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VALIDATION OF THE ALGORITHM
FOR
DEPOT MATERIAL MANAGEMENT OVERHEAD COSTS
FOR
THE COMPONENT SUPPORT COST SYSTEM
(D160B)

Contract No. F33600-82-C-0543

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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 the CSCS algorithm titled "Depot Material Management Overhead Costs." This algorithm addresses the costs of acquiring, managing, and storing material at the depot.

The algorithm applies a fixed percentage (21.7%) to the sum of all base and depot costs calculated by the CSCS for materials, exchangeable repairs, modifications, or condemnation spares.

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.

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Next, the algorithm is 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 algorithm is provided as required by the contract. It addresses the following topics:

- o Verification of assumptions and approximations for appropriateness and accuracy.
- o Validation of accuracy of source data.
- o Validation of appropriateness of source data as inputs to CSCS logic.
- o Investigation of accuracy and appropriateness of algorithms.
- o Consideration of replacement of indirect cost methods with more direct ones.
- o 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 Depot Material Management Overhead Cost algorithm, all aspects are affirmed. Information Spectrum recommends that it be retained in its present form.

However, the investigations led to two recommendations. There is reason to suspect that CSCS data processing procedures in this area do not provide exactly the desired output. A detailed

recommendation for assuring the suitability of these procedures is provided. The second recommendation calls for a vigorous effort to identify the organization which generated the material management overhead factor currently being used. The recommendation calls for either validating the appropriateness of that factor for CSCS needs or for replacing it by a more suitable one. In either case, substantiating documentation should be provided.

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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 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 Algorithm

This report provides the verification and validation of algorithm 30 of Table 2, "Depot Material Management Overhead Cost." This is the cost of acquiring, managing, and storing material at the depot.

The algorithm applies a fixed percentage (21.7%) to the sum of all base and depot costs calculated by the CSCS for materials, exchangeable repairs, modifications, or condemnation spares.

TABLE 1. CSCS OUTPUT REPORTS

<u>Number*</u>	<u>Name</u>
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.

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

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

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.

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.

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.

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.

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 algorithm for Depot Material Management Overhead Costs.

Section 3.1 provides a detailed description of the algorithm and of the input data it uses. 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 the calculation formula is stated in Section 3.1.1. The input data elements and their sources are provided in Section 3.1.2. The calculations are 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.

3.1.1 Calculations

Depot material management overhead costs are calculated separately for base material cost elements and depot material cost elements. For base cost elements the calculations are organized by NSN, MDS, base, and WUC. For depot cost elements the calculations are organized by NSN, MDS, ALC, and WUC. (However, when the material cost element is TCTO material, there is no associated WUC.)

The material cost elements for which depot material management overhead costs are calculated encompass all of the material categories considered by the CSCS. These categories, which are mutually exclusive, are

- TCTO material
- Direct material
- Exchangeable repair
- Class IV modifications
- Class V modifications
- Condemnation spares

Cost elements include engine costs wherever these apply.

For each cost element, the associated component of depot material management overhead cost is the product of the cost element and a number known as the Material Management Overhead Factor.

3.1.2 Inputs

All of the input cost elements are outputs of other CSCS algorithms. The Material Management Overhead Factor is currently a fixed value of 21.7%. According to reference [1], it will be updated periodically by AFLC/ACM.

3.1.3 Description of Calculation Procedure

The basic calculation is a simple multiplication, as described in Section 3.1.1. The resulting material management overhead cost elements are aggregated by the CSCS in various ways. This aggregation process is addressed in Section 3.2.

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.

As indicated above, the material management overhead cost elements are aggregated by the CSCS in various ways. Careful study of reference [3] indicated to Information Spectrum that the procedures being used to aggregate costs and display them in reports may fail to provide a non-overlapping, exhaustive accounting of material management overhead costs.

The aggregation and display processes are not part of the algorithm itself. Accordingly, they are outside the scope of the contractual effort, and do not fit into the framework which has been established for criticism of the algorithms. Criticism of the material management overhead cost aggregation and display procedures are provided in Attachment 1.

