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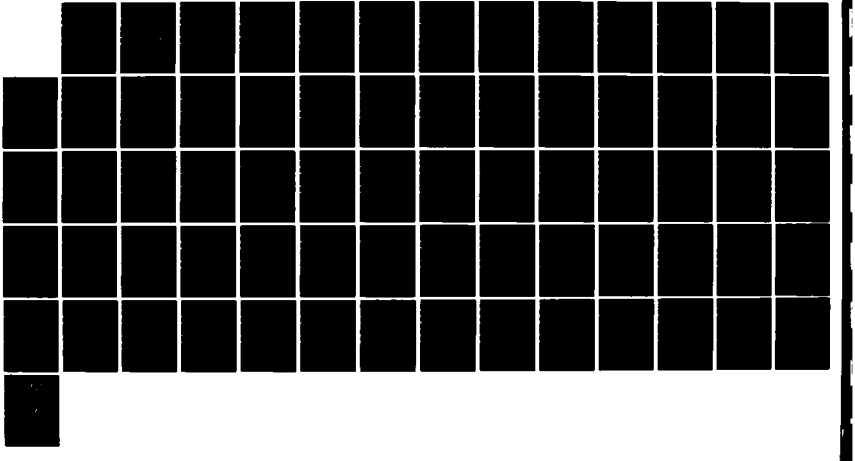

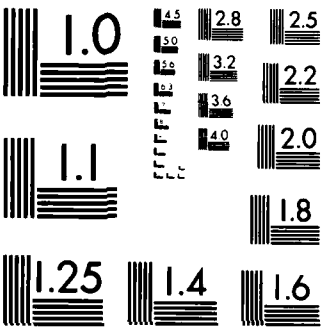

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VALIDATION OF THE ALGORITHM FOR BASE LABOR COST FOR THE COMPONENT SUPPORT COST SYSTEM (D160B)

Contract No. F33600-82-C-0543

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Submitted to:

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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 data 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 of 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 algorithm called "Base Labor Costs." For the purposes of presentation in CSCS reports, all direct labor expended on aircraft maintenance at the base level is identified with one of four categories: Inspection, Other Support General, Time Compliance Technical orders, and all other direct labor. These categories are mutually exclusive and exhaustive.

The CSCS treatment of the costs of the first three kinds of labor were addressed in previous reports. "All other direct labor," addressed in this report, is essentially all other direct maintenance labor, both scheduled and unscheduled. Like Inspection and Other Support General Costs, Base Labor Costs can be identified to a five digit WUC.

The algorithm is simple in concept: The appropriate labor hours are summed and the result is multiplied by a labor cost

rate. This labor cost rate is of added significance because it is also used in several other cost algorithms.

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 than applied to each algorithm. This report first describes the analysis procedures, without reference to the specific algorithm addressed by this report.

Next, the Base Labor Cost algorithm is defined and described in detail. This description includes identification 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:

- 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.

The following defects in the Base Labor Cost algorithm have been noted.

(1) A military labor rate is multiplied by a sum of military and civilian labor hours.

(2) Annual inflation factors are applied to the direct labor rate on a quarterly basis.

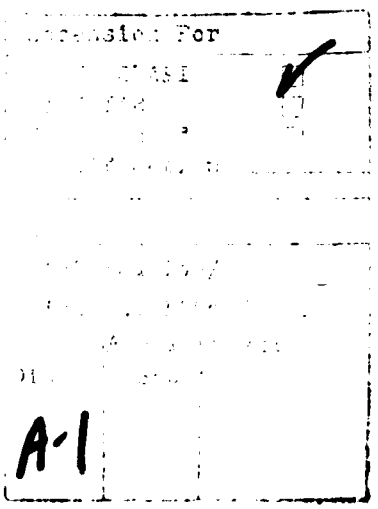
(3) Adjustment of labor rates on the basis of inflation factors becomes increasingly inaccurate as time elapses. No explicit provision is made for recognizing or correcting the inaccuracy.

(4) The direct labor rate is based upon on a 1980 sample of data so there is no periodic way of adjusting the data for changes in personnel mix over time.

In addition to these flaws, the report notes a problem in accuracy of input data systems. Published reports indicate that manhour data provided by the Maintenance Data Collection System is significantly deficient in both accuracy and timeliness. These deficiencies, if left incorrected, would tend to negate the usefulness of the algorithm. However, the Air Force is currently designing a new system, the Core Automated Maintenance System, with considerable promise of correcting the deficiencies.

Several recommendations are provided for correcting the flaws in the algorithm. The first entails providing to the CSCS separate manhour data for civilian and military maintenance personnel. This would require changes in coding reports within the Maintenance Data Collection System, in processing these reports by the Product Performance System (D056), and in processing by the CSCS itself. In addition to providing more accurate labor costs, the recommendation would permit separate display of military and civilian base labor costs.

A comprehensive examination of the current methodology for computing a direct labor rate for each MDS is provided. A recommendation is made for an additional interface with the base level MMICS system that will not depend on a manual interface with the Maintenance Cost System, will adjust for changes in the mix of base maintenance personnel, and will provide for changes in personnel costs as pay raises or other changes are implemented.



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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 components thereby enhancing design tradeoff studies.

(4) To provide historical cost information at the component 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

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 if the table.

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 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 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 7 of Table 2, "Base Labor Costs." The cost of direct labor performed in maintenance of aircraft is a major component of support costs. For the purposes of presentation in CSCS reports, all direct labor expended on aircraft maintenance at the base level is identified with one of four categories: Inspection, Other Support General, Time Compliance Technical Orders, and all other direct labor. These categories are mutually exclusive and exhaustive.

The CSCS treatment of the costs of the first three kinds of labor were addressed in references [23], [24], and [17]. "All other direct labor," addressed in this report, is essentially all

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

other direct maintenance labor, both scheduled and unscheduled, applied at the base level. Like Inspection and Other Support General Costs, Base Labor Costs can be represented at the five digit WUC level.

The algorithm, as will be seen, is simple in concept. The appropriate labor hours are summed and the result is multiplied by a labor cost rate. This labor cost rate is of particular significance because it is also used in the other three direct labor other cost algorithms mentioned above.

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 algorithm 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 studied. Assumptions about data processing procedures 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 depended 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 of all algorithms 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

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*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, 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 then 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 Base Labor Costs. This algorithm is fundamentally identical to the one for Base TCTO Labor Costs, which was reported on by reference [17]. There is one important difference - in this algorithm costs are calculated separately for each five-digit Work Unit Code (WUC).

The procedures which were used to produce the FY 1980 labor rates for each MDS were reviewed with AFAFC/ACMI since that was the organization that provided them for use in the CSCS (see reference [16]). The procedures were reviewed orally with individuals who were peripherally involved. No current documentation on the procedures exists and the individual who performed the calculations using FY 1980 data is no longer assigned to AFAFC/ACMI. This makes the repeatability of this manual computation procedure somewhat tenuous.

