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THESIS

A DUES MANAGEMENT EXPERT SYSTEM FOR
INVENTORY MANAGERS AT RETAIL STOCK POINTS

by

Albert F. Potwin

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Advisor:	A.W. McMasters
Co-Advisor:	T.R. Sivasankaran

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A Dues Management Expert System for Inventory Managers at Retail Stock Points

by

Albert F. Potwin
Captain, United States Marine Corps
B.S., Seattle Pacific University, 1982

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ABSTRACT

The job of the retail inventory manager at Navy Stock Points is complex and labor intensive. The inventory manager deals with a vast array of information in the form of reports from the Uniform Automated Data Processing - Stock Point (UADPS-SP) system. Because the responsiveness of the Navy Supply System depends upon the effectiveness of inventory managers, Navy Stock Points must find a way to process their ever increasing information workloads more efficiently than before. Improvements in productivity and training are feasible through the application of "expert systems" technology. This thesis presents the continuation of the design and development process of an expert system for the task of Delinquent Dues Processing. The area of retail inventory management dealing with System Cancellations Processing was also implemented to establish a more complete Dues Management System. The resulting revised prototype presents a system with more problem solving capabilities and a more natural "user friendly" interface.

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I. INTRODUCTION

A. BACKROUND

The job of the retail inventory manager at Navy Stock Points is very demanding. The position is complex and labor intensive. The inventory manager is tasked with managing a large number of individual National Stock Numbers (NSNs). One of the major goals of the job is to minimize the response time to fleet customers. The efficient and effective management of the NSNs under his or her control is vitally important to the ongoing support of those fleet customers.

The daily routine of the inventory manager may require liaison with a number of different agencies. These include the Defense Logistics Agency (DLA), the General Services Administration (GSA), the Navy Ships Parts Control Center (SPCC), the Navy Aviation Supply Office (ASO), or any number of ICPs of other services, each with some unique procedures that requires a thorough understanding by the inventory manager. [Ref. 1:pp. 7-8]

In addition to this external environment, the inventory manager deals with a vast array of information in the form of reports from the Uniform Automated Data Processing - Stock Point (UADPS-SP) system. There are also a number of

local reports, listings and manual aids which must be mastered for the position.

At the present time there is no formal school for inventory managers. The acquisition of sufficient knowledge to perform adequately is a laborious process which normally requires several years of on-the-job training and close managerial supervision [Ref. 1:p. 8]. This training is essential for inventory managers to be able to make complex decisions based on specialized skills.

The Naval Supply Systems Command (NAVSUP) recognized this difficulty in achieving and maintaining the high skill levels required of inventory managers to perform their jobs. They subsequently sponsored thesis research in expert system development. It was the initial thought that improvements in productivity and training was feasible through the application of expert system technology. Expert systems, also known as knowledge systems, use human knowledge and experience to solve problems that could otherwise be solved by an expert in a reasonable length of time. These expert systems enhance productivity by making this expertise available to others, helping them make decisions and solve problems effectively.

Because the responsiveness of the Navy Supply System depends upon the effectiveness of inventory managers, the efficient organization and management of information technology is imperative. Navy Stock Points must find a way

to process their ever increasing workloads more efficiently than before. The integration of expert system technology with existing hardware and information assets can greatly assist the inventory manager in dealing with these increased workloads.

B. THESIS OBJECTIVE

NAVSUP is sponsoring this research to investigate the feasibility of the implementation of a full-scale expert system for inventory management at retail stock points. The project was initially divided into three areas of research. The first was the identification of inventory manager tasks that would provide the most benefit from expert system technology. Upon this identification, the next stage was to develop a basic prototype expert system. Further research would then be necessary to improve the design, add more problem solving capabilities and to expand expert systems technology into other areas of retail inventory management.

The identification of inventory manager tasks and the formulation of initial knowledge factors and decision rules was completed in December, 1986 [Ref. 1]. The development of a basic prototype expert system implementing details of delinquent dues processing and variable ranking lists was completed in March, 1987 [Ref. 2]. The objective of this thesis was to continue the design and development process of the expert system prototype and to improve the user

interface. Subsequent theses are expected to further expand expert system technology into other areas and to concentrate on the integration of this technology with existing computer hardware and data base assets.