3.2.1 Appropriateness and Accuracy of Assumptions and Approximations

In order to consider the appropriateness and accuracy of assumptions and approximations, it is necessary first to establish where the factor of 21.7% came from and what it means. Reference [1] states that it was provided by a HQ USAF/ACD, 5 Sep 1980, letter. The Office of VAMOSC provided ISI with a copy of a letter (reference [47]) which, although from ACM, is apparently the one in question. That letter provides, among other things, "procedures to develop... Materials Mark-up," which "will be published as Chapter 6 of AFR 26-1."

With the letter, the Office of VAMOSC provided an extract from an attachment. ISI has verified that the extract has indeed been incorporated in AFR 26-1. The relevant portion of this extract reads as follows:

6. Materials Mark-up Develop a weighted mark-up rate to account for non-installation government agency management overhead for the five supply EEICs which have multiple sources (EEIC 600, 602, 605, 609, 628). The Cost Comparison Handbook (CCH) identifies overhead rates for General Services Administration (GSA) and Defense Logistics Agency (DLA) sources of supply. Other agency rates for AFLC, Army, Navy have been determined to be 21.7%.

The quotation above mentions the Cost Comparison Handbook. Also provided to ISI by the Office of VAMOSC was an excerpt from that handbook, further identified as Supplement No. 1 to OMB Circular No. A-76. From an update of that excerpt we extract the following:

Pricing material from other government agencies.
For purposes of the cost analysis, indirect costs associated with direct material obtained from other agencies will be added to the direct material cost...

- (1) General Services Administration. In most instances, the prices charged by GSA for material do not include all of the costs of the acquisition and storage functions performed by GSA.
.....
- (3) Other agencies. The furnishing agency must be requested to determine the costs of acquiring, managing, and storing its material. These costs will usually be presented as a percentage of its total material costs.

It is clear from other portions of the extracts that "other agencies" means other than GSA or DLA.

Study of material from AFR 26-1, the Cost Comparison Handbook, and the supplement to OMB circular A-76 indicates that all are concerned with the costs of materiel which might be obtained from various sources. If the source is the Army, Navy, or Air Force, the stock list price is not an adequate measure of the cost. To that price should be added the costs of acquisition, management, and storage. For these sources (the military departments), on the average, the costs for these activities are 21.7% of the material cost. The CSCS adopts this estimate for depot management of all material.

With this understanding, Information Spectrum has identified two assumptions and one approximation implicit in the algorithm. The first assumption is that the given overhead factor applies to all depot material, not just the five EEICs identified in the extract from AFR 26-1.

ISI has identified the five EEICs as follows:

<u>EEIC</u>	<u>Cost Category</u>
600	Solid utilities fuel (coal, etc.)
602	Packaged oil and lubricants
605	Net issues of supplies, System Support Division
609	Net issues of supplies, General Support Division
628	Net issues, expensed equipment, General Support Division

This list excludes investment items, while the first two items are not of current direct interest to the CSCS. ISI can see no reason to believe that this list of EEICs should bias the overhead factor.

The second assumption is that the depot material management overhead cost associated with a particular item is proportional to the cost of the item. Depot management costs are not recorded

against the items being managed, and it is obviously impractical to try to do so. The only characteristics which can be imagined as a basis for allocating material management costs are item cost, weight, or item count. No analytic basis for selecting one of these is evident, and our experience and intuition supports the use of item cost. Thus Information Spectrum affirms the appropriateness of the two assumptions.

The approximation, of course, is the value 21.7%, applied to the item list price in order to estimate the material management overhead cost. In order to affirm the accuracy of this factor and its applicability for CSCS purposes, its origin should be clearly understood. The earliest available identification of the factor is reference [47], dated 5 September 1980, which was provided to the Office of VAMOSC by Mr. Henry Ring, APMC. Information Spectrum contacted Mr. Ring directly to try to trace the derivation of the 21.7%. Mr. Ring acknowledges that he must have sent the information some time ago, but he no longer has any idea where it came from.

Further investigation led to the Cost Analysis Division of the Comptroller's Group of Headquarters, USAF. There an analyst, Mr. Scott Dillon, provided the most current information available. The next issue of AFR 26-1 will not call for a material markup rate of 21.7%. Instead, it will require use of the same markups as currently prescribed in AFR 26-1 for supplies provided by the Defense Logistics Agency: 24.5% for "wholesale" supplies, and 13.4% for "direct delivery." The meanings of these classes are

provided by the following extract from the Cost Comparison Handbook:

The wholesale program involves the distribution of common-use, commercially available items through a network of supply distribution facilities located throughout the United States. Also included is the Stores Direct Delivery Program. This program provides the same type of items carried in stock which, because of volume orders, are procured from the vendor for direct delivery to the requisitioner in instances when delivery time is not critical.

