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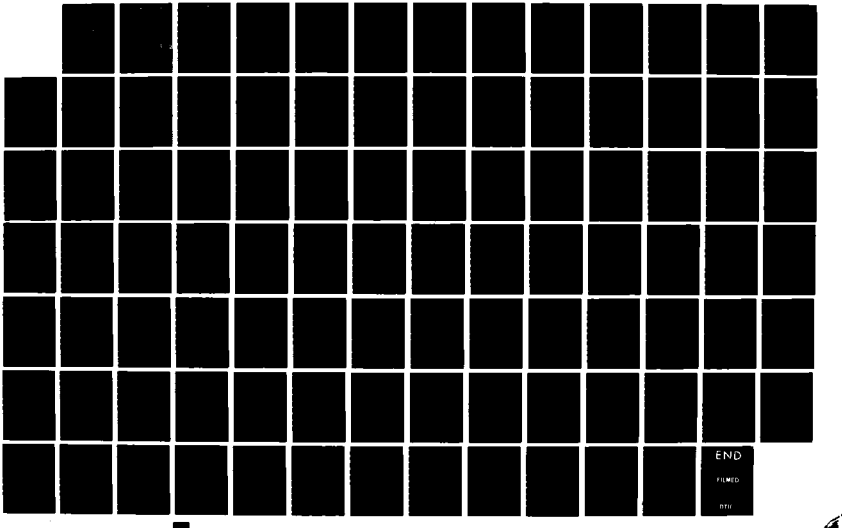

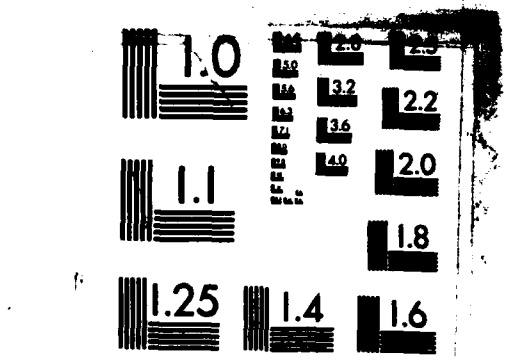

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AD-A157 604

AN INVESTIGATIVE ANALYSIS OF THE NSN-WUC CROSS-REFERENCE DICTIONARY FOR THE COMPONENT SUPPORT COST SYSTEM (D160B)

Contract No. F33600-82-C-0543

Report Number
V-84-31859-20

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Submitted to:

HEADQUARTERS
AIR FORCE LOGISTICS COMMAND
MM(VAMOSC)
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This study is the twentieth 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 is an investigative analysis of the National Stock Number (NSN) - Work Unit Code (WUC) Cross-Reference Dictionary used 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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1.0 INTRODUCTION

Visibility and Management of Operating and Support Costs (VAMOSC) 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 VAMOSC II CSCS 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.

1.1 Purpose

A comprehensive, independent analysis of the accuracy, logical validity, and data integrity of the CSCS has been undertaken and

is reported here ~~and in separately delivered volumes.~~ This volume documents the research conducted in compliance with the following specific task description, excerpted from the Contract Statement of Work:

> One of the more critical parts of the CSCS logic is the development of the NSN/WUC cross reference dictionary. This dictionary associates the costs collected at base maintenance level in WUC terms, with base supply and depot maintenance which are collected in NSN terms. The continued accuracy and validity of this relationship is considered to be vital to the overall credibility of CSCS. The contractor shall devise suitable methodology to verify accuracy of the dictionary as well as techniques to insure continued accuracy.

Initial research reported in this volume revealed an existing body of automated and manual procedures for initialization, verification, and maintenance of the NSN-WUC Cross-Reference Dictionary. The remainder of the research effort reported here and the development recommendations presented in this report were based, to the maximum feasible extent, on these existing resources consistent with the VAMOSC philosophy.

1.2 Report Structure

The report which follows is organized in the following major sections:

2. BACKGROUND
3. DATA STRUCTURES
4. SPECIFIC USES & ASSOCIATED LOGIC
5. DICTIONARY MAINTENANCE
6. DISCUSSION: PROBLEMS AND SOLUTION CONCEPTS
7. INTRODUCTION OF A NEW MDS
8. RECOMMENDATIONS

2.0 BACKGROUND

The objective of the VAMOSC Component Support Cost System (CSCS) can be stated as "...the capability to assimilate, portray, and retain for historical reference, the quarterly cost of resources (labor, material, services and overhead) directly and indirectly associated with base and depot logistics support of aircraft sub-systems and components" (see Reference 1). All elements of the cost are to be assessed to the attributable five digit Work Unit Code (WUC) and Mission Design Series (MDS), except for the elements Base and Depot Support General and Base and Depot On-Aircraft Modification, which are logically attributable to the aircraft MDS for which the costs were incurred. With the exception of high-failure-rate components or components otherwise requiring highlighting for the special attention of engineering or maintenance management, WUCs are assigned to repairable components and assemblies only.

Unfortunately, some costs are not reported by MDS-WUC. At the base level, consumable material costs incurred for repair of components are reported by two digit WUC by MDS, necessitating cost allocation to the five digit WUCs comprised by the two digit WUC system. Base condemnations and base exchangeables, which incur spares and repair costs respectively, are reported principally by MDS and NSN. Associated WUCs are not reliably reported. At the depot level, repair and issue of exchangeables are reported by National Stock Number (NSN), not MDS or WUC.

Depot exchangeables costs arise in two distinct, but closely related ways. They originate when a recoverable item of equipment is removed from an aircraft during Programmed Depot Maintenance (PDM) and directly replaced from stock, for repair or modification purposes. In addition, they originate with the issue from stock of a recoverable item in order to effect the repair of a job-routed assembly, removed for repair purposes from such an aircraft. A job-routed item is one which is removed from the aircraft and submitted to the appropriate accessories repair shop, with instructions to return, when repaired, for re-installation in the same aircraft. Job routing is authorized when a serviceable replacement is not available in supply.[1,2]

As a consequence of the reporting of depot exchangeables cost data by NSN, a way is needed to bridge the gap from NSN to MDS-WUC. A two-stage linkage is utilized to perform that bridge function. The control number uniquely associated with the MDS undergoing PDM, which originated an exchange action, is reported in the depot level AFLC Retail Stock Control and Distribution System (D033) with the NSN of the recoverable item being issued. In addition, this control number and the corresponding MDS are

1. This explanation based on in-person discussions with Major Steven Erickson, AFLC/LEYM, the Pentagon, Washington, DC, 25 February 1983.

2. Confirmed by Roger W. Steinlage, AFLC/ACMCI, in meeting at AFLC HQ, 16 March 1983.

reported in the depot's Job Order Master Production System G004L. Therefore, G004L data can be used as a bridge from control number to MDS.[1]

Theoretically, the MDS and NSN should be enough to uniquely determine the WUC. However, no single, integrated, automated, and mature source existed during the design of the CSCS which would serve as a means to convert the MDS-NSN to the corresponding WUC. As a result, as well as for purposes of administrative support, a specific sub-objective of the CSCS is to provide a NSN-to-WUC within-MDS cross-reference capability.

One additional CSCS sub-objective also bears implications for design of the NSN-MDS-WUC cross-reference capability; specifically, to provide an automated capability to relate subassemblies to their parent assemblies via the WUC structure. The hierarchical numbering rules by which WUCs are assigned are not hard and fast (see Reference 2). Exceptions are permitted which may make it impossible to program a computer to recognize the parent assembly WUC of an item by analysis of the item's own WUC. For instance, if there are more than 32 components at the five digit level, unused characters in the fourth digit position will be used to differentiate among those in excess of 32. As a consequence, the need arose to explicitly associate the Next Higher Assembly, i.e., parent assembly WUC with each WUC on each MDS.

1. Confirmed by Roger W. Steinlage, AFLC/ACMCI, in meeting at AFLC HQ, 16 March 1983.

A variety of Air Force information systems were identified which, in combination, could provide a baseline NSN-MDS-WUC Cross-Reference Dictionary. These include the following (see Reference 3, Section 4):

Primarily - D041, K051
Secondarily - D024, D143F, D046, H036, Contractor Tapes

The K051 System is being replaced by the CSCS. In particular, the Logistics Support Cost Ranking function is retained and incorporated into the CSCS design (see Reference 4, Page 34, Report Control Symbol HAF-LEY(AR) 8112).[1] As a result, K051 was capable of serving a role in the initial file build process for the Cross-Reference Dictionary, but not in its maintenance process. On the other hand, the D041 system, which supports depot material requirements planning, not only contributed to the initial file build, but is also available for purposes of annual reconciliation, which is currently under consideration.[2]

In order for the CSCS to achieve a fully operational status, it was recognized that the integrity of the Cross-Reference Dictionary must be achieved and procedures instituted to assure the maintenance of that integrity. Integrity, in this context, includes the correctness and completeness of the cross-reference relationships represented in the file and any descriptive data represented in the file for WUCs or NSNs.

1. In the remainder of this report, output reports will be identified as Report No. nnnn, where HAF-LEY(AR)nnnn is its Report Control Symbol.

2. This information initially provided by Norm Prince in meeting at HQ AFLC, 9 December 1983.

In general, aircraft maintenance and supply functions are performed by separate, but closely interfacing organizations at both the base and depot levels. The language and procedures of the supply organization are oriented about the NSN as a means of uniquely identifying each centrally procured or centrally managed item. The maintenance organization uses the WUC, essentially as a hierarchical numbering scheme to uniquely identify the functional role of an assembly or component in each MDS aircraft on which it is installed, and as a vehicle to report direct maintenance activity. The Air Logistics Centers (ALCs) represent the single central organizational source of both NSNs and WUCs, and knowledge of their cross relationships and hierarchical relationships. Each ALC represents, among other things, a central point of responsibility for procurement, initial spares provisioning, generation of WUC manuals and Illustrated Parts Breakdowns (IPBs), and coordination of NSN assignments, for new systems and subsystems assigned to it by the AFLC. While each aircraft MDS is assigned for the above purposes to an ALC under the System Manager's Control, some classes of equipment common across aircraft MDSs are assigned to a single ALC. For instance, avionics are generally assigned to the Warner Robins ALC.

The potential was, therefore, recognized for knowledgeable verification of the initial Cross-Reference Dictionary by cognizant personnel at the respective ALCs - Warner Robins, San Antonio, Oklahoma City, Ogden, and Sacramento. In addition, it was recognized that no single or combined automated sources(s)

could be expected to feed all NSN-WUC relationship updates without errors and omissions to the CSCS (see Reference 5, reproduced in Appendix A). It was, therefore, anticipated that resolution of exceptions in NSN-WUC relationships, arising during monthly CSCS processing, would likewise require continuing ALC support. The twin goals were established:

- complete initial verification by fourth quarter of 1985
- 98% of NSN-WUC relationship updates to be obtained from automated sources, after completion of initial verification.

The balance of this report will present the structures of the NSN, the WUC, and the Cross-Reference Dictionary; a description of the initial Dictionary file build method; specific ways in which the Dictionary is used; sources of automated updates to NSN-WUC relationships; and manual verification and update procedures. Potential problems and improvements will also be covered.

The CSCS is in a continual state of development. This report reflects the state of CSCS development at a snapshot in time.

on NSN and MDS with a given cost record in the NSN Computation file is selected. The resulting file is subsequently processed to generate the Report No. 8114, illustrated in Exhibit IV (from Reference 4, Figure 3-13, Page 36).

The Cross-Reference File sorted by MDS-NHAWUC-WUC-NSN can be used to build a file of assembly and associated subassembly costs, by extracting these costs from the MDS-WUC Totals file in the proper sequence.[1] This extract file is subsequently processed to generate the Report No. 8115, illustrated in Exhibit V (from Reference 4, Figure 3-14, Page 37).

4.3 Data Lookup by NSN

Several data elements associated uniquely with NSNs are stored in the Cross-Reference Dictionary. These elements are presented in Exhibit VI (see Reference 3, Pages B-24, B-24.1, and B-24.2). These data are stored in the Dictionary either for efficiency in data lookup during processing (e.g., unit price, weight) or for traceability of updates (e.g., equipment specialist and item manager codes). Other than weight (obtained from the 0013 system), these data are obtained from the Master Inventory Item Control System (D043) and the Interchangeability & Substitutability Data Maintenance System (D097) via the D046 System, under control of the D071 Stock Number User Directory (SNUD). D043 provides unit price, Expendability Recoverability Repairability Category (ERRC) and other catalog management data. D097 provides I&S updates.

Commonality, as described above in Section 4.1, leads to the need to use the Cross-Reference Dictionary for data lookup.

1. See Section 6.3 for rollup method actually implemented in current system.

On the other hand, where a NSN is used in the identical functional role and, presumably, under the same stresses, in multiple locations on a particular MDS, a single WUC is to be assigned, at a single location. All other uses are to be identified at the appropriate location in the WUC manual for that MDS, with reference to the single common WUC. This class of commonality is of concern, because rollup, or aggregate costs of two or more systems (2 digit WUCs) can be distorted by the common use of the same WUC item. A sampling of WUC manuals indicates that the Air Force has not fully complied with the requirement (i.e., assignment of only one WUC to a common item in a particular MDS aircraft). As long as separate, unique WUCs are assigned, the rollup distortion problem will not surface.

As mentioned in Section 2.0, the costs associated with depot exchangeables are converted from NSN-MDS to MDS-WUC via the Cross-Reference Dictionary. For a NSN used at multiple WUCs in a particular MDS aircraft, the CSCS algorithms currently assign the costs to the first WUC in alphanumeric sequence encountered for that NSN-MDS combination on the Cross-Reference Dictionary file. This arbitrary assignment rule will tend to distort the system level rollup costs associated with NSNs used in more than one system on a MDS aircraft.

The Cross-Reference Dictionary sorted by NSN-MDS-WUC is used to extract a WUC for incorporation into records of cost by NSN-MDS (i.e., base and depot condemnations and exchangeables repair costs). The first record in the Cross-Reference Dictionary file matching

EXHIBIT 111.

HQ AFLC/LO(VA-OSC) RCS HAF-LEY(AR)8110 COMPONENT SUPPORT COST SYSTEM (CSCS) AS OF FY 99-1 Q-D1608-DDG-AR-2QC
PRODUCED 99 XXX 99 MDS-WUC-NSN CROSS-REFERENCE MDS XXXXXXX
SEQUENCE: MDS-WUC PAGE 99999

MDS	WUC	WUC NOUN	CPA	VMA WUC	NSN	NSN NOUN	IM	UNIT PRICE	ERRC	WEIGHT
XXXXXXX	XXXXX	XXXXXXXXXXXXXXXXXXXX	999	XXXXX	XXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXX	XX	$999,999.99	X	99,999
	XXXXX	XXXXXXXXXXXXXXXXXXXX	999	XXXXX	XXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXX	XX	$999,999.99	X	99,999
	XXXXX	XXXXXXXXXXXXXXXXXXXX	999	XXXXX	XXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXX	XX	$999,999.99	X	99,999
					XXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXX	XX	$999,999.99	X	99,999
					XXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXX	XX	$999,999.99	X	99,999
	XXXXX	XXXXXXXXXXXXXXXXXXXX	999	XXXXX XXXXX	XXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXX	XX	$999,999.99	X	99,999
	XXXXX	XXXXXXXXXXXXXXXXXXXX	999	XXXXX	XXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXX	XX	$999,999.99	X	99,999
	XXXXX	XXXXXXXXXXXXXXXXXXXX	999	XXXXX	XXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXX	XX	$999,999.99	X	99,999
	XXXXX	XXXXXXXXXXXXXXXXXXXX	999	XXXXX	XXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXX	XX	$999,999.99	X	99,999
	XXXXX	XXXXXXXXXXXXXXXXXXXX	999	XXXXX	XXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXX	XX	$999,999.99	X	99,999
					XXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXX	XX	$999,999.99	X	99,999
	XXXXX	XXXXXXXXXXXXXXXXXXXX	999	XXXXX	XXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXX	XX	$999,999.99	X	99,999
	XXXXX	XXXXXXXXXXXXXXXXXXXX	999	XXXXX	XXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXX	XX	$999,999.99	X	99,999
	XXXXX	XXXXXXXXXXXXXXXXXXXX	999	XXXXX XXXXX	XXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXX	XX	$999,999.99	X	99,999
	XXXXX	XXXXXXXXXXXXXXXXXXXX	999	XXXXX	XXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXX	XX	$999,999.99	X	99,999
	XXXXX	XXXXXXXXXXXXXXXXXXXX	999	XXXXX XXXXX	XXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXX	XX	$999,999.99	X	99,999
	XXXXX	XXXXXXXXXXXXXXXXXXXX	999	XXXXX	XXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXX	XX	$999,999.99	X	99,999
					XXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXX	XX	$999,999.99	X	99,999
					XXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXX	XX	$999,999.99	X	99,999
					XXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXX	XX	$999,999.99	X	99,999
					XXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXX	XX	$999,999.99	X	99,999
	XXXXX	XXXXXXXXXXXXXXXXXXXX	999	XXXXX XXXXX	XXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXX	XX	$999,999.99	X	99,999
	XXXXX	XXXXXXXXXXXXXXXXXXXX	999	XXXXX	XXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXX	XX	$999,999.99	X	99,999

Figure 3–10. CSCS MDS–WUC–NSN Cross Reference Report.