The basic input data for the worldwide direct labor rate computation by MDS was obtained from the Maintenance Cost System (MCS) Report 1A. This hard copy report is produced at base, MAJCOM, USAF and DOD levels. AFAFC receives all MAJCOM data and summarizes the data to produce an annual version of the 1A report for HQ USAF that includes all Air Force for each MDS worldwide. The procedures employed by AFAFC in producing the FY 1980 direct

labor rates for each MDS (which were provided by Reference [16]) follow.

The total civilian and military labor hours and their cost as determined by the MCS were manually totaled for all bases which reported on the MDSs assigned. In some cases an aircraft generated maintenance labor hours while under more than one Program Element Code (PEC), so each PEC was reviewed for data on each MDS. Once the total annual hours and costs for FY 1980 were manually totaled for all bases, a worldwide annual cost per direct labor hour (for both military and civilians) was manually computed for each MDS. The values were reported to the Office of VAMOSC (OOV) by reference [16]. The CSCS programming applies official DOD published annual inflation factors to escalate these values for use in subsequent fiscal year processing. It was planned to continue this procedure, and at some undetermined point in time the MCS data would be sampled again to produce new rates. It must be pointed out that the only MCS data being sampled is that involved with direct labor costs. All other costs produced by the MCS that are relevant to components are being provided by the CSCS.

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 COBOL-type data names are used to express the algorithm output and its 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.

This description provides a formula for the calculation that is derived from the Users Manual and other sources. It is not the same as the formula provided in the Users Manual. It is intended to be more explicit. The formula is 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.

3.1.1 Calculations

MDS-WUC-BASE-LABOR-COST = (MDS-WUC-BASE-MH-ON
+ MDS-WUC-BASE-MH-OFF) x DLR-MDS

3.1.2 Inputs

Name: MDS-WUC-BASE-MH-ON

Definition: On-equipment manhours (not TCTO*) reported for the MDS, WUC, base, and calendar quarter.

Source System/File: D056A/MNI70K0

Name: MDS-WUC-BASE-MH-OFF

Definition: Off-equipment manhours (not TCTO*) reported for the MDS, WUC, base, and calendar quarter.

Source System/File: D056C/MPI15K0

Name: DLR-MDS

Definition: Average direct military labor rate for maintenance for the MDS

Source: Reference [7] provides average direct labor rates for FY 80 for each MDS. The Military rates are inflated annually by the CSCS by multiplying the applicable annual inflation index for military manpower cost (referred to FY 80 as a baseline), published annually in AFR 173-13. According to reference [1], rates will be recalculated on an as required basis. No procedure has been established for determining when or how to recalculate the rates.

3.1.3 Description of Calculation Procedure

D056A File MNI70K0 and D056C File MPI15K0 are received monthly. Records include SRD, WUC, base code, and both on-equipment and off-equipment non-TCTO* manhours (as well as other data) (Reference [3]). SRDs are converted to MDS using internal CSCS tables. The program recognizes engine SRDs, and identifies the associated aircraft MDS. For each MDS/WUC/base combination, the program sums all on-equipment and off-equipment non-TCTO manhours reported for the calendar quarter. The result is multiplied by the direct labor rate for the MDS.

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*TCTO refers to Time Compliance Technical Orders, discussed in reference [17].

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.

3.2.1 Appropriateness and Accuracy of Assumptions and Approximations.

Information Spectrum has identified two approximations and one assumption implicit in the algorithm. One approximation is the application of the same average labor rate for the entire MDS to each Work Unit Code. It is reasonable to expect that repairs of some WUCs should, on the average, use more highly skilled personnel than repairs of others. However, no suitable data are currently available to provide a basis for such labor rate adjustments. Development of separate rates for different WUCs would be a costly and time consuming procedure. It is the opinion of Information Spectrum that the potential improvement in precision of labor cost estimates would not justify the effort of development of separate labor rates for different WUCs. Accordingly, we consider the use of a single labor rate for the entire MDS a satisfactory approximation.

The second approximation is application of the average direct labor rate for all kinds of maintenance to the particular category of maintenance addressed by this algorithm which does not include Support General or TCTO and hence is primarily unsched-

uled repairs. It is our belief, based on experience, that in fact the average labor rate for repairs may be slightly higher than the average rate for all maintenance. However, a review of sample data has indicated that the great bulk of direct maintenance labor is for repairs, so that any differences in the average rates would be small. Here, as for the first approximation, the potential improvement in precision of labor cost estimates would not justify the effort of developing separate labor rates.

An implicit assumption in the algorithm is that escalation of labor rates for non-TCTO labor due to inflation would be the same as escalation for all military personnel. The recommendations of this report provide a replacement procedure that makes escalation of FY 1980 labor rates unnecessary.

Accordingly, ISI affirms the appropriateness and accuracy of assumptions and approximations incorporated in this algorithm.

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 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.

The source data consists of manhours by MDS and WUC provided monthly by the Product Performance System (D056), military labor

rates for each MDS computed on the basis of FY 80 data provided on a one-time basis, and inflation factors published annually by the Air Force.

Published reports such as references [10] and [11] indicate that manhours data provided by D056 are quite inaccurate. The data in D056 are sent to it by each base, through a system known as the Maintenance Data Collection System (MDCS). The MDCS, in turn, gets its data from forms filled out manually at the base level by maintenance personnel. MDCS data have been assailed as plagued by inaccuracy and lack of timeliness. Reference [11], known in Air Force VAMOSC circles simply as "the GAO report," provides indictment of the MDCS data and suggests that systems based on it will not be believed or much used by the maintenance community. The GAO report often relies on small samples, and it is more anecdotal than scientific. Nevertheless, as a whole it is convincing.

One study whose results are incorporated (though not explicitly identified) in the GAO report, is provided by reference [10]. This study, conducted in the fall of 1978, was concerned with the accuracy of base maintenance manhours reported by the MDCS. The study was restricted to two Tactical Air Command bases, and a total of 119 maintenance events, selected to be of short duration. Although this sample cannot be freely extrapolated to all maintenance events in the Air Force, there is no doubt about the significance of two of the findings.

First, of the maintenance events observed, only about half could later be identified among the reports in the Maintenance Data Collection (MDC) system, despite determined efforts. Note that this was an unexpected result for which the study had not been designed. The report does not give the explicit criteria which were used to identify a match. The second significant result was that for the maintenance events which could be identified, the manhours reported to the MDC system averaged about twice as much as the quantities recorded by the study personnel.

The Air Force is testing an automated system which holds promise of considerably improving the accuracy of reporting of maintenance manhours. This system, called the Automated Maintenance System (AMS), provides for real time, automated input, editing, and retrieval of data of the MDCS. The AMS is currently being tested at Dover AFB. The GAO report does not provide direct evidence of improved accuracy provided by the AMS, but it cites impressive improvements in the number of maintenance actions reported as completed. It also indicates that Air Force officials believe that the AMS virtually eliminates inaccuracy in MDC input data.

On the basis of the published reports, ISI concludes that manhours data provided by the D056 system is at present generally subject to significant errors, with direct adverse impact on the accuracy of the output of the algorithm.