According to Mr. Dillon, the change in AFR 26-1 is in response to a memorandum from the honorable Lawrence J. Korb, Assistant Secretary of Defense for Manpower, Reserve Affairs, and Logistics.

In view of the foregoing discussion, Information Spectrum provisionally affirms the accuracy of the 21.7%. We expect that when AFR 26-1 is updated, the OOV will update to the 24.5% value given for "wholesale" supplies.

Section 4.1 recommends further action to assure a valid material management overhead markup factor.

3.2.2 Accuracy of Source Data and Congruence of Data Element Definitions

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.

For the Depot Material Management Overhead Cost algorithm, one input is the 21.7% value. No published criticism has been found. The background material in Section 3.2.1 permits ISI to affirm the congruence of the definition of this factor with its use by the CSCS.

The other inputs to the algorithm are all depot material costs which are outputs of the CSCS itself. Information Spectrum has provided recommendations to refine some of these cost calculations in reports generated as part of this effort. With the assumed adoption of these recommendations, we can affirm the accuracy of the input material costs.

A question arises regarding the definition of material costs. For direct material, TCTO material, and condemnations, the cost is the stock list price. For exchangeable repairs or modifications, the CSCS "cost" includes labor, materials, overhead, etc. An initial view may suggest that the 21.7% should not apply to all of these elements. But exchangeables are returned to depot stocks, where they do incur storage and management costs. Also, the exchangeable cost is almost surely less than the stock list price, or else it would be preferable to throw away the item instead of repair it. Accordingly, ISI concludes that the costs used in the algorithm are defined in congruence with the application of the material management overhead factor.

3.2.3 Appropriateness of Source Data as Inputs

No alternative source for a material management overhead factor could be found. The CSCS itself is obviously an appropriate source for the material costs. Given the nature of the algorithm, ISI affirms the appropriateness of the source data.

3.2.4 Accuracy and Appropriateness of Algorithm

The essence of the algorithm is the allocation of management costs in proportion to item costs. For any indirect cost an

allocation is inevitable. Section 3.2.1 has already supported the use of item cost as an appropriate basis for allocation.

The accuracy of the algorithm is, as previously noted, open to question until the origin of the 21.7% can be further investigated. However, Section 1-2 of reference [1] emphasizes the CSCS objectives of permitting comparison of costs among existing or projected equipment items. For such applications the absolute accuracy of any indirect cost algorithm is not critical. In view of the CSCS objectives, ISI affirms both the appropriateness and the accuracy of the algorithm as satisfactory.

3.2.5 Directness of Costing

Material management overhead costs are indirect costs, not directly related to the end items being managed. For any indirect cost it is appropriate to use an allocation method. Information Spectrum affirms the costing method of the algorithm as appropriately direct.

3.3 Application to CSCS Output Reports

Depot material management overhead costs are components of CSCS reports as described by Table 3. The accuracy and validity of the algorithm output 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.

TABLE 3

CONTRIBUTION OF DEPOT MATERIAL MANAGEMENT OVERHEAD
COSTS ALGORITHM TO CSCS OUTPUT REPORTS

<u>OUTPUT REPORT</u> ⁽¹⁾	<u>COST ELEMENTS CONTRIBUTED TO BY THE ALGORITHM</u> ⁽²⁾
1. MDS Logistics Support Costs/8104	1. For all MDS: a. WUC COMPONENT COSTS (1) BASE (2) DEPOT b. TOTAL MDS COSTS c. By subsystem: WUC QTR COST
2. Cost Factors/8105	2. For all MDS and bases: MATERIAL MANAGEMENT OVERHEAD RATE
3. Base Work Unit Code (WUC) Costs/8106	3. By Base, MDS, and WUC: a. MAT MGT OV/HEAD b. TOTAL WUC
4. Total Base Work Unit Code (WUC) Costs/8107	4. By MDS and WUC for all bases: a. MAT MGT OV/HEAD b. TOTAL WUC
5. Depot On-Equipment Work Unit Code (WUC) Costs/8111	5. By ALC, MDS, and WUC: a. MAT MGT OV/HEAD b. WUC TOTAL COST
6. Total Base and Depot Work Unit Code (WUC) Costs/8108	6. By MDS and WUC: a. MAT MGT OH COST (1) BASE (2) DEPOT b. BASE & DEPOT WUC TOTAL
7. Summary of Cost Elements/8113	7. By MDS: DEPOT NON-MAINTENANCE a. BASE MAT MGMT OVERHEAD COST b. DEPOT MAT MGMT OVERHEAD COST