EXHIBIT II.

HQ AFLC/LOIVA(USCI) — NCS MAF-LEVIA(81C9 — COMPONENT SUPPORT COST SYSTEM (CSCS) — NSN XXXXXXXXXXXXXX

PRODUCED 99 XXX 99 — NSN-MDS-SUC CROSS-REFERENCE — AS OF FY 99-1 Q-01600-DDF-AR-20C

SEQUENCED NSN-MDS-WUC — PAGE 99999

NSN	NSN NOUN	IN	UNIT PRICE	ERRC	WEIGHT	MDS	WUC	WUC NOUN	QPA	WUC NHA
XXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXX	XX	$999,999.99	X	99,999	XXXXXXX	XXXXX	XXXXXXXXXXXXXXXXXXX	999	XXXXX
							XXXXX	XXXXXXXXXXXXXXXXXXX	999	XXXXX
						XXXXXXX	XXXXX	XXXXXXXXXXXXXXXXXXX	999	XXXXX
						XXXXXXX	XXXXX	XXXXXXXXXXXXXXXXXXX	999	XXXXX
XXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXX	XX	$999,999.99	X	99,999	XXXXXXX	XXXXX	XXXXXXXXXXXXXXXXXXX	999	XXXXX
XXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXX	XX	$999,999.99	X	99,999	XXXXXXX	XXXXX	XXXXXXXXXXXXXXXXXXX	999	XXXXX
							XXXXX	XXXXXXXXXXXXXXXXXXX	999	XXXXX
							XXXXX	XXXXXXXXXXXXXXXXXXX	999	XXXXX
						XXXXXXX	XXXXX	XXXXXXXXXXXXXXXXXXX	999	XXXXX
						XXXXXXX	XXXXX	XXXXXXXXXXXXXXXXXXX	999	XXXXX
							XXXXX	XXXXXXXXXXXXXXXXXXX	999	XXXXX
XXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXX	XX	$999,999.99	X	99,999	XXXXXXX	XXXXX	XXXXXXXXXXXXXXXXXXX	999	XXXXX
XXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXX	XX	$999,999.99	X	99,999	XXXXXXX	XXXXX	XXXXXXXXXXXXXXXXXXX	999	XXXXX
XXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXX	XX	$999,999.99	X	99,999	XXXXXXX	XXXXX	XXXXXXXXXXXXXXXXXXX	999	XXXXX
							XXXXX	XXXXXXXXXXXXXXXXXXX	999	XXXXX
							XXXXX	XXXXXXXXXXXXXXXXXXX	999	XXXXX
						XXXXXXX	XXXXX	XXXXXXXXXXXXXXXXXXX	999	XXXXX
						XXXXXXX	XXXXX	XXXXXXXXXXXXXXXXXXX	999	XXXXX
XXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXX	XX	$999,999.99	X	99,999	XXXXXXX	XXXXX	XXXXXXXXXXXXXXXXXXX	999	XXXXX
							XXXXX	XXXXXXXXXXXXXXXXXXX	999	XXXXX
							XXXXX	XXXXXXXXXXXXXXXXXXX	999	XXXXX
						XXXXXXX	XXXXX	XXXXXXXXXXXXXXXXXXX	999	XXXXX
						XXXXXXX	XXXXX	XXXXXXXXXXXXXXXXXXX	999	XXXXX
XXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXX	XX	$999,999.99	X	99,999	XXXXXXX	XXXXX	XXXXXXXXXXXXXXXXXXX	999	XXXXX
XXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXX	XX	$999,999.99	X	99,999	XXXXXXX	XXXXX	XXXXXXXXXXXXXXXXXXX	999	XXXXX
							XXXXX	XXXXXXXXXXXXXXXXXXX	999	XXXXX
							XXXXX	XXXXXXXXXXXXXXXXXXX	999	XXXXX
						XXXXXXX	XXXXX	XXXXXXXXXXXXXXXXXXX	999	XXXXX
						XXXXXXX	XXXXX	XXXXXXXXXXXXXXXXXXX	999	XXXXX
							XXXXX	XXXXXXXXXXXXXXXXXXX	999	XXXXX
XXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXX	XX	$999,999.99	X	99,999	XXXXXXX	XXXXX	XXXXXXXXXXXXXXXXXXX	999	XXXXX

Figure 3-9. CSCS NSN–MDS–WUC Cross Reference Report.

accessible source of this commonality information. Specifically, Report No. 8109, illustrated via the sample in Exhibit II (from Reference 4, Figure 3-9, Page 32), provides this information. Note the indication of multiple MDSs for a given NSN and multiple WUCs within a given MDS for a given NSN.

The analyst using CSCS data may be expected to benefit from an easy reference to I&S relationships. For instance, the analyst may be unable to obtain adequate data about a particular equipment under study. With ready access to I&S relationships, the analyst may be able to identify equivalent equipments for which the requisite data are readily available. Specifically, Report No. 8110, illustrated via the sample in Exhibit III (from Reference 4, Figure 3-10, Page 33), provides this information. Note the indication of multiple NSNs for the same MDS-WUC.

4.2 NSN-WUC Conversion and Hierarchical Aggregation of Data

The multiplicity conditions described above raise issues concerning the effects on cost assignment and aggregation processes. These issues will be presented in this section.

According to the applicable Military Standard (see Reference 2), the assignment of WUCs to a common item depends on circumstances. Specifically, a NSN used in multiple MDS aircraft is assigned a WUC(s), independently for each MDS, by the respective system managers. A NSN used in different functional roles and, hence, under potentially differing stresses, in the same MDS, even within the same parent (i.e., next higher) assembly, is to be assigned a unique WUC for each usage.

4.0 SPECIFIC USES AND ASSOCIATED LOGIC

The uses of the Cross-Reference Dictionary fall into four categories—

- source file for cross-reference reports
- NSN-WUC conversion
- hierarchical aggregation of data
- data lookup by NSN

These uses were determined via careful tracing of information flow as diagrammed in the System Specification, as confirmed through discussions with Mr. Norman Prince, the lead analyst responsible for design and programming of the Cross-Reference Dictionary.

4.1 Source File for Cross-Reference Reports

As mentioned in Section 2.0, one of the CSCS sub-objectives is to provide a NSN-WUC Cross-Reference Dictionary for administrative as well as data processing purposes. An output report listing the NSNs used to fill the role of a particular WUC on a particular MDS aircraft and one listing the MDS-WUCs at which a particular NSN is used would facilitate communication between the supply and maintenance communities.

A cost analyst frequently uses an existing equipment and associated data as a baseline in preparing acquisition or life cycle cost estimates, or analyzing contractor estimates, for a new equipment. Knowledge of multiple uses of various equipments considered as candidates for use as a baseline can aid in the selection of a baseline equipment, as well as interpretation and use of the associated data. The Cross-Reference Dictionary represents a readily

13 positions of the "NSN" maintained in the Dictionary. The remaining positions correspond to a two character alphanumeric code called the Materiel Management Code. These codes "are assigned as a means for selective management and may apply to specific items within a Federal Supply Classification group or class, or they may apply to a range of Federal supply groups and classes which combine to form a selective aggregation "(see Reference 8).[1] Thus, by use of these codes, the AFLC renders the NSN much more flexible in supporting its material management control procedures.

Data elements 5 and 6—National Stock Number Noun and Work Unit Code Noun, respectively—represent an opportunity for multiple descriptions of the same item—one in a supply system context and the other reflecting the where-and-how-used context.

There are a variety of codes included in each record for purposes of tracing questionable relationships to their human source. These include data elements 12, 19, 24, and 25—item manager, equipment specialist, responsible ALC, and clerk designator respectively.

Data elements 9 and 13—unit price and weight, respectively—are maintained in the Cross-Reference Dictionary file to facilitate lookup during CSCS processing.

1. Initially described by Captain Michael Drake in meeting at HQ AFLC, 15 March 1983.

primarily the VAMOSC CSCS predecessor system (K051) and the Recoverable Consumption Item Requirements System (D041). The structure of data in these two systems provided a natural means of identifying full four-key relationships, i.e., MDS-WUC-NSN-NHAWUC. The relevant data structures of these systems are provided below:

D041	K051
NSN	MDS
MDS	WUC
NHANSN	NSN

"NHANSN" stands for Next Higher Assembly NSN. Neither system alone provided both NSN-WUC cross-reference relationships and hierarchical relationships. However, both types of relationships were identified via combined use of both systems' data, as displayed above. First, for a given record in D041, the NSN and MDS were used in combination to look up WUC in K051. This provided the cross-reference relationship. Second, the NHANSN for this D041 record, in combination with the MDS, was used to look up WUC in K051. This WUC was then taken to be the NHAWUC corresponding to the item identified in D041 by NSN and MDS, and this provided the hierarchical relationship.

It should be noted that data element 4—National Stock Number—is defined in the Cross-Reference Dictionary as consisting of 15 alphanumeric characters. As mentioned above, the NSN consists of a 13-position, all numeric number. This corresponds to the first

To facilitate update processing, CSCS maintains three separate versions of the Cross-Reference Dictionary, identical except for sort sequence. The three files are described by the following table:

Doc ID	File Number	Sort Sequence
DTA	PKMDTAO	MDS-WUC-NSN-NHAWUC
DTB	PKMDVBO	MDS-NHAWUC-WUC-NSN
DTC	PKMDUCO	NSN-WUC-MDS-NHAWUC

"NHAWUC" in the above table stands for Next Higher Assembly WUC. Each record represents the use of a particular NSN item in a particular MDS aircraft in a particular WUC location. It identifies the NHAWUC associated with each such unique occurrence of an item.[1]

In the above table, the sort sequence is interpreted by associating the data elements from left to right with the primary, secondary, tertiary, and quaternary sort keys.

The reasons for these separate sort sequences are provided in Section 4. The reason for maintaining three separate master files, one for each sort sequence, is to avoid the need to sort a single master file, each processing cycle, into two alternative sequences.

The initial file build of the Cross-Reference Dictionary, as mentioned in Section 2, relied on a wide variety of automated sources,

1. Actually, there may be more than one NHAWUC for the same MDS-WUC-NSN combination. This can occur only through a data error, but the system is currently configured to treat MDS-WUC-NSN-NHAWUC as the unique identifier.

SS-K-14010A(C2)
INPUT /OUTPUT RECORD

SYSTEM NUMBER: D160B

TITLE: WUC-XREF-MASTER

DATA RECORD LENGTH: 280

TAPE RECORD LENGTH/ BLOCKING FACTOR: 2 RECORDS

REMARKS: WUC X-REF MASTER

INPUT / OUTPUT	FILE NUMBER	RUN NUMBER	SEQUENCE OF FILE
I	PKMDTAO	PKPCC	2,3,4,8
I/O	PKMDVBO	PKPDV	2,8,3,4
I/O	PKMDTAO	PKPDT	2,3,4,8
I/O	PKMDUCO	PKPDU	4,3,2,8
I	PKMDVCO	PKPDH	4,3,2,8

NO.	DATA ELEMENT NAME	POSITION OR BLOCK	STRUCTURE LENGTH	STRUCTURE CHARAC
36	SOURCE CODE-1 (SRC-CD01-PKDT "PKPCC")	252	1	AN
37	SOURCE CODE-2 (SCR-CD02-PKDT "PKPCC")	253	1	AN
38	SOURCE CODE-3 (SRC-CD03-PKDT "PKPCC")	254	1	AN
39	YEAR AND DAY ESTB (ESTB-DT01-PKDT "PKPCC")	255-259	5	N
40	DATE RECEIVED (RCV-DT-PKDT "PKPCC")	260-264	5	N
41	FOLLOW UP DATE (FOL-UP-DT-PKDT "PKPCC")	265-269	5	N
42	MDS D160B (AV-ID02-PKDT "PKPCC")	270-276	7	AN
42a	FILLER	277-279	1	AN
43	RECORD MARK (RCD-MRK01-PKDT "PKPCC")	280	1	AN

EXHIBIT I. Continued

SS-K-14010A (C2) INPUT /OUTPUT RECORD	SYSTEM NUMBER D160B	PAGE 2 OF 3 PAGES

TITLE	INPUT / OUTPUT	FILE NUMBER	RUN NUMBER	SEQUENCE OF FILE
JC-XREF-MASTER	I	PKMDTAO	PKPCC	2,3,4,8
DATA RECORD LENGTH 280 / TAPE RECORD LENGTH/ BLOCKING FACTOR Z RECORDS	I/O	PKMDVBO	PKPDV	2,8,3,4
	I/O	PKMDTAO	PKPDT	2,3,4,8
REMARKS	I/O	PKMDUCO	PKPDU	4,3,2,8
	I	PKMDVCO	PKPDH	4,3,2,8
WUC XREF MASTER				

NO.	DATA ELEMENT NAME	POSITION OR BLOCK	STRUCTURE LENGTH	STRUCTURE CHARAC
15	MDS D041 (AV-ID01-PKDT "PKPCC")	113-119	7	AN
16	SPECIAL INV (SPCL-END-PC-INV-PKDT "PKPCC")	120-123	4	N
17	DELETE CODE (DEL-CD-PKDT "PKPCC")	124	1	AN
18	USE FACTOR (WUC-USE FAC-PKDT "PKPCC")	125-128	4	N
19	EQP SPECIALIST (EQP-SPCL-CD-PKDT "PKPCC")	129-130	2	AN
20	I&S COMPUTER CODE (MACH-I-S-CD-PKDT "PKPCC")	131	1	AN
21	I&S NSN CODES (I-S-CD-PKDT "PKPCC")	132	1	AN
2	1st I&S NSN (MSTR-I-S-NSN-PKDT "PKPCC")	133-145	13	AN
23	UNIT ISSUE (U-I-PKDT "PKPCC")	146-147	2	AN
24	RESPL ALC CODE (RESP-ALC-CD-PKDT "PKPCC")	148	1	A
25	ITEM MANAGER CODE (IM-CLRK-DESIG-PKDT "PKPCC")	149-151	3	AN
26	SOURCE CODE (SRC-CD-PKDT "PKPCC")	152	1	AN
27	YEAR & DAY EST (ESTB-DT-PKDT "PKPCC")	153-157	5	N
28	MANAGEMENT GROUP (SUPL-MGT-GRP-CD-PKDT "PKPCC")	158	1	AN
28a	FILLER	159	1	AN
29	RECORD MARK (RCD-MRK-PKDT "PKPCC")	160	1	AN
30	NHA NSN (MSTR-I-S-NSN01-PKDT "PKPCC")	161-175	15	AN
31	COUNTER (NR-VAR-CTR-PKDT "PKPCC")	176-177	2	N
32	1st FEDERAL SUPPLY CODE (MFR-FED-SUPL-CD-PKDT "PKPCC")	178-182	5	N
33	1st REFERENCE CODE (REF-NR-PKDT "PKPCC")	183-214	32	AN
34	2nd FEDERAL SUPPLY CODE (MFR-FED-SUPL-CD01-PKDT "PKPCC")	215-219	5	N
35	2nd REFERENCE CODE (REF-NR-1-PKDT "PKPCC")	220-251	32	AN

