Investigation of Alternatives to an Equipment Assembly Structure for a MAMC/MAXIMO Data Base

by
James H. Johnson

The Madigan Army Medical Center (MAMC), Fort Lewis, WA, has been designated by the Army Medical Command (MEDCOM) as a Medical Facilities Management Center of Technical Expertise. This Center is currently responsible for investigating and proposing an Army-wide Hospital Maintenance Management System (HMMS) for Service Medical Centers and Hospitals. MAMC previously developed a local HMMS based on the (commercially available) MAXIMO Maintenance Management Program. This experience has contributed to the initiation of a configuration proposal for a General Service HMMS.

This initial stage of research reviewed the MAMC/MAXIMO data base currently in use at Madigan Army Medical Center and verified its potential effectiveness for general use at Army hospitals. This study concludes that, with limited adjustments, the MAMC/MAXIMO data base may be "upgraded" to an optimal level for general Army hospital use. This study also found that a re-engineering of the Equipment Assembly Structure (EAS) is a key element for achieving an effective MAXIMO Program process, efficient user interfaces, and refined report/printout generation. With this system, HMMS users may conform to Command EAS Network standards, while adapting Operations EAS Network guidance to their local needs.
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### Abstract
The Madigan Army Medical Center (MAMC), Fort Lewis, WA, has been designated by the Army Medical Command (MEDCOM) as a Medical Facilities Management Center of Technical Expertise. This Center is currently responsible for investigating and proposing an Army-wide Hospital Maintenance Management System (HMMS) for Service Medical Centers and Hospitals. MAMC previously developed a local HMMS based on the (commercially available) MAXIMO Maintenance Management Program. This experience has contributed to the initiation of a configuration proposal for a General Service HMMS.

This initial stage of research reviewed the MAMC/MAXIMO data base currently in use at Madigan Army Medical Center and verified its potential effectiveness for general use at Army hospitals. This study concludes that, with limited adjustments, the MAMC/MAXIMO data base may be "upgraded" to an optimal level for general Army hospital use. This study also found that a re-engineering of the Equipment Assembly Structure (EAS) is a key element for achieving an effective MAXIMO Program process, efficient user interfaces, and refined report/printout generation. With this system, HMMS users may conform to Command EAS Network standards, while adapting Operations EAS Network guidance to their local needs.
Foreword

This study was conducted for Madigan Army Medical Center (MAMC) under Military Interdepartmental Purchase Request (MIPR) No. 5MCERDH036; “MAMC Hospital Maintenance Management System (HMMS) Design Proposal for U.S. Army Medical Command (MEDCOM) Acceptance and DA/DOD.” The technical monitor was John Williamson, MCHJ-FMD.

The work was performed by the Industrial Operations Division (UL-I) of the Utilities and Industrial Operations Laboratory (UL), U.S. Army Construction Engineering Research Laboratories (USACERL). The USACERL principal investigator was James H. Johnson. Ralph E. Moshage is Acting Chief, CECER-UL-I; John T. Bandy is Operations Chief, CECER-UL; and Gary W. Schanche is Chief, CECER-UL. The USACERL technical editor was William J. Wolfe, Technical Resources.

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1 Introduction

Background

The Madigan Army Medical Center (MAMC), Fort Lewis, WA, has been designated by the Army Medical Command (MEDCOM) as a Medical Facilities Management Center of Technical Expertise. This Center is currently responsible for investigating and proposing an Army-wide Hospital Maintenance Management System (HMMS) for Service Medical Centers and Hospitals. MAMC previously developed a local HMMS based on the (commercially available) MAMC/MAXIMO Maintenance Management System Program. This experience has contributed to the initiation of a configuration proposal for a general service HMMS.

An important aspect to the proposal is tracking and reporting maintenance activities and costs by “zone.” The MAMC hospital/clinic environment includes a dozen geographical or functional zones, diverse system maintenance activities, and a cost/charging status that must be tracked in each zone. Summaries from all zones should in turn be summarized in roll-up (totalized) values to MAMC management for internal evaluation and eventual MEDCOM/DA submittal.

A precondition to this work was that the proposal should maintain a flexible balance between maintaining existing practices at MAMC, and identifying better ways to meet the installation’s needs, to use its capabilities fully, and to suggest constructive ways for incorporating lessons learned from this investigatory stage. An initial area of study in the project was to review the MAMC/MAXIMO data base to verify its effectiveness for general use at Army hospitals, specifically focusing on the Equipment Assembly Structure (EAS) format on which well-ordered MAXIMO summary reports and printouts depend.

Objective

The overall objective of this study is to re-engineer the EAS of the MAMC/MAXIMO data base to meet the current and future needs of an automated Hospital Maintenance Management System (HMMS) for Army Medical Centers. The specific objective of this initial stage of research was to review the MAMC/MAXIMO data base currently in use
at Madigan Army Medical Center to verify its effectiveness for general use at Army hospitals.

**Approach**

1. The current MAMC/MAXIMO data base was investigated to identify opportunities for innovation and improvement.
2. The Equipment Assembly Structure (EAS) of the MAXIMO Program was researched as a potential tool for the development and control of Maintenance Management System reports and printouts.
3. At the EAS operations level, potential candidates for EAS upgrade were identified.
4. Alternative EAS networks were investigated for their abilities to meet the special HMMS requirements of MEDCOM installations other than MAMC.
5. Conclusions were drawn and recommendations made to guide further development of an HMMS for application at this location and Army-wide.

**Scope**

It was determined that a carefully prepared MAXIMO data base requires a carefully constructed EAS Network; as a first step, this study investigated, adapted, and developed an EAS Network from an on-line system under test at MAMC. These customized capabilities facilitate the retrieval and processing of data related to structural and maintenance operations at this specific data base location.
2 Re-Engineering the EAS

Assumptions

This study assumes that the MAMC Facility Management Division (MCHJ-FMD or FMD) at Fort Lewis, WA will be the sole site for MAMC/MAXIMO data base design/development approval, test, and evaluation. It is further assumed that modifications to the MAXIMO Program and its functions, as installed and proven at the MAMC FMD, will be held to a minimum. Hence, the current EAS data base field (size) and its programmed relationships in the MAXIMO Program are to be retained.

Background

The MAMC Facility Management Division (FMD) has been designated by the U.S. Army Medical Command (MEDCOM) to be a Medical Facilities Management Center of Technical Expertise. Appendix A more fully describes the MAMC configuration and command structure, HMMS areas of responsibility, duties performed, and the relationships between MAMC and Center activities.

The HMMS Plan

Currently, this Center is responsible for investigating and proposing to MEDCOM an automated Army Hospital Maintenance Management System (HMMS) Development Plan for MEDCOM's many medical installations. The MAMC/MAXIMO data base associated with the MAMC HMMS was originally developed cooperatively between the MAMC DPW Health Care Support Division under the Fort Lewis DPW, USACERL, and Project & Software Developments Inc. (PSDI). It is an implied objective that the HMMS plan will use the MAMC-FMD experience gained in previous HMMS development and implementation activities.

MAXIMO Program

The existing MAMC HMMS uses the commercially available MAXIMO Maintenance Management Program. The basic System Flow of the MAXIMO Program is a factory-oriented “Maintenance Management System” platform (Figure 1).
(This software is not compiled and has been adapted and modified to meet MAMC needs and anticipated MEDCOM/Army/DOD requirements.) The flowchart shown in Figure 1 shows that MAXIMO addresses key plant maintenance concerns that are also of interest to Army hospital facility and equipment upkeep. Process monitoring/control and data collection/ordering/storage are overall capabilities. “Work Order” procedural steps are tracked from receipt to completion-closing or cancellation; associated resource scheduling and direct dispatch control are also provided. Demands on supply are considered through an inventory tracking and purchase monitoring system. All of these operations data can be customized to user needs. These categorized data are collected, processed, and displayed in forms meaningful to the involved processes.

Figure 2 shows the impact of the MAXIMO program on MAMC FMD maintenance operations and how the MAXIMO MMS system fits conceptually into the total scheme of things. The MAMC/MAXIMO data base supports:

1. System/equipment status information for continuous facility engineer (FE) monitoring, and quarterly or year-end summary reporting
2. Selected control/operations data for command review and MEDCOM submittal
3. Customer charge computation and billing outputs.

**Data Base Organization**

Organizing data generated from multiple maintenance operations is a complex task. The use of the EAS Network based on the Computer-Aided Cost Estimating System (CACES) numbering system makes this task more comprehensible and manageable.

Section B-3 of Appendix B shows the current use of the CACES numbering system by MAMC in an EAS context. This system was devised to provide maintenance management control for approximately 25,000 equipment units in the new Madigan Hospital. The EAS design incorporates the following CACES maintenance topics:
Figure 1. MAXIMO program system flow chart.
Figure 2. Overall relationship of the MAXIMO program to MAMC M&R operations and upward reporting.
The Hopes for an Automated HMMS

Current circumstances make it desirable to update and generalize the current MAMC/ MAXIMO data base. This resultant data base can then be incorporated into an HMMS as part of a MAMC Development Plan for submittal to MEDCOM and formal review by MEDCOM/DA/DOD. A key to ordering and understanding output data in MAXIMO is in the network structures allowed by the program. The reason for organizing the data collection stations into a supertree is that such a structure makes functional “neighbors” readily identifiable so they can be automatically aggregated for cost and engineering analysis or comparison.

Assessment of the Equipment Assembly Structure

The EAS investigations in this study identify the elements in EAS configurations that best support MAMC operational needs and that still meet all of the recognition and processing requirements of the MAXIMO Program. The following discussions outline EAS ciphering/networking techniques developed to meet the needs of the command and operations phases of maintenance operations.

EAS Number/Label Configurations

The transparency goal of this project requires that an EAS entry be meaningful to MAXIMO report generation and to management/craftsman interpretation. At the MAMC management and top maintenance management levels, the EAS “number” may be decomposed from an alphabetical source that reflects (identifies) the responsible commands; at maintenance operations levels, alphanumeric adaptations of the CACES numbering system are most informative (Figure 3). (At the operations level, something like the CACES Numbering System now used at MAMC HMMS in a MAXIMO data base context is a well understood and effective approach for the EAS network.) As previously mentioned, the two EAS number/network systems used at MAMC represent a Control and Operations phases. These networks can be further described as:
Figure 3. A two-phase EAS approach as used in the MAXIMO data base at MAMC.
1. **Acronym (Alphabetical) Symbols.** Commonly used acronyms for offices or management stations should be standardized and used for upper echelon designations in the MAXIMO database, and these should also be readily recognized at all medical maintenance areas. Eight (8) spaces are allowed for the EAS number in MAXIMO submittalreview screens; of these, five (5) spaces should be sufficient for the first or upper station designations. These command designations make up Part 1 of the EAS Network or the “Control EAS Phase.”