(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)

8. NSN-WUC Logistics
Support Cost/8114

9. Assembly-Subassembly
WUC Costs/8115

8. BY NSN, MDS, and WUC:
a. MAT MGT OV/HEAD
 (1) BASE COSTS
 (2) DEPOT COSTS
b. TOTAL NSN

9. By MDS and WUC:
a. MAT MGT OH COST
 (1) BASE
 (2) DEPOT
b. BASE & DEPOT WUC TOTAL

4.0 RECOMMENDATIONS

Section 3.2 has affirmed all aspects of the Depot Material Management Overhead Cost algorithm. Information Spectrum recommends that it be retained in its present form.

However, Section 3.2 and Attachment 1 have indicated a lack of confidence in the data processing procedures used to implement the algorithm. Section 4.1 provides an appropriate recommendation.

Section 3.2.1 showed that the material management overhead factor used by the CSCS was developed by the Air Force for other purposes. Section 4.2 provides a recommendation addressing the value of this factor.

4.1 Data Processing Procedures

Information Spectrum recommends that the OOV consult with the CSCS programming activity to assure that the CSCS data processing procedures and outputs for depot material management overhead costs meet its needs. Attachment 1 provides a foundation for such an effort. If any discrepancies are discovered, corrective action should be taken through the generation of Data Automation Requests (DARs).

4.1a Office of VAMOSC Comments

Concur. The DAR requesting investigation into the actual calculation of MMOH costs will be submitted by 28 Sep 84.

4.2 Validation of Material Management Overhead Factor

The material management overhead factor currently used by the CSCS was developed as part of the cost comparison procedures which implement the policy and requirements of OMB Circular No. A-76. These procedures address the "comparison of the estimated cost to the Government of acquiring a service by contract and of providing the service with in-house government resources."⁽¹⁾ This factor may or may not be well suited to CSCS purposes.

Information Spectrum recommends that the OOV determine the organization responsible for developing the current material management overhead rates promulgated by AFR 26-1. This organization should be well qualified to help establish a rate more suited to CSCS needs, if this proves desirable. ISI's experience in trying to trace these rates suggests that a forceful, formal, diligent effort will be needed.

When the appropriate organization is identified, they should be asked to help determine whether the material management overhead rate is applicable to CSCS needs. Important features of the material management overhead rate needed by the CSCS include the following:

- The rate should account for labor, not storage facilities or equipment, for depot level storage and management of material.
- The rate should be a multiplicative factor. It should

⁽¹⁾ Cost Comparison Handbook, Supplement (Part IV) to OMB Circular No. A-76, Performance of Commercial Activities, Aug 4, 1983.

apply, as a reasonable approximation, to the list price of newly purchased material, and to the repair or modification cost of exchangeable items.

- The rate should account for management costs over the average depot holding period, from receipt into depot supply to issue.

If the existing rate is considered inappropriate to CSCS needs, the organization's assistance should be requested in developing a rate which is appropriate. Whether the old rate or a new one is used, documentation should be requested which describes the data collected, the data collection procedure, and the processing and calculations leading to the rate.

4.2a Office of VAMOSC Comments

Concur. The CSCS OPR will contact those individuals who develop the MMOH rates found in AFR 26-1 and solicit their help in determining the applicability of those rates to CSCS. In addition, procedures will be set up to ensure that VAMOSC personnel are alerted to any future updates of the rates.