EXHIBIT I. CROSS-REFERENCE DICTIONARY FILE LAYOUT

SS-K-14010A(C2) INPUT/OUTPUT RECORD	SYSTEM NUMBER D160B	PAGE 1 OF 3 PAGES

TITLE	INPUT/OUTPUT	FILE NUMBER	RUN NUMBER	SEQUENCE OF FILE
WUC-XREF-MASTER	I	PKMDTA0	PKPCC	2,3,4,8
DATA RECORD LENGTH: 280 / TAPE RECORD LENGTH/BLOCKING FACTOR: 2 RECORDS	I/O	PKMDVB0	PKPDV	2,8,3,4
	I/O	PKMDTA0	PKPDT	2,3,4,8
REMARKS: WUC X-REF MASTER	I/O	PKMDUC0	PKPDU	4,3,2,8
	I	PKMDVC0	PKPDH	4,3,2,8

NO.	DATA ELEMENT NAME	POSITION OR BLOCK	STRUCTURE LENGTH	STRUCTURE CHARAC
1	DOC ID (DI-PKDT "PKPCC")	1-3	3	AN
2	MDS <D160B> (AV-ID-PKDT "PKPCC")	4-10	7	AN
3	WUC (WUC-PKDT "PKPCC")	11-15	5	AN
4	NSN (INCL-MMC-NSN-PKDT "PKPCC")	16-30	15	AN
5	NSN NOUN (ITM-NOMEN-PKDT "PKPCC")	31-50	20	AN
6	WUC NOUN (WUC-DSCRP-PKDT "PKPCC")	51-69	19	AN
6a	FILLER	70	1	AN
7	QUANTITY PER APPLICATION (QPA-PKDT "PKPCC")	71-73	3	N
8	NHAWUC (NHA-WUC-PKDT "PKPCC")	74-78	5	AN
9	EXTENDED UNIT PRICE (EXT-PRC-PKDT "PKPCC")	79-88	10	N
10	K DESIGN (K-DESIGN-PKDT "PKPCC")	89	1	A
11	CATAGORY IND (CTGY-FAIL-MAL-IND-PKDT "PKPCC")	90	1	A
12	ITEM MANAGER CODE (IM-ALC-CD-PKDT "PKPCC")	91-92	2	AN
13	WEIGHT (WT-PKDT "PKPCC")	93-98	6	N
14	ERROR CODE (ERR-CD-CGI-PKDT "PKPCC")	-	-	-
14a	ERROR CODE-1 (ERR-CD-PKDT "PKPCC")	99-100	2	AN
14b	ERROR CODE-2 "" ""	101-102	2	AN
14c	ERROR CODE-3 "" ""	103-104	2	AN
14d	ERROR CODE-4 "" ""	105-106	2	AN
14e	ERROR CODE-5 "" ""	107-108	2	AN
14f	ERROR CODE-6 "" ""	109-110	2	AN
14g	ERROR CODE-7 "" ""	111-112	2	AN

uniquely correspond to the WUC of an item. Even the combination of NSN and MDS is not guaranteed to uniquely identify the WUC. The reason for this is that the same item, with the same NSN, may be used in more than one location on an aircraft, in the identical functional role and virtually identical environment. Although the applicable Military Standard (see Reference 2) directs that only one WUC be assigned to such an item relative to that MDS, the Air Force has, in some cases, assigned a different WUC at each location where the item is used. This phenomenon of commonality requires that the Cross-Reference Dictionary provide for multiple WUC records with the same NSN-MDS combination.

Similarly, but for different reasons, the MDS-WUC combination does not necessarily identify a unique item NSN. Any given WUC on a given MDS aircraft may have associated with it a group of Interchangeable & Substitutable (I&S) NSNs, some or all of which satisfy the requirements of that WUC on that MDS, in general or under circumstances requiring a maintenance technician's approval (see Reference 7). This I&S phenomenon requires that the Cross-Reference Dictionary provide for multiple NSN records with the same MDS-WUC combination.

The record layout for the NSN-WUC Cross-Reference Dictionary file is displayed in Exhibit I (from Reference 3, Pages B-24, B-24.1, and B.24-2). Several observations present themselves. First, data element number 1 is a document identifier, or "Doc ID". Each data file of each AFLC information system contains a unique Doc ID. The Doc ID is a standard header included in each record of the file.

3.0 DATA STRUCTURES

In this section, the structure of the NSN and WUC, their relationship, and the Cross-Reference Dictionary will be described, and issues relating to their use introduced.

The NSN is a 13 digit, all numeric identifier (see Reference 6, Vol. I, Part 1, Pages 7-12). Its structure, from left to right, is:

Federal Supply Classification	4 digits
National Item Identification Number	9 digits
National Codification Bureau	2 digits
Non-significant digits	7 digits

The Federal Supply Class of an item of supply is a systematic grouping of related parts to which the item belongs, established to facilitate supply management, and subject to reassignment. The National Codification Bureau code identifies the country assigning the number. The remaining non-significant digits are serially assigned.

The WUC is a five digit alphanumeric identifier, the first two digits of which are standard, numeric digits designating the aircraft system to which the particular item (see Reference 2) belongs. The remaining three digits essentially identify the major assembly, subassembly, and specific component of equipment. Items of equipment assigned a WUC are generally recoverable items, although they may include non-recoverables requiring close monitoring of maintenance activity because of criticality or reliability/maintainability problems.

The same item may be used on a number of MDS aircraft, with a different WUC on each. For this reason, a NSN does not always

```
HQ AFLC/LOGMA-OSC1                    CONFIGURENT SUPPORT COST SYSTEM (CSCS)                    NSN XXXXXXXXXXXXXX
                    RCS HAF-LEV(AR)0114      NSN-WUC LOGISTICS SUPPORT COST      AS OF FY 99-1  Q-D1688-DDJ-AR-20C
PRODUCED 99 XXX 99                              SEQUENCE: NSN-MDS-WUC                            PAGE 99999

 NSN XXXXXXXXXXXXXX   NOUN XXXXXXXXXXXXXXXXXX   IN XX
  MDS XXXXXXX
    WUC XXXXX   WUC NOUN XXXXXXXXXXXXXXXXXX   QPA 999   SPECIAL INVENTORY 9,999                    TOTAL W/I MDS  $9,999,999
                                  TCTO     TCTO     EXCH  EXCH MOD  EXCH MOD  2ND DEST  CONDEMN  MAT MGT
                                 MATRL    TRANS   REPAIR   (CL IV)   (CL VI)     TRANS   SPARES  OV/HEAD
                BASE COSTS:  $99,999  $99,999  $99,999  $99,999  $99,999  $99,999  $99,999  $99,999
                DEPOT COSTS:                    $99,999  $99,999  $99,999           $99,999  $99,999

          OP                                 ----------NTBM----------      ---NR OF MAINT EVENTS (ON EQUIP)---
         TIM     MTTR     RTS    NRTS  CONDEMNED    INHERENT  INDUCED   OTHER  NO DEFECT      INHERENT  INDUCED  OTHER  NO DEFECT
      99,999  99,999  99,999  99,999     99,999      99,999   99,999  99,999     99,999        99,999   99,999  99,999     99,999

      ------NR OF MAINT MAN-HOURS (ON EQUIP)-------      ------NR OF MAINT MAN-HOURS (OFF EQUIP)------
   INHERENT  INDUCED   OTHER  NO DEFECT    TOTAL       INHERENT  INDUCED   OTHER  NO DEFECT    TOTAL
     99,999   99,999  99,999     99,999   99,999         99,999   99,999  99,999     99,999   99,999

  MDS XXXXXXX
    WUC XXXXX   WUC NOUN XXXXXXXXXXXXXXXXXX   QPA 999   SPECIAL INVENTORY 9,999
                                  TCTO     TCTO     EXCH  EXCH MOD  EXCH MOD  2ND DEST  CONDEMN  MAT MGT
                                 MATRL    TRANS   REPAIR   (CL IV)   (CL VI)     TRANS   SPARES  OV/HEAD
                BASE COSTS:  $99,999  $99,999  $99,999  $99,999  $99,999  $99,999  $99,999  $99,999
                DEPOT COSTS:                    $99,999  $99,999  $99,999           $99,999  $99,999

          OP                                 ----------NTBM----------      ---NR OF MAINT EVENTS (ON EQUIP)---
         TIM     MTTR     RTS    NRTS  CONDEMNED    INHERENT  INDUCED   OTHER  NO DEFECT      INHERENT  INDUCED  OTHER  NO DEFECT
      99,999   9,999   9,999   9,999      9,999       9,999    9,999   9,999      9,999         9,999    9,999   9,999      9,999

      ------NR OF MAINT MAN-HOURS (ON EQUIP)-------      ------NR OF MAINT MAN-HOURS (OFF EQUIP)------
   INHERENT  INDUCED   OTHER  NO DEFECT    TOTAL       INHERENT  INDUCED   OTHER  NO DEFECT    TOTAL
     99,999   99,999  99,999     99,999  999,999         99,999   99,999  99,999     99,999  999,999

    WUC XXXXX   WUC NOUN XXXXXXXXXXXXXXXXXX   QPA 999   SPECIAL INVENTORY 9,999                    TOTAL W/I MDS  $9,999,999
                                  TCTO     TCTO     EXCH  EXCH MOD  EXCH MOD  2ND DEST  CONDEMN  MAT MGT
                                 MATRL    TRANS   REPAIR   (CL IV)   (CL VI)     TRANS   SPARES  OV/HEAD
                BASE COSTS:  $99,999  $99,999  $99,999  $99,999  $99,999  $99,999  $99,999  $99,999
                DEPOT COSTS:                    $99,999  $99,999  $99,999           $99,999  $99,999

          OP                                 ----------NTBM----------      ---NR OF MAINT EVENTS (ON EQUIP)---
         TIM     MTTR     RTS    NRTS  CONDEMNED    INHERENT  INDUCED   OTHER  NO DEFECT      INHERENT  INDUC D  OTHER  NO DEFECT
      99,999   9,999   9,999   9,999      9,999       9,999    9,999   9,999      9,999         9,999    9,999   9,999      9,999

      ------NR OF MAINT MAN-HOURS (ON EQUIP)-------      ------NR OF MAINT MAN-HOURS (OFF EQUIP)------
   INHERENT  INDUCED   OTHER  NO DEFECT    TOTAL       INHERENT  INDUCED   OTHER  NO DEFECT    TOTAL
     99,999   99,999  99,999     99,999  999,999         99,999   99,999  99,999     99,999  999,999

                                                                                    TOTAL NSN      $99,999,999
```

Figure 3–13. CSCS NSN–WUC Logistics Support Cost Report.

EXHIBIT V.

HQ AFLC/LOI(AMOSC) — COMPONENT SUPPORT COST SYSTEM (CSCS) — MDS XXXXXXX

PRODUCED 99 XXX 99 — RCS HAF-LEY(AR)8115 — ASSEMBLY - SUBASSEMBLY WUC COSTS — AS OF FY 99-1 — Q-D1608-DDK-AR-ZQC

MDS XXXXXXX — PAGE 99999

TOTAL ACTIVE INVENTORY 9,999 — FLYING HOURS 999,999 — SORTIES 9,999 — LANDINGS 9,999

ASSY WUC XXXXX NOUN XXXXXXXXXXXXXXXXXXX QPA 999 SPECIAL INVENTORY 9,999

	-----LABOR----		DIRECT	OTHER	----EXCH REPAIR COSTS----			CONDEMNED	SUP MGT	MAT MGT	2ND DEST	BASE & DEPOT
	MHS	COST	MATRL COST	COSTS	REPAIR	MOD IV	MOD V	SPARES COST	OH COST	OH COST	COST	WUC TOTAL
BASE:	9,999	$999,999	$9,999,999		$99,999	$99,999	$99,999	$999,999	$999,999	$999,999	$999,999	
DEPOT:	9,999	$999,999	$9,999,999	$99,999	$99,999	$99,999	$99,999	$999,999		$999,999		$999,999,999

SUBASSY WUC XXXXX NOUN XXXXXXXXXXXXXXXXXXX QPA 999

	-----LABOR----		DIRECT	OTHER	----EXCH REPAIR COSTS----			CONDEMNED	SUP MGT	MAT MGT	2ND DEST	BASE & DEPOT
	MHS	COST	MATRL COST	COSTS	REPAIR	MOD IV	MOD V	SPARES COST	OH COST	OH COST	COST	WUC TOTAL
BASE:	9,999	$999,999	$9,999,999		$99,999	$99,999	$99,999	$999,999	$999,999	$999,999	$999,999	
DEPOT:	9,999	$999,999	$9,999,999	$99,999	$99,999	$99,999	$99,999	$999,999		$999,999		$999,999,999

SUBASSY WUC XXXXX NOUN XXXXXXXXXXXXXXXXXXX QPA 999

	-----LABOR----		DIRECT	OTHER	----EXCH REPAIR COSTS----			CONDEMNED	SUP MGT	MAT MGT	2ND DEST	BASE & DEPOT
	MHS	COST	MATRL COST	COSTS	REPAIR	MOD IV	MOD V	SPARES COST	OH COST	OH COST	COST	WUC TOTAL
BASE:	9,999	$999,999	$9,999,999		$99,999	$99,999	$99,999	$999,999	$999,999	$999,999	$999,999	
DEPOT:	9,999	$999,999	$9,999,999	$99,999	$99,999	$99,999	$99,999	$999,999		$999,999		$999,999,999

SUBASSY WUC XXXXX NOUN XXXXXXXXXXXXXXXXXXX QPA 999

	-----LABOR----		DIRECT	OTHER	----EXCH REPAIR COSTS----			CONDEMNED	SUP MGT	MAT MGT	2ND DEST	BASE & DEPOT
	MHS	COST	MATRL COST	COSTS	REPAIR	MOD IV	MOD V	SPARES COST	OH COST	OH COST	COST	WUC TOTAL
BASE:	9,999	$999,999	$9,999,999		$99,999	$99,999	$99,999	$999,999	$999,999	$999,999	$999,999	
DEPOT:	9,999	$999,999	$9,999,999	$99,999	$99,999	$99,999	$99,999	$999,999		$999,999		$999,999,999

SUBASSY WUC XXXXX NOUN XXXXXXXXXXXXXXXXXXX QPA 999

	-----LABOR----		DIRECT	OTHER	----EXCH REPAIR COSTS----			CONDEMNED	SUP MGT	MAT MGT	2ND DEST	BASE & DEPOT
	MHS	COST	MATRL COST	COSTS	REPAIR	MOD IV	MOD V	SPARES COST	OH COST	OH COST	COST	WUC TOTAL
BASE:	9,999	$999,999	$9,999,999		$99,999	$99,999	$99,999	$999,999	$999,999	$999,999	$999,999	
DEPOT:	9,999	$999,999	$9,999,999	$99,999	$99,999	$99,999	$99,999	$999,999		$999,999		$999,999,999

SUBASSY WUC XXXXX NOUN XXXXXXXXXXXXXXXXXXX QPA 999

	-----LABOR----		DIRECT	OTHER	----EXCH REPAIR COSTS----			CONDEMNED	SUP MGT	MAT MGT	2ND DEST	BASE & DEPOT
	MHS	COST	MATRL COST	COSTS	REPAIR	MOD IV	MOD V	SPARES COST	OH COST	OH COST	COST	WUC TOTAL
BASE:	9,999	$999,999	$9,999,999		$99,999	$99,999	$99,999	$999,999	$999,999	$999,999	$999,999	
DEPOT:	9,999	$999,999	$9,999,999	$99,999	$99,999	$99,999	$99,999	$999,999		$999,999		$999,999,999

Figure 3–14. CSCS Assembly-Subassembly WUC Costs Report.

