with the Queen Bee Concept, engine shipments from one base to another should involve short distances, and reduced shipping rates should apply. We recommend that the Office of VAMOSC support a study to establish a reduction factor to be applied to shipping rates for these shipments.

4.2.2a Office of VAMOSC Comments

Concur. The OOV will request data on overseas-to-Queen Bee shipments in conjunction with our request for CONUS and overseas shipping data.

4.2.3 Engine Shipment Costs

Section 3.2.4 presented ISI's conviction that the CSCS should provide visibility into differences in shipping costs for different engine TMS. We recommend that the CSCS support a study, and apply the results, as follows.

4.2 Engine Second Destination Transportation Algorithm

There are three aspects to our recommendations regarding second destination transportation costs for engines. First, reports of receipts of engines by depots should be properly counted. Second, provision should be made for accounting for costs of transportation of engines between Forward Operating Bases and Queen Bees. Finally, the methodology for converting engine shipment counts to engine shipment costs should be revised. Each of these recommendations is further detailed below. Appropriate DAR entries for the D042 and CSCS systems are provided in Attachments 2 and 3.

4.2.1 Counting Engine Receipts at Depots

Information Spectrum recommends that the current data provided to the CSCS by D042A be replaced by reports of all engine receipts by depots, and of all receipts other than "RA" where both receiver and shipper are not depots. "RA" reports apply to installed engines, and do not incur transportation costs. Pending implementation of the recommendation of Section 4.2.3, we recommend that the reports of receipts by depot be used to generate two-way shipment costs as is done in the current algorithm. However, it should be recognized that the "cost per pound" approach is an oversimplification, as discussed in Section 3.2.4. Moreover, it should be recognized that the cost of shipping engine "packaging" is not currently accounted for.

4.2.1a Office of VAMOSC Comments

Concur. The DAR requesting this change will be submitted by 28 Sep 84. OOV personnel will contact the D042A OPR and inform them

The final issue is the exact meaning of the individual rates in AFLCP 173-10. Figure A1-3 provides an extract from that reference. Section 3-11 states "Transportation cost factors... have been computed based on... total weight shipped." Section 3-10 makes it clear that "total weight" includes packaging, and is almost twice as large as unpackaged weight.

Section 3-11.d(1) says "add the CONUS air... rates to the overocean air rate." This makes it clear that the overseas air rates of AFLCP 173-10 apply to the overseas portion of a shipment only. If a part were shipped by air from SAALC to Germany, for instance, the "overocean" rate in AFLCP 173-10 does not cover the portion of the trip from San Antonio to the East Coast.

For surface shipments, Section 3-11.d(2) says that the CONUS surface rate, the overocean surface rate, and a port handling charge should be added.

Combining these understandings of AFLCP 173-10 with the methodology of VAMOSC Operating Instruction 7, it is evident that the average rates being used in the CSCS for overseas shipments are average costs per packaged pound of the overseas portion of shipments, excluding port handling costs (if applicable).

11/1/83 J.B. McGill AFLC/ACMCI (74622) gave me this correction.

Europe, Mediterranean, or Africa; Area 3 - Western Pacific. The source of the data is AFM 67-1. The OPR is HQ AFLC/LOLSC. The prescribing directive is AFM 67-1, volume I, part 1, chapter 24.

	01-03	04-08	09-15
A. Requisition Submission	1	1	2
B. Passing Action	1	1	2
C. Inventory Control Point Availability Determination	1	1	3
D. Depot/Storage Site Processing	1	2	8
E. Transportation Hold and CONUS Intransit	3	6	13
F. Overseas Shipment Delivery			
Area 1	4	4	38
Area 2	4	4	43
Area 3	5	5	53
G. Receipt Takeup by Requisitioner	1	1	3
Total Order and Shipping Time CONUS (SUM A thru E + G)	8	12	31
Total Order and Shipping Time Overseas (SUM A thru F + G)			
Area 1	12	16	69
Area 2	12	16	74
Area 3	13	17	84

3-10. Packaging Cost. The direct labor and the direct material cost associated with preparing material for shipment are presented below. The ratio of package item weight to unpackaged item weight is also presented. Since most items receive level B pack and level A preservation, the difference for CONUS and overseas is insignificant. Cost elements and weight elements are defined as follows:

a. Packaging Material Cost - The cost of preservatives, barriers, containers, cushioning and dunnage used to protect items during transportation and storage.

b. Packaging Labor Cost - The wages paid to fabricate, assemble and apply protective shipping and storage measures up to, but not including shipment processing.

c. Unpackaged Item Weight - The bare weight of an item in a storage configuration.

d. Packaged Item Weight - The combined weight of the item, plus preservative materials, dunnage and container.