C. SCOPE

This study concentrated on expanding the problem solving capabilities of the initial prototype expert system dealing with delinquent dues processing. A revision of the delinquent dues knowledge base was included in the expanded system. The area of retail inventory management dealing with system cancellations status was implemented to establish a more complete Dues Management system.

D. PREVIEW

Chapter II starts with a brief overview of the historical backround of expert systems. It then is followed by a discussion of basic concepts and techniques that support the development of expert systems. These include attributes of knowledge-base programming, human problem solving, knowledge representation and a discourse of languages and tools.

Chapter III explains the fundamental concepts of Dues Management. This includes an overview of Delinquent Dues Processing and System Cancellations Processing. Both the initial prototype and the revised Dues Management expert system are explained. The chapter is concluded with sample

consultations that review the logic and structure of the system. Chapter IV provides a brief summary, conclusions and recommendations for further research.

II. EXPERT SYSTEMS

A. HISTORICAL BACKROUND OF EXPERT SYSTEMS

Computers were initially developed to carry out complex numerical computations. This resulted in large computers that were very fast calculating machines. Some scientists, however, explored the ability of computers to manipulate non-numerical symbols. Individuals were interested in areas such as human problem solving and sought to develop computer programs with the capacity to simulate human behavior. This interest in both symbolic processing and human problem solving has formed an interdisciplinary subfield of computer science call Artificial Intelligence (AI). [Ref. 3:pp. 2-3] The basic concept of AI is that of a computer system that produces results normally affiliated with human intelligence.

In the area of AI, many computer scientists are conducting research to determine what kind of things computers can be made to do. In the initial stages of research, people were not concerned with commercial application of their work. Within the last ten years, however, AI research results have indicated that many concepts and techniques developed in AI laboratories have great commercial value. These areas include natural

languages, robotics, improved human interfaces, exploratory programming and expert systems. [Ref. 4:p. 4]

Expert systems have received the most attention of any commercial activity resulting from AI research. Expert systems are so called because they function as effectively as human experts at a highly specialized task. They are also called knowledge-based systems since they rely on reservoirs of knowledge. A more detailed definition is [Ref. 3:p. 5]:

> **...an intelligent computer program that uses knowledge and inference procedures to solve problems that are difficult enough to require significant human expertise for their solution. Knowledge necessary to perform at such a level, plus the inference procedures used, can be thought of as a model of the expertise of the best practitioners of the field.**
>
> **The knowledge of an expert system consists of facts and heuristics. The "facts" constitute a body of information that is widely shared, publicly available, and generally agreed upon by experts in a field. The "heuristics" are mostly private, little-discussed rules of good judgment (rule of plausible reasoning, rules of good guessing) that characterize expert-level decision making in the field. The performance level of an expert system is primarily a function of the size and the quality of a knowledge base it possesses.**

B. ATTRIBUTES OF KNOWLEDGE-BASE PROGRAMMING

Knowledge-base systems are highly interactive. In a conventional program, if a nonprogrammer stopped the execution of the program and examined the code to see what was happening, he or she would not be likely to learn anything. In an expert system program by contrast, a user

can halt processing at any time and ask why a particular question is being pursued or how a conclusion was reached.

Other areas of contrast between expert systems and conventional programs as listed in Harmon-King, [Ref. 3:p. 8] are as follows:

- **The task performed by the expert system was previously performed by a human specialist.**
- **Knowledge engineers and experts maintain knowledge systems. Conventional programs are maintained by programmers.**
- **The knowledge base of an expert system is readable and easy to modify.**
- **Conventional programs tend to rely on algorithms to provide their overall structure, whereas knowledge systems tend to rely on heuristics for their structure.**

Individuals involved with the development of an expert system use highly interactive techniques. They meet frequently with the expert. They implement a small prototype, test the prototype to see how it works and then return to the expert to ask more questions. This interactive approach also assists in convincing the experts that their knowledge can be represented in a working system.