2. **Coded (Alphanumeric) Sequence.** At the maintenance operations levels, the CACES numerical system provides activityperformancestatus designations for classes of systems or specific system/equipment units (Figure 4). Here, the coding may be adjusted to local needs without disrupting the capability for M&R tracking by MEDCOM. This is the main (second) EAS Network, i.e., the “EAS Operations Phase.”

Note that the linkages in an EAS Network with two logic patterns (coding methods) are no problem to MAXIMO processing since the predecessor-successor relationship in the MAXIMO database is an assigned one, and is not dependent on any content of the EAS entry.

**EAS Command and Control Phase**

The EAS Command and Control Network of Figure 5 reflects a configuration used in the current MAMC/MAXIMO database and will be the selected development path for selecting the similar database activities at all MEDCOM installations. Although still under CERL/MAMC study, this type of network could be developed as a fixed (standardized) format for these installations. Management reporting sequences are identified in this flow from the Commander and subordinate offices down to Zone and System Category responsibility levels.

The MAMC definitions in Appendix A are a basis for developing the command flow structure of Figure 5. Tables A2 and A3 (Appendix A) are the sources of the Zone and Command/Division horizontal line categories of Figure 5. Classes of Systems and the EAS Operations Phase interface are represented in the final two lines, as shown.

A further description of the EAS Designator (EAS Control “Number”) development process is provided in Appendix B.
Figure 4. EAS network representation of MAMC facility engineer operations.
Figure 5. Command flow for reports generation by the EAS linkage.
EAS Operations Phase

The scope of EAS networking possibilities for an operations phase is developed in Appendix B. The EAS information content and network characteristics are:

1. **Information Content**: For the network of Figure B-1 (Attach. B), extensive information is coded into each EAS number. The first entry of the EAS network designates activity or geographical zones (Z); the second entry identifies the shop/skill or overall maintenance category (S). The remaining entries identify the class to specific systems and/or their dimensions down to individual equipment/machine level. Of course, these EAS designations do not actually appear in the data base; they are the “shorthand” used in this report to simplify EAS content discussions.

Briefly, the eight digits of an Operations EAS “Number” for this report will contain selections from the following designators:

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Z</td>
<td>Zone</td>
<td>Y</td>
</tr>
<tr>
<td>S</td>
<td>Shop/Skill Cat.</td>
<td>N</td>
</tr>
<tr>
<td>G</td>
<td>Skill Subcategory</td>
<td>A</td>
</tr>
<tr>
<td>M</td>
<td>M&amp;R Activity Class</td>
<td>F</td>
</tr>
<tr>
<td></td>
<td></td>
<td>E</td>
</tr>
<tr>
<td>C</td>
<td>Class of Systems under Category M</td>
<td></td>
</tr>
<tr>
<td>T</td>
<td>Type of System under Class C.</td>
<td>P</td>
</tr>
</tbody>
</table>

For example, the coded EAS Number could be represented in an 8 digit format, for a specific maintenance support area, as:

```
1 2 3 4 5 6 7 8
Z S M C T N F E.
```
2. **Zones & Performance Activity**: The first two digits of the above EAS Number representation are zones and activities, an approach that is common to all of the concepts or approaches in the operations phase of the network. These two entries can be defined as follows:

\[ Z = 0 \quad \text{which indicates NO geographic or functional zones are used} \]

(OR)

\[ Z = n \quad \text{which indicates the SUM of ALL zones (for whatever conditions are specified by the rest of the number (i.e., the following six digits of the EAS)} \]

Note that for the initial \( Z = 0 \), there can be no operations (CACES numbered) parent; children can be another \( Z = 0 \), but for multi-zone installations, must eventually contain non-zero valued Zs.

\[ Z = n \quad \text{which identifies a specific geographic or functional zone. Again this zone's parent is initially the } Z = 0 \text{ roll-up level.} \]

\[ S = n \quad \text{which identifies Skill Class and/or FE Shop for that class. Its parent is the Zone for this branch of the network and its ultimate children are the EAS levels with the same follow-on zero designator for the M&R Class.} \]

Follow-on entries will be as developed in Appendixes B and C.

3. **Exploratory Application**. To explore some of the EAS features previously discussed, the following example applies them to a diverse equipment category, i.e., Heating, Ventilation & Air Conditioning (HVAC) Systems.

HVAC Systems place many system/equipment tracking duties on an automated HMMS—an example of which is the “unpackaged” air conditioning system diagrammed in Figure 6. This figure shows the potential relationship between an EAS numbering approach and Medical Center operations systems and the supporting maintenance activities for these systems. It is also designed as a logical roll-up for a specific EAS configuration; here chosen as:

ZS MYC NEP
Figure 6. Unconstrained EAS operation network (using unpackaged AC system as the example).
4. **Best-Fit Networks.** Actual best-fit EAS Operation Networks for selected M&R skills/activities are developed in Appendix C from the letter definitions (p 19). Developed EAS entry representations are:

<table>
<thead>
<tr>
<th>Skills (CACES#)</th>
<th>EAS-Number Format</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mech Systems</td>
<td></td>
</tr>
<tr>
<td>Utilities</td>
<td>ZS - MC - NEP</td>
</tr>
<tr>
<td>Plumbing</td>
<td>ZS - CT - NFE</td>
</tr>
<tr>
<td>HVAC</td>
<td>ZS - MCT - NFE(P)</td>
</tr>
<tr>
<td>Electricity</td>
<td></td>
</tr>
<tr>
<td>Internal-HV</td>
<td>ZS - MCT - NFE</td>
</tr>
<tr>
<td>Internal-LV</td>
<td>ZS - MCT - NFE</td>
</tr>
</tbody>
</table>

**Overview**

The Operations Portion of the EAS Network uses a CACES-coded numbering system. In Figure 6, the EAS Number is “coded” to “ZS MYC NEP” as an illustrative convenience. This EAS Network configuration can change with different installations and with each “S” (Shop/Skill-Class), according to the needs of local maintenance operations. Similarly, “T” totaling activities are not mandated, but are used wherever an operations cost aggregation level is desired for that shop or activity.
3 EAS Network and Program Performance

The EAS Network is a "reference" by which maintenance resources, activities, and equipment are matched into an integrated statement by the MAXIMO Program. The EAS network is likewise a useful tool in setting up a particular data base for specific applications. This chapter summarizes the control and operations phases of the EAS Network in the MAMC/MAXIMO data base most applicable to generalized HMMS planning using the existing EAS configuration and some site-adaptable alternatives for the operations EAS.

The Total EAS Network

The Command and Operation Phases are represented by two EAS network configurations for a Control EAS Network (Figure 7) and for an Operations EAS Network (Figure 8). The ordering of the EAS entities in the network is by rank in the Command Phase of Figure 7, and numerically in the Operations Phase of Figure 8. Management (control) submittal levels are identified in Figure 7 from the Commander and subordinate offices to Zone and System Category responsibility levels. The formatting approach of the Operations EAS Network in Figure 8, however, places system/activity ownership in an EAS numerical sequence.

It is planned that HMMS users will conform to provided Command EAS Network standards, but will adapt Operations EAS Network guidance to their local needs. The ordering by MAMC Command of the first EAS Network (Figure 8) derives from the MAMC Organization of Table A3 (Appendix A). This ordering shows that Operations EAS Network designations can be stated in field maintenance terminology, so that the CACES numbering model may be followed completely or partially, allowing for operations-familiar, in-plant labeling when this best facilitates the process.
Figure 7. Rank ordering of the EAS control network for the command level.
EAS OPERATIONS NETWORK  
HVAC MAINTENANCE PERFORMANCE EXAMPLE

ZSS MC NFE

JNMSH09 {Fig.8} (Fig.8)

N09 00 000
V
N09 n0 000

n = 1 to (max) ith branch

N09 10 000
|
N09 i0 000
V
N09 i0 00T labeled
V
N09 in 000
(ith branch)
V
N09 ii 000
V
.
.
V
N09 ii in0 $0 <= i <= G$
V
N09 ii iin
(optional)
V

[ANY "PLANT" DESIGNATIONS]

Figure 8. Numerical ordering of the EAS operations network.
Potential Variables

The EAS Operations Designators can accommodate a customizing of the HMMS database with locally needed variables or features. Take, for instance, numbering levels at or above specific equipment designations (E); special labels can be placed in the “E” position; e.g., the EAS number with a location label “09 111 10L.” Typically, labels will indicate aggregated cost (T), customer charges (R), location identification (L), associated contracts (K), etc. These letters create a dummy EAS number in the EAS Network, which can be queried by MAXIMO without disrupting the EAS numbering logic.

Example Run-Through of the MAMC EAS Operations Network for HVAC Activities

Basic and numerical EAS developments can be illustrated by a Heating, Ventilation and Air Conditioning (HVAC) application. The basic premise of the system is to restrict the HVAC EAS to a simple Skill/Class/System/Subsystem/Equipment hierarchy, all adapted to total/ zone/customer roll-ups. For actual operations use, apply specific maintenance activity labor and equipment charges (L&E inputs) to proper levels as attribute records at these levels. The EAS entry representations is:

ZS-MCT-NFE:

which denotes:

<table>
<thead>
<tr>
<th>ZS</th>
<th>MCT</th>
<th>NFE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zones/Skills</td>
<td>Categories/Classes of Systems/Types of Systems</td>
<td>Subsystem ID/ Equipment Types/Specific Equipment Description and Unit No.</td>
</tr>
</tbody>
</table>

Table 1 lists single and multiple zone MAMC EAS numerical sequences and Table 2 lists associated equipment/system plant designations. Here, the above plan is followed at MAMC up to the 6th letter (tier) “N,” where the option exists for either continuing with CACES-type numbers or switching to industrial or local type procedural identifications that are more meaningful to maintenance and repair (M&R) field workers and their supervisors. Application III (Appendix C) gives a good example of the application of Table 1 methods.
Table 1. Current MAMC EAS operations network.