EXHIBIT VI. NSN ASSOCIATED DATA ELEMENTS

NSN	Responsible ALC Code
NSN Noun	Item Manager/Clerk Code
Quantity per Application	Source Code
Extended Unit Price	Year & Day Established
K Design	Management Group
Category Indicator	1st Federal Supply Code
Item Manager Code	1st Reference Code
Weight	2nd Federal Supply Code
Special Inventory	2nd Reference Code
Use Factor	Source Code-1
Equipment Specialist Code	Source Code-2
I&S Computer Code	Source Code-3
I&S NSN Code	Year & Day Established
Master I&S NSN	Date Received
Unit of Issue	Follow-up Date

An issue raised by commonality is the assessment to a particular MDS-WUC of repair costs associated with base Not Repairable This Station (NRTS) actions, reported by NSN in the History Accumulation Subsystem (D143F). The NSN is used to look up repair rates in G004L and average repair costs in the Depot Maintenance Industrial Fund Accounting Production Report System (H036B). The extent of repairs required may depend, however, on the operating enviroment of the item and, therefore, on MDS-WUC. The originating MDS-WUC cannot be linked to the subsequent depot activities without institution of new reporting systems. The smoothing effect resulting from the use of average repair cost data by NSN is not believed to be sufficiently significant to warrant consideration of such a development.

A closely related, but separate, issue is raised in relation to I&S items. The NSN identified in D143F for a condemnation or NRTS action is that of the turned-in item, even when the turned-in item is replaced by the supply department with an interchangeable item or a substitutable item acceptable to the maintenance technician (see Reference 6, Vol. II., Part 2, Chapter 9). Before proceeding with the implications of this practice, a brief presentation of I&S concepts is appropriate.

I&S items are classified as follows (see Reference 7). Two items are interchangeable if they are equivalent in form, fit, function, and durability and can, therefore, be readily used, either one in place of the other, without approval of the requisitioner. Substitutable items exhibit an ordered preference relationship to

each other. That is, one is considered preferable to the other in terms of its physical, functional, or other inherent characteristics. Issue of a suitable substitute does not require approval of the requisitioner. A suitable substitute is freely issued in place of older items or those with less performance capability. A limited substitute, however, cannot be issued without requisitioner approval because, in this case, substitutability depends on circumstances such as the operating environment for which the item is intended.

Each group of physically and functionally equivalent NSNs has a single master NSN determined by research to be the most desirable item for meeting a particular Air Force requirement. Each such I&S group may have multiple subgroups consisting of interchangeable items. Each subgroup of interchangeable items has a primary item—the NSN most desired for retention in the inventory. Each item in an I&S group is coded as to its position in the order of preference.

Returning to the consequences of turn-in reporting at base supply, it is clear that the NSN of the turned-in item may not be the NSN of the item procured to replace it. Their replacement costs may vary significantly. With centralized procurement of stock numbered items, it is conceivable that wide pricing disparities exist among manufacturers of equivalent items as a result of quantity effects, such as learning and discounts, as well as competitive, financial, and efficiency factors. The NSN of the turned-in item, obtained from D143F, is used by the CSCS logic to look up the unit price for assessing the cost of Base Condemnation

Spares. The master NSN (or the primary NSN in its interchangeable subgroup, were it maintained in the Dictionary) may be a more realistic proxy for the item to be ultimately procured to replace it. Indeed, the turned-in item may no longer be actively procured.

It should also be noted that when the NSN is missing on a NRTS or condemnation record from the D143F system, the CSCS logic searches the Cross-Reference Dictionary file for the first NSN record for the particular MDS-WUC (if any), and uses that NSN directly. The master (or primary) NSN may be more appropriate to incorporate into the CSCS logic.

5.0 DICTIONARY MAINTENANCE

This section presents a description of the established procedures for manually verifying the initial automated file build of the Cross-Reference Dictionary, and procedures for continuing maintenance. Both manual and automated maintenance procedures will be described. Potential problems and candidate solutions will be discussed in Section 6.

5.1 Manual Verification Procedures

When the initial file build was completed in July 1981, the resulting Cross-Reference Dictionary was printed, organized by MDS, and the listings were distributed to the applicable MDS system managers at the respective ALCs. A VAMOSC focal point was established at each ALC to coordinate the initial Dictionary verification process, and the continuing maintenance process, at that ALC. In some cases, dictionary listings for certain classes of equipment were transferred to the prime ALC for that class of equipment. For example, the Sacramento ALC transferred avionics listings to Warner Robins ALC for the latter to verify. The originally assigned ALC focal points are presented below:

AIR LOGISTICS CENTER	AIR FORCE BASE	VAMOSC FOCAL POINT
Oklahoma City	Tinker	Carolyn Hines
Ogden	Hill	Bob Murphy
San Antonio	Kelly	Monte Montemayor
Sacramento	McClellan	Sam Burns
Warner Robins	Robins	Hugh Nelson

Some of the above individuals were contacted and questioned as to the procedures followed in the initial verification process.[1,2]

1. Hugh Nelson, by telephone, 25 January 1983 and Carolyn Hines, by telephone, 23 August 1983.
2. Spoke also with airframe equipment specialist Fred Patterson, Oklahoma City ALC, 31 August 1983.

The results of these discussions are presented in the remainder of this section.

Hugh Nelson provided procedural and managerial insight into the verification process as implemented at the Warner Robins ALC.[1] Mr. Nelson wrote the step-by-step procedures presented in Exhibit VII, recruited 10 clerks and a maintenance manager, and trained them in verification.

The Cross-Reference Dictionary listings generated in the initial file build process and distributed by the Office of VAMOSC were used as edit listings for indicating the following types of corrections required for each NSN:

- filling in missing data for captured relationships
- correcting erroneous data
- correcting erroneous MDS-WUC-NHAWUCs
- adding MDS-WUC relationships not captured

In addition, it is the ALC focal point's responsibility to add NSNs not captured in the initial file build process. Edit Cards are keypunched directly from the marked up edit listings. The punch card formats are presented in Reference 4, Supplement 1. The document pertains to monthly exception processing, but the edit card formats are the same as those used for the initial file edit process.

The total verification workload at Warner Robins ALC was initially 84,662 Dictionary entries, representing approximately 28,000 NSNs. In addition, the Sacramento ALC transferred about 4,000 Dictionary entries to the Warner Robins ALC for verification. Mr. Nelson monitored the verification process from October 1981

1. Telephone conversation, 25 January 1983.

EXHIBIT VII.

WORK UNIT CODE/NATIONAL STOCK NUMBER CROSS REFERENCE DICTIONARY

Procedures For Verification

1. Initial File Build Document containing NSN and possibly P/N and WUC is received by equipment specialist.

2. If P/N is available on the File Build Document proceed to the -4 Illustrated Parts Breakdown (IPB). If the P/N is not contained in the File Build Document, convert the NSN to P/N and then proceed to IPB.

3. Locate the P/N in the IPB, identify the system to which the P/N is applied and the nomenclature for both and the next higher assy nomenclature. Proceed to the aircraft Work Unit Code Manual.

4. Locate the appropriate system code, e.g., 11000 for structural systems. Then locate the WUC for the P/N being researched and record it. Then locate the WUC for it's next higher assy and record this code. (Note: Recording of these codes is done in the appropriate data fields on the Initial File Build Document for this is also the keypunch document for this system.)

5. Have these documents keypunched.

6. When these keypunched cards are received from the keypunch operators, these cards should be compared to the Initial File Build Document to insure accuracy. (Note: It may be necessary to do this check on a sample basis depending on the volume of work to be checked.

7. When the accuracy check has been accomplished, file the Initial File Build Document and mail the cards to HQ AFLC/LMVR WPAFB OH 45433.

to August 1982, at which time verification of 16.5% of the initially assigned Dictionary entries, and all of those transferred from Sacramento, had been accomplished. The process seemed to be efficiently administered, as evidenced by a 2% rate of rejection in edit processing.

One significant area of difficulty arose in applying the above verification procedure. Black boxes are not identified in an IPB, nor are the constituent printed circuit cards so identified. As a consequence, Step 3 above required the assistance of the cognizant equipment specialists, which was provided in most cases.

An issue of managerial concern was encountered and resolved during the investigation of the ongoing manual verification process. At issue was a manpower assignment problem, stemming from the need to recruit, train, and monitor personnel on an ad hoc basis. For instance, at the Warner Robins ALC, Mr. Nelson recruited 10 clerks and a maintenance manager, trained them, and monitored their verification activities through an estimated 16.5% completion status, as of August 1982. At that time, all 11 persons were reassigned, suspending the VAMOSC validation process at the Warner Robins ALC. Corrective action, however, was subsequently taken, at the request of the Office of VAMOSC (see Exhibit VIII).

5.2 Automated Maintenance Processing

In each monthly CSCS processing run, the Cross-Reference Dictionary is updated via a complex series of programs designed to completely and consistently incorporate updates to MDS, [prime] ALC Code, WUC, NSN, NHAWUC, and I&S relationships from the following sources:

EXHIBIT VIII. VERIFICATION MANPOWER REQUEST

(RDB)/Harris/72906/11 Jan 83/HARR Ltr 1-11/Working 1/Terri

LO (VAMOSC) 12 JAN 1983

Manpower Requirement in Support of the Component Support Cost System (CSCS)

LOM

1. The National Stock Number/Work Unit Code (NSN/WUC) Cross Reference File is most recently directed upon AFLC by DAF DPD numbered HAF-D-78-03-2, 14 Apr 81. That DPD requires AFLC to "notify HQ USAF of any inability to perform task assignments of this DPD or any situation that may have an adverse impact on the prescribed milestones." The Office of VAMOSC (OOV) believes that unless additional resources are committed to the NSN/WUC Cross Reference File, it cannot be completed by the 4th quarter of FY85. In fact, if only existing approved resources are used, the file will never be completed.

2. In March 1982, each ALC was allocated 4 manpower authorizations per year for three years to complete the initial verifications and 2 manpower authorizations per year from then on to perform file maintenance. With implementation of the CSCS, file maintenance will begin in FY83. As of this date, there are 55 manyears of effort remaining in the initial workload plus the file maintenance workload. The Office of VAMOSC proposes providing manning authorizations as shown in Atch 2 to this letter. The background workload information to substantiate this requirement is shown in Atch 1. The net effect is to increase total authorizations from 20 to 32 and to extend this level through FY85. From FY86 on, the manning reverts to the two per ALC currently approved.

3. The NSN/WUC Cross Reference File is a basic data requirement for all major proposed logistical support and acquisition management information systems. Without this file there is no capability to relate base level maintenance and reliability data with AFLC support capabilities. This is a critical capability that is needed immediately and if delayed will preclude accurate requirements computations.

4. The OOV point of contact is Capt Drake/74963. Your earliest attention to this is solicited. Please contact us if we can be of any assistance.

PAUL A. REID, Major, USAF
Chief, Office of VAMOSC
DCS/Logistics Operations

EXHIBIT VIII. Continued

ATTACHMENT 1

Verification Workload by ALC

1. Number of Verifications

ALC	Total File	As of 31 Dec 82	Remaining Workload
OC	77,000	16,000	61,000
OO	54,000	15,000	39,000
SA	40,000	17,000	23,000
SM	62,000	14,000	48,000
WR	85,000	14,000	71,000
	318,000	76,000	242,000

2. Manhours of Verifications

ALC	MANHOURS	MANYEARS*
OC	24,400	15.0
OO	15,600	7.5
SA	9,200	7.5
SM	19,200	10.0
WR	28,400	15.0

* Adjusted to allow full PE assignment

EXHIBIT VIII. Continued

ATTACHMENT 2

Required Manning

1. Initial Verifications

	3/83	4/83	1/84	2/84	3/84	4/84	1/85	2/85	3/85	4/85	1/86 on
OC	6	6	6	6	6	6	6	6	6	6	0
OO	3	3	3	3	3	3	3	3	3	3	0
SA	3	3	3	3	3	3	3	3	3	3	0
SM	4	4	4	4	4	4	4	4	4	4	0
WR	6	6	6	6	6	6	6	6	6	6	0

2. File Maintenance

	3/83	4/83	1/84	2/84	3/84	4/84	1/85	2/85	3/85	4/85	1/86 on
OC	2	2	2	2	2	2	2	2	2	2	2
OO	2	2	2	2	2	2	2	2	2	2	2
SA	2	2	2	2	2	2	2	2	2	2	2
SM	2	2	2	2	2	2	2	2	2	2	2
WR	2	2	2	2	2	2	2	2	2	2	2

NOTE: Total staffing requirement is computed by adding initial verification requirement plus file maintenance requirement.

- D056B
- D043
- D097
- ALC VAMOSC verification teams
- D143F

The types of updates provided by these sources, and an analysis of their processing in the CSCS, will be presented in the remainder of this section.

5.2.1 Update Transactions

D056B provides the following types of update transactions (see Reference 9, Chapter 2 and Note 1 below).

- Change-MDS (B8)
- Change-ALC Code (B9)
- Add-WUC (B4)
- Change-WUC (B6)
- Delete-WUC (B1)

B4 transactions are also used to provide attribute data about a WUC on a MDS, i.e., data other than MDS, ALC Code, or WUC. These attribute data items are: WUC Noun, Quantity per Application, Use Factor, Special Inventory, and Category Indicator (see Exhibit I above and Reference 9, Chapter 2).

D043 provides changes to catalog management data about NSNs, i.e., those in Exhibit VI above except for I&S data elements (see Reference 7, Chapter 35). It does not provide notification of new NSNs. A D056B Add-WUC transaction, however, inherently "alerts the system" to the possibility of a new NSN.

D097 provides the following types of updates to I&S relationships among NSNs (see Reference 7, Chapter 36):

- delete entire I&S group associated with a master NSN
- delete a specific NSN
- change I&S data

1. Telephone conversation with Chuck Gross, AFLC/MMEA, 15 May 1984.

ıe new updated Dictionary master files, the NHAWUC sequenced ıster file would be matched against the WUC sequenced master ıle to identify orphan WUCs and childless parent WUCs. This ɔuld be accomplished by means of a program incorporating bidirectional match logic which checks for:

- NHAWUC on the NHAWUC master file not appearing as a WUC on the WUC master file (orphan)
- WUC on the WUC master file not appearing as a NHAWUC on the NHAWUC master file (childless parent)

The periodic (perhaps annual) execution of such a standalone rogram, in lieu of incorporating it into the regular monthly rocessing, would place it in a natural role as adjunct to the 056B reconciliation recommended above. The exposure of nomalies in inter-record relationships, uncovered by the above tructural anomaly search program, cannot be represented in he format of the File Maintenance Error Rejection Report. A pecially formatted exception listing should be produced by the rogram. It would, of course, be organized by MDS and, for each DS, would provide two exception lists -- a list of anomalous UC-NHAWUC pairs representing orphans, and a list of anomalous UCs representing childless parents.

The above anomaly search program would have helped to more uickly expose the system design error discussed in the following aragraphs, which was uncovered by means of analysis of CSCS proramming specifications, discussions with D056B personnel, and eview of relevant documentation (see Reference 9).[1,2]

. Telephone conversation with Mr. Robert L. Newman, AFLC/LOEP, 28 July 1983.

. Telephone conversation with Mr. Robert E. Siler, AFLC/LMVRP, 28 July 1983.

(i.e., BTU) transaction. The transaction could also be directed to Error Rejection Report for verification.

- If an ALC Add transaction matches a B4 Add-WUC record, from D056B, on MDS-WUC, it is bypassed. Instead, it should overlay the memo record representing the B4 transaction, since it has full relationship data and the memo record has only MDS-WUC. At the same time, direction of the D056B B4-Add transaction to Error Rejection Report should be inhibited, as relationship data are, of course, already being received from the ALC, and notification of the D056B activity is unnecessary.