There is congruence between the definitions of non-TCTO manhours as provided by the input data system and as used by the Base Labor Cost algorithm.

The next inputs considered are the labor rates for each MDS that are applied to the non-TCTO manhours and to the direct labor hours for several other algorithms. Reference [7] provides military and civilian labor rates which were calculated for each MDS. Reference [16] indicates that these rates were calculated using the same procedure as normally used by the Maintenance Cost System. Section 3.0 above provides a description of the procedure used.

The manner in which these labor rates (regardless of their value) are applied is of some significance, however. The algorithm applies the labor rates to manhours which are the sum of military and civilian maintenance manhours. The rate applied, however, is the military labor rate. The civilian rates are not used. This lack of congruence distorts the algorithm results.

The final inputs are the inflation factors for military pay. These factors are based on accurate, well documented data, and ISI affirms their accuracy. There is, however, another problem in congruence of definition. The inflation factors provided by reference [15] apply to the midpoint of the year The CSCS reports are quarterly. It would be appropriate to use inflation factors scaled to the quarter or to apply the pay increases as they occur in real time. The current procedure applies a

full year's worth of inflation to the transition from the end of one fiscal year to the beginning of the next, and none in between. ISI finds the lack of congruence between the definitions of inflation rate as provided by the input system and as used by the CSCS unacceptable.

3.2.3 Appropriateness of Source Data as Inputs

The need for non-TCTO manhours data as inputs to this algorithm is self-evident. The D056 data accurately reflects the data logged by maintenance personnel. No source of manhours data other than that provided by the MDCS to D056 exists. Accordingly, ISI affirms the use of the D056 data as a source of non-TCTO manhours. It must be recognized, however, that improvement in source data accuracy is highly desirable. As discussed in Section 3.2.2 the AMS is expected to provide the means for increasing the accuracy of reported maintenance labor hours.

The appropriateness of the average labor rates as adjusted by inflation is questioned at present, since it will deteriorate with time. The base direct labor rates, on which the labor rates by MDS used in this algorithm depend, represent a mix of pay grades that were valid in 1980. This mix will lose validity as the Air Force manpower mix changes with time. The assertion of reference [1] that the labor rates will be recalculated "on an as required basis" is not supported by a definite methodology. For these reasons ISI finds the average labor rate currently used is inappropriate.

3.2.4 Accuracy and Appropriateness of the Algorithm

Ideally, each maintenance man would report the hours worked on non-TCTO (as well as on other jobs) and his pay rate. It would then be a trivial procedure to calculate the cost of direct non-TCTO labor. In practice, personnel do report the hours worked on direct non-TCTO labor through the MDCS but not their pay rates. The report fields of the AFTO 349 do not require a pay rate. Also, some maintenance actions require more than one man to accomplish, and in these cases the total manhours for the group of people are reported. Again the AFTO 349 form does not provide the capability to report a group of pay rates. The most appropriate accommodation to this fact of life is to apply an average pay rate, if available. Accordingly, ISI confirms that the algorithm is fundamentally sound, subject to the criticisms in Sections 3.2.2 and 3.2.3. Appropriate recommendations for a procedure to calculate a direct labor rate is provided in Section 4.

3.2.5 Directness of Costing

This algorithm provides a direct costing methodology, and except for a better methodology for computing a direct labor rate by MDS, a more direct costing methodology is neither possible or necessary.

3.2.6 Application to CSCS Output Reports

Base labor costs are components of CSCS reports as described by Table 3. The accuracy 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 report will also be provided in the final report of this effort and after ISI conducts a survey of users.

TABLE 3
CONTRIBUTION OF BASE LABOR COST
ALGORITHM TO CSCS OUTPUT REPORTS

REPORT NAME/NUMBER	COST ELEMENTS CONTRIBUTED TO BY THE ALGORITHM
1. MDS Logistics Support Costs/8104	1. By MDS for all bases: a. WUC COMPONENT COSTS, BASE b. TOTAL MDS COSTS
2. Base Work Unit Code (WUC) Costs/8106	2. By MDS and base: a. TOTAL BASE COSTS, COMPONENT b. WUC COSTS (1) ON EQUIPMENT LABOR (2) OFF EQUIPMENT LABOR (3) TOTAL WUC
3. Total Base Work Unit Code (WUC) Costs/8108	3. By MDS for all bases: a. TOTAL BASE COSTS, COMPONENT b. WUC COSTS (1) ON EQUIPMENT LABOR (2) OFF EQUIPMENT LABOR (3) TOTAL WUC
4. Total Base and Depot Work Unit Code (WUC) Costs/8108	4. By MDS for all bases: a. TOTAL COSTS, COMPONENT b. BY WUC: (1) LABOR, BASE HRS (2) LABOR, BASE COST (3) BASE & DEPOT WUC TOTAL
5. Summary of Cost Elements/8113	5. By MDS for all bases: a. ORGANIZATIONAL COSTS, BASE LABOR (ON-EQUIP) b. INTERMEDIATE COSTS, BASE LABOR (OFF-EQUIP)
6. Assembly-Subassembly WUC Costs/8115	6. By MDS and WUC for all bases: a. LABOR, BASE HRS b. LABOR, BASE COST c. BASE & DEPOT WUC TOTAL

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

Capital letters indicate the titles printed on the report.

data should be changed to accept the new format. This change is described in Attachment 2.

The MOA and data input formats from D056 to the CSCS must be modified to include military and civilian maintenance manhours. The CSCS would then be modified to accept and process the data. These changes are described in Attachment 3.

4.1a Office of VAMOSC (OOV) Comments

We agree that military and civilian labor could be costed separately; however, the utility of portraying labor costs separately on output products is questionable. Maintenance actions, including TCTOs, are assigned to individuals based on availability and experience of the work force. Workers will be paid regardless of the type of work performed. Therefore, little consideration is given to civilian versus military pay scales when assigning work tasks to individuals.

OOV sampled Weapon System Support Costs (WSSC), DSD D160., data and found that from 2 to 3 percent of the total base maintenance squadron work force are civilians. Therefore, there is some question as to the utility of costing military and civilian labor separately. In addition, OOV does not expect that the necessary changes to MDCS will be possible until FY86 when the Phase IV data system is implemented. In the meantime, OOV will further review this proposal.

4.2 Development of Average Labor Rates

The degree of accuracy of the direct labor rates for pricing the cost of direct labor hours (military and civilian) expended on each aircraft component (identified by WUC) is an issue that requires some background discussion to place the matter into proper context. The VAMOSC requirement to provide a means to express historical maintenance costs at the component level is a DOD requirement that is applicable to each of the Armed Services. The manner in which direct maintenance labor is costed by each service is therefore of interest.