<table>
<thead>
<tr>
<th>GENERAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>TO ILLUSTRATE, THE EAS NUMBER CONTAINING THE ROLL-UP OF MAINTENANCE ACTIVITIES AT MAMC FOR A TOTAL HVAC OPERATION IS:</td>
</tr>
<tr>
<td>09 000 000 HVAC Maintenance, Mechanical; Mech HVAC Totals.</td>
</tr>
<tr>
<td>SINGLE ZONE INSTALLATION:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FIRST TIER</th>
<th>TOTAL INSTALLATION</th>
<th>(Z=0)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Z = 0;</td>
<td>Provides Total Maintenance Recorded Costs or Hours for all Shops and Skills.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SECOND TIER</th>
<th>SHOP/SKILL DESIGNATIONS</th>
<th>(S=n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>09</td>
<td>Z = 0; S = 9:</td>
<td>Provides Total Maintenance Recorded Costs or Hours for a specific Shop/Skill (HVAC).</td>
</tr>
<tr>
<td></td>
<td>or</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SS = 09:</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>THIRD TIER</th>
<th>MAINTENANCE ACTIVITY CATEGORY</th>
<th>(M=n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>09 1</td>
<td>HVAC, General Support</td>
<td></td>
</tr>
<tr>
<td>09 2</td>
<td>Heating Systems</td>
<td></td>
</tr>
<tr>
<td>09 3</td>
<td>Ventilation &amp; Forced Draft Systems</td>
<td></td>
</tr>
<tr>
<td>09 4</td>
<td>Cooling Generation Systems</td>
<td></td>
</tr>
<tr>
<td>09 5</td>
<td>Air Conditioning Systems, Packaged</td>
<td></td>
</tr>
<tr>
<td>09 6</td>
<td>AC Systems, Non-packaged</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FOURTH TIER</th>
<th>CLASS OF SYSTEM</th>
<th>(C=n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>09 100</td>
<td>HVAC, General Support (M = 1)</td>
<td></td>
</tr>
<tr>
<td>09 110</td>
<td>Class of Systems (C = n)</td>
<td></td>
</tr>
<tr>
<td>09 120</td>
<td>Heating &amp; Cooling Systems</td>
<td></td>
</tr>
<tr>
<td>09 130</td>
<td>Controls &amp; Instrumentation</td>
<td></td>
</tr>
<tr>
<td>09 140</td>
<td>HVAC Testing &amp; Balancing</td>
<td></td>
</tr>
<tr>
<td>09 200</td>
<td>Others</td>
<td></td>
</tr>
<tr>
<td>09 210</td>
<td>Heating Systems</td>
<td></td>
</tr>
<tr>
<td>09 220</td>
<td>Heat Energy Sources</td>
<td></td>
</tr>
<tr>
<td>09 230</td>
<td>Furnaces</td>
<td></td>
</tr>
<tr>
<td>09 300</td>
<td>Spare</td>
<td></td>
</tr>
<tr>
<td>09 400</td>
<td>Vent &amp; FD Systems, etc.</td>
<td></td>
</tr>
<tr>
<td>09 410</td>
<td>Cooling Generation Systems</td>
<td></td>
</tr>
<tr>
<td>09 420</td>
<td>Simple Refrigerant Systems</td>
<td></td>
</tr>
<tr>
<td>09 430</td>
<td>Chillers</td>
<td></td>
</tr>
<tr>
<td>09 440</td>
<td>Heat Rejection Systems</td>
<td></td>
</tr>
<tr>
<td>09 500</td>
<td>Others</td>
<td></td>
</tr>
<tr>
<td>09 510</td>
<td>Air Conditioning (Packaged) Systems, All Zones</td>
<td></td>
</tr>
<tr>
<td>09 520</td>
<td>Window Systems</td>
<td></td>
</tr>
<tr>
<td>09 530</td>
<td>Low Volume (Local Area Control) Systems</td>
<td></td>
</tr>
<tr>
<td>09 600</td>
<td>High Volume (Building Control) Systems</td>
<td></td>
</tr>
<tr>
<td>09 610</td>
<td>AC Systems, Unpackaged</td>
<td></td>
</tr>
<tr>
<td>09 620</td>
<td>AC System, Up - Type # 1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AC System, Up - Type # 2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>etc.</td>
<td></td>
</tr>
</tbody>
</table>
This Point Can Include an EAS NETWORK OPTION (OR) A DESIGNATION SWITCH (Set EAS = to Plant No.s) SEE TABLE 2

### FIFTH TIER
- **09 610**: AC System, Unp (ACN) - Type # 1
- **09 611**: List of Specific ACN Units (Type 1).
- **09 611**: ACN Unit #1.

### SIXTH TIER
- **09 611 n00**: Subsystem n of ACN # 1
- **09 611 100**: Piping System for Chillers.
- **09 611 200**: Chiller # 1
- **09 611 300**: Chiller # 2.

### SEVENTH TIER
- **09 611 2n0**: Chiller # 1 Components
- **09 611 210**: Component # 1 OF Chiller # 1 (say this is Pump #1 for Chiller # 1 of ACN Unit # 1).

### EIGHTH TIER
- **09 611 21n**: Machinery Components of Pump # 1.
- **09 611 211**: Say the Motor of Pump # 1; here, Motor Unit inventory number and description is supplied.

### MULTIPLE ZONE INSTALLATION:

**FOR Z = 0:**
Installation-wide summaries for multiple zone bases are usually not needed past the third or fourth tier as shown for the Single Zone installation above.

**FOR Z = A:**
(illustration using Zone A as an example.)

### FIRST & SECOND TIER
**TOTAL CHARGES FOR AN INDIVIDUAL ZONE AND A SPECIFIC SHOP**
- **nn'**: Indicates entry is as in Single Zone Case
- **A9**: Z = A; S = 9;

### THIRD TIER
**OVERALL CLASS OF MAINTENANCE ACTIVITY**
- **A9 1**: HVAC, General Support
- **A9 2**: Heating Systems
- **A9 3**: Ventilation & Forced Draft Systems
- **A9 4**: Cooling Generation Systems
- **A9 5**: Air Conditioning Systems, Packaged
- **A9 6**: AC Systems, Non-packaged
- **A9 7**: [Spare]
<table>
<thead>
<tr>
<th>FOURTH TIER</th>
<th>CLASS OF SYSTEM</th>
<th>(C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A9 100</td>
<td>HVAC, General Support, Zone A</td>
<td></td>
</tr>
<tr>
<td>A9 110</td>
<td>Heating &amp; Cooling Systems</td>
<td></td>
</tr>
<tr>
<td>A9 120</td>
<td>Controls &amp; Instrumentation</td>
<td></td>
</tr>
<tr>
<td>A9 130</td>
<td>HVAC Testing &amp; Balancing</td>
<td></td>
</tr>
<tr>
<td>A9 140</td>
<td>Others</td>
<td></td>
</tr>
<tr>
<td>A9 150</td>
<td>Spare</td>
<td></td>
</tr>
<tr>
<td>etc.</td>
<td>AC Systems, Unpackaged</td>
<td></td>
</tr>
<tr>
<td>A9 600</td>
<td>AC System, Unit # 1</td>
<td></td>
</tr>
<tr>
<td>A9 610</td>
<td>AC System, Unit # 2</td>
<td></td>
</tr>
<tr>
<td>A9 620</td>
<td>etc.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FIFTH TIER</th>
<th>SPECIFIC TYPES OF SYSTEMS</th>
<th>(T)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A9 610</td>
<td>AC System, Unit # 1</td>
<td></td>
</tr>
<tr>
<td>A9 611</td>
<td>Component # 1 (Chiller # 1)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SIXTH TIER</th>
<th>MAJOR SUBSYSTEMS OR COMPONENTS</th>
<th>(Y&amp;N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>09 611 000</td>
<td>Subsystem n of ACN # 1</td>
<td></td>
</tr>
<tr>
<td>A9 611 200</td>
<td>Chiller Component # 2 (Pump # 1)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SEVENTH TIER</th>
<th>MACHINERY/EQUIPMENT TYPES</th>
<th>(F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>09 611 2n0</td>
<td>Machinery Components of Pump # 1.</td>
<td></td>
</tr>
<tr>
<td>A9 611 210</td>
<td>Pump Component # 1 (Motor)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>EIGHTH TIER</th>
<th>SPECIFIC EQUIPMENT OR MACHINERY</th>
<th>(E)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A9 611 210</td>
<td>Pump Component # 1 (Motor)</td>
<td></td>
</tr>
<tr>
<td>09 611 21n</td>
<td>Machinery Components of Pump # 1.</td>
<td></td>
</tr>
<tr>
<td>09 611 211</td>
<td>Say the Motor of Pump # 1; here, Motor Unit inventory number and description is supplied.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NINTH TIER (!) - PARTS IDENTIFICATION</th>
<th>(P)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A9 611 110</td>
<td>Pump Component Classifications</td>
</tr>
<tr>
<td>A9 611 111</td>
<td>Motor Drive Identification</td>
</tr>
<tr>
<td>A9 611 112</td>
<td>Impeller &amp; housing Identification</td>
</tr>
</tbody>
</table>
Table 2. Example MAMC equipment/system plant designations.

<table>
<thead>
<tr>
<th>HVAC SYSTEMS, AIR HANDLING UNITS (AHUs)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>EAS #</strong></td>
</tr>
<tr>
<td>---------------------</td>
</tr>
<tr>
<td>09A 11 100</td>
</tr>
<tr>
<td>AHU-092:</td>
</tr>
<tr>
<td>AHU-100</td>
</tr>
<tr>
<td>to 105:</td>
</tr>
<tr>
<td>AHU-106:</td>
</tr>
<tr>
<td>09A 11 200</td>
</tr>
<tr>
<td>AHU-20:</td>
</tr>
<tr>
<td>AHU-27:</td>
</tr>
<tr>
<td>AHU-47:</td>
</tr>
<tr>
<td>AHU-94:</td>
</tr>
<tr>
<td>to 97:</td>
</tr>
<tr>
<td>AHU-99:</td>
</tr>
<tr>
<td>09A 12 100</td>
</tr>
<tr>
<td>AHU-14:</td>
</tr>
<tr>
<td>09A 12 200</td>
</tr>
<tr>
<td>AHU-37:</td>
</tr>
<tr>
<td>AHU-41:</td>
</tr>
<tr>
<td>AHU-67:</td>
</tr>
<tr>
<td>09A 12 300</td>
</tr>
<tr>
<td>AHU-09</td>
</tr>
<tr>
<td>to 11:</td>
</tr>
<tr>
<td>AHU-15, 16 &amp; 18:</td>
</tr>
<tr>
<td>AHU-44:</td>
</tr>
<tr>
<td>&amp; 45:</td>
</tr>
<tr>
<td>AHU-56A</td>
</tr>
<tr>
<td>&amp; 63:</td>
</tr>
<tr>
<td>AHU-74</td>
</tr>
</tbody>
</table>

Operations EAS Configuration Alternatives

Once an EAS Operations configuration is chosen, installed, tested, and brought on line, the configuration is fixed for that organization until subsequent change requests are authorized by MEDCOM. The flexibility described here is designed into the data base so it can be tailored to meet various local medical center (LMC) needs, but still maintained in a standard form for MEDCOM's use.
Allowable Operations EAS

Alternative EAS Network configurations are now provided that illustrate what is available to meet LMC maintenance needs—at the time of software installation/implementation. Table 3 indicates the choice of EAS Network approaches that may be incorporated into the MAXIMO procedure for any particular Army Medical Center at data base setup time. (Interpretation of the Operations EAS entries shown in Table 3 depends on referencing EAS letter “designators” (p 19).