Hierarchical disconnects can arise in the evolution of the ictionary. In particular, four types were considered:

1 - a n-digit WUC with a NHAWUC having more than (n-1) digits

2 - a n-digit WUC with a NHAWUC having less than (n-1) digits

3 - an orphan WUC -- a 3, 4, or 5 digit WUC whose NHAWUC does not appear as the WUC in any Dictionary record

4 - a childless parent WUC -- a 2, 3, or 4-digit WUC not appearing as NHAWUC in any Dictionary record[1]

t has been determined that an ALC Add or Change-Keys transaction hich would result in a type-1 anomaly is rejected by the initial dit and validation program PKPBR.[2] No other hierarchical edit ests are applied in the Cross-Reference Dictionary file maintenance rocess. The edit tests in Program PKPBR can readily be strengthned to prevent type-1 and type-2 anomalies.

Based on the correspondence cited, a concept was developed hich can expose existing and prevent future occurrence of type-3 nd type-4 anomalies.[2] Following completion of the building of

1. It should be noted that a childless parent is not necessarily an error, but is a strong indication of one.

2. Letter from Captain Michael Drake dated 3 August 1983, in response to ISI Memorandum "Questions for Norm Prince" dated 18 July 1983.

with erroneous WUCs.

It may be that such errors will be visually detected in the initial Dictionary file verification process. Explicit highlighting of such occurrences, however, would facilitate the cleansing of the Dictionary.

The general philosophy of accepting data from automated feeder systems as accurate (with exceptions to be discussed later,) is a reasonable one, especially considering the volume of manual verification which would otherwise result. Other manifestations of this philosophy are the bypassing of:

- B4 Add-WUC or Change-Data transactions with exact match in Dictionary on keys and data
- all records with MDS outside of the CSCS MDS table

The assumption is made in the former case that the new record or data were added earlier by an ALC file maintenance transaction. The assumption is made in the latter case that the MDS is one which is in the Air Force inventory, but not within the scope of the VAMOSC CSCS.

On the other hand, no such philosophy should be applied to file maintenance transactions submitted by the ALCs. However, based on a review of the System Specification for the Program PKPCC, two situations were found which appear to reflect that philosophy (see Reference 3, Page 4.42.1, Paragraph 4):

- If an ALC Add (i.e., BTA) transaction matches the Dictionary master file on all four keys, it is bypassed. This ignores the possibility of an ALC data entry error, which could lead to failure to add records to the Dictionary. It also ignores the possibility that some of the data are more current. The transaction data could be used to update the matching master record(s) by generating an update

Two reasonable possibilities arise for improved WUC validation. The first is to test new WUCs for a valid two digit system WUC. This would provide a simple, but immediate screening of new WUCs entering the Dictionary. Second, inconsistencies with D056B can be minimized by means of a periodic reconciliation of the Dictionary master file with the B4 master file in D056B. Annual reconciliation would probably be sufficiently frequent, considering that the common source of WUC updates, i.e., ALC equipment specialists, mitigates the rate of infiltration of new WUC inconsistencies. Reconciliation with D056B has been discussed, but no Data Automation Request (DAR) has been prepared to accomplish it.

Until recently, the only unmatched WUC condition directed to the Error Rejection Report was that of an unmatched Old WUC in a B6 Change-WUC transaction from D056B, rejected as a critical edit test failure. Even this test has now been eliminated, a potential problem which will be further discussed in the next paragraph.

B1 Delete-WUC and B6 Change-WUC transactions from D056B, with valid MDS but WUC unmatched in the Dictionary, are now bypassed, without directing the unmatched transaction to the Error Rejection Report. Presumably, this is based on the joint assumptions of D056B transaction accuracy and CSCS Cross-Reference Dictionary completeness.

The former assumption, of D056B accuracy, may be appropriate, based on D056B validation testing; however, the latter assumption, of Dictionary completeness, is the kind of loophole which can degrade the reliability of CSCS output data for its users, by allowing obsolete and phased out assemblies to remain in the Dictionary

6.0 DISCUSSION: PROBLEMS AND SOLUTION CONCEPTS

The potential problems in Cross-Reference Dictionary file maintenance processing, uncovered by the analysis outlined in Section 5 above, are treated in the following major subsections:

6.1 File Integrity
6.2 Workload Management
6.3 Cost Output Useability
6.4 Data Base Organization
6.5 Pending Improvements

6.1 File Integrity

This subsection presents those problems which can and may lead to data disintegrity in the Cross-Reference Dictionary. These problems and the candidate solutions revolve around edit testing, reconciliation, consistency checking, and effective use of ALC expertise.

All WUCs, including NHAWUCs, are currently tested for consisting of five alphanumeric characters. No table of valid two digit (i.e., system) codes is maintained, nor is a match made against the B4 master records for the applicable MDS in D056B. This is in contrast to the system's treatment of a new NSN, added by an ALC file maintenance transaction. In the latter case, D071 is checked and, if the NSN is not on the SNUD for D160B, the request to add it is forwarded. If subsequent interrogation of D046 reveals the invalidity of the NSN, an error rejection message is directed to the originating ALC, and the condition is retained on a suspense file for follow-up action.

- WUC transactions are extended to all affected NSNs
- NSN transactions are extended to all affected MDS-WUCs
- I&S Master File is updated
- WUC change history file is updated

The analysis of the Dictionary file maintenance programs led to observations, presented in the next section, of potential problems and candidate solution concepts.

EXHIBIT IX.

SS-K-14010A

AS OF 99 XXX X-REF FILE MAINTENANCE ERROR/REJECTION REPORT XX-ALC Q-D160B-LMO-MO-MDZ

PRODUCTION DATE 99 XXX 99 RCS XXX-XX(X)XXXX PAGE 99999

DOC/ID	ALC	MDS	WUC	MSN	WUC/NHA	WUC NOUN	QPA	IM	WEIGHT	INV	USE	ERR/CD
XXX	XXXX	XXXXXXX	XXXXX	XXXXXXXXXXXXXXX	XXXXX	XXXXXXXXXXXXXXXXXXXX	XXX	XX	XXXXX	XXXX	XXXX	XXXX
XXX	XXXX			XXXXXXXXXXXXXXX	XXXXX	XXXXXXXXXXXXXXXXXXXX		XX	XXXXX	XXXX	XXXX	XXXX
		_____	____	**********			___					

44

*** INCORRECT DATA

UNDERLINE MISSING DATA

case of an Update transaction, it is critical because more than one NHAWUC may have been generated, in the initial Dictionary file build process, for the same MDS-WUC-NSN, and only one is appropriate to update. [The others should be deleted and, indeed, will be deleted by the end of the initial validation period, projected to end in the fourth quarter of 1985 (see Exhibit VIII above).]

If the non-blank key data fields do not conform to the key field format of one of the hierarchy of acceptable transactions (see Section 5.2.1), the transaction will be rejected and the appropriate data fields will be highlighted in the File Maintenance Error Rejection Report, in accordance with the type(s) of error detected (see Exhibit IX above).

All accepted updates are held in a memo update file until the end of the Dictionary update phase of processing. Only at that point are these memo updates incorporated into the Dictionary Master files. The reason for carrying a memo update file is the fact that several passes of the current master file, in various sort sequences, against various types of update transactions, from the various sources, are required for assimilation of all the changes. During the multi-stage processing, a number of activities take place:

- format and consistency exceptions are detected
  - some are resolved
  - conflicts are directed to the File Maintenance Error Rejection Report
- memo update file is evolved

MDSs are tested by comparison against a table of authorized CSCS MDSs. If a D056B record has an unmatched MDS, the transaction is simply bypassed, presumably on the assumption that the MDS is valid on an Air Force wide basis, but outside the scope of the CSCS. If, on the other hand, an ALC transaction has an unmatched MDS, the transaction is rejected and directed to the File Maintenance Error Rejection Report (see Exhibit IX), on the assumption that it represents a data error.

The WUC and NHAWUC fields, where present, are tested for five alphanumeric characters. The NSN field, where present, in transactions from any source other than D056B, is validated by testing for numeric/alphanumeric values in the appropriate positions, depending on the nature of the item:

- not catalogued (NC)
- not definitive (ND)
- a kit (K)
- standard NSN item

If an ALC edit transaction fails the NSN format test, it is rejected for correction. If a feeder system transaction fails the test, it is simply bypassed, presumably on the assumption either that such a condition can't happen (i.e., because of strong feeder system validation) or that it would not be traceable to its source document or originator, and correctable.

The NHAWUC is tested, in addition to alphanumericity, for its presence in Add and Update transactions submitted by the ALCs. This requirement is critical in the case of an add transaction because the new record is not complete without NHAWUC. In the

5.2.2.2 Basic Architecture

There are six basic sub-phases to Dictionary file maintenance:

- Validation
- MDS-ALC-WUC processing
- NHAWUC processing
- NSN processing
- Master File updating
- File Maintenance Error Rejection Report generation

Each of these sub-phases is accomplished in sequence by a module of programs.

Validation of incoming D056B and D143F records, and ALC edit transactions, is performed in the first and subsequent programs encountered in the Dictionary update processing phase of the system flow. The types of errors detectable by means of these validation tests (see Reference 3, Section 4) are:

- MDS--invalid or not authorized
- WUC--format or unmatched with Dictionary master file
- NSN--format or unmatched with Dictionary master file
- NHAWUC--format or not present
- Quantity per Application--non-numeric
- Change transaction with all new data = old values

Critical data field edit tests result in rejection or bypass of violating transactions, depending on the source, as described in the following paragraphs.

program. These programs were analyzed one at a time, in the order of their occurrence in the processing flow.

Once a basic understanding was achieved, another analytical pass was made through the programming specifications to search for potential problems, i.e., oversights, unanticipated conditions, or ineffective treatment of certain circumstances. Assumptions underlying specified actions were surmised, confirmed, and evaluated for reasonableness. The problem areas sought in this manner include, but are not strictly limited to:

- unnecessary rejection of potentially useful information
  - absolutely
  - until subsequent processing cycle
- acceptance of erroneous information
  - directly
  - by highly suspect interpretation
    - requesting ALC verification
    - without requesting ALC verification
- weak validation testing of feeder system data
- failure to address certain sets of circumstances
  - normal
  - exceptional
- creation of structural inconsistencies
- improper sequence of updates
  - sort sequence
  - time sequence
- incomplete use of existing information
  - to generate appropriate updates to related records
  - to screen incoming transactions for logical validity (i.e., structural consistency)
- arbitrary limits (e.g., table sizes) without treating the situation in which they are exceeded.

Transactions of the above types are organized, under CSCS control, according to the above hierarchy in order that all transactions affecting a specific set of records precedes those affecting a subset of that set. This precedence structure enables the application of group updates to all members of a set of Dictionary records, and targeted updates to specified members of the set.

In addition, priorities are established, under CSCS logic, among transaction types to ensure that multiple transactions against the same set of records are properly sequenced and applied where meaningful, and that conflicting transactions are reported as such. For instance, an Add transaction and an Update-data transaction against the same record is permitted by placing the Update-data transaction subsequent to the Add transaction. On the other hand an Add and Delete, for example, against the same record is a conflict, and is treated as an error.

5.2.2 Processing Logic

The methodology and results of the logic flow analysis of Dictionary update processing are presented in the remainder of this section.

5.2.2.1 Analysis Methodology

Those programs which contribute to the processing of Dictionary updates were identified by tracing through the system information flow diagram in the System Specification (see Reference 3, Appendix H).

The specific processing logic of each of these programs was then analyzed by studying the programming specifications for each

they will all be deleted. Otherwise, the ALCs are required to affect one record at a time; no blanket edits are permitted.

D143F provides Not Repairable This Station (NRTS) and condemnation action counts by MDS-WUC-NSN. In one situation, an incoming D143F record is treated as a Dictionary update transaction. This is described below in Section 6.5.

Except for I&S update transactions from D097, catalog management data from D043, and D143F updates, all of the transactions described above can be classified according to the following hierarchy of identifying keys and associated transaction types:

HIERARCHIC LEVEL	TRANSACTION TYPE
• MDS blank blank blank	Change in MDS or specific data elements that are applicable to all records within a MDS--B8, B9 transactions from D056B.
• MDS WUC blank blank	Changes of WUC data for a specific MDS, i.e. Add, Delete or Change WUC, WUC Noun, and/or other WUC data--B1, B4, B6 transactions from D056B.
• MDS WUC NSN blank	Delete Master record transaction submitted by ALC verification teams.
• MDS WUC NSN NHAWUC	Delete transaction (to eliminate wrong NHAWUC), Add Master Record transaction or Change key data in Master Record Transaction or Update attribute data in Master Record transaction--submitted by ALC verification teams.

New NSNs associated with a "related" NSN for which D160B is on the SNUD as a user are provided. Additions of NSNs to the I&S group associated with a master NSN for which D160B is on the SNUD as a user are provided, in the form of a complete, updated group table. New NSNs which are not associated with a group master NSN or "related" NSN are not provided.

The VAMOSC focal point at each ALC submits every month a set of edit cards for input to the next scheduled CSCS processing run. These edit transactions represent a combination of Dictionary updates determined, via research by the ALC's VAMOSC verification team, with assistance by the respective equipment specialists, to be needed for correction, completion, or update of the Dictionary. The edit transactions submitted in any given month result from:

- continuing research for validation of the initial Dictionary file
- research of exceptions encountered in the previous monthly processing run
- correction of format errors detected in the previous month's edit transaction submittal

These transactions may include adding records, changing key data fields of existing records (i.e., WUC, NSN, NHAWUC), changing attribute data fields of existing records (e.g., WUC Noun, NSN Noun, etc.), and deleting records.

To make any of the above types of changes, all four keys of the target record must be specified—with two exceptions. First, a Change-Keys transaction can be applied to a record with blank WUC, NSN, or NHAWUC. Second, a MDS-WUC-NSN relationship can be deleted without specifying a NHAWUC. If records exist for more than one NHAWUC as associated with the specified MDS-WUC-NSN,

There are two types of edit transaction received from D056B which have hierarchical implications—B1 Delete-WUC and B6 Change-WUC. B6 transactions are generally used in anticipation of a replacement of an old piece of equipment with a new one. The transaction links all of the existing historical data in the B4 master record for that MDS-WUC to the new WUC, freeing the old WUC for subsequent reuse for the new equipment. B6 transactions are also used to restructure constituent WUCs to support modified maintenance practices or management requirements.

A B1 transaction is generally used to delete an obsolete WUC from the B4 master file for the applicable MDS, when the referenced piece of equipment is no longer in the inventory, subject to maintenance.

B4 master file maintenance processing in D056B is not based on any assumed implications of a B6 transaction for constituent WUCs. A separate B6 transaction is generated for each constituent WUC requiring conversion.

On the other hand, a B1 transaction is interpreted, in D056B processing, as a delete of the entire referenced WUC, including all constituent WUCs, if any. As a result, only one B1 transaction is generated to accomplish the delete of an entire WUC. D056B file maintenance processing rolls the delete action down hierarchically, applying it to every constituent WUC, in turn, at all lower levels.

Unfortunately, the CSCS was designed on the assumption that a B1 record would be submitted to the CSCS for the referenced WUC

and, separately, for each constituent WUC, at all lower levels. As a consequence, the CSCS does not delete constituent WUCs of obsolete WUCs deleted in their entirety from the B4 master file of D056B. This will surely lead to errors when the obsolete WUCs are reused. Such reuse is officially permitted after 90 days of non-use, although D056B does not reject earlier reuse.

No mechanism exists in the CSCS software to guard against inadvertent elimination of an entire NSN (or WUC) occurring when a specific MDS-WUC-NSN record is deleted via an ALC file maintenance transaction (i.e., a BTD transaction). This can happen when only one of the WUCs which use a particular NSN is recorded in the Dictionary against that NSN (or vice versa). An efficient protection mechanism is described in the following paragraph.