4.2.1 Background

The Army efforts in providing VAMOSC costs (at the component level) have not met with success, since the Army does not have a detailed maintenance data collection system at the organizational level. The Navy does have a detailed maintenance system for aircraft that was modeled after the Air Force system. The Navy also has developed VAMOSC systems analogous to the Air Force Weapon System Support Cost (D160) system and the Component Support Cost System (D160B). The Navy analogous versions are called the Total Support System (TSS) and the Maintenance Subsystem (MS). The MS provides detailed maintenance costs to the component level (WUC) for aircraft. In developing the direct labor rate for the MS, the Navy has been far less detailed than the Air Force. The direct labor rate used by the Navy is a single labor rate that is developed for all aircraft in the Navy.

It is based upon authorized personnel levels as opposed to the actual assigned labor hours used by the Air Force in CSCS, and is developed from a representative sample of aircraft squadron planning documents by aircraft type. Historical data on all individual squadrons are not included in this computation. Additionally, the labor rate used by the Navy for costing the authorized manhour levels is one which contains a much higher level of overhead cost than the military standard composite rate does. As a result, the Navy military rates are nearly double those of the Air Force. The Navy does not include civilian costs because of their very low proportion. The Navy does compute a separate labor rate for intermediate level (based shop level) direct labor, however. It is based on a similar process and produces a labor rate that is more than double the military rate that is developed by the Air Force for all base level direct labor. Thus each service is applying its own standards as to the adequacy and accuracy of this rate. A uniform methodology or standard has not been defined for this rate. The current detail of calculation for each of the services is driven by the availability of existing data sources. The methodology is driven as much by what is technically possible as it is by any clearly specified requirement.

The visibility of direct labor costs required by the algorithms of the CSCS demands a direct labor rate by individual aircraft type (i.e., MDS). The Air Force has a number of ways

that are available to it to compute this cost. These vary in complexity, accuracy and detail. The current rates used in the CSCS are derived from hard copy reports produced by the Maintenance Cost System (MCS). The MCS methodology for computing this one cost element is the most detailed and accurate of all the services. It is also very costly in terms of system operation. The procedures are founded on accounting principles, and during the development of the MCS, the methodology for costing direct labor was reviewed and approved by the GAO. However, there is some question (unresolved) as to whether the level of accuracy provided by the MCS is required for a historical cost collecting system such as the CSCS. There is also some question as to the continued viability of the MCS and there are indications that other data from the system (i.e, data other than the direct labor rate) is not being used. There is currently no system interface to provide either the base direct labor rate or worldwide direct labor rate per MDS in an automated fashion to the CSCS.

4.2.2 MCS Methodology for Producing Direct Labor Rates

The accuracy of the direct labor rate by MDS produced by the MCS is based upon the capture of appropriate detailed data at the base level from the MMICS (a base level system). Based upon actual manning levels of the Chief of Maintenance Organization by rating and the local computation of available hours performed by the MMICS, the MCS develops labor and cost rates for direct,

indirect, and overhead labor. These labor categories are coded as 100, 300, and 310 respectively. CSCS only requires an input of direct labor (100) since indirect and overhead costs are computed in the CSCS by a separate methodology.

The MCS obtains the available (assigned) labor hours from the MMICS by the currently assigned military ratings and the currently assigned civilians by grade. It also accounts for available hours by contractor and foreign nationals where applicable. The military available hours are costed by applying an hourly rate of pay for each military grade obtained from the standard military rate table published annually in AFR 177-101, chapter 33. The total costs for available direct labor at each base for the monthly period is divided by the total available direct labor hours for that same period to produce an average military labor rate per assigned direct labor hour per base that uniquely reflects the numbers and kinds of maintenance personnel available at that base for that period. This procedure is described for all categories of base maintenance labor (direct, indirect, and overhead) in AFM 177-380, Paragraph 2.11.4 and illustrated in Figure 2-4 of the same publication. In summary, the procedure for developing a military direct labor rate by base depends upon the identification of available direct labor hours monthly by pay grade from MMICS (a base level only system) and costing these hours by the current pay rate for that grade at standard rates. The total cost of these assigned hours is

divided by the total assigned hours to produce a direct labor rate by base. The procedure is followed at each base, and thus the military standard rate pay table must be updated at each base. The procedure provides an average base direct labor rate that uniquely reflects the military labor mix at that base. It also provides a means for reflecting pay changes as they occur by updating the pay rate table. Thus pay inflation is accounted for as it actually occurs and an inflation rate need not be applied to the labor costs.

A similar procedure is followed in the MCS for civilian direct labor at each base. The computation procedure is described for all categories of civilian labor (direct, indirect, and overhead) in AFM 177-380, Paragraph 2.11.1 and illustrated in Figure 2-3 of that publication. The civilian direct labor rate thus obtained similarly reflects the mix of labor and similarly provides for a cost per civilian pay grade that is updated as pay changes occur.

The base labor rates thus determined are applicable to both "On" and "Off" labor hours reported by the MDCS at each base. Accordingly, it does not provide for a differentiation in the cost of labor between organizational and shop level repairs.

The MCS applies the base labor rates for both military and civilians to the direct labor hours (both "on" and "off") reported by the Maintenance Data Collection System (MDCS) by MDS. These data are displayed in the local (base) version of the MCS 1A report. This report is entitled the "Organizational and

Intermediate Maintenance - USAF Consolidated Cost Report (Thous Dollars)-WBS within MDS within PEC." These data are aggregated for all bases at the MAJCOM level and further aggregated for all MAJCOMS by AFAFC. Figure 4.2.2-1 shows a sample of the 1A report produced by AFAFC. The fiscal year 1980 version of the MCS 1A report produced by AFAFC was used to manually compute the military and civilian direct labor rates per MDS (worldwide). These rates were provided to AFLC/MM (VAMOSC) by Reference [7]. As illustrated by Figure 4.2.2-1, the dollar costs of this consolidated version of the MCS 1A report are represented only in thousands of dollars. This contributes to a certain level of inaccuracy in the manual computation of labor rates using these data.

The significance of this MCS process for CSCS is that it produces: (1) a direct labor rate by base for military and civilian personnel that uniquely reflects the mix and grade structure of the personnel assigned to the Chief of Maintenance organization; (2) a means to reflect the change in cost of maintenance personnel as changes in the pay for both military and civilians occur; and (3) a worldwide direct labor rate for each MDS that reflects the mix and grade level of the base organizations.