Since each of the maintenance categories in the CACES System follows a pattern in its procedural approach, an EAS Network Configuration may be represented by a “Generalized Designator Series” for the EAS Number of each maintenance category. Table 3 lists “EAS Designators” in both a basic and alternative form. This limited option permits a delivered automated HMMS product in an easy-to-maintain standardized form, but also with application functions variable enough to meet individual installation’s needs and to create customized roll-up and summary reports.

Table 3. Permissible EAS network configurations at the maintenance operations level.

<table>
<thead>
<tr>
<th>CACES Description</th>
<th>(S#'s)</th>
<th>Basic EAS Rep.</th>
<th>EAS Designators</th>
<th>Altern.Single Zone EAS</th>
<th>Altern.Multi-Zone EAS</th>
</tr>
</thead>
<tbody>
<tr>
<td>BUILDINGS:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ROOFING</td>
<td>(03)</td>
<td>ZSS GM CN0</td>
<td>0S GMC N00</td>
<td>ZS GMC N00</td>
<td></td>
</tr>
<tr>
<td>EXT.CLOSURE</td>
<td>(04)</td>
<td>ZSS MC NF0</td>
<td>0S MCN F0L</td>
<td>ZS GMC N0L</td>
<td></td>
</tr>
<tr>
<td>INT.CLOSURE</td>
<td>(05)</td>
<td>ZSS GM CN0</td>
<td>0S GMC N0L</td>
<td>ZS GMC N0L</td>
<td></td>
</tr>
<tr>
<td>FINISHES</td>
<td>(06)</td>
<td>ZSS GM CN0</td>
<td>0S GMC N0L</td>
<td>ZS GMC N0L</td>
<td></td>
</tr>
<tr>
<td>UTILITIES</td>
<td>(07)</td>
<td>ZSS GM CNE</td>
<td>0S GMC NEO</td>
<td>ZS GMC NEP</td>
<td></td>
</tr>
<tr>
<td>INT.PLUMBING</td>
<td>(08)</td>
<td>ZSS MC TNE</td>
<td>0S MCT NFE</td>
<td>ZS MCT NEP</td>
<td></td>
</tr>
<tr>
<td>HT, VENT &amp; AC</td>
<td>(09)</td>
<td>ZSS GM CNF</td>
<td>0S GMC NFE</td>
<td>ZS GMC NFE (or)</td>
<td>ZS MCT YFE</td>
</tr>
<tr>
<td>ELECTRICAL:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EXT.EL.- HV</td>
<td>(10)</td>
<td></td>
<td>External electrical systems are not currently monitored for HV.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>INT.EL.- HV</td>
<td>(10)</td>
<td>ZSS MC TN0</td>
<td>SS MCT NFE</td>
<td>ZS MCT NFE</td>
<td></td>
</tr>
<tr>
<td>INT.EL.- LV</td>
<td>(11)</td>
<td>ZSS MC TN0</td>
<td>SS MCT NFE</td>
<td>ZS MCT NFE</td>
<td></td>
</tr>
<tr>
<td>SPCL.SYSTEMS</td>
<td>(12)</td>
<td>ZSS GM TH0</td>
<td>SS GMT H00</td>
<td>ZS MCT YNE</td>
<td></td>
</tr>
<tr>
<td>[Communications]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CONVEYANCES</td>
<td>(13)</td>
<td>ZSS GM 000</td>
<td>SS GM0 TNE</td>
<td>ZS MCT YNE</td>
<td></td>
</tr>
</tbody>
</table>
4 Conclusions and Recommendations

Conclusions

This initial stage of research has reviewed the MAMC/MAXIMO data base currently in use at Madigan Army Medical Center and verified its potential effectiveness for general Army medical facilities use. This study concludes that, with limited adjustments, the MAMC/MAXIMO data base may be “upgraded” to an optimal level for general use in Army medical centers, hospitals, and clinics.

This study also found that a re-engineering of the EAS is a key element to achieve effective MAXIMO Program processing, efficient user interfaces, and refined report/printout generations. The use of the EAS Network based on the CACES numbering system makes this task more comprehensible and manageable. Table 3 (p 31) identifies EAS Operator Network configurations suitable for the MAMC/MAXIMO data base.

With the approach recommended in this report, HMMS users may conform to Command EAS Network standards, while adapting Operations EAS Network guidance to their local needs. The flexibility described here will be designed into the data base so it can be tailored to meet various local medical center needs, but can still serve MDCOM as a software standard. By combing CACES and plant designations (Chapter 3), there will be no installation machinery/system representation that cannot be met.

A finalization of this study will determine if these results may be better integrated and/or optimized in any way. It is also concluded that:

1. The assumptions for this study are valid and should be accepted as stated.
2. From functional software studies, the MAXIMO Platform is sufficient and adequate to support the data base refinements planned.
3. For any particular MDCOM installation, uniformity in operations between maintenance shops (or skill areas) is not found in practice, and should not unnecessarily constrain data base or procedural developments.
Recommendations:

1. Appropriate training and documentation should be provided to keep Medical Center implementations within HMMS/MAXIMO data base tolerances that allow and ensure acceptable IFS-M and MEDCOM interfaces.

2. This report and follow-on reports and documentation should be coordinated to:
   a. Generate a CERL/MAMC Data Base Development Plan (DDP) and coordinate this plan with MEDCOM; upgrade the DDP to satisfy coordinated/approved Plan changes
   b. Verify compatibility of DDP with total HMMS planning
   c. Set up the next coordination phase with the Walter Reed or Brooke (Fort Sam Houston) Medical Centers, and the Reynolds Army Hospital (Fort Sill).

3. This project should continue to develop by this sequence:
   a. Upgrade the DDP into a first-cut of the “Final Plan” (DDP-Alpha)
   b. Generate DDP-Alpha software; test DDP-Alpha at MAMC DPW
   d. Modify SW & Plan according to Lessons Learned and MMS integration studies; plan DDP-Beta test phase
   e. Coordinate/test DDP-Beta at a selected medical center and Army hospital; document and distribute the Final DDP.
Appendix A: MEDCOM/MAMC Organizational Features

The relationship of MEDCOM to MAMC and MAMC to Center activities should be understood. The MEDCOM/MAMC Command Structure, and MAMC HMMS areas of responsibility (and duties performed) are basic to this understanding. This relationship impacts the 27 Hospitals, 9 Medical Centers, and 469 Clinics now under MEDCOM supervision. Table A1 lists the affected Army Hospitals and Medical Centers.

Table A1. Impacted Army hospitals and medical centers under MEDCOM supervision.

<table>
<thead>
<tr>
<th>Hospital</th>
<th>Location</th>
<th>Medical Center</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bayne-Jones</td>
<td>Fort Polk, LA</td>
<td>William Beaumont</td>
<td>Fort Bliss, TX</td>
</tr>
<tr>
<td>Bassett</td>
<td>Fort Wainwright</td>
<td>Brooke</td>
<td>Fort Sam Houston, TX</td>
</tr>
<tr>
<td>Raymond Bliss</td>
<td>Fort Huachuca, TX</td>
<td>D.D. Eisenhower</td>
<td>Fort Gordon, GA</td>
</tr>
<tr>
<td>Darnall</td>
<td>Fort Hood, TX</td>
<td>Fitzsimmons</td>
<td>Aurora, CO</td>
</tr>
<tr>
<td>DeWitt</td>
<td>Fort Bliss, TX</td>
<td>Madigan</td>
<td>Fort Lewis, WA</td>
</tr>
<tr>
<td>Evans</td>
<td>Fort Carson, CO</td>
<td>Walter Reed</td>
<td>Washington, DC</td>
</tr>
<tr>
<td>Fox</td>
<td>Redstone Arsenal, AL</td>
<td>Womak</td>
<td>Fort Bragg, NC</td>
</tr>
<tr>
<td>Ireland</td>
<td>Fort Knox, KY</td>
<td>Tripler</td>
<td>Oahu, HI</td>
</tr>
<tr>
<td>Irwin</td>
<td>Fort Riley, KS</td>
<td>Landstuhl Regional</td>
<td>Germany</td>
</tr>
<tr>
<td>Kenner*</td>
<td>Fort Lee, VA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kimbrough</td>
<td>Fort Meade, MD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lyster</td>
<td>Fort Rucker, AL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Martin</td>
<td>Fort Bliss, TX</td>
<td></td>
<td></td>
</tr>
<tr>
<td>McDonald</td>
<td>Fort Eustis, VA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moncrief</td>
<td>Fort Jackson, SC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Munson</td>
<td>Fort Lee, VA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nobel</td>
<td>Fort McClellan, AL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patterson</td>
<td>Fort Monmouth, NJ</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GEN L. Wood</td>
<td>Fort Leonard Wood, MO</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reynolds</td>
<td>Fort Sill, OK</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weed</td>
<td>Fort Irwin, CA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wilcox</td>
<td>Fort Drum, NY</td>
<td></td>
<td></td>
</tr>
<tr>
<td>William Kellar</td>
<td>West Point, NY</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Winn</td>
<td>Fort Stewart, GA</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* To be downsized to an Army Clinic in FY97.
Figure A1 shows the MEDCOM command structure, its subcommands/offices, and medical labs and clinics.