Other than BTC (i.e., Change-Keys) transactions, which are used to correct errors in coding of MDS, NSN, WUC, NHAWUC, and their interrelationships, the BTD (i.e., Delete) transaction is currently the only one which is acceptable with a blank key data field; in particular, NHAWUC may be blank. The rationale is that it will often be necessary to delete a MDS-NSN-WUC relationship, regardless of associated NHAWUCs, and that the requirement to include NHAWUC would impose an unnecessary burden on the ALC VAMOSC verification teams, especially in cases of multiple NHAWUC records for a particular MDS-WUC-NSN. By permitting a blank NSN or WUC field as well, on a BTD transaction, a <u>blanket</u> delete action could be explicitly requested. If a BTD transaction specifying NSN <u>and</u> WUC,

when processed in the final section of Program PKPCC, were found to result in elimination of all records for a NSN and/or WUC, it could be rejected on the assumption that such a blanket delete was not intended. Further, such a blanket transaction capability would probably simplify the initial file verification process significantly, and facilitate ongoing maintenance. The workload issue will be treated more extensively in Section 6.2.

The issue of updating the Cross-Reference Dictionary to accommodate introduction of new equipments appears to require more extensive consideration. First consider the case of a minor modification. When an equipment is redesigned in such a way that its form, fit, and function is preserved, its WUC identification will generally not be changed. If its substructure (i.e., subassemblies/components) is changed, WUCs may be modified accordingly, at the affected, i.e., lower, level(s). In the latter case, D056B will provide notification of such WUC changes to the CSCS. In such cases, however, it is desirable that the ALC equipment specialist, who is the original source of these changes, submit them, in conjunction with applicable NSNs, as updates to the CSCS before the CSCS receives them from D056B. Receipt from D056B, without NSN data, leads to incomplete costing of maintenance actions reported against new substructure WUCs, pending ALC resolution of the consequent mismatches. It appears that Dictionary updates to reflect such modifications are not submitted to the respective ALC VAMOSC focal points for inclusion in monthly file maintenance.

In addition, such minor modifications generally result in the creation of an I&S group or interchangeable subgroup, or the

addition of a new NSN (i.e., that of the new, modified equipment) to such a group or subgroup. Such I&S updates are provided to the CSCS by D097 via D046, but without associated WUCs. Therefore, the failure of ALC equipment specialists to submit the applicable Dictionary file maintenance transactions to the CSCS may lead to NSN mismatches and WUC mismatches, exacerbating the already large Dictionary verification/research workload.

In cases of major redesign or introduction of functionally new equipment, the new NSNs will not be submitted via D046 to the CSCS. Such new NSNs are not I&S changes and, therefore, must be interrogated for data via D046 to achieve their incorporation into the list of accessible NSNs for D160B. A new NSN can be interrogated via D046 only if it has been added to the Dictionary master file via an ALC file maintenance transaction.

There is, at present, no provision in ALC procedures for Dictionary file maintenance, to introduce NSN-WUC relationships for new equipment into the Dictionary in advance of notification by D056B of WUC changes or additions. Again, such a priori update transactions would preclude the need for a posteriori (i.e., after-the-fact) research of new WUCs and its attendant research workload and incomplete costing, pending resolution.

In addition, a periodic match of the Dictionary master file against the D041 master file by NSN-MDS might uncover some new NSNs not otherwise captured. Whereas D046 and D097 can, respectively, provide MDS-independent catalog management data and I&S updates for only those NSNs for which D160B is a "user" registered on the SNUD (D071 Stock Number User Directory), D041 can provide a listing

of NSNs associated with each MDS, as well as NHANSN.

The topic of incorporation of a new MDS into the Dictionary will be separately addressed in Section 7.

6.2 Workload Management

The current plan, as documented above in Section 2.0, for initial Dictionary file verification, envisions completion of the process in the fourth quarter of 1985. This plan may be optimistic, as the equipment specialists assigned to verification are not dedicated to that effort, and have been and probably will continue to be reassigned as priorities change. Several ideas are offered in this section for reducing the Dictionary verification/research workload so as to streamline and facilitate the process and increase the probability of meeting or exceeding the schedule objective.

The concept of a blanket edit capability was introduced above in Section 6.1, in the context of a mechanism to protect against inadvertent elimination of a NSN or WUC. It was mentioned that the blanket delete feature would provide the option to submit a single, powerful edit transaction to accomplish a multiple record correction.

Under the current system design philosophy of the CSCS, in order to reflect in the Dictionary the elimination of an obsolete NSN from the supply system, it is necessary to prepare a BTD (i.e., Delete) transaction for every MDS-WUC at which that NSN is used. If it is a common item, the research effort may be great, not to mention the additional workload in the coding/keypunch/verification cycle. In order to delete an obsolete WUC from the

Dictionary, separate transactions must be prepared to delete the target WUC and all constituent WUCs, and all associated NSNs and NHAWUCs.

In order to change a WUC, a separate transaction must be generated to change the NHAWUC of each constituent WUC, as well as for each NSN assigned to the WUC and constituent WUCs. The philosophy behind this procedure is to allow full maintenance flexibility. However, flexibility without powerful transactions is tedious, time consuming, and ultimately more error-prone.

The CSCS design assumes that all blanket transactions will be transmitted to CSCS via the applicable automated feeder systems. This, however, does not address the errors inherent in the initial Dictionary master file undergoing verification. The small risk of an inadvertent blanket edit transaction, perhaps minimized through stronger data quality assurance, would be more than compensated by the benefits accruing from the expedited verification process.

A major contributor to ALC verification/research effort is D143F processing. All NRTS and base condemnation records from D143F which do not match the Dictionary master file on MDS-WUC-NSN are directed to the Error Rejection Report. The rationale is twofold:

- all mismatches represent potential new relationships requiring incorporation into the Dictionary
- the WUC on D143F records is so unreliable as to preclude automatic update of the Dictionary without ALC research[1]

1. Letter from Captain Michael Drake dated 22 July 1983, in response to ISI Memorandum "Questions for Norm Prince" dated 14 June 1983.

Fortunately, this rationale can be refined so as to significantly reduce the resulting verification/research workload. D143F records matching the Dictionary master file on NSN-MDS but unmatched on WUC probably represent a WUC data error. If a WUC is already in the Dictionary master file for this NSN-MDS, it can be used in the applicable costing algorithms and the record can be bypassed as far as Dictionary update is concerned. Similarly, if more than one WUC is in the Dictionary for this NSN-MDS, the reported actions can be apportioned to the respective WUCs, or assigned to the first one encountered. ALC research could not improve on such a procedure assuming, as is quite probable, that the unmatched WUC represents a data error, not a missing WUC requiring incorporation.

To minimize the risk of bypassing a WUC which should be added to the Dictionary, the following powerful heuristic could be employed:

- match the D143F record in question against the incoming D056 maintenance action data file by MDS-WUC
- if no match, bypass as unlikely candidate for addition to Dictionary
- if a match is found:
  - direct the D143F MDS-WUC-NSN to Error Rejection Report as likely candidate for addition to Dictionary
  - place in suspense file for follow-up
  - mark matching D056 maintenance action record(s) to inhibit additional error reject on subsequent D056 maintenance action data processing.

The case of no WUC in the Dictionary master record(s) of the matching NSN-MDS is discussed below in Section 6.5.

When a Delete-NSN transaction, processed by D097, is received by the CSCS via D046, it is not fully implemented in the current

processing cycle. Instead, the NSN is changed in all Dictionary records with that NSN to a string of "9"s in order to both:

- retain it on file pending ALC verification
- highlight it for ALC attention

In contrast, however, a Delete-WUC transaction received from D056B is fully implemented in the current processing cycle, and no opportunity for reaction by the cognizant ALC equipment specialist is offered. Indeed, consistent with the general philosophy of automated feeder system data acceptance, excluding D143F WUCs, as cited above, no such opportunity is deemed necessary. Likewise, this philosophy could be applied to Delete-NSN transactions, for consistency and to further reduce the ALC file verification/research workload.

The facet of CSCS design which tolerates multiple NHAWUCs for the same MDS-WUC led to the question:

> "If records exist for multiple NHAWUCs associated with the same MDS-WUC, how are costs rolled up from the component to subassembly and subassembly to assembly levels?"

The envisioned possibilities include:

- separately roll up to each NHAWUC on file
- roll up to the first NHAWUC encountered on file
- allocate to all NHAWUCs on file

Of course, the first possibility would lead to multiple counting of costs and the second would risk distortion error in rollup cost totals. The third method seems the best.

Investigation[1] led to the discovery of a fourth possibility.

1. Telephone conversation with John Madrid, Computer Resource Information Center, Sacramento ALC (formerly a principle CSCS system analyst), 29 August 1983.

The method currently implemented for assembly and subassembly rollups in the Report No. 8108, illustrated via the sample in Exhibit X (from Reference 4, Figure 3-8, Page 31), is based on WUC level of indenture, i.e., first three or four digits of the constituent WUC. The method does not use the NHAWUC after all.

The constituent-WUC-level-of-indenture method for rollups is subject to the error of distortion which results from WUC assignment anomalies occurring on complex equipments. For illustrative purposes only, it is possible that WUC 73B1's true NHAWUC is 73A, not 73B, because of a large number of subassemblies of 73A. The distortion associated with the constituent-WUC-level-of-indenture method is uncontrollable. The CSCS rollup totals will be subject to such errors long after the initial Dictionary file verification phase is completed and the CSCS is in a fully operational mode. This distortion error should be eliminated from the generation of Report No. 8108 to improve its useability.

On the other hand, the method currently implemented for assembly and subassembly rollups in the Report No. 8115 (see Exhibit V above) uses the NHAWUC associated with a given WUC.[1] Since the Cross-Reference Dictionary currently includes multiple NHAWUCs for a given WUC, this method leads to multiple counting of costs. The error associated with controlling rollups on NHAWUC will, however, be minimized as the occurrences of multiple NHAWUCs are cleansed from the Dictionary.

1. Letter from Lieutenant Michael Howenstine dated 26 June 1984, in response to preliminary draft of this report, and follow-up telephone conversation on 9 July 1984.

HQ AFLC/LOIVAP0SC1 — COMPONENT SUPPORT COST SYSTEM (CSCS) — MDS XXXXXXX

MCS MAF-LEV(AF18104 TOTAL BASE AND DEPOT WORK UNIT CODE (WUC) COSTS AS OF FY 99-1 Q-D1669-DO_-AR-2QC

PRODUCED 99 XXX 99 — MDS XXXXXXX — PAGE 99999

TOTAL ACTIVE INVENTORY 9,999 FLYING HOURS 999,999 SORTIES 9,999 LANDINGS 9,999

TOTAL COSTS

COMPONENT: $9,999,999 SUPPORT GENERAL: $9,999,999 TCTO: $9,999,999

WUC 123AB WUC NOUN XXXXXXXXXXXXXXXXXXX OPA 999

	LABOR M-S	LABOR COST	DIRECT MAT COST	OTHER COSTS	EXCH REPAIR COSTS REPAIR	EXCH REPAIR COSTS MOD IV	EXCH REPAIR COSTS MOD V	COMMND SPARE COST	SUP MGT COST	MAT MGT OH COST	2ND DEST COST	BASE & DEPOT WUC TOTAL
BASE:	99,999	999,999	99,999		99,999	99,999	99,999	99,999	99,999	99,999	99,999	
DEPOT:	99,999	999,999	99,999	99,999	99,999	99,999	99,999	99,999		99,999		9,999,999

WUC 123AA WUC NOUN XXXXXXXXXXXXXXXXXXX OPA 999

	LABOR M-S	LABOR COST	DIRECT MAT COST	OTHER COSTS	EXCH REPAIR COSTS REPAIR	EXCH REPAIR COSTS MOD IV	EXCH REPAIR COSTS MOD V	COMMND SPARE COST	SUP MGT COST	MAT MGT OH COST	2ND DEST COST	BASE & DEPOT WUC TOTAL
BASE:	99,999	999,999	99,999		99,999	99,999	99,999	99,999	99,999	99,999	99,999	
DEPOT:	99,999	999,999	99,999	99,999	99,999	99,999	99,999	99,999		99,999		9,999,999

WUC 123AB WUC NOUN XXXXXXXXXXXXXXXXXXX OPA 999

	LABOR M-S	LABOR COST	DIRECT MAT COST	OTHER COSTS	EXCH REPAIR COSTS REPAIR	EXCH REPAIR COSTS MOD IV	EXCH REPAIR COSTS MOD V	COMMND SPARE COST	SUP MGT COST	MAT MGT OH COST	2ND DEST COST	BASE & DEPOT WUC TOTAL
BASE:	99,999	999,999	99,999		99,999	99,999	99,999	99,999	99,999	99,999	99,999	
DEPOT:	99,999	999,999	99,999	99,999	99,999	99,999	99,999	99,999		99,999		9,999,999

123AX

BASE	999,999	9,999,999	999,999		99,999	99,999	99,999	999,999	999,999	999,999	99,999	
DEPOT	999,999	9,999,999	999,999	999,999	99,999	99,999	99,999	999,999		999,999		
TOTAL	999,999	9,999,999	999,999	999,999	999,999	999,999	999,999	999,999	999,999	999,999	99,999	99,999,999

WUC 1235C WUC NOUN XXXXXXXXXXXXXXXXXXX OPA 999

	LABOR M-S	LABOR COST	DIRECT MAT COST	OTHER COSTS	EXCH REPAIR COSTS REPAIR	EXCH REPAIR COSTS MOD IV	EXCH REPAIR COSTS MOD V	COMMND SPARE COST	SUP MGT COST	MAT MGT OH COST	2ND DEST COST	BASE & DEPOT WUC TOTAL
BASE:	99,999	999,999	99,999		99,999	99,999	99,999	99,999	99,999	99,999	99,999	
DEPOT:	99,999	999,999	99,999	99,999	99,999	99,999	99,999	99,999		99,999		9,999,999

WUC 1235A WUC NOUN XXXXXXXXXXXXXXXXXXX OPA 999

	LABOR M-S	LABOR COST	DIRECT MAT COST	OTHER COSTS	EXCH REPAIR COSTS REPAIR	EXCH REPAIR COSTS MOD IV	EXCH REPAIR COSTS MOD V	COMMND SPARE COST	SUP MGT COST	MAT MGT OH COST	2ND DEST COST	BASE & DEPOT WUC TOTAL
BASE:	99,999	999,999	99,999		99,999	99,999	99,999	99,999	99,999	99,999	99,999	
DEPOT:	99,999	999,999	99,999	99,999	99,999	99,999	99,999	99,999		99,999		9,999,999

123XX

BASE	999,999	9,999,999	999,999		99,999	99,999	99,999	999,999	999,999	999,999	99,999	
DEPOT	999,999	9,999,999	999,999	999,999	99,999	99,999	99,999	999,999		999,999		
TOTAL	999,999	9,999,999	999,999	999,999	999,999	999,999	999,999	999,999	999,999	999,999	99,999	99,999,999

123XX

BASE	999,999	9,999,999	999,999		99,999	99,999	99,999	999,999	999,999	999,999	999,999	
DEPOT	999,999	9,999,999	999,999	999,999	99,999	99,999	99,999	999,999		999,999		
TOTAL	9,999,999	99,999,999	9,999,999	999,999	999,999	999,999	999,999	9,999,999	999,999	9,999,999	999,999	999,999,999

Figure 3–8. CSCS Total Base and Depot WUC Cost Report.

As a consequence, therefore, the NHAWUC method is preferable in the long run and, for consistency, should be applied to the generation of both Report Nos. 8108 and 8115. In the interim, the costs associated with a given WUC having multiple NHAWUCs according to the Dictionary should be allocated to those NHAWUCs so as to eliminate multiple counting. A simple scheme, i.e., uniform allocation, would suffice since the multiple NHAWUC problem is on its way to being resolved via the verification process.