C. HUMAN PROBLEM SOLVING

1. Information processing

An information processing model of human mental activity consists of a perceptual system, a cognitive system, and a motor system. In the perceptual system, external stimuli are the input for the human information

processing system. These stimuli enter through sensors, such as eyes and ears. The cognitive processor cycles periodically as it obtains information from the sensory buffers and transfers it to working memory. This working memory could also be described as short-term memory. Long-term memory corresponds to a large number of stored symbols with a complex indexing system. Related symbols are associated with one another. A human thinks of a symbol in memory and then associates other related symbols that are activated in response to that symbol. The output of the human information processing system is the motor system. Motor processors initiate actions of muscles and other systems. This results in some observable activity. [Ref. 3:pp. 22-25]

2. Problem solving

Problem solving can be defined as the process of starting in an initial state and searching through a problem space in order to identify the sequence of operations or actions that will lead to a desired goal. Humans process information to assist in this technique.

Problem solving is a mental activity. It usually means thinking about how to solve problems that a person does not know how to solve at the onset. Humans solve problems easily because they have stored experience that they can use to simplify a problem. They can consult knowledge sources and as a result immediately dismiss many

logical options. Complex problem solving becomes a matter of determining what knowledge is needed in order to be able to reduce a large ill-structured problem to a more manageable size. [Ref. 3:pp. 29-30]

3. Types of Knowledge

Compiled knowledge means information that is organized, indexed, and stored in a way that is easily accessed. This compiled knowledge is readily usable for problem solving. Compiled knowledge is gained in two ways. First, subjects may be studied formally as in a school lecture situation and from reading books. This type of knowledge is also referred to as deep knowledge. A second way to compile knowledge is by experience or by learning from a mentor. This is also called surface knowledge. This knowledge compiled from experience results in heuristics. Heuristics are rules-of-thumb that allow experts to reduce problems to a manageable size.

An expert is a person who possesses both surface and deep knowledge. A general definition of an expert is an individual who is widely recognized as being able to solve a particular type of problem that most other people cannot solve nearly as efficiently or effectively. Most expert systems include only surface knowledge which is very domain specific. The nature of surface knowledge composed of heuristics and facts tend to prune a problem to a manageable size. [Ref. 3:pp. 31-33]

D. KNOWLEDGE REPRESENTATIONS

Knowledge refers to a body of information that is organized to be useful. A knowledgeable individual not only knows a lot of facts about a subject, but can use that information to analyze problems and make judgments. The following are major strategies for the representation of knowledge:

1. Semantic Networks

A semantic network or semantic net is a collection of objects called nodes connected together by arcs or links. Nodes are used to represent objects and descriptors. Objects can be physical objects or conceptual entities. Descriptors provide information about objects. Links are used to relate the nodes. Common links include:

- Is-a: represents instance relationship
- Has-a: Represents property relationship
- "Verbs": To capture other heuristic knowledge (e.g., caused-by, reports-to, segregated-by)

Figure 2.1 illustrates a portion of an inventory manager's knowledge of delinquent dues represented as a semantic network.

2. Object-Attribute-Value

The Object-Attribute-Value (O-A-V) is a special case of semantic nets (some nodes are objects, some others are values, and attributes are represented by arcs). As in