![MEDCOM command structure network](image)

where the designations are:

- **AMEDD** Army Medical Dept
- **CHPPM** Center for Health Promotion & Preventive Medicine
- **DENCOM** The Dental Command
- **DSSA** Dental Services Support Area
- **HFPA** Health Facilities Planning Agency
- **HSSA** Hospital Services Support Area
- **MRMC** Medical Research & Materials Command
- **NW-HSSA** Northwest - Hospital Services Support Area
- **VETCOM** The Veterinary Command
- **VSSA** Veterinary Services Support Area

Figure A1. MEDCOM command structure network.

Facility reports submitted to these entities should use the 5 Digit Construction Category Codes (CC) from the DA Facillity Classes and Construction Categories (AR and DA PAM 415-28). These CC codes are recognized by IFS-M, and are in the vocabulary of MEDCOM personnel for identifying medical facility types:

**First Digit:** The defining first digit is identified as follows:

- 10000 Operational & Training Facilities
- 20000 Maintenance & Production Facilities
- 30000 Research, Development, Test, and Evaluation Facilities
- 40000 Supply Facilities
- 50000 Hospital & Medical Facilities
- 60000 Administrative Facilities
- 70000 Housing & Community Facilities
- 80000 Utilities & Ground Improvements
- 90000 Real Estate

**Second Digit:** Identifies the Category Group

- 510 00 Medical Centers/Hospitals
- 530 00 Laboratories
Third Digit: Identifies the Facility Sub-Group, defined by DOD
   510 10   Hospital
   510 20   Hospital Clinic

According to MEDCOM personnel several identifiers have been added to this coding:

Fourth & Fifth Digit: Identifies a specific item within the basic category, a level of reporting required by the Army.

Sixth & Seventh Digits: These are OPTIONAL MACOM expansions of the HQDA five-digit Real Property Category Codes. Units of measure must correspond to those of the five-digit category codes.

MAMC

Table A2 lists the labels for MAMC designated zones/areas. Table A3 lists the MAMC command structure, and Figure A2 shows a matrix of zones versus FMD support services.

Table A2. MAMC-FMD maintenance support areas/zones.

<table>
<thead>
<tr>
<th>HA</th>
<th>Ambulance &amp; helicopter</th>
</tr>
</thead>
<tbody>
<tr>
<td>HC</td>
<td>Troop medical clinic</td>
</tr>
<tr>
<td>HF</td>
<td>Fuel oil Rx &amp; handling</td>
</tr>
<tr>
<td>HI</td>
<td>Clinical investigations</td>
</tr>
<tr>
<td>HM</td>
<td>Emergency power (old MAMC)</td>
</tr>
<tr>
<td>HB</td>
<td>Backup SA's service areas (SAs)</td>
</tr>
<tr>
<td>HD</td>
<td>Dental clinics (TMC)</td>
</tr>
<tr>
<td>HG</td>
<td>Grounds, parking lots &amp; facilities roads, &amp; external structures</td>
</tr>
<tr>
<td>HL</td>
<td>Street &amp; Grounds lighting</td>
</tr>
<tr>
<td>HN</td>
<td>NEW MAMC hospital &amp; clinic facilities</td>
</tr>
</tbody>
</table>
Table A3. Madigan Army Medical Center (MAMC) organizational structure.

| Office of the Commander, MAMC          | MCHJ-CG       |
| Deputy Commander for Clinical Services | MCHJ-CL       |
| Chief of Staff/Deputy Commander for Administration | MCHJ-DCA/CS |
| Northwest Support Area (SA):            |               |
| Lead Agent                             | MCHJ-NWLA     |
| Contracting Center                     | MCAA-NW       |
| Health Service SA                      | MCHJ-HSSA     |
| Dental Service SA                       | MCDS-NI       |
| Veterinary Service SA                    | MCVS-NWV      |
| Divisions:                              |               |
| Coordinated Care                        | MCHJ-CCD      |
| Facilities Management                   | MCHJ-FMD      |
| Human Resources                         | MCHJ-HRD      |
| Information Management                  | MCHJ-IM       |
| Logistics                               | MCHJ-LO       |
| Nutrition Care                          | MCHJ-NC       |

Table A4. Distribution of FMD maintenance services across MAMC functional zones.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
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<tbody>
<tr>
<td>Zone</td>
<td>BC</td>
<td>BE</td>
<td>CS</td>
<td>EL</td>
<td>EX</td>
<td>FP</td>
<td>MD</td>
<td>MS</td>
<td>NV</td>
<td>ST</td>
<td>PS</td>
<td>OO</td>
</tr>
<tr>
<td>HA</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>HC</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>-</td>
<td>x</td>
<td>x</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>HD</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>-</td>
<td>x</td>
<td>x</td>
<td>x</td>
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<td>-</td>
<td>-</td>
</tr>
<tr>
<td>HF</td>
<td>x</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>x</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>HG</td>
<td>x</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>x</td>
<td>-</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>HI</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>-</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>-</td>
<td>-</td>
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</tr>
<tr>
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<tr>
<td>HN</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

* = indicated FMD maintenance support (column) is supplied to the designated zones (rows).
Appendix B: Equipment Assembly Structure (EAS) Functional Considerations

B-1: EAS NUMERICAL DEFINITIONS

For the alternate (improved) network concept of Figure 4 (Page 17), the EAS numbering contains ciphered data that are decoded by the following information.

Organizational Relationships

**First Entry (Z).** For Entry 1, a Zone (Z) designation is required:

- $Z = 0$: Indicates NO geographic or functional zones are used;
  (OR)
- Indicates the SUM of ALL zones in the EAS.

- $Z = n$: Identifies a specific geographic or functional zone,
  where "n" is a positive number.

**Second Entry (S).** The second entry is reserved for the skill/shop (S) area designation. There may be 15 possible numerical S values here to be specified by a one digit entry. Hence, a Hexadecimal Counting System is required, viz: $n = 1$ to $F$ (where $F = 15$).

For example, Attachment B: Applications IV (Page 28) shows that for an EAS Number of "0B 000 000" the "B" would be 11 in our decimal system and would stand for a CACES designation of “The Maintenance of Interior Electrical Systems” (under 600 Volts).

**Skill Area or Class of System**

**Third Entry (M).** A SYSTEM CATEGORY designator—the overall functional categories served by the particular Shop from the Second entry are totaled in this data section (for all contributing zones if $Z = 0$).
**Fourth Entry (C).** The CLASS of SYSTEM (COS) can be identified here; also the number and type of subsystems will be designated (usually from locally assigned Plant Numbers).

**Fifth Entry (T).** The Specific TYPE of SYSTEM is identified by the fifth entry (from a choice of system types for the C class). The EAS turns from a general activity to specific maintenance area at this point. Hence, data files, queries, and other support may be called in here or by subsequent entries.

**Designation/Identification of Specific Equipment**

**Sixth Entry (Y).** Identifies a SPECIFIC SYSTEM by plant or DPW assigned system-number; each numbered data set has a list of associated major subsystems.

**Seventh Entry (N).** Identifies a SPECIFIC SUBSYSTEM from the Y selection; each such subsystem has a list of associated equipment or connection systems with their assigned numbers. Also designates equipment classification (name such as motor, pump, etc.) and type, by size, features, and manufacturer; where T(n) = 1 to G.

**Eighth Entry (E).** Identifies SPECIFIC EQUIPMENT UNIT by DPW or Plant Number, serial number, and work history; the parts list is callable from an EQNUM Table in MAXIMO.

Hence, the formatted EAS Number is:

Z S M C T Y N E.
B-2: EAS NETWORK OPERATIONS-LEVEL ALTERNATIVES

Column 1 of Figure B1 outlines the in-place (current) MAMC MMS for HVAC procedures in an EAS Network form, but using a “streamlined” EAS numbering system. Also under each maintenance class/shop activity box, the EAS revision intentions by this study are indicated.

Column 2 of Figure B1 provides conceptual EAS networks laid over the current MAMC MMS MAXIMO database. On the left, an advance in the EAS numbering system is shown while keeping the current network logic. On the right of the Figure B-2 graph is an alternative (improved) EAS Network for representing mechanical systems. This improved EAS configuration allows:

- mechanical systems structure logic
- clear time & materials roll-up charging
- direct customer-charge pull-outs.

The Example Alternative EAS network shows all nonpackaged air conditioning systems (AN-N) under control of an HVAC Shop and the maintenance and repair (M&R) record stations for each system class/type and its successor component listings. Note that the Year-to-Date, monthly, or weekly charges (resources, downtime or other costs) at all or a portion of these AC-N levels may be obtained from (automated) reports or requested printouts that are generated from a search for EAS numbers with an imbedded “T” (for totals).

Such a “T” entry is within network logic and EAS numerical sequencing. It is easily identified visually and by PC logic. Note the “T” entry contains essential charge summations, whereas its parent contains status and descriptive text information.
B-3  EAS Operations Network:  MAMC Use of CACES Numbering in EAS Designations

HN  New Hospital/Clinic Facilities
HNBC  Building Components

N03 00 000 BUILDING ROOF-SYSTEMS

N03 10 000 ROOFING
N03 11 000 Roof Coverings
N03 11 n00  Types of Roofings \( [n = 1 \text{ to } 4] \)
  o roofing materials

N04 00 000 EXTERIOR CLOSURES
N04 10 000 EXTERIOR WALLS
N04 11 000 Exterior Wall Construction
N04 12 000 Interior Skin Construction
N04 13 000 Screen Walls
N04 14 000 Soffits & Facia
N04 15 000 Exterior Facades/Finishes
  - Finish Materials (36 kinds)

N04 20 000 EXT BUILDING DOORS & FRAMES
N04 2n 000 Classes of Doors \( [n = 1 \text{ to } 7] \)
  - Types of Finishes
    o Floor locations
N04 30 000 EXTERIOR WINDOWS
N04 3n 000 Classes of Windows
  - Frame Materials & Types of Windows
    o Floor locations