In order to expedite the process of cleansing multiple NHAWUCs, a major structural anomaly, from the Dictionary, a special program can be developed to list all MDS-WUC-NSNs exhibiting multiple NHAWUC records. This listing, organized by MDS, could then be distributed to the respective ALCs for priority verification. This standalone program is conceptually very simple, and the selection of a single NHAWUC for a MDS-WUC can be expected to be a relatively quick type of verification process. A Delete-All-But-One transaction type would facilitate preparation of the necessary edit transactions.

As a result, by highlighting and prioritizing this structural anomaly, it might be possible to make significant progress, in a short time, toward the goal of cleansing and completing the Dictionary. Once the multiple NHAWUCs have been purged from the Dictionary, the door can be closed to future infiltration of this anomaly by instituting a three key system, whereby MDS-WUC-NSN is a unique identifier of any record in the Dictionary, and NHAWUC is just an attribute data element associated with a MDS-WUC-NSN.

Another problem which can result in rollup distortion relates to WUC assignments to common equipment on a MDS, and is described

above in Section 4.2. Investigation of the policy and practice of WUC assignment revealed inconsistent practice engendered by ambiguous policy.[1]

In particular, the applicable Military Standard (see Reference 2) covers the following cases:

- a multiple-occurrence component serving same system or assembly
  - in same functional & environmental role
  - in different functional or environmental roles
- a single-occurrence component serving multiple systems

The case of a multiple-occurrence component used in multiple systems is not explicitly covered. As a result, it can be anticipated that WUC assignment for common components used in more than one system of a MDS aircraft may or may not lead to a unique WUC within each system where used.

The above problem is, of course, an administrative one, and falls outside the scope of the Office of VAMOSC's authority to control.

6.3 Cost Output Useability

The reliability, completeness, and visibility of maintenance costs portrayed by CSCS output reports is inextricably related to the reliability and completeness of the Cross-Reference Dictionary, and the precision with which the applicable cost algorithms utilize the relationship information maintained in the Dictionary. The sooner the initial Dictionary file verification process is completed, and the more precisely the applicable cost

1. Telephone conversation with Greg Harding, AFLC/LOLMC, 29 August 1983.

lgorithms are formulated, the faster will be the growth of CSCS ıtput cost data useability, and the more accurate and acceptable t will ultimately become. Initial production runs exhibited ımerous and, in cases, severe data quality problems, as reported n separate deliverables under this contract.

In addition to the rollup method discussed in Section 6.2, hich is strongly tied to the workload management issue, several ost algorithms in the CSCS rely heavily on the Cross-Reference ictionary and, thus, link it to the issue of cost output useability.

Base maintenance actions and direct maintenance hours reported n D056 by MDS-WUC are converted to dollars and portrayed in output eports by the WUC reported in D056, even if the WUC is unmatched n the Dictionary master file after D056B updates have been ncorporated. In addition, if such a mismatch occurs, it is irected as an exception to the applicable ALC for research. xceptions of this type may reflect WUCs missing from the Cross-eference Dictionary and, therefore, need to be researched for ossible additions to the Dictionary. They may, however, instead epresent errors or shortcuts in filling out AFTO 349 maintenance ction forms. Once the initial Dictionary verification process s completed, this can be expected to be the sole source of such xceptions, assuming the B4 master file in D056B to be well main-ained.

At that time, therefore, the logic which responds to these xceptions should be changed. They should not be directed to the LC for research, as the equipment specialists cannot be expected

ectify such data entry errors. Further, instead of portraying derived maintenance costs against the erroneous reported WUC, should be accumulated in a "bucket" labeled with a special digit WUC, e.g., "99", to segregate the costs associated with ıe poorly identified maintenance actions. A refinement of ı approach would be to also provide a "bucket" for each two .t system WUC, e.g., "7399", to capture costs for maintenance ›rted against a valid system, but an invalid five digit WUC. bucket labeled "99" could then be used to capture costs for those actions not reported against a valid system WUC.

In addition to segregating unidentified actions from validly ɜd actions, the bucket approach provides a means for quickly ɜssing this particular measure of data quality, highlighting tems which are particularly subject to this type of data ›rting problem.

As described above in Section 4.3, the algorithms for Base ɗemnation Spares and Base Exchangeables Repair are driven by ɗemnations and NRTS actions reported via D143F against the ıed-in item NSN. In the case of condemnation of an I&S item, group master NSN is a more realistic proxy for the ultimate lacement item than the removed NSN, since the purchase price :he former is more representative of the true cost resulting n the condemnation action. It should be noted that it is <u>not</u> ropriate to convert the NSN of a NRTS action to the group master for purposes of the Base Exchangeables Repair cost algorithm. turned-in NSN is its own best proxy for the ultimate depot repair.

- inhibit subsequent error rejection reporting triggered by B4 Add-WUC transaction.

f) Develop and periodically execute a standalone structural anomaly search program to highlight all occurrences of:

- orphan WUCs
- childless parent WUCs.

i) Implement a method, using the NHAWUC sequenced Dictionary master file to apply a B1 Delete-WUC transaction from D056B to all constituent WUCs at all lower levels.

i) Institute the necessary administrative measures to ensure that new or modified MDS-WUC-NSN relationships are submitted by the cognizant equipment specialists for incorporation into the Dictionary, in advance of the introduction to the inventory of new or modified items.

j) Implement an annual reconciliation with D041, to ensure that new MDS-NSN relationships are incorporated into the Dictionary.

k) Implement a blanket delete capability for use by the ALCs in Dictionary file maintenance.

Workload Management

a) Implement an optional blanket version of the BTC and BTD, transactions, and a mandatory blanket version of BTU.

b) When a new relationship is added via a BTA or BTC transaction, obtain all:

- stock number determined data elements from a like-NSN record
- WUC determined data elements from a like-WUC record
- MDS determined data elements from a like-MDS record.

c) For Dictionary edit purposes bypass, and do not reject as errors, D143F records matching the Dictionary master file on NSN-MDS, but unmatched on WUC

- if a WUC(s) is (are) present in the Dictionary master record(s) matching on NSN-MDS, assign (apportion) the reported actions to it (them), for costing purposes

RECOMMENDATIONS

The findings of this study, as detailed in Sections 6 and 7, d to recommendations for action on a number of fronts. Rather n prioritize them, which is beyond the study's intended scope, y are organized according to the categories by which the porting findings were presented. Each recommendation is pre- ted *in abbreviated form.* For supporting details, the reader referred back to Sections 6 and 7. For quantitative cost- efit analyses, additional tasks beyond the scope of this study ld be required.

File Integrity

a) Add a test on all WUCs, including NHAWUCs, for a valid two digit system WUC.

b) Institute annual reconciliation with the D056B B4 master file.

c) Reinstate critical edit reject of those B6 (i.e., Change-WUC) transactions from D056B, which have a valid MDS, but with a WUC unmatched in the Dictionary.

d) Apply the same critical edit reject rule to B1 (i.e., Delete-WUC) transactions.

e) If a BTA (i.e., Add) transaction submitted by an ALC identically matches a Dictionary master record, except for differences in some attribute data elements:

   - generate a BTU (i.e., Update-Data) transaction

   - direct to Error Rejection Report.

f) If a BTA transaction matches on MDS-WUC a memo record reflecting a B4 Add-WUC record from D056B:

   - overlay the memo record with the BTA transaction record

:ord in the NHAPLISN file. The latter WUC would then be the
:ired NHAWUC.

It should also be noted that the full implications of the
)ve concepts and developments warrant a feasibility study out-
le the scope of this investigation.

ata elements, and is selected at ALC discretion. In practice, t least at the Oklahoma City ALC, WUC is a checked-off data tem, required to be submitted by the contractor, for major eapon system acquisition programs.[1] As a consequence, the next ajor Air Force weapon system, currently undergoing provisioning lanning, the B-1B, will be incorporated in D220 with WUCs.

Two relatively small gaps in this WUC information can generally e anticipated. First, long-lead items procured before official UC manuals have been developed will be identified in D220 by reliminary contractor-assigned WUC proxies called pseudocodes. econd, common items, used in more than one assembly or system of he aircraft, will be identified by only one WUC, selected arbi- rarily.

It should be noted that the data element NHAWUC, anticipated in the CSCS System Specification to be an input forthcoming from 220, is not available in that system. However, with some data anipulation, similar to that performed on D041 and K051 data to uild the initial Dictionary file, the NHAWUC can be generated.

In particular, associated with each provisioned item is a rovisioning Line Item Sequence Number (PLISN) and, significantly, ts next higher assembly's PLISN, call it NHAPLISN. By sequen- ially matching two copies of the D220 input file, one sequenced y PLISN and the other by NHAPLISN, the WUC of a record in the LISN file can be linked to the WUC of the PLISN-NHAPLISN matching

1. Telephone conversation with Bob Stewart, Jr., Chief of Provisioning, Oklahoma City ALC, 31 August 1983.

It interfaces with other systems and produces listings to support reviews for procurement decision making.

The system, since going operational in March 1977 for the General Dynamics F-16 program, has expanded its scope to 400 active contracts. This scope is expected to grow to between 95 and 100% of all active Air Force contracts.

Three types of Air Force contract are excluded from D220 -- follow-on provisioning actions on equipments to which D220 was not previously applied, those involving security classified data or programs, and those under which technical documentation is provided on Air Force Acquisition Documents (AFADS). AFADS have been replaced by DoD standard formats specified in Military Standards 1552 and 1561. D220 was programmed to accept the Military Standard formats only.

D220 input record layouts are included in the D160B System Specification (see Reference 3, Pages A-33.1 and A-33.2). No Memorandum of Agreement, however, has yet been negotiated. While WUC is presently an optional data field in D220, it could be changed to a mandatory field, thus presenting an opportunity to gain much of the requisite data for the NSN-WUC Cross-Reference Dictionary from this source.

In particular, the Provisioning Technical Documentation Data Selection Sheet (Form DD 1949-1 and its Air Force amendment) is included with each Provisioned Item Order submitted to a contractor (see Reference 11). This is filled in at the prime ALC to indicate which data must be provided by the contractor. WUC is one of the

7.0 INTRODUCTION OF A NEW MDS

As massive as the effort is to manually verify the initial Dictionary master file, built in an automated manner using data from available sources, the research, transaction preparation, and verification tasks required to manually update the Dictionary master file to incorporate new weapon systems, would be massive.

Two automated information systems in use by the AFLC appear to be candidate sources of NSN-WUC relationships for a new MDS being introduced to the inventory.

The Logistic Support Analysis Record System (D194), currently under development, was investigated as a candidate feeder system during the CSCS development effort (see Reference 5, reproduced in Appendix A). This LSAR System is envisioned as part of an overall Unified Database Technology program conducted jointly by Clemson University and the Lockheed-Georgia Company, for the Air Force Human Resources Laboratory. The system is intended to support the weapon systems acquisition process, accounting in an integrated manner for the impact of design evolution on logistics support planning, and facilitating the retrieval and use of historical data in the process. One of the features of the system will be the generation of provisioning technical documentation required as input to the AFLC Provisioning System (see Reference 10).

The AFLC Provisioning System (D220) is used to select the range of items to be initially provisioned (i.e., for the first 12-24 months of operation, until the replenishment pipeline is established).[1]

1. The information about D220 presented in the following paragraphs was obtained from Mr. Hal Nielsen, AFLC/LOLCP, by telephone on 8 February 1983 and 17 February 1983, as well as an in-person meeting at AFLC HQ on 15 March 1983.

While there is no mechanism in the CSCS processing logic to protect against inadvertently destructive or erroneous ALC file maintenance transactions, a DAR is pending which will ensure that such errors are visible to the respective ALCs. DAR No. LOC-D82-028, submitted in July 1982, will provide each ALC with a complete listing of the previous month's file maintenance transactions, not just the transactions rejected for failure of format and/or validation tests.

Currently, if a D143F record is received with a valid MDS and NSN, but no WUC is present on the matching record(s) in the Dictionary master file, the D143F WUC is inserted into the matching Dictionary master record(s) via an artificially generated Change-Keys (i.e., BTC) transaction, and the resulting records are directed to the Error Rejection Report for ALC verification.

It has long been recognized that the D143F WUC is highly unreliable. As a result, DAR No. LOC-D82-034 was submitted in August 1982, to prevent the likely WUC errors by suspensing this unmatched WUC condition, pending ALC verification.[1]

1. Based on telephone conversation with Norm Prince, 31 August 1983.

create a unique identifier. Again, WUC is the sole attribute data element.

The NSN-MDS-SEQA file would provide the WUC(s) at which a particular NSN is used on a particular MDS aircraft for purposes of assigning (or allocating) NSN costs to the associated WUC(s). The MDS-NHAWUC-SEQB file would provide the WUCs associated with a given NHAWUC for purposes of applying B1 (Delete-WUC) and B6 (Change-WUC) transactions from D056B. The random access required of this file would necessitate implementation as an indexed sequential file.

It must be mentioned at this point that the full conversion to a modern Data Base Management System (DBMS), of which the normalization process is only one step, would also open the doors to the following capabilities:

- real-time utilization
  - on-line update
  - on-line inquiry
- instantaneous transaction error reporting
- tailored report generation

Any further consideration of a DBMS conversion, and the system modifications necessitated by it and by Dictionary normalization, would require special analyses beyond the scope of this study.

6.5 Pending Improvements

Two Data Automation Requests (DARs) have been submitted for CSCS processing modifications which will have an impact on ALC verification/research management and integrity of the Dictionary master file.

by NSN. MDS and WUC are both superfluous keys for these elements. Others, such as ALC Code, are uniquely determined by MDS. WUC and NSN are superfluous. Such data elements, over-determined by MDS-WUC-NSN, must be maintained on all master records having the same NSN, for instance.

Based on a preliminary application of the above concepts, a fully normalized Dictionary would consist of the files listed below by their respective primary keys:

MDS
NSN
MDS-WUC
NSN-MDS-SEQA
MDS-NHAWUC-SEQB

The first two files, as briefly discussed above are straightforward in composition and purpose. The third file would store data associated with a particular WUC on a particular MDS aircraft, e.g., WUC Noun, NHAWUC, etc. NHAWUC would be used for rollup control as discussed above in Section 6.3.

The last two files would be used exclusively for cross-referencing purposes. Since there may be multiple WUCs associated with a given NSN-MDS, and since WUC is the output of this conversion process, a sequence number field is appended to the NSN and MDS fields to create a unique identifier. WUC then appears as the sole attribute data element in this file. Similarly, since a given parent assembly can be the NHAWUC to several WUCs, a sequence number field is appended to the MDS and NHAWUC fields to

all data associated with a particular stock numbered item as used at a particular WUC on a particular MDS aircraft. The Dictionary master file is updated in sequential order, and three identical copies of it must be maintained, each in a different sort sequence.

This is the simplest possible data base organization for this application. Unfortunately, that simplicity engenders data redundancy which leads to three types of problems:

- greater processing time
- greater data storage volume
- more complex processing logic
  - reduced software maintainability
  - reduced software reliability

The implications of complex processing logic warrant discussion. Clearly, the more complex the logic, the more difficult and time consuming are software modifications. In addition, the probability of software faults increases with increasing complexity. The faulty match logic associated with D143F and D033 record processing, discussed above in Section 6.3, is a direct example. If stock number associated information were maintained on a separate stock number data file, with exactly one record per stock number, this error could not have arisen, and the resulting loss of cost information would not have occurred.

In the simplest terms, the concept of data base normalization is the process of associating data elements with the keys which uniquely determine them. Many data elements are currently maintained in the Dictionary by the keys MDS-WUC-NSN. Some Dictionary data elements, however, such as unit price, are uniquely determined

reliability of the Exchangeables Repair cost elements. The use of a full year of H036B data would alleviate both of the above concerns.

6.4 Data Base Organization

Overall, the design of the Cross-Reference Dictionary file maintenance subsystem of the CSCS is highly sophisticated and intelligently conceived. The level of complexity inherent in a system which has numerous structural interrelationships (e.g., hierarchical and I&S), uses a wide array of input sources, both automated and manual, encompasses a multitude of transaction types exhibiting a wide range of input data reliability, and which processes batches of transactions affecting numerous possible combinations of key data fields, is unavoidably monumental.