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- [4] TO-00-20-2, Technical Manual: The Maintenance Data Collection System, 1 November 1981
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- [8] Air Force Magazine, May 1983 (Almanac Issue)
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- [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
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- [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
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- [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

MEMORANDA OF AGREEMENT
FOR SYSTEM INTERFACES

<u>Ref. No.</u>	<u>Memorandum No.</u>	<u>Date</u>
[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

MEMORANDA OF AGREEMENT
FOR SYSTEM INTERFACES (Continued)

<u>Ref. No.</u>	<u>Memorandum No.</u>	<u>Date</u>
[6.24]	H036B/RC/D160B-A	10 Feb 1981
[6.25]	H069R/M024B/D160B-B	19 Jan 1981
[6.26]	O013/BDN/D160B	22 Jul 1982

Attachment 1: Criticism of CSCS Data Processing Procedures Used for Material Management Overhaul Calculations

Study of reference [3], the CSCS System Specification, led to identification of several apparent deficiencies in the data processing procedures as described there. These deficiencies are described as follows:

1. The following outline shows where the calculations of material management overhead cost elements are described.

<u>Program</u>	<u>Page</u>	<u>Par.</u>	<u>Cost Element</u>
PKPLJ	4-138	11a	Base exchangeable repair Base Class IV mods. Base Class V mods. Base condemnation spares
		11b	Depot exchangeable repair Depot Class IV mods. Depot Class V mods. Depot condemnation spares
		11c	Base TCTO material
PKPLN	4-141	4b	Base direct material
PKPLQ	4-144	3c	Depot direct material

There is no description of a calculation of material management overhead costs for depot TCTO material. This appears to be an error.

2. Page C-50 provides the format of a CSCS file labeled PKLQA, and titled "Depot MDS Compute Record." This record includes the following elements:

<u>Number</u>	<u>Description</u>
013	Other modifications MMOC*
018	Class IV modifications MMOC
023	Class V modifications MMOC
029	MMOC (unspecified)

*Material management overhead cost

ISI cannot see what element 013 should mean. There is no description of any program which separately calculates elements 013, 018, or 023. It is not evident what element 029 embraces. Elements 018 and 023 appear to be included in material management overhead costs generated by program PKPLN and apparently stored in other files (PKLJA, B, C). This leads to a suspicion of double accounting. It should be determined where each of the MMOC entries of file PKLQA comes from, and what is done with them.

3. File PKLQB has a single entry identified as a depot MMOC. It should be determined where this comes from and what is done with it.

4. The formats of the CSCS output reports do not address MMOCs at the level of detail at which they are being generated. As a result, it is not evident what MMOC elements are included in which outputs. ISI suspect that MMOCs corresponding to TCTO material do not appear under any MMOC headings nor under any TCTO headings. This may imply that these elements are not incorporated into higher level (e.g., whole MDS) logistics support costs, and are not included in any printed outputs. It is recommended that the OOV determine exactly which MMOC elements actually are incorporated into each printed output. This determination should be extended to magnetic tape output products produced by the CSCS. The OOV should then arrange to correct any deficiencies revealed.

INFORMATION SPECTRUM, INC.

3993 HUNTINGDON PIKE • HUNTINGDON VALLEY, PA. 19008 • (215) 947-6060

31 May 1984

HQ AFLC/ACMC
Wright-Patterson AFB, OH 45433

Attention: Henry Ring

Dear Mr. Ring:

Thank you for your cooperation on the telephone on 30 May. Enclosed is a copy of reference material which I received from the Office of VAMOSC some months ago. I find the material quite obscure. I am trying to decide whether it is appropriate to multiply the stock list price of materials managed by depot supply by 21.7% in order to account fully for depot supply management overhead associated with those materials. Obviously, the result would be an estimated average overhead cost.

The current VAMOSC algorithm multiplies 21.7% times the cost of exchangeable items, among others. But exchangeable costs in this system include labor and overhead. I suspect that it is improper to apply the 21.7% to the labor and overhead costs.

For your information, I can make out the content of the obscured lines in the first attachment to the letter. They say

"Develop weighted average mark-up rate to account for non-installation government agency management overhead..."

The reference to five EEICs suggests that the overhead rate may not even apply to all supplies, but I can't tell.

Any clarification which you can provide will be deeply appreciated.