N04 40 000 EXT PORCHES & LOADING DOCKS
N04 41 000 Decks, Exterior Porches/Docks
  - Decking Materials
N04 42 000 Railings, Exterior Porches
  - Railing Materials
N04 43 000 Porch Support Members
  - Support Materials
N04 44 000 Porch Columns
  - Column Materials
N04 45 000 Misc:
N04 45 100 Balconies, Thresholds
N04 45 200 Fire Escapes
  - Metal or Wood
N04 50 000 EXT ORNAMENTS
N04 51 000 Cornices
  - Stone or Wood
N04 60 000 EXT STAIRS & RAMPS
N04 61 000 Stair/Ramp Railings, X
  - Materials
N04 62 000 Steps, X
  - Matr.s
N04 63 000 Handicap Ramps, X
  - Matr.s
N04 70 000 EXT DOOR/WINDOW HARDWARE
Figure B1. Ordering logic of EAS network numbering system—zone 1.
**NO5 00 000 INTERIOR BLDG STRUCTURE & HARDWARE**

| NO5 10 000 | BLDG WALLS/FIX-PARTITIONS/FLOORING, INT |
| NO5 11 000 | Walls & Partitions, Int |
| -          | Part. Materials |
| NO5 12 000 | Bldg. Floors |
| -          | Subfloors |

**NO5 20 000 INT PARTITIONS, MOVABLE**

| NO5 21 000 | Movable Metal Partitions |
| -          | Steel |
| NO5 22 000 | Movable Fabric Partitions |
| -          | same |

**NO5 30 000 INT BLDG DOORS & DOOR FRAMES**

| NO5 31 000 | Metal D&P's |
| NO5 31 n00 | Type of metal & finish \([n = 1 \text{ to } 3]\) |

| NO5 32 000 | Fully Glazed Doors, Int |
| NO5 32 n00 | Type of frame material: |
| -          | type of finish |

| NO5 33 000 | Wood Doors & Frames |
| NO5 33 n00 | Type of wood & finish \([n = 1 \text{ to } 3]\) |
| -          | Hollow core |

| NO5 34 000 | Special (Type) Doors, Int |
| NO5 34 n00 | Types of Sp.Int.Doors |
| NO5 35 000 | Roll-Up Int.Doors |
| NO5 35 n00 | Mtl(2) & Wood, Single & Double |
\([n = 1 \text{ to } 6]\) |

**NO5 40 000 INTERIOR FIXTURES**

| NO5 41 000 | Wood or Wood/Plastic |
| -          | Cabinets/Ctrtops/Msc. |
| NO5 42 000 | Metal |
| -          | Medicine chest/cabinet |

**NO5 50 000 FIREPLACES**

**NO5 60 000 INT ORNAMENTS**

**NO5 70 000 INT STAIRS**

**NO5 80 000 INT HARDWARE**

**NO6 00 000 INTERIOR FINISHES**

| NO6 10 000 | WALL FINISHES |

| NO6 1n 000 | Types of int wall materials/finishes |
\([n = 1 \text{ to } A]\) |

| NO6 20 000 | FLOOR FINISHES |
| NO6 2n 000 | Types of int floor materials/finishes |
\([n = 1 \text{ to } A]\) |

| NO6 30 000 | CEILINGS & CEILING FINISHES |
| NO6 3n 000 | Types of int ceiling materials/finishes |
\[ n = 1 \text{ to } A \]

HNBE BUILDING EQUIPMENT
[Unknown]

HNMS MEDICAL SUPPORT
[CACES NOT USED.]

HNMS MECHANICAL SYSTEMS:

HNMS-S/T: SEWER/STEAM (UTILITIES)

N07 00 000 UTILITIES

N07 10 000 Supplier Provided Utilities
N07 11 000 Natural Gas System

N07 20 000 MAMC Plant/Unit Generated Utilities
N07 21 000 Steam Plants, Heating/Power Generation
N07 21 100 Boiler (NG)
N07 21 200 Boiler (Coal)
N07 21 300 Boiler (Oil)
N07 21 400 Fuel Oil (FO) Boiler Equipment
N07 21 500 Boiler, Dual Fired
N07 21 600 Special Steam Generators & Enhancers
N07 21 700 Coal/Ash Handling Equipment
N07 21 800 Boiler Fd Wtr Additives
N07 21 900 Feed Water Supply
N07 21 A00 Deaerator
N07 21 B00 Blowoff
N07 21 C00 House Furnace (Gas)
N07 21 D00 HF (Oil)
N07 21 E00 HF (El)
N07 21 F00 Induction Furnace Gas/Oil
N07 21 G00 Surge Tank, 1000 Gallons

N07 22 000 Fixtures, Heating Generation
N07 23 000 Interconnections, HG
N07 24 000 Distr. Piping Sys, HG
N07 25 000 Unused

N07 26 000 El Power Gen Systems
N07 26 100 Engine Generator Sets
  - Diesel
  - Gasoline
GENPLANT NMA/MC Emergency Generator Plant & Equipment

N07 26 200 Turbines

N07 26 300 Power Controls
TS/BPI-XXX Automatic Transfer & By-Pass Isolation Switch [600 to 2000 Amps]

N07 37 000 Uninterruptable Power Sources
N07 37 100 Static Charger, Battery
### Plumbing

**NO8 00 000** Plumbing Support

#### NO8 10 000 MFS: Sanitary Systems

- n = 1: Lavatory Equipment
- 2: Sinks
- 3: Main Waste Lines

#### NO8 20 000 Fresh Water System, Interior

- n = 1: Supplier Interface System
- 2: Cold Water Distribution System
- 3: Spare
- 4: Hot Water (1 to A)

#### NO8 30 000 Rain Water Drainage System

- 1: Fixtures
- 2: Rain Drainage
- 3: Seepage Drainage

#### NO8 40 000 Special Plumbing Systems

- NO8 41 000 Compressed Air
- NO8 41 100 Simple CA
- NO8 41 200 Special CA Applications
- NO8 41 300 Heavy Duty Pipe/Fittings for CA

- NO8 42 000 Industrial Gases
- NO8 42 100 Simple Gas Compressor
- NO8 42 200 Hose, Ind Gases
- NO8 42 300 P&F for IG

#### NO8 50 000 Special Kitchen Plumbing Systems

- NO8 51 000 K Plumbing Fixtures
- NO8 51 100 K Sanitary Eq.
- NO8 51 200 K/Restaurant Dispensers
- NO8 51 300 K/R Water Softeners

#### NO8 52 000 Laundry Plumbing Fixtures

#### NO8 52 100 L Washing Systems

#### NO8 53 000 Unassigned, Sp. Systems

#### NO8 54 000 Fire Suppression, Sp. Systems

### Heating, Ventilation & Air-Conditioning (HVAC)

**NO9 00 000** HVAC Systems

#### NO9 10 000 Heating Furnaces, Natural Gas (NG)

- NO9 A1 n00 Fan Coils

#### NO9 11 000 NG Supply System

- NO9 12 000 NG Piping Systems

#### NO9 13 000 NG Heating Equipment

- NO9 A1 D00 Unit Heater

#### NO9 20 000 Heating Furnace, Fuel Oil (PO)

- NO9 A1 B00 Unit Vents

- NO9 A1 C00 S2 Draw Thru
N09 21 000 PO Supply System
N09 22 000 PO Distr. System
N09 23 000 PO Heating Equipment
N09 30 000 HEATING FURNACES, LPG SYSTEMS
N09 31 000 LPG Supply System
N09 32 000 LPG Heating Equipment
N09 40 000 STEAM HEAT (FROM A CENTRAL SOURCE)
N09 41 000 Steam Heating & Processing Systems
N09 50 000 HEATED WATER (FROM A CENTRAL SOURCE): xxxxxxxxxxxxxxxxxxxxxxx
N09 51 000 HW Piping System
N09 60 000 EL HEATING SYSTEMS
N09 61 000 Baseboard Heaters
N09 62 000 Wall & Ceiling Heating Systems
N09 63 000 Industrial Heaters
N09 70 000 HEATING, SOLAR SYSTEMS
N09 71 000 Equipment, Solar Systems
N09 72 000 Piping, Solar Systems
N09 80 000 OTHER HEAT GEN. SYSTEMS
N09 90 000 COOLING GENERATION SYSTEMS
N09 91 000 Equipment, CGS
N09 92 000 Fixtures, CGS
N09 93 000 Interconnecting FS; CGS
N09 94 000 CGS Distr.
N09 94 n00 Pipe Fittings
   1: P&F
   2: Gate Valves
   3: Cooling Generation
   4: Circulator Pumps
N09 A0 000 HEATING & COOLING GENERATION SYSTEMS
N09 A1 000 Equipment, H&C
Ahu-clin Clinic Air-Handling Units
   AHU- 1 to 109
N09 A1 100 H&Z Multi-Zone
N09 A1 200 Dual Duct
N09 A1 n00 n = 3 to D

HWEI INTERIOR ELECTRICAL SYSTEMS,
HIGH VOLTAGE (>600 Volts)