AIR FORCE ACCOUNTING AND FINANCE CENTER DENVER COLORADO 80279 C12

PREPARED 82 DEC 07
PAGE 0167

ORGANIZATIONAL AND INTERMEDIATE MAINTENANCE
USAF CONSOLIDATED COST REPORT (THOU DOLLAR)
----- WBS WITHIN MDS WITHIN PEC -----

PAGE 0167 OF REPORT NR 1A
AS OF 82 SEP 30 MCS: HAF-ACF(Q)7403

PEC:28015F
MDS: F015A
WBS:

		CIVILIAN LABOR	MILITARY LABOR *	MATERIAL (FUNDED)	MATERIAL (UNFUNDED) **	CONTRACTOR MAINT	GOV FURN MATERIAL ***	INDIRECT	OVERHEAD ****	TOTAL
ACFT	HRS	4,915	72,685					106,467	33,818	217,885
	COST	66	506	45	25	32	0	1,057	365	2,096
AFRM	HRS	122	443					603	216	1,384
	COST	2	3	41	96	0	0	6	2	150
ENG	HRS	199	13,550					26,028	4,725	44,502
	COST	3	94	18	2,576	0	0	241	57	2,989
ACSS	HRS	231	1,195					1,875	604	3,905
	COST	3	8	55	103	0	0	19	7	195
ECOM	HRS	83	8,124					10,338	3,434	21,979
	COST	1	57	28	1,150	2	0	104	37	1,379
ARMT	HRS	52	2,734					2,999	1,060	6,845
	COST	1	19	15	22	0	0	31	11	99
AGE	HRS	0	0					0	0	0
	COST	0	0	0	0	0	0	0	0	0
TOTAL	HRS	5,602	98,731					148,310	43,857	296,500
	COST	76	687	202	3,972	34	0	1,458	479	6,908
FLYING HOURS 896										
MAN HRS PER FLYING HR		6	110					165	48	330
COST PER FLYING HR		84	766	225	4,433	37	0	1,627	534	7,709

* INCL $ 35 FOR 5,006 HOURS MILITARY OVERTIME
** INCL $ 3,970 FOR 20% EXCHANGE RATE
*** INCL $ 0 FOR INVESTMENT MATERIAL
**** INCL $ 0 FOR ACCRUED CIVILIAN ANNUAL LEAVE

4.2.2-1 SAMPLE MCS CONSOLIDATED REPORT-1A

The direct labor rate by base provides an additional level of visibility that is not yet reported by the CSCS. The pay table approach enables a change in pay to be effective when and only when pay changes actually occur. It voids the necessity to employ escalators for inflation and thus is inherently more accurate.

4.2.3 Recommended Procedure for Future Computation of Direct Labor Rates for CSCS.

There are three factors that determine the worth and usefulness of a direct labor rate for the organizational and intermediate level (base). The first is that the labor rate should accurately reflect the mix (military to civilian) and pay grade structure of the personnel performing the maintenance. The second is that the cost of the labor should accurately reflect changes in pay when they occur. The third is that rate should be computable on a regular basis so as to reflect current conditions.

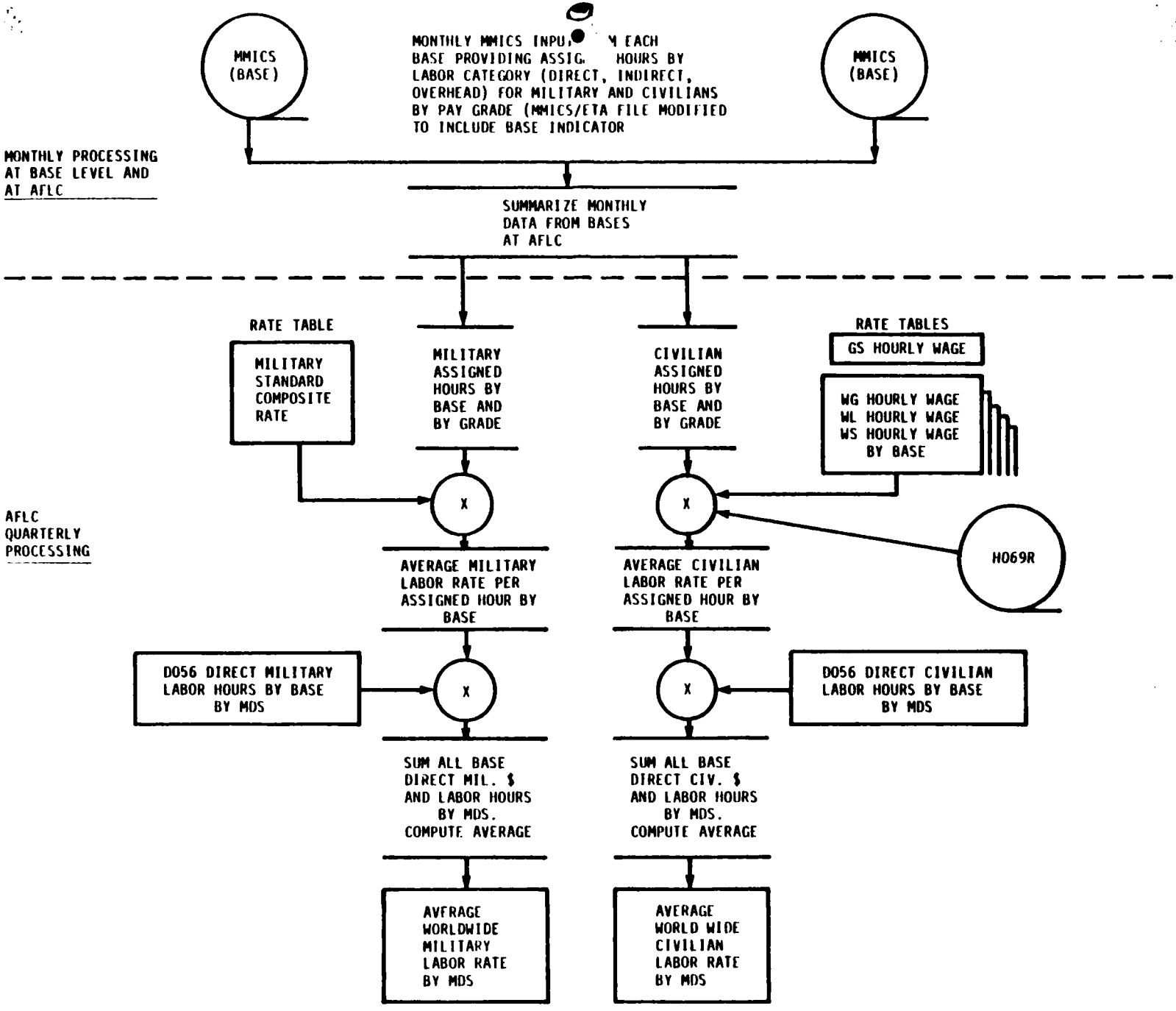
One way for CSCS to achieve the first objective is to require the individual reporting the maintenance labor hours on the AFTO 349 to also record his pay grade. But even this procedure is subject to approximations in those cases when a group of people of different pay grades work on the same maintenance task. To provide the capability to record more than one person on a maintenance task would require a significant modification to the AFTO 349 and the MDCS. This recommendation is considered impractical, particularly since MDCS reporting accuracy is already suspect.

Adding to the complexity of current manual reporting does not seem to be productive.

The methodology proposed here reflects the general methodology of the MCS as described in Section 4.2.1. This methodology meets each of the three criteria listed above. It deliberately avoids the use of the MCS system proper because of its uncertain future and it focuses on direct labor costs only. None of the other data from the MCS are considered necessary at this time.

The procedure described here is considered the most detailed that is currently practical. It must be recognized at the beginning that the attempt here is to describe the most detailed and accurate methodology currently possible from existing systems. The procedures here may be simplified, or summarized, should other factors such as processing time or cost determine a modification. The essential thing is that the three requirements described above be met regardless of subsequent compromises that may be required in the details of implementation.