Sincerely,


Sheldon J. Einhorn
Chief Scientist

SJE:gg
Copies: HQ AFLC/MML (VAMOSC)
Wright-Patterson AFB, OH 45433
Att: Lt. Col. Paul Reid

Russ Cook

1746 JEFFERSON DAVIS HIGHWAY
ARLINGTON, VIRGINIA 22202
(703) 992-9000

1040 KINGS HIGHWAY NORTH
CHERRY HILL, NEW JERSEY 08034
(609) 667-6161

Attached is a copy of the
AF/ACM ltr 5 Sep 80 with the
portion of the attachment that
talks about the 21.7% factor.

Also attached is an extract
from the OMB Circular A-76
handbook that discusses
the material mark-up factors.

The 21.7% material mark-up
factor is also referenced in
AFR 26-1, ^{V&S} 2 Oct 1981, page 43,
paragraph 6-6

Henry Ring 77816
HENRY RING ACME



DEPARTMENT OF THE AIR FORCE
HEADQUARTERS UNITED STATES AIR FORCE
WASHINGTON, D. C.

7-21

5 SEP 1980

REPORT TO
ATTN OF ACM

SUBJECT: Commercial/Industrial Type Activities (CITA) Factor Development
Procedures (RCS: HAF-ACM(AR)8004) (AF/MPMX Msg, 251445Z Jul80)

ALMAJCOM-SOA/ACM/ACC/ACR

1. The factor development instructions to assist Manpower and Organization activities in implementing the 29 March 1979 OMB Circular A-76, "Policies for Acquiring Commercial or Industrial Products and Services needed by the Government" are provided in attachment 1. These revised procedures for factor development will be published as Chapter 6 of AFR 25-1. The new instructions to develop base-level factors for Civilian Fringe Benefits, Materials Mark-up, General and Administrative Expense, and Material Overhead use a worksheet methodology which was developed by TAC/ACM with the assistance of MAC and ATC. Our special appreciation goes to SMSgt Jack Maculley for developing the worksheet procedures.

2. To begin the FY 81 factor development program, this package should be forwarded to your bases as soon as possible. Each MAJCOM should append to this package any unique cost centers or instructions which are peculiar to the Command. The following areas highlight the FY 81 factor development program:

a. Time constraints of year-end reports and the requirement for new factors for the coming fiscal year, necessitate that bases use the prior fiscal year data to develop cost comparison factors. The FY 80 factors were completed using FY 79 data; however, the due date was delayed to accommodate the year-end reports and first year factor development procedures. It is unlikely this situation will occur in the future. Therefore, to establish a recurring cycle for factor development, it will be necessary this year to utilize the FY 79 data base to develop FY 81 factors (FY 80 data will be used for FY 82 factors). For those bases which do not have FY 79 data available, current FY 80 data plus year-end projections should be used for developing FY 81 factors.

b. This year, the majority of our bases should have the prior fiscal year data required for factor development. However, it is critical you stress that each base establish a recurring requirement for the reports listed in attachment 1 (to atch 1) of the new instructions.

c. Since the 31 Oct 79 instructions, there have been revisions in cost collection, methodology, and cost center

assignments. Insure your bases identify these new revisions which impact the FY 81 factors.

d. The new instructions also allow, in certain areas, for the development of MAJCOM factors which may be provided for base-level application.

3. Each MAJCOM is encouraged to establish base/MAJCOM milestones, which are necessary to meet the 1 Jan 81 suspense (referenced message) to the base Management Engineering Teams (MET). The milestones should allow time for factor development at base-level and approval of these factors through a MAJCOM validation. During the factor development/validation phases the following activities should occur:

a. Each MAJCOM should document the base level review findings with a study of factor variations between bases.

b. A copy of the MAJCOM study will be forwarded to HQ USAF/ACMM by 1 Mar 81, including a summary of factors, by base, with a cost element summary for each (see para 12 of instructions). Bases and commands are also encouraged to make recommendations to the factor development procedures at that time.

c. Each MAJCOM/SOA is required to provide a short status report of factor development, by message, at the end of each month until factor validation is complete (see Atch 2).