	FY82
Avg Packaging Cost/Pound	~~$1.94~~ 1.38
Packaged Weight/Item Weight Factor	1.941

3-11. Transportation Cost. The charges for freight, cartage, demurrage and port handling incurred in the shipment of Air Force materiel. Transportation cost factors for shipments within the CONUS and shipment from CONUS to overseas areas (Europe — USAFE, Pacific — PACAF, Alaska — AAC) have been computed based on total shipment costs and total weight shipped. Air shipments to overseas areas are via Military Airlift Command scheduled service (MAC channel traffic); surface shipments CONUS to overseas are via Military Sealift Command (MSC). Rates for shipments within CONUS and shipments overocean from CONUS to overseas areas expressed in FY82 dollars per pound are presented. Guidance to be used in estimating transportation costs:

a. Priority 1 through 8 (immediate end use) shipments - use applicable air rate unless size forbids it.

b. Priority 9 through 15 (stock replenishment) shipments - use applicable surface rate.

c. CONUS air shipments - use the LOGAIR rate unless the shipping or receiving location is not serviced by LOGAIR.

d. CONUS to overseas shipments:

(1) Air - add the CONUS air (Government bill of lading (GBL) or LOGAIR) rate to the overocean air rate CONUS port handling, overseas inland air transportation and overseas port handling have been included in the overocean rate for AAC, USAFE and PACAF.

(2) Surface - sum the CONUS surface rate, the CONUS port handling rate and the overocean surface rate. Overseas inland surface transportation and overseas port handling are not included in the overocean rate for AAC, USAFE and PACAF.

The source of the data is the Military Airlift Command Tonnage and Cost System (O027A), the Surface Transportation Tonnage and Cost System (O027B) and the Overseas Ocean Terminal Handling and Inland Line Haul Cargo Cost Report, RCS: MTMC-79(R2). The OPR is HQ AFLC/LOZX.

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 $ .018

Figure A1-3 Extract From AFLCP 173-10

Attachment 2: Proposed DAR Entries Supporting Changes in Selection of Data Provided to D160B by D042A

Requirement:

Memorandum of Agreement D042A/BDN/D160-A dated 4 November 1983 calls for provision of records with "condition/status codes "JL" and "RL" ... reported at Contractor/Depot respectively..." These codes are evidently properly identified as transaction/condition codes.

Request that the criteria for record selection be changed to the following

(1) Provide records for all reports of receipt (transaction code "R") by a depot or contractor, except for transaction/condition code "RA" (receipt of installed engine).

(2) Provide records for all reports of receipt (transaction code "R") where neither shipping SRAN nor receiving SRAN is a depot or contractor, except for transaction/condition code "RA".

Impact Statement

Analysis has shown that D160B can use only the "RL" reports of those currently provided. These account only for shipments of engines to depots for major overhaul. The change will permit more complete accounting for engine transportation costs, including shipments between bases and shipments to depots for minor repairs.

Justification Benefits/Cost Savings

Reasonably accurate cost estimates are needed so that the

Component Support Cost System can function effectively as a tool for decision making.

Attachment 3: Proposed DAR Entries Supporting Modification of Calculation of Second Destination Transportation Costs, Engine by D160B

Requirement:

A separate DAR is requesting that D042A provide two classes of engine receipt records to D160B:

- Receipt of engines by depots or contractors
- Receipt of engines shipped from one base to another.

Note that the SRAN of the organization reporting receipt is in characters 46-49 of the record; the sender's SRAN is in characters 87-90. The CSCS would have to store a table of SRANs of depots and engine overhaul contractors.

It is requested that the CSCS continue to accumulate engine costs for shipments to depot or contractors as before, counting two-way shipments and associating the cost with the shipping base.

For shipments from one base to another, one-way costs should be counted. The cost should be associated with the receiving base for "RB" and "RR" reports, and with the shipping base for other reports. The shipping rates used for these base-to-base shipments should be new rates generated manually by Office of VAMOSC personnel.

Impact Statement

The modification permits an estimate of costs of shipping engines from base to base, notably for "Queen Bee" operations. These constitute a significant part of engine management, and are not covered by the present system.

Justification Benefits/Cost Savings

Reasonably accurate cost estimates are needed so that the Component Support Cost System can function effectively as a tool for decision making.

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This study is the nineteenth of a set of reports documenting the findings of a study conducted by Information Sepctrum, Inc (ISI) for the Office of VAMOSC, Air Force Logistics Command. This study constitutes an assessment of the algorithms for Second Destination Transportation Costs within the Component Support Cost System (CSCS subsystem of VAMOSC, the Air Force Visibility and Management of Operating and Support Cost system. CSCS deals with subsystems and components for aircraft.

20. This report provides the verification of the three algorithms dealing with second destination transportation (SDT) costs. The CSCS system subdivides SDT costs into three categories. The first category is SDT costs for time compliance technical orders (TCTOs) performed at depots for equipment other than engines. The second category is SDT costs for other maintenance for equipment other than engines. The final category is SDT costs for all engine activities.

Since existing data systems do not track shipping costs for individual items, the algorithms are based on Air Force-wide average shipping costs per pound, calculated separately for continental United States (CONUS) and overseas shipments. For each Work Unit Code, each algorithm determines the number of items shipped during the calendar quarter and the item weight. The product of the number of items shipped, the item weight, and the average shipping cost (CONUS or overseas depending on the base location) is taken to be the SDT cost.

This volume presents ISIs conclusions and recommendations, and the comments of the Office of VAMOSC.