Figure 4.2.3-1 is a schematic of the process recommended. The process assumes that earlier recommendations have been implemented to obtain military and civilian direct labor hours separately from D056. The number of military and civilian personnel assigned to the Chief of Maintenance Organization and assigned manhours by paygrade (military and civilian) and by labor classification (direct, indirect, and overhead) can be obtained monthly from the MMICS Administration/Exception Time Accounting



4.2.3-1 SCHEMATIC OF PROCESS TO DEVELOP DIRECT LABOR RATES BY MDS

(ETA) system of each base. The tape file number is ARF9IT/ARG9IT from MMICS and ARF80T/ARG80T if from the ETA. These tape files are currently produced at the base level as inputs to the MCS and they are not files from the MCS. They are available not later than the eight day after the month being reported. Figure 4.2.3-2 provides a layout of this existing file. Because the file was originally designed for base level processing there is no indicator code to indicate the base. A MMICS system modification must be initiated to add a base code. It is proposed that a copy of this modified file be sent each month to AFLC for CSCS processing either by physically mailing a copy of the tape file or by AUTODIN. A base table must be established by the CSCS to provide automated accounting of these numerous and frequent inputs. These data will be aggregated monthly at AFLC for quarterly processing.

A table of military standard composite rates must be established at AFLC. These rates would be part of a composite table of military and civilian rates that would be similar to Figure 4.2.3-3. These rates are available from AFR 177-101, Chapter 33 and are updated as necessary by HQ USAF/MPPB. HQ USAF/MPPB has indicated that when ever military pay rates change they are able to compute new standard rates and promulgate them within a month. Only one military pay table is required at AFLC since it will be applicable to all bases. This table would be updated by the

RECORD LAYOUT

FILE TITLE	RECORD TITLE		CLASSIFICATION
	ETA (ARF80T/ARG80T) Admin (ARF91T/ARG91T) Detail Record		UNCLASSIFIED
			RCS/PCN
FILE DESCRIPTION	**RECORD POSITIONS**	**TYPE/CLASS**	**SPECIAL INSTRUCTIONS**
MAJCOM-ID (Perf)	01-02	(2)AN	
Organization Name	03-11	(9)AN	ADE OR-340
Work Center	12-16	(5)AN	
Labor Code	17-19	(3)UN	100, 300, or 310.
Grade Code	20-22	(3)AN	See para 3.1.4.4c.
Assigned Man-Hours	23-28	(6)SN	Note
Avg Assigned Pers	29-33	(5)UN	
JDTE	34-38	(5)UN	
MCS Ind	39	(1)AN	X or blank.
Filler	40	(1)AN	

NOTE:

* Negative man-hours are only permitted when input is from tape ARF91T/ARG91T). Correction cards with negative man-hours must not be input.

AF FORM 1190 AUG 70 PREVIOUS EDITIONS ARE OBSOLETE.

FIGURE 4.2.3-2 LAYOUT OF MMICS BASE LEVEL INPUT OF ASSIGNED HOURS TO THE MCS

PREPARED 81 JUL 02 15:43
RUN NUMBER: 6

MCS MANUAL INPUT / TABLE VERIFICATION LISTING
LABOR RATES

AS OF 81 JUL 01 PCN SH129-202

AB	AMN	A1C	SGT	SSG	TSC	MSG	SMS	CMS	WO1	WO2	WO3	WO4	2LT	1LT	CPT	MAJ	LTC	COL
4.71	5.16	5.63	6.64	7.53	8.78	10.05	11.49	13.45	13.93	13.93	13.93	13.93	9.19	11.64	15.53	17.92	20.94	24.64

GS-1	GS-2	GS-3	GS-4	GS-5	GS-6	GS-7	GS-8	GS-9	GS-10	GS-11	GS-12	GS-13	GS-14
4.21	4.67	5.17	5.80	6.49	7.23	8.03	8.90	9.83	10.82	11.89	14.85	16.95	20.03

WG-1	WG-2	WG-3	WG-4	WG-5	WG-6	WG-7	WG-8	WG-9	WG-10	WG-11	WG-12	WG-13	WG-14	WG-15
6.47	7.05	7.35	7.71	8.07	8.42	8.80	9.16	9.53	9.89	10.25	10.62	10.98	11.34	11.71

WL-1	WL-2	WL-3	WL-4	WL-5	WL-6	WL-7	WL-8	WL-9	WL-10	WL-11	WL-12	WL-13	WL-14	WL-15
7.42	7.77	8.00	8.48	8.88	9.27	9.68	10.08	10.48	10.88	11.28	11.67	12.09	12.47	12.88

WS-1	WS-2	WS-3	WS-4	WS-5	WS-6	WS-7	WS-8	WS-9	WS-10	WS-11	WS-12	WS-13	WS-14	WS-15	WS-16	WS-17	WS-18	WS-19
9.70	10.01	10.31	10.67	11.04	11.39	11.76	12.12	12.50	12.85	13.11	13.45	13.87	14.36	14.94	15.60	16.33	17.13	18.03

Figure 3-15. Table Verification Listings (cont).

PAGE 1

4.2.3-3 SAMPLE LABOR RATE TABLE

Office of VAMOSC as part of the current table update procedures. Currently a similar table is required at each base by the MCS.

A table of civilian labor rates is also required for GS and wage grade levels. A single table is required for GS grades, but wage grade rates vary on a regional basis so a table is required for each region. The wage grade rates are applicable to all bases within that region. The data sources for the GS and wage grade rates are different.

The latest GS pay rates can be obtained from AFR 173-13. A single number is presented in Table 3-8 of AFR 173-13 for each GS grade level. The value in Table 3-8 is derived from historical costs of civilian pay. The value is derived from special reports of actual historical expenditures of base pay by GS rating received by HQ USAF/ACB from San Antonio and from the monthly Civilian Manpower and Funding Report (RCS DD Comp (AR) 1092) provided to HQ USAF/ACB by AFAFC/XSPC. The Civilian Manpower and Funding Report is used to provide the historical costs of benefits and other costs which are added to the base pay costs received from San Antonio. HQ USAF/ACB computes the required values every fall and spring but also provides the data to the OPR for AFR 173-13 (HQ USAF/ACMC) on request. When a pay raise or other fiscal change occurs, HQ USAF/ACMC requests a special computation of this rate and promulgates the new rates by message. The publication is normally updated on an annual basis.