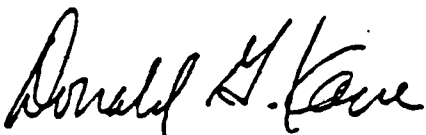
4. Attachment 3 provides the current HQ USAF factors, and budgeted inflation guidance to be used for FY 81 factor development. The data in this attachment may be transferred to TAB X in the instructions for reference during factor development. The General and Administrative (G&A) rate calculated in base year dollars is not affected by inflation; however, in Material Overhead (General Support and Fuel Management) where factors are stated in dollars per unit or unit of issue, apply the budgeted inflation indices to inflate the dollar factors to first performance year dollars. The inflation weighting technique using overhead pool costs is shown in TAB Y of the instructions. Provide the result to the MET in both FY 81 and FY 82 dollars (some studies may have a first performance period in FY 82).

5. At the 1-2 July 1980 CITA workshop several discussions concerned the role of ACM in support of CITA studies. HQ ATC/ACM shared a 27 Jun 80 letter (Atch 4) with the workshop participants which further defines the Manpower/Management Analysis relationship in the cost comparison process. AF/MPMX and AF/ACMM have

concluded that ATC has correctly defined the relationship, but recommended the "line-by-line" review in paragraph 5 should more appropriately be "section-by-section" to avoid direct participation in the cost comparison preparation.

6. Many of our analysts still require A-76 cost comparison training. Please insure that bases are scheduling their A-76 primary and backup analysts for one of the Army Logistic Management Center's on-going courses. A list of courses scheduled for FY 81 is in attachment 5. Questions/comments regarding the FY 81 factor development should be referred to Captain John R. Valaika, autovon 22-75975.

FOR THE CHIEF OF STAFF



DONALD G. KANE
Colonel, USAF
Director of Cost and
Management Analysis

5 Atch

1. Factor Development Instructions
2. Monthly Status Report Format
3. HQ USAF Factors and Inflation Guidance
4. HQ ATC ltr, 27 Jun 80
5. FY 81 CITA Course Schedule

cc: ALMAJCOM-SOA/Manpower & Organiza

The J-99 retrieval (Atch 4) is a standard LGS product available from the Design Center, Hunter AFB, AL. Output of the J-99 supply retrieval will provide the majority of the estimated dollar values of supplies and materials obtained from the following major source of supply:

Source	Mark-Up
GSA Retail	36%
GSA Wholesale and Stores Direct Delivery	21%
GSA Non Stores Direct Delivery and Competitive Federal Supply Schedules	5%
DLA Wholesale Stock Fund	24.5%
DLA Direct Delivery	13.4%
Base Local Purchase	0%
Other Agency (Army, Navy, AFLC)	21.7%

An example of this output of the J-99 retrieval is as follows:

DESCRIPTION	EEIC	TOTAL \$ VALUE	GSA WHSAL	GSA RETAIL	GSA DIRECT DELIVERY	DLA WHSAL	DLA DIRECT DELIVERY	OTHER	LOC.
SD-EQUIP	628	\$648,273	\$178,495	\$0	\$0	\$366,488	\$0	\$1,014	\$102,2

b. In addition to the source groupings extracted from the supply data base, materials and supplies expensed through the GSA retail store must be identified. These GSA retail supply costs bypass the item demand process in the supply computer and must be manually added to the supply retrieval if identified. From Accounting and Finance Materiel Section files, research paid GSA vouchers 3146, GSA Forms 789 (billing) and GSA Forms 952 (single line item billing register - a detailed backup to 789). Review GSA vouchers 3146 and sum total annual expenses. These costs are primarily EEIC 609 and should be included in the EEIC 609 mark-up calculation unless specific EEICs can be identified.

*Extract from Atch 1
to USAF Ltr 5 Sep 1980*

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and
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b. Material shall be classified as direct when:

- (1) it is essentially directly related to the product or service;
- (2) the material cost can be measured with reasonable effort; and
- (3) the material cost is significant.

c. The estimate of direct material costs begins with a review of the work statement to determine the types and quantities of material needed. Available material usage data and detailed listings of material requirements (bills of material) prepared for the same or similar work will be used to estimate the material needed. Differences between the work statement and past practice or workload in an existing Government activity must be taken into consideration, and historical material usage data adjusted accordingly. Allowance for normal scrap, spoilage, overruns, and defective work must be included. To this extent, the estimated quantity of direct material to be used will exceed the minimum necessary to meet the requirements of the work statement. A detailed listing of each type of direct material and the quantity needed will be developed and retained as supporting documentation.

d. The next step is to determine the cost of the direct material to be used. When unit prices from past purchases are used, they must be adjusted for price level changes to the time period of the first year of the comparative analysis. If there is no usable purchase history, the appropriate supply or procurement activity should be requested to estimate expected prices, using recent purchase prices, suppliers' catalogs, and other available information.

e. Pricing material from other government agencies. For purposes of the cost analysis, indirect costs associated with direct material obtained from other agencies will be added to the direct material cost and be included on Line 1 of the Cost Comparison Form.