N10 00 000 INTERIOR ELECTRICAL SYSTEMS, HIGH VOLTAGE
<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>N10 10 000</td>
<td>SERVICE &amp; DISTRIBUTION POWER</td>
</tr>
<tr>
<td>N10 21 000</td>
<td>POWER DELIVERY COMPONENTS</td>
</tr>
<tr>
<td></td>
<td>INTERIOR</td>
</tr>
<tr>
<td>N10 21 100</td>
<td>Circuit Breakers (CB); six CB's.</td>
</tr>
<tr>
<td>N10 11 000</td>
<td>MAIN FEEDER SWITCHES &amp;</td>
</tr>
<tr>
<td>N10 21 200</td>
<td>Safety Switches (5)</td>
</tr>
<tr>
<td>N10 21 300</td>
<td>Cncts/Relay/Sw, HV</td>
</tr>
<tr>
<td>N10 11 100</td>
<td>El.Power Panels</td>
</tr>
<tr>
<td>N10 11 200</td>
<td>Switches &amp; Disconnects</td>
</tr>
<tr>
<td>N10 11 300</td>
<td>Main Feed Controls &amp; Monitors</td>
</tr>
<tr>
<td>N10 11 400</td>
<td>Spare</td>
</tr>
<tr>
<td>N10 12 000</td>
<td>OVERHEAD SERVICE FEEDERS</td>
</tr>
<tr>
<td>N10 12 100</td>
<td>Cables</td>
</tr>
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<td>N10 12 200</td>
<td>Channels</td>
</tr>
<tr>
<td>N10 13 000</td>
<td>POWER PROTECTION EQUIPMENT</td>
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<td>N10 13 100</td>
<td>Switchgear, Mainframe (MSG)</td>
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<tr>
<td>N10 13 110</td>
<td>MSG - 1200 Amps</td>
</tr>
<tr>
<td>N10 13 120</td>
<td>Two primary 15 KV Switchgear Systems</td>
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<tr>
<td>N10 13 200</td>
<td>Overload Protection Systems</td>
</tr>
<tr>
<td>N10 13 210</td>
<td>Circuit Breakers, Branches &amp; Main Lines</td>
</tr>
<tr>
<td>N10 13 220</td>
<td>Fuze Protection, HV</td>
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<tr>
<td>N10 13 230</td>
<td>Spare</td>
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<tr>
<td>N10 13 300</td>
<td>Spare</td>
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<tr>
<td>N10 14 000</td>
<td>TRANSFORMERS, HV</td>
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<td>N10 14 100</td>
<td>Liq.Filled Tx's, &gt;600V</td>
</tr>
<tr>
<td>N10 14 200</td>
<td>Dry Txas, &gt;15000 V</td>
</tr>
<tr>
<td>N10 14 300</td>
<td>Dry Txas, 600V to 15K Volts</td>
</tr>
<tr>
<td>N10 14 400</td>
<td>Spare</td>
</tr>
<tr>
<td>N10 15 000</td>
<td>Spare</td>
</tr>
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<td>N10 16 000</td>
<td>Spare</td>
</tr>
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<td>N10 17 000</td>
<td>LIGHTNING PROTECTION</td>
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<td>N10 17 100</td>
<td>Switchgear, Indoor, &gt;600V</td>
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<td>N10 17 200</td>
<td>Spare</td>
</tr>
<tr>
<td>N10 18 000</td>
<td>POWER &amp; LIGHTING (P&amp;L) DISTRIBUTION</td>
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<td>N10 18 100</td>
<td>P&amp;L Indoor Switchgear, &gt;600V</td>
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<td>N10 18 110</td>
<td>Sw.s &amp; Recepticles</td>
</tr>
<tr>
<td>N10 18 120</td>
<td>O'load System</td>
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<td>N10 18 130</td>
<td>Spare</td>
</tr>
<tr>
<td>N10 18 200</td>
<td>P&amp;L Feeder Lines</td>
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<td>N10 18 210</td>
<td>Cables, 3 types</td>
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<tr>
<td>N10 18 300</td>
<td>P&amp;L Branch Wiring</td>
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<tr>
<td>N10 18 310</td>
<td>Branch Wiring, &gt;600V</td>
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<td>N10 18 400</td>
<td>Buss Duct</td>
</tr>
<tr>
<td>N10 18 500</td>
<td>Conduit EMT</td>
</tr>
<tr>
<td>N10 18 600</td>
<td>Spare</td>
</tr>
<tr>
<td>N10 19 000</td>
<td>SPECIAL INSTR. &amp; EQUIPMENT</td>
</tr>
<tr>
<td>N10 19 100</td>
<td>Usage Meters</td>
</tr>
<tr>
<td>N10 19 200</td>
<td>Spare</td>
</tr>
<tr>
<td>N10 19 300</td>
<td>Inverters, &gt;600V</td>
</tr>
<tr>
<td>N10 19 400</td>
<td>Rectifier, &gt;600V</td>
</tr>
</tbody>
</table>
N10 20 000 POWER SYSTEMS

N11 00 000 INTERIOR ELECTRICAL SYSTEMS, LV

N11 10 000 Service & Distribution Power, <600V

N11 11 000 Main Feeder Switching & Control Equipment

N11 11 100 Electrical Power Panels
  PANEL-01: 27 PANEL BOARDS
  PANEL-03: 25 "
  PANEL-04: 50 "
  PANEL-05: 48 "
  PANEL-06: 46 "
  PANEL-07: 02 "
  PANEL-08: 08 "
  PANEL-10: 09 "
  PANEL-11: 03 ANESTH. POWER CENTERS
  12 POWER CENTERS
  PANEL-12: 26 PANEL BOARDS

N11 11 200 Switches & Disconnects
  11 SWITCHBOARDS

N11 11 300 Main Pd Controls & Monitors

N11 11 400 Spare

N11 12 000 Overhead Service Feeders

N11 12 100 El. Cables

N11 12 200 El. Conductor Channels

N11 13 000 Power Protection Equipment

N11 13 100 Switchgear, Mainframe (3)

N11 13 200 Overload Protection Systems
  CB's and Fuzes

N11 14 000 TRANSFORMERS, LP (<600V)

N11 14 100 Tx, Liq

N11 14 200 Tx, Dry
  TX-01: 18 Transformers
  TX-02: 02 "
  TX-03: 06 "
  TX-04: 08 "
  TX-05: 02 "
  TX-06: 02 "
  TX-07: 00
  TX-08: 08 "
  TX-09: 03 "
  TX-10: 00
  TX-11: 00

N11 15 000 ?

N11 16 000 Spare

N11 17 000 LIGHTNING PROTECTION

N11 17 100 Indoor Switchgear

N11 17 200 Spare

N11 18 000 P&L Distribution

N11 18 100 P&L Control & Protection Eq.

N11 18 110 Power Sw. & Receptacles
n11 18 120 Lt Sw & Dimmers
n11 18 130 P&L overload System
n11 18 140 Spare
n11 18 200 P&L Feeder Lines
n11 18 210 El Cables
n11 18 220 Cable, Flex/Metallic
n11 20 000 POWER SYSTEMS, < 600V
n11 21 000 Power Delivery System (PDS) Components
n11 21 100 PDS Circuit Breakers
n11 32 400 HID LFs
n11 21 200 PDS Safety Switches [4 SS's;  1 LV Cartridge, 1 Plug Fuze)
N11 21 300 Cntcts, Relays, Switches
n11 21 310 Contactors/Relays
n11 21 320 Switch Wiring
n11 21 330 Transfer Switches
n11 21 340 Hmrg.Power Tx Switch
n11 51 600 Exit LFs
n11 32 700 Emerg. LFs
n11 21 400 Receptacles and Plugs
n11 21 410 Same

N11 32 000 INDUSTRIAL FIXTURES
n11 32 100 Incand. LFs
n11 32 200 Fluorescent LFs
n11 32 300 Quartz LFs
N11 32 500 Sodium Arc (NA) Lamps
N11 32 510 NA - HP (250 WATTS)
N11 32 520 NA - LP (200 WATTS)
N11 40 000 GROUNDING SYSTEMS
N11 41 000 El Service Ground
N11 42 000 Bldg Structure Ground
N11 43 000 Lightning Protection
N11 44 000 Computer System Ground
N11 45 000 Special Ground Systems
N11 50 000 APPL CONNECTIONS/POWER SUPPLIES
N11 51 000 Kitchen Fixtures
N11 51 100 Sanitary Equipment (Kitchen)
N11 51 110 Dishwashers, Residential
N11 51 120 Dishwashers, Commercial
N11 51 130 Pot/Cart Washer
N11 51 140 Waste Disposals, Residential
N11 51 150 Waste Disposals, Commercial
N11 51 200 Food Prep Appliances
N11 51 210 Blender/Pulpers
N11 51 220 Meat Slicer/Choppers
N11 51 230 Grinders/Tenderizers
N11 51 240 Meat Patty Makers
N11 51 250 Veg.Peeler/Choppers
N11 51 260 Mixers
N11 51 270 Coffee Grinder
N11 51 280 Coffee Maker
N11 51 300 El Cooking/Baking
N11 51 310 Convect. Ranges
N11 51 320 Microwave Oven
N11 51 330 Hot Top Range
N11 51 340 Stack Oven
N11 51 350 Spare
N11 51 360 El Grill/Griddle
N11 51 370 El Fry Pan
N11 51 380 El Deep Fat Fryer
N11 51 390 El Boiler/Steamer
N11 51 3A0 Sliced Bread Toaster
N11 51 400 Food Warmers (5)
N11 51 410 VI of Rotor & Field Coils
N11 51 420 VI of El Connections

n11 51 500 El Service Systems
<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>N11 22 430</td>
<td>PM of Motor Comp.s</td>
</tr>
<tr>
<td>N11 22 440</td>
<td>Repl of AC Motor</td>
</tr>
<tr>
<td>N11 22 500</td>
<td>Vent Fan &amp; Air Blower Drives</td>
</tr>
<tr>
<td>N11 23 000</td>
<td>Spare</td>
</tr>
<tr>
<td>N11 30 000</td>
<td>LIGHTING SYSTEM</td>
</tr>
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<td>N11 31 000</td>
<td>Office Lighting Fixtures</td>
</tr>
<tr>
<td>N11 31 100</td>
<td>Incandescents</td>
</tr>
<tr>
<td>N11 31 110</td>
<td>Light Standard, &lt; 150 Watts</td>
</tr>
<tr>
<td>N11 31 120</td>
<td>Flood Lamps, &gt; 150 Watts</td>
</tr>
<tr>
<td>N11 31 200</td>
<td>Spare</td>
</tr>
<tr>
<td>N11 51 510</td>
<td>Tray Conveyor</td>
</tr>
<tr>
<td>N11 51 520</td>
<td>Timers</td>
</tr>
<tr>
<td>N11 51 530</td>
<td>Spare etc.</td>
</tr>
</tbody>
</table>

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
Appendix C: Trial Applications I Through IV, Using Current MAMC-DPW Data Base Records

Examples of Best-Fit Eas Operations Network Configurations

<table>
<thead>
<tr>
<th>TRIAL</th>
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<th>EAS NUMBER FORMAT</th>
<th>PAGE</th>
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</thead>
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<td>II</td>
<td>PLUMBING</td>
<td>ZSMCT-NE0</td>
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<td>HVAC</td>
<td>ZSG-MC-NEE</td>
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<td>IV</td>
<td>INTERNAL</td>
<td>ZSMCT-YNE</td>
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<tr>
<td>V</td>
<td>ELECTRICAL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VI</td>
<td>SP.SYSTEMS</td>
<td>ZSMCO000</td>
<td>56</td>
</tr>
<tr>
<td></td>
<td>(Communications)</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>CONVEYANCES</td>
<td>ZSMCO000</td>
<td>57</td>
</tr>
</tbody>
</table>

TRIAL APPLICATION I:
SINGLE ZONE ANALYSIS,
UTILITY SERVICES EXAMPLE

ZSG-MC-NEP: Zones/Skills/Skill Category - System Category - Specific Class & Types of Systems - Specific System Type & Location/Specific System Unit/ Component List & Status.

07 0 00 000 Z = 0 (Single Zone); S = 7 (Utilities): Provides a record for the Total Utilities roll-up of costs or hours for all Zones and Utility Systems.