A secondary procedure for establishing the GS rates can be used, but it is less accurate than using the historical basis of actual costs derived from the AFR 173-13 table. The procedure is the one currently used by the MCS. The hourly pay rate for each GS grade is obtained by determining the annual salary rate for each grade using step 4. This value is divided by 2080 hours to arrive at an hourly rate for each GS employee. This procedure provides a computation of base pay only and does not include many of the additional costs such as leave, special entitlements (etc.) that are automatically provided from rates in AFM 173-13. Neither procedure accounts for the value of accrued but unexpended leave. The MCS provides a special computation to add this cost (Section 3.18 of AFM 177-380) but this computation involves the effort of the local base MCS manager and is not considered a meaningful cost to the maintenance of aircraft components. It is not recommended that this cost be included. If however, a decision is made to include the cost at a later time, the value of accrued leave can be obtained from the civilian pay system and distributed to each MDS and WUC on the basis of direct labor hours. The cost of this computation for return value is not considered cost effective.

A table of wage grade rates similar to the last 3 lines of Figure 4.2.3-3 must also be established. Unlike the representation in Figure 4.2.3-3, a separate table of wage grade hourly

rates must be established for each region that contains a base, and each base must be identified with that regional wage scale. This is represented in Figure 4.2.3-1 by depicting multiple tables for wage scale values. These values change more often than military or GS wage scales, so they must be monitored closely by the Office of VAMOSC. These wage rates are established by the DOD Wage Fixing Board on the basis of economic surveys. When new rates are established they are distributed to the affected regions and to Headquarters organizations. HQ AFLC/MPKC (Civilian Pay Office) receives all of these wage rates and changes, thereto as they are distributed. The Office of VAMOSC need only be placed on the local AFLC distribution list for these changes, and the wage scales can be updated in a timely manner.

Once both military and civilian pay rate tables are established, the assigned labor hours for each pay grade by base obtained from the MMICS can be multiplied by the appropriate hourly rate to establish the total cost for assigned hours by base. This total value can then be divided by the total assigned hours for the base to produce an average labor rate per assigned hour for each base. The computation for military labor is the same as that accomplished in the MCS and described in AFM 177-380, Section 2.11.4 and Figure 2-4. Only direct labor is computed here, however. Figure 4.2.3-4 is an excerpt from AFM 177-380 and illustrates this process of developing an average military direct labor rate per base.

PREPARED 76 OCT 21 09:13 PCS LABOR RATE COMPUTATION REPORT PCN SH129-203
ORGANIZATION 0100SRCHG MILITARY RUN NUMBER:02

RANK	HOURLY RATE	HOURS ASCAC	TOTAL COST	HOURS ASGAD	TOTAL COST	HOURS ASCNE	TOTAL COST
E01	2.00	0	.00	0	.00	0	.00
E02	3.20	8144	26060.80	704	2252.80	1056	3379.20
E03	3.50	32936	115276.00	1352	4732.00	1936	6776.00
E04	4.34	51684	224300.56	3792	16457.28	2816	12221.44
E05	5.07	29172	147902.04	11684	59237.88	7760	39343.20
E06	5.93	3488	20683.84	16720	99149.60	5408	32069.44
E07	6.90	0	.00	6520	44988.00	5984	41209.60
E08	7.63	0	.00	384	3006.72	2784	21798.72
E09	9.15	0	.00	176	1410.40	1056	5662.40
001	5.81	0	.00	0	.00	176	1022.56
002	7.01	0	.00	0	.00	520	4123.60
003	9.98	0	.00	208	2075.84	1552	15480.96
004	11.64	0	.00	0	.00	000	10243.20
005	14.06	0	.00	0	.00	704	5098.24
006	16.44	0	.00	0	.00	176	2093.44
W01	9.75	0	.00	0	.00	0	.00
W02	10.00	0	.00	0	.00	0	.00
W03	10.25	0	.00	0	.00	0	.00
W04	10.50	0	.00	0	.00	0	.00
TOTAL		125424	534231.24	41540	233510.52	32816	210210.08

MILITARY DIRECT LABOR RATE:

(B) 534231.24 / (A) 125424 = 4.25

MILITARY INDIRECT LABOR RATE:

(D) 233510.52 / (C) 41540 = 5.62

MILITARY OVERHEAD LABOR RATE:

(F) 210210.08 / (E) 32816 = 6.40

PCN SH129-203 PAGE 3

Figure 2-4. Military Labor Rate Computation.

AFM 177-380

19 October 1976

2-19

FIGURE 4.2.3-4 SAMPLE PROCESS TO DEVELOP AVERAGE MILITARY DIRECT LABOR RATE PER BASE

The computation for civilian labor is slightly different and involves using the assigned labor costs for all categories of cost (direct, indirect, and overhead) to factor actual costs for civilian labor derived from the quarterly input from H069R. The computation is the same as that described in AFM 177-380, Section 2.11.1 and Figure 2-3 of that publication. Figure 4.2.3-5 is a copy of Figure 2-3 of AFM 177-380 to illustrate this process.

The average labor rates per assigned hour per base for military and civilian direct labor is a new cost element not currently computed by CSCS. It will create a meaningful differentiation in the computation of base costs such as those in the CSCS 8104 and 8106 reports. It will also impact the methodology currently used to compute these costs; and so, will affect a number of programs that produce CSCS output reports. It must also be pointed out that the development and display of an average direct labor rate per assigned hour per base may be considered an optional one since it need not be displayed or used in computation of base labor. The average labor rate per base may be considered as an interim calculation and may be developed only to produce an average labor rate per MDS worldwide. The development of this MDS labor rate is shown as the final computations of Figure 4.2.3-1. The average labor rate per base is multiplied times all the direct labor hours for each MDS reported by that base to the MDCS. These hours are available from the current D056 input to

PREPARED 77 FEB 28 22:44
ORGANIZATION 043AMALWG

MCS LABOR RATE COMPUTATION REPORT
CIVILIAN

PCN SH129-203
RUN NUMBER:03

CONTRACT LABOR RATE = 5.59
(INPUT BY MCS MANAGER)

CIVILIAN SERVICE AND/OR LOCAL NATIONAL EMPLOYEES

LABOR CATEGORY	TOTAL COST	/	TOT COMBINED COST ALL LABR	X	ACTUAL TOTAL PAYROLL	/	TOTAL ASGND HRS	=	LABOR RATE
DIRECT LABOR	190204.08	/	272822.96	X	359587.20	/	27832	=	9.00
INDIR LABOR	25700.56	/	272822.96	X	359587.20	/	3360	=	10.08
OVERHEAD	56918.32	/	272822.96	X	359587.20	/	9136	=	8.21

DIRECT LABOR COMPUTATION

CTV HRS	X	LAB RATE	+	CTR HRS	X	LAB RATE	/	TOTAL HRS(CIV-CTR-LN)	=	COST PER HR
(28080	x	9.00)	+	(1	X	5.50)	/	28090	=	9.00

DIRECT LABOR RATE COMPUTATION

CTV HRS	X	LAB RATE	+	CTR HRS	X	LAB RATE	/	TOTAL HRS(CIV-CTR-LN)	=	COST PER HR
(3360	X	10.08)	+	(0	X	5.59)	/	3360	=	10.08

OVERHEAD LABOR RATE COMPUTATION

CTV HRS	X	LAB RATE	+	CTR HRS	X	LAB RATE	/	TOTAL HRS(CIV-CTR-LN)	=	COST PER HR
(9136	X	8.21)	+	(0	X	5.59)	/	9136	=	8.21

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Figure 2-3. Civilian Labor Rate Computation.