- (1) General Services Administration. In most instances, the prices charged by GSA for material do not include all the costs of the acquisition and storage functions performed by GSA. Since inclusion of some of these costs in GSA prices is not authorized by law, it will be necessary to adjust

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*Extract from Cost Comparison
Handbook, Supplement No 1
to DMI Circular No A-76*

GSA prices for purposes of Circular A-76 cost estimates. Following is a description of the material supply services provided by GSA together with mark-up rates to be applied to GSA prices to show full costs:

Wholesale and Stores Direct Delivery. This program area involves the distribution of common-use, commercially available items, to agency requisitioners worldwide, through a network of supply distribution facilities located throughout the United States. Also included is the Stores Direct Delivery Program which is designed to provide customers with the same type of items carried in stock which, because of volume orders, are procured from the vendor for direct delivery to the requisitioner in instances when delivery time is not critical. Add 21%.

Retail. The Retail Program provides the agency requisitioner with high demand common-use office and janitorial requirements from retail outlets located in areas of concentrated Federal activity. Add 36%.

Nonstores Direct Delivery and Competitive Federal Supply Schedules. This program is concerned with obtaining customer nonstock requirements through direct shipment from the vendor. Presently, agencies are ordering directly from vendors using schedules established by the GSA Federal Supply Service. Agencies pay the vendors directly for goods and services obtained. Add 5%.

(2) Department of Defense. The following definitions describe material supply services provided by the Defense Logistics Agency (DLA). The appropriate mark-up rates to be applied to DLA prices to show full costs are noted.

Wholesale Stock Fund. Material for which the Defense Stock Fund has procurement, receiving, storage, and shipping responsibility. Add 24.5%.

Direct Delivery. Material for which the
Defense Stock Fund has procurement

*Extract from Cost Comparison
Handbook, Supplement No 1
to OMB Circular No A-76*

responsibility only, and which is delivered directly to the customer from the vendor. Add 13.4%.

(3) Other agencies. The furnishing agency must be requested to determine the indirect costs of acquiring, managing, and storing the material. These indirect costs will usually be presented as a percentage of direct costs. For guidance in identifying the costs, the furnishing agency may use the instructions on Material Overhead in section III.B.3. of this Handbook.

f. The supporting documentation for the costs estimated for direct material is summarized in Figure 1. The material items, quantities, prices, supporting calculations, and sources of information must be indicated.

*Extract from Cost Comparison
Handbook, Supplement No. 1
to OMB Circular No A-76*

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Validation of the Algorithm for Depot Material Management Overhead Costs for CSCS (D160B)		5. TYPE OF REPORT & PERIOD COVERED Technical Report
7. AUTHOR(s) Dr. Sheldon J. Einhorn		6. PERFORMING ORG. REPORT NUMBER V-83-31859-18
9. PERFORMING ORGANIZATION NAME AND ADDRESS Information Spectrum, Inc 1745 S. Jefferson Davis Highway Arlington, VA 22202		8. CONTRACT OR GRANT NUMBER(s) F33600-82-C-0543
11. CONTROLLING OFFICE NAME AND ADDRESS HQ AFLC/MML (VAMOSC) Wright-Patterson AFB, OH 45433		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		12. REPORT DATE August 1984
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18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) VAMOSC O&S Costs Cost Allocation		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This study is the eighteenth of a set of reports documenting the findings of a study conducted by Information Spectrum, Inc (ISI) for the Office of VAMOSC, Air Force Logistics Command. This study constitutes an assessment of the algorithm for Depot Material Management Overhead 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 algorithm dealing with the costs of acquiring, managing and storing material at the depot. This algorithm applies a fixed percentage (21.7%) to the sum of all base and depot costs calculated for materials, exchangeable repairs, modification, or condemnation spares.

This volume presents ISI's conclusions and recommendations, and the comments of the Office of VAMOSC.

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