07 n 00 000 UTILITY SERVICES: RESPONSIBLE SOURCE (G)

07 1 Base Plant/Unit Generated Lighting Utilities
07 2 Base Plant/Unit Generated Electrical Heat & Power*
07 3 Base Stored Energy Systems
07 4 Base Natural Gas (NG) Base Distributions
07 5 Base Oil Fuel (OF) Distribution
07 6 Base Potable Water Systems Distribution
07 7 Base Non-Potable Water Distribution
07 8 Base Sewage System
07 9 Spare
07 A Supplier Provided Lighting Utilities
07 B Supplier Provided Electrical Power
07 C Supplier Provided Electrical Heating
07 D Supplier Provided Stored Energy Systems
07 E Spare
07 F Fuel Oil Heating Supplies
07 G Natural Gas Supplies
07 W or H Non-Potable Water System

* Asterix indicates the entry which is selected as the development example.
07 S or I  Sewage Support Systems (External)

For n(3rd level) = 2
072 00 000  Base Plant/Unit Generated Electrical Heating & Power (System Class)
072 00 00T  Plant/Unit Generated Electrical Heating & Power ___ Total Charges.

072 90 000  Base Steam-Plant/Unit-Generated Electrical Heating & Power

072 n0 000  Steam Plants, Heating/Power Generation
  For n(4) = 1:
072 10 000  Designates Steam Plant # 1.

072 1n 000  Class of Systems - Boilers
  n(5) = 1* to 8 [Gas-fired (GFB) to Dual Boiler (DB) systems].

072 11 000  Gas Fired Boilers (GFB)
072 11 00T  Total GFB Charges
072 11 n00  GFB System Types (n = 1 to 6)
  - All the Children of 072 11 00T.

For n(6) = 1:
072 11 100  GF Boiler System Type 1
  [Parent of 07 211 10(T/L)]
072 11 10T  Boiler System Type 1 - Charges for all 10 Type 1 Boilers
  (Parent of all 07 211 1n0 entries)
072 11 10L  Parts List for 07 211 000, Type 1, Boiler
  (No children)

072 11 1n0  The Specific Boiler System; Unit # n,
  n(7) = 1* to 10 (where "A" = 10).
072 11 11l  Description - List of Components
  (per inventory) for GFB Unit # 1.

072 11 110  Breakdown of Components for GFB Unit # 1
072 11 11n  Component-designation "n" for GFB Unit #1
TRIAL APPLICATION II:
SINGLE ZONE ANALYSIS
PLUMBING SERVICES EXAMPLE

Z S - M C T - N E 0:

Zones/Skills - Categories/Classes of Systems/Types of Systems - Specific Systems of Type T (for Loc.L)/Specific Equipment Unit #s/Spare

08 000 000 Z = 0; S = 8

(Pl Services);M = 0 (Categories of Pl Services): Provides a record for the Total Plumbing Services roll-up of costs or hours for all Zones and Plumbing Systems.

08 000 000

PLUMBING SERVICES: RESPONSIBLE SOURCES

08 000 000 Categories of Major Systems
08 100 000 Sanitary Systems*
08 200 000 Fresh Water System, Interior
08 300 000 Rain Water Drainage

+ 08 100 000 Sanitary Systems
08 1n0 000 Types of Pl Systems
08 110 Lavatory Fixtures*
08 120 Utility Sinks
08 130 Waste & Vent Systems
08 140 Water Supply, Sanitary System

+ 08 110 000 Lavatory Fixtures
08 110 n00 Type of Fixture (n = 1* to 8)

08 111 000 WC - Tankless (Fixture Type)
08 111 n00 Specific Type n - Model & Manufacturer
08 111 10T WC Type 1 Total Charge

08 111 1n0 Specific WC Fixture: Unit # n.
08 111 1nL Location (Bldg/Floor/Room)

* Asterix indicates the entry selected as the development example.
TRIAL APPLICATION III:
MULTI-ZONE ANALYSIS,
HEATING, VENTILATION & AIR CONDITIONING (HVAC) ; MECHANICAL

Z S G - M C - N F E: Zone/Skill/Skill-Subcategory - System Category/ System Class-
Specific System/Sp.Sys.Class/ Equipment Number & ID.

00 Z = 0; S = 0: Provides Total Maintenance Recorded Costs or Hours for all Zones/Skills/
Systems.
n0 Z = n; S = 0: Indicates entry is as above but only for Zone n (n = 1 to G).

N9 1 EXAMPLE FOR HVAC GENERAL SUPPORT:
(Top to bottom EAS Network track for Zone N):

N00 00 000 Total roll-up for Zone N, all shops and skills
N90 00 000 Total HVAC Roll-up for Zone N
N91 00 000 HVAC, General Support, Zone N

N91 10 000 Heating & Cooling Systems, Types Used
N91 11 00T Roll-up Station
N91 11 000 The Type of System - ID & Description
N91 11 001 Customer # 1 (User of Alpha-one, below)

N91 11 100 H&C Type & Plant Unit #, Alpha-one
N91 11 10T Roll-up Station
N91 11 110 Component Classification (motor/pump/--) for Alpha-one and EQUUM below.
N91 11 111 Component Plant ID Number (EQUUM).

N9 6 EXAMPLE FOR NON-PACKAGED AIR CONDITIONING SYSTEMS
(AC-N) IN ZONE N:

N80 00 000 HVAC for Zone N

ZSG MC 000
N96 00 000 HVAC/AC-N for Zone N (Skill Subcat.# 6)
N96 n0 000 AC-N; Type # n (Description)
N96 10 000 AC-N: Type # 1 (Mfr.& Model)
N96 10 00T Cost Roll-up Station for AC-N Type 1
N96 1n 000 All AC-N Type 1 Specific Systems - Unit # n
N96 11 00T Cost Roll-up for Subsystems of Unit # 1

ZSG MC NFE
N96 11 n00 AC-N Type 1/Unit 1 Subsystem (SS) # n
N96 11 10T Cost Roll-up Station for SS # 1 (Chiller A)
N96 11 1n0 Chiller A Section/Pump # n
N96 11 11T Cost Roll-up for Chiller A, Section/Pump # 1
N96 11 11n Pump # 1: Component # n (ID's name of comp; e.g., motor/impellar/plumbing
interfaces, etc.)
N96 11 111 Motor (Pump # 1) ID & Description
TRIAL APPLICATION IV
INTERIOR ELECTRICAL MAINTENANCE,
LOW VOLTAGE

Z S -M C T - Y N E: Zones/Skills - System Category/System Class/Type of System - T Subsys-

tems/Specific System/Specific Equipment for N.

00 Z = 0; S = 0: Provides Total Maintenance Recorded Costs or Hours, For All Zones, Skills and

Systems.

n0 Z = n; S = 0: Indicates entry is as above but only for Zone z, where z = 1- G.

0B 000 000 Interior Electric, Low Volt(<600Volts); IE Totals, All Zones (AZ).

OS M
0B 1 Service & Distribution Power, <600Volts
0B 2 Power Systems, <600V
0B 3 Lighting Systems
0B 4 Grounding Systems
0B 5 Power Supplies & Appliance Connections
0B 6 [Spare]
    Parent to all
0B 100 Service&Distr.Power, <600Volts, AZ. < ZB 100 000 entries

OS MCO
0B 110 Main Feeder Switching & Control
0B 120 Overhead Service Feeders, AZ
0B 130 Power Protection Systems, AZ
0B 140 Primary Transformer Systems, AZNo Children
0B 150 Spare
0B 160 Spare
0B 170 Lightning Protection, AZ
0B 180 P&L Distribution, Interiors, AZ
0B 190 Special Equipment, AZ

FOR Z = A:

ZS MCT 000
AB 110 000 Main Feeder Switching & Control Systems, AZ.
AB 110 00T El Power Panel Charges (Collection point)
AB 111 000 El Power Panels
AB 112 000 Switches & Disconnects
AB 113 000 Controls & Monitoring Devices

ZS MCT YNE
AB 111 n00 Type of Power Panel (n = 1 - 9)
AB 111 100 Type of Power Panel, Type #1
AB 111 1n0 Specific Panel Group & its Customer (n = 1 to G)
AB 111 110 Panel/Customer 1

AB 111 11n Specific Power Panel (EQNUM), n = 1 to G.
AB 111 111 Power Panel No. 1 (for Panel Type #1).
**TRIAL APPLICATION V**

**SPECIAL SYSTEMS, INTERIOR ELECTRICAL MAINTENANCE,**

**COMMUNICATIONS:**

Z S -M C T - Y N E: Zones/Skills - Category or Class of Systems/ System or Subsystem/Equipment/Parts ID.

<table>
<thead>
<tr>
<th>0C 000 000</th>
<th>Special Interior Electrical Systems; Total for all Zones.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0SM</td>
<td></td>
</tr>
<tr>
<td>0C1</td>
<td>Sound Systems*</td>
</tr>
<tr>
<td>0C2</td>
<td>Alarm Systems</td>
</tr>
<tr>
<td>0C3</td>
<td>Television Systems</td>
</tr>
<tr>
<td>0C4</td>
<td>Control Systems</td>
</tr>
<tr>
<td>0C5</td>
<td>Omitted</td>
</tr>
<tr>
<td>0C6</td>
<td>Clock &amp; Program Systems</td>
</tr>
</tbody>
</table>

| 0S MC      |                                                          |
| 0C 100     | Sound Systems                                            |
| 0C 110     | Telephones*                                              |
| 0C 120     | Intercoms                                                |
| 0C 130     | PA Systems                                               |
| 0C 140     | Radio Communication Systems                              |
| 0C 150     | Audio Signalling Systems                                 |
| TBS        |                                                          |

* Asterix indicates the entry which will be selected as the development example.
TRIAL APPLICATION VI:
CONVEYANCES & OTHER SPECIAL EQUIPMENT

Z S - M C T - Y N E: Zones/Skills - Category/Class of Systems/Type of System or Subsystem/Equipment Unit.

0D1 Human Conveyances*
0D2 Message/Data Conveyances
0D3 Freight/Bulk Conveyances
0D4 Spare
0D 100 Human Conveyances
0D 110 Elevators/Lifts
0D 120 Escalators
0D 130 Crawl-Space Transport Vehicles*
0D 200 Data Conveyances
0D 210 Pneumatic Tubes
0D 220 Automated Box Conveyors (ABC)
0D 300 Freight Conveyances
0D 310 Freight Elevators
0D 320 Automated Transport System (ATS)

* Asterix indicates the entry which will be selected as the development example.
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