FIGURE 4.2.3-5 SAMPLE PROCESS TO DEVELOP AVERAGE CIVILIAN DIRECT LABOR RATE PER BASE

CSCS. The total costs for each MDS from all bases is determined along with the total direct labor hours "on" and "off" for the MDS. The total cost (now worldwide for the MDS) is divided by total hours (worldwide for the MDS) to produce an average worldwide labor rate by MDS - the final objective of this process.

This final process is similar to the manual aggregation of costs accomplished by AFAFC/XSMC in 1980 to produce the direct civilian labor rate from the worldwide summation of data in the MCS consolidated MCS 1A report (see reference [16] and Figure 4.2.2-1 of this report). The major difference is that the labor rate produced by the procedure described here is available quarterly from current data. It need not be escalated.

The process described above is considered the most detailed that is practical to achieve in the current environment. It must be borne in mind that there are many definitions of what is considered "adequate" for costing purposes, and this procedure affords many opportunities for accomplishing procedures in a more summarized, less discrete manner if this is desired. If decisions are made to modify this procedure, they should be made with the three ultimate requirements of an accurate labor rate in mind, and the impact of the decisions in the light of these requirements should be considered. As stated earlier they are:

a. The labor rate should accurately reflect the personnel structure of the performing maintenance activity.

b. Changes in labor rates should be reflected when they actually occur.

c. The labor rate computation should be frequent enough to reflect changing conditions.

The procedure above meets all of the requirements.

4.2.4 Impacts of the Recommended Procedure on CSCS

The following are the functional impacts on CSCS created by the recommended procedure for development of direct labor rates.

a. A design change to MMICS must be implemented to add a base indication to files ARF9IT/ARG9IT and ARF80T/ARG80T.

b. An MOA must establish a new interface with MMICS at each base to receive files ARF9IT/ARG9IT and ARF80T/ARG80T.

c. A new program to process the monthly MMICS input must be written for CSCS.

d. A table of MMICS data sources must be established by CSCS and an administrative program written to record monthly status of MMICS input data.

e. A table of pay rates for military and civilian pay grades must be established by CSCS. OOV must include upkeep procedures for these files in its local instruction for table upkeep.

(1) OOV must place itself on the distribution of Wage Rate Table changes by letter request to AFLC/MPKC.

f. CSCS programs must be modified to compute a base labor rate separately for military and civilians.

(1) Computation procedures and outputs for base level algorithms must be modified so all output reports display military and civilian labor computation separately.

g. D056 inputs to CSCS must provide inputs by military and civilian direct labor hours.

h. The CSCS must compute a separate labor rate by MDS for military and civilian labor.

4.2a Office of VAMOSC (OOV) Comments

Concur. OOV will further review this proposal prior to FY86 as indicated in Paragraph 4.1a of this report. In the meantime, annually, OOV will compute a direct labor rate (DLR) for each MDS using MCS 1A reports. The DLR will be a composite military and civilian rate, weighted based on the reported number of military and civilian hours.

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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

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

Attachment 1: Proposed DAR Entries Supporting Modification of Maintenance Data Collection System to Transmit Civilian and Military Manhours Separately to AFLC.

Requirement

Currently, base level files of the Maintenance Data Collection System include a field called "category of labor," which distinguishes military from civilian manhours. Reports transmitted to the Product Performance System at AFLC do not distinguish military from civilian manhours.

The current format of transmitted records involves 80 columns, all of which are used. However, a change in coding would permit distinguishing military and civilian manhours.

Column 80 of transmitted records is called "Record Code." Table A-1 identifies all values currently used. Of these records, only A, E, F, G, H, and S provide manhours. These codes should be reserved for military manhours, and additional codes (e.g. B, C, D, J, K, and U) used for civilian manhours in corresponding cases.

Request that record transmittal formats be changed to permit distinguishing military from civilian manhours.

Impact Statement

Failure to implement makes it impossible for the Product Performance System to provide military and civilian manhours separately to the CSCS. The CSCS in turn will remain unable to distinguish military and civilian labor costs.

TABLE A-1. RECORD CODES TRANSMITTED TO PRODUCT PERFORMANCE SYSTEM

Code	Application
A	On-equipment aircraft, missile and JETD C-E maintenance
E,F	On-equipment engine maintenance
G	On-equipment non-airborne maintenance
H	Off-equipment maintenance
L	Lead-the-force report
P	Parts replaced during repair
R	Removal of sterialized components
S	Summarized aircraft support general
T	Removal/installation of aircraft engine

Justification Benefits/Cost Savings

Critically required to permit the CSCS to accurately portray labor costs and to maintain the congruence of the algorithm output with the input data.

Attachment 2: Proposed DAR Entries Supporting Modifications to Product Performance System to Process Civilian and Military Manhours Separately.

Requirement

Currently, the Product Performance System receives from the Maintenance Data collection System reports on maintenance manhours which do not distinguish between civilian and military labor. A separate DAR, provided with this report as Attachment 1, proposes a data format incorporating this distinction.

Request that the Product Performance System be modified to accept inputs coded as described in Attachment 1. These reports would be forwarded to the CSCS in the new format.

Impact Statement

Failure to implement makes it impossible for the Product Performance System to provide military and civilian manhours separately to the CSCS. The CSCS in turn will remain unable to distinguish military and civilian labor costs.

Justification Benefits/Cost Savings

Critically required to permit the CSCS to accurately portray labor costs and to distinguish military from civilian costs, thus contributing to management decisions on economical maintenance.

Attachment 3: Proposed DAR Entries Supporting Modifications to CSCS to Process Military and Civilian Manhours Separately.

Requirement

Currently, the CSCS receives from the Product Performance System reports on maintenance manhours which do not distinguish between civilian and military labor. A separate DAR, provided with this report as Attachment 1, proposes a data format incorporating this distinction. A second DAR proposes that the Product Performance System forward to the CSCS the reports in the proposed modified format.

Request that the CSCS be modified to accept the reports in this format, and apply military and civilian pay rates to the respective manhours. The separate results should replace the TCTO labor data displayed in the MDS Logistics Support Costs Report, the Base WUC Cost Report, the Total Base WUC Cost Report, the Total Base and Depot WUC Cost Report and the Summary of Cost Elements Report.

Impact Statement

If not implemented, CSCS users will continue to get reports of TCTO labor costs that this analysis considers inaccurate.

Justification Benefits/Cost Savings

Critically required to permit the CSCS to accurately portray TCTO labor costs.

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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

This study is the sixth 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 Base Labor Cost 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.

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20. For the purposes of presentation in CSCS reports, all direct labor expended on aircraft maintenance at the base level is identified with one of four categories: Inspection, Other Support General, Time Compliance Technical orders, and all other direct labor. These categories are mutually exclusive and exhaustive. "All other direct labor," addressed in this report is essentially all other direct maintenance labor, both scheduled and unscheduled.

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

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