For example, in a batch update system permitting changes to key data fields, multiple competing transactions addressing the same record, or inclusive group of records, must be prioritized, conflicts must be resolved, and the maximum amount of information must be extracted from these multiple transactions and incorporated into the applicable Dictionary master records. This is accomplished in the CSCS through the use of memo files, hierarchically sorted transaction files, override codes, and selective transaction build logic. These concepts are briefly outlined above in Section 5.2.1.

Fortunately, a major simplification in the processing logic can be achieved via a more refined approach to the organization of the data base, i.e., the Dictionary. The Dictionary is currently organized in a single master file, in which each record contains

in the introduction of a new NSN-MDS to the Dictionary, the suspense file would be searched on the new NSN-MDS and matching suspensed records processed for accumulation into quarterly and annual totals. Such "new" costs could also be added to the historical data base to render it more complete.

Before proceeding to Question 2, it should be mentioned that the D143F and D033 match logic in the CSCS, by which D143F and D033 records are determined to match or not match the Dictionary, is a comparison on NSN-MDS. Under this logic, if a common component is used on MDS 1 and MDS 2, and the component's NSN appears in the Dictionary only as related to MDS 1, then a D143F record against that NSN and MDS 2, or a D033 record against that NSN and relatable (via G004L) to MDS 2, will be rejected and the associated Condemnation Spares costs lost. Fortunately, a simple modification of this match logic to match on NSN alone would plug this "hole" and result in more complete Condemnation Spares costs. A data base organizational concept which would prevent "holes" like this one from occurring is described below in Section 6.4.

In considering Question 2 above, the area of concern is the scheduling of component repair. It is possible that no repair actions will take place on a given component in a given calendar quarter. As a result, while a large number of NRTS actions may take place on a particular NSN, there may be no average depot repair cost for that NSN on the corresponding quarter's H036B extract file. Moreover, the average depot repair cost for a NSN may be based on a small quantity of repairs reported within a given calendar quarter for that NSN, reducing the statistical

An action reported via D143F against a NSN-MDS unmatched in the Dictionary master file results in the mismatch being directed to the Error Rejection Report for ALC research, and leads to the following cost implications:

1 - if a condemnation action, its contribution to Base Condemnation Spares is not computed

2 - if a NRTS action other than a base condemnation, the contribution to Base Exhangeables Repair is computed

A D033 issues record unmatched in the Dictionary master file is treated similarly with respect to Depot Condemnation Spares and Depot Exchangeables Repair.

The above dichotomy stems from the following observations:

- the unit price of a NSN is maintained, for use by the Condemnation Spares cost algorithms, in each record for that NSN, if any, in the Dictionary master file

- the average depot repair cost, on the other hand, is maintained, for use by the Base and Depot Exchangeables Repair cost algorithms, in an extract file received quarterly from H036B for all NSNs repaired in the latest quarter.

Two questions are immediately raised by the above considerations:

1 - "Are the missing Condemnation Spares costs, resulting from mismatches with the Dictionary, lost forever, or are they captured upon the appropriate updates to the Dictionary?"

2 - "Are gaps also possible in the H036B extract file tapped by the Exchangeables Repair cost algorithms?"

A suspense mechanism required to subsequently capture costs associated with actions unmatched in the current processing cycle, as contemplated in Question 1, is not currently implemented in the CSCS. Such a mechanism would retain a current file of unmatched actions. Whenever an ALC file maintenance transaction results

As Dictionary verification proceeds, the group master NSN, if an I&S item, will eventually be available in any of the Dictionary records for that NSN, and it will generally be identified in all such records, because the I&S group to which a stock numbered item belongs is independent of the MDS-WUC at which the item is used.

In the same vein, condemnation and NRTS actions reported in D143F against a MDS-WUC matched in the Dictionary master file, with blank NSN field, are assigned to the first NSN encountered in the Dictionary for that MDS-WUC. If this occurs in the case of a MDS-WUC having multiple NSNs, such an action should, instead, be assigned to the group master NSN. As Dictionary verification proceeds, the group master NSN will eventually be available, in such cases, in any of the NSN records for that MDS-WUC, and it will generally be identical in all such records, because all NSNs serving at the same MDS-WUC have the same group master NSN.

It should be noted that no use is currently made of the group master NSN record in each Dictionary master record for an I&S item.

The arbitrary assignment of Depot Exchangeables costs, derived by NSN-MDS, to the first WUC encountered in the Dictionary for that NSN-MDS, can have a distorting effect on rollup totals. For example, if a common power supply is used in three different avionic systems on a MDS aircraft, the entire cost of Depot Exchangeables derived for that NSN, as incurred for that MDS, will be ascribed to one particular system. This can be very misleading. This problem can be corrected by uniformly allocating these costs to the respective WUCs at which the NSN is used on that MDS.

- if match found in D056 maintenance action data file:

    - direct the D143F MDS-WUC-NSN to Error Rejection Report, as likely new relationship to be verified

    - place in suspense file for follow-up

    - inhibit subsequent error rejection report triggered by the D056B maintenance action

- if no match found in D056 maintenance action data file, bypass as probable data entry error

- continue implementation of that portion of DAR No. LOC-D82-034 which will suspense D143F records unmatched on MDS-WUC-NSN, matched on NSN-MDS, and having no WUC in the matched Dictionary master records.

d) Eliminate verification requirement for Delete-NSN transactions received via D046 from D097.

e) Develop a special program to list all MDS-WUC-NSNs exhibiting multiple NHAWUC records

- distribute the listing to the respective ALCs for priority verification

- implement Delete-All-But-One transaction type to expedite cleansing the Dictionary of multiple NHAWUCs.

f) After purging all multiple NHAWUC records from the Dictionary:

- institute a three key system, using MDS-WUC-NSN as the key of each master record, instead of MDS-WUC-NSN-NHAWUC

- modify the method of rollup of subassembly and assembly costs in Report No. 8108 to control on NHAWUC, instead of the current constituent-WUC-level-of-indenture method

- in generating rollups in Report Nos. 8108 and 8115, allocate costs to multiple NHAWUCs on a uniform basis.

g) Institute the necessary administrative measures to ensure that:

- WUCs for new MDS aircraft (e.g., B-1B) be assigned to provide maximum visibility of maintenance costs to individual uses of common equipments
- the appendix of Reference 2 be clarified to ensure the recognition and continuity of visibility policy.

h) Conduct an investigation into the assignment of WUCs to multiple-occurrence assemblies and subassemblies in the WUC manuals for all MDSs in the CSCS.

8.3 Cost Output Useability

a) Upon completion of the initial Dictionary verification process, modify exception handling of D056 maintenance action records unmatched in the Dictionary master file, so that:

- they are not directed to the Error Rejection Report
- the associated costs are accumulated in the appropriate bucket:
  - a two digit WUC bucket, e.g., "7399", if the first two characters of the D056 WUC represent a valid two digit system WUC
  - a MDS-level bucket, e.g., "99", if the first two digits do not represent a valid system WUC.

b) Modify the algorithm for Base Condemnation Spares to use the unit price of the group master NSN (if one exists) associated with the turned-in NSN reported in D143F, rather than that of the turned-in NSN.

c) Modify the treatment of a D143F record which matches the Dictionary master file on MDS-WUC, but exhibits no NSN, so that it assigns the group master NSN associated with that MDS-WUC (if one exists), rather than the first NSN encountered in the Dictionary for that MDS-WUC.

d) Modify the algoirthms for Depot Exchangeables costs, so that in case of multiple WUCs for a given NSN-MDS, the costs are uniformly allocated to the respective MDS.

e) Implement a suspense system, to enable all Condemnation Spares costs currently lost due to an unmatched NSN-MDS, to be computed when they are resolved, and included in accumulating quarterly and annual totals, as well as the historical data base.

f) Modify the match logic relative to D143F and D033 record processing, so that the match criterion is NSN, instead of NSN-MDS.

g) Implement a revolving file update system for H036B data

- maintain a master file of depot repair costs and action quantities, for each of the four most recent calendar quarters, by NSN

- merge the file received from H036B each quarter, representing the latest quarter's depot repair activity, with the master, purging the oldest quarter's data and aging the remaining quarters' data

- maintain a moving average depot repair cost field in the depot repair cost master file, recomputing it for each NSN at each quarter's update.

8.4 Data Base Organization

a) Apply the rules for data base normalization to the Cross-Reference Dictionary.

b) Modify CSCS processing logic and flow to take advantage of a fully normalized Dictionary.

c) Seek authorization to conduct a feasibility study of the conversion of the CSCS to a modern Data Base Management System.

8.5 Introduction of a New MDS

a) Conduct a feasibility study of the respective advantages and disadvantages of using D194 or D220 as candidate sources of NSN-WUC-NHAWUC relationships for a new MDS.

b) Develop a Memorandum of Agreement with the selected system(s) and implement the necessary interfaces.

REFERENCES

1. Air Force Logistics Command, Office of VAMOSC (AFLC/LO), Component Support Cost System (CSCS) Functional Description, FD-K-14010C, Undated draft.

2. Air Force Logistics Command, Military Specification, Manuals, Technical: Work Unit Code, MIL-M-38769C (USAF), 22 October 1982.

3. Air Force Logistics Command, Office of VAMOSC (AFLC/LO), Component Support Cost System (CSCS) System/Subsystem Specification, SS-K-14010A, 8 January 1981 and subsequent changes.

4. Air Force Logistics Command, Visibility And Management of Operating and Support Cost Program (VAMOSC), Volume IV: Component Support Cost System (CSCS), Air Force Regulation AFR 400-31, 6 August 1982.

5. Major Karen Umberger, Air Force Logistics Command, Office of VAMOSC (AFLC/LO), memo dated 24 April 1981.

6. United States Air Force, USAF Supply Manual, AFM 67-1, November 1982.

7. Air Force Logistics Command (LOL), Federal Supply Cataloging: Cataloging and Standardization, Air Force Logistics Command Regulation AFLCR 72-2, Chapter 23, 28 May 1982.

8. United States Air Force, Unclassified Data Elements and Codes, microfiche, AFR 300-4, Volume III, 1 May 1982.

9. Air Force Logistics Command (LOE), Equipment Maintenance: Product Performance, Air Force Logistics Command Regulation AFLCR 66-15, 2 July 1980.

10. Thomas, Everett L., College of Engineering, Clemson University, Clemson SC 29631, Unpublished paper, 1982.

11. Aceto, Joseph E., Chief Initial Acquisition Support Branch, Logistics Operations, Air Force Addendum to the Provisioning Requirement Statement, Air Force Logistics Command, dated 1 December 1982, transmitted 13 December 1982.

APPENDIX A

Memo from Major Karen Umberger, AFLC/LO(VAMOSC), 24 April 1981

24 APR 1981

LO(VAMOSC)/K. Umberger/74963/kp/23 Apr 81

Request for LSA Data

AFALD/PTA

1. The Component Support Cost System (D160B) is a system which tracks costs of components at both base and depot level by WUC and MDS. An integral part of the cost tracking capability is an accurate NSN/WUC cross reference dictionary. A part of the initial effort is the manual verification of all depot reparable NSNs. Once this is accomplished, we anticipate that file maintenance and update procedures will be accomplished 98% of the time through computer inputs and only 2% through manual intervention. If this is to be accomplished for newly provisioned items, it is necessary that D160B receive a tape extract from contractors of Logistics Support Analysis Data. The information required is maintained on Data Sheet H, Supply Support Requirements. The information required is shown on attachment 1. This information would be required when the item goes into production. The information would be required monthly until PMRT.

2. The Office of VAMOSC also needs to be notified of all contracts for purchase that do not require Data Sheet H. This is necessary so that D160B will be aware of modification/changes that will impact the accuracy of the NSN/WUC cross reference dictionary for which no data will be received.

3. An output summary of this type is not currently available, request that this information be provided as part of the standard list of output products.

FOR THE COMMANDER

KAREN C. UMBERGER, Capt, USAF
CSCS Project Officer

1 Atch
Information

LSA Control Number	11 positions
National Stock Number	20 positions
QPA	3 positions
Weight	6 positions
Unit of Issue	2 positions
SMR Code	6 positions
WUC	11 positions
Usable on Code	48 positions

Atch 1

VAMOSC OUTPUT SUMMARY
(NSN/WUC CROSS REFERENCE SUMMARY)

The office of VAMOSC (AFLC/LO (VAMOSC)) has identified data elements required to maintain the NSN/WUC cross reference dictionary used by the Component Support Cost System (CSCS) (D160B). This system tracks costs of components at both base and depot level by WUC and MDS. The dictionary is an essential part of the cost tracking capability of CSCS and must contain accurate and current data.

The information contained in the summary would be required starting when an item goes into production and continuing on a monthly basis until PMRT.

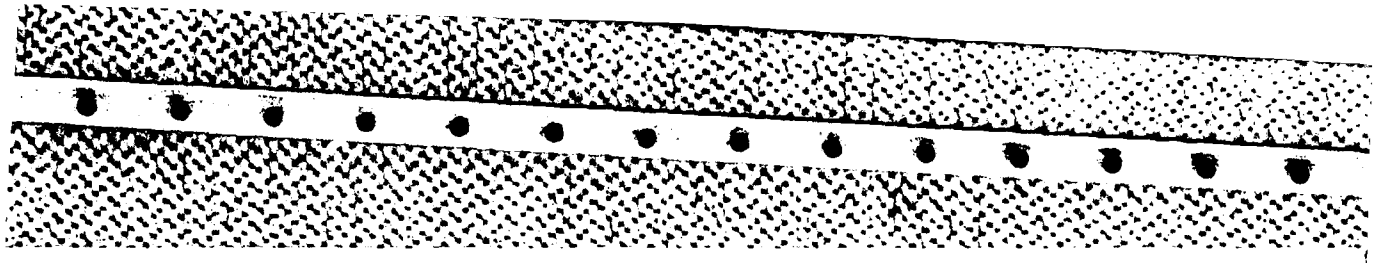
This summary will be provided to:

AFLC/LO (VAMOSC)
Attn: CSCS
Wright-Patterson AFB OH 45433

VAMOSC OUTPUT SUMMARY
(NSN/WUC CROSS REFERENCE SUMMARY)

The following list indicates the data elements required, their field length, and location on Data Sheet H, Supply Support Requirements.

Data Element	Field Length	Location
LSA Control Number (LSACN)	11 positions	H07-14-2
National Stock Number (NSN)	20 positions	H05-2
Quantity Per Assembly (QPA)	4 positions	H07-10
Weight	6 positions	H02-8
Unit of Issue (UI)	2 positions	H02-11
SMR Code	6 positions	H07-4
Work Unit Code (WUC)	11 positions	H11-9
Usable on Code	48 (2000) positions	H10-4



LSA-XX, NSN/WUC Cross Reference Summary

This summary provides a National Stock Number to Work Unit Code cross reference for all newly provisioned items. It is used to maintain the NSN/WUC cross reference dictionary for VAMOSC's Component Support Cost System.

VAMOSC OUTPUT SUMMARY

(NSN/WUC CROSS REFERENCE SUMMARY)

DATE YY MM DD PAGE XXXXX

WEIGHT	SMR CODE	USABLE ON CODE
XXXXXX	XXXXXX	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
XXXXXX	XXXXXX	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
XXXXXX	XXXXXX	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
XXXXXX	XXXXXX	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
XXXXXX	XXXXXX	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
XXXXXX	XXXXXX	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
XXXXXX	XXXXXX	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
XXXXXX	XXXXXX	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
XXXXXX	XXXXXX	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
XXXXXX	XXXXXX	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

s report documents the research conducted on one of the more
tical parts of the CSCS logic - the development of the NSN-WUC
ss reference dictionary. This dictionary associates the
ts collected at base maintenance level in WUC terms, with
e supply and depot maintenance which are collected in NSN terms.
continued accuracy and validity of this relationship is
sidered to be vital to the overall credibility of CSCS.

s volume presents ISIs conclusions and recommendations.

END

FILMED

9-85

DTIC