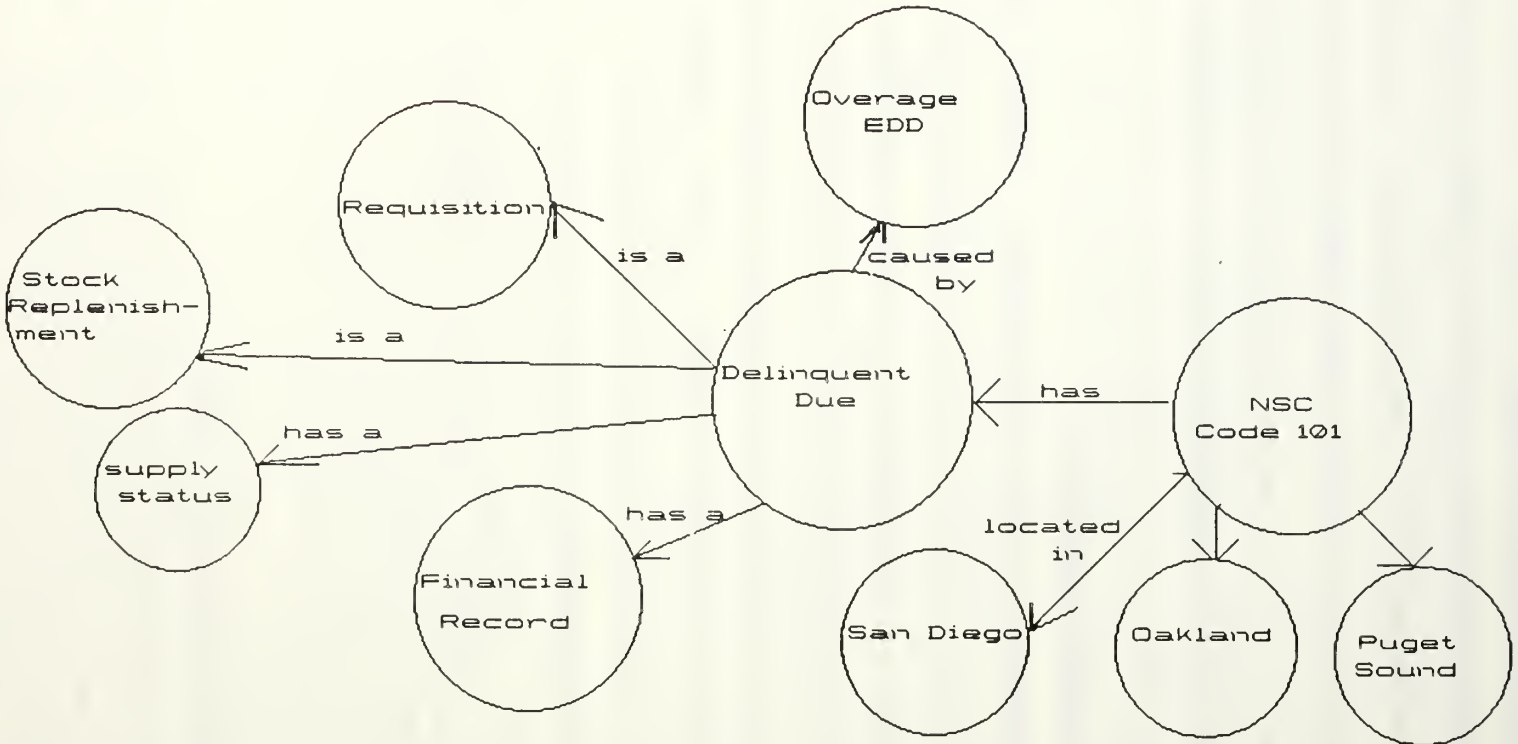

Figure 2.1 Delinquent Due Semantic Net

semantic nets, objects are related. Figure 2.2 is an example of the (O-A-V) concept.

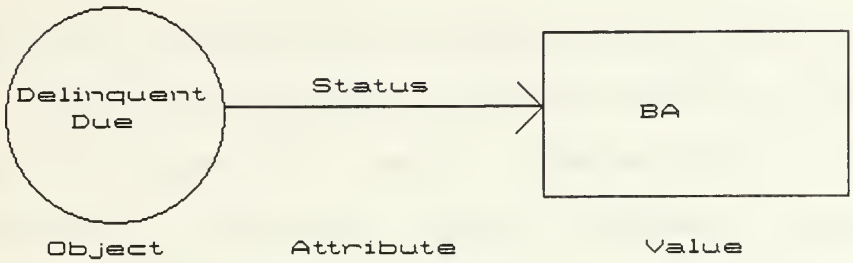

Figure 2.2 (O-A-V)

3. **Rules**

Rules are used to represent relationships. The basic syntax of a rule is as follows:

If (one or more if-clauses connected by and, or, not) **PREMISE**

Then (one or more then-clauses connected by and, or, not) **CONCLUSION**

If X can be established to be TRUE
Then put Y in working memory

Certainty factors can be attached to rules. If the conclusion based on a premise is less than definite, a certainty factor of less than 1 would be appended. For example:

Premise: If X can be established to be TRUE

Conclusion: Then put Y in working memory (cf .7)

This certainty factor allows the possibility of multiple system recommendations with an associated degree of confidence attached.

4. Frames

A frame is a description of an object that contains slots for all of the information (facts and rules) associated with the object. Slots, like attributes may store values, or default values. Slots can be declarative to simply assert that a fact is true. Slots can also be procedural representing a fact that is indeed a set of instructions to be carried out. The advantage of frames is that they are dual semantic (both declarative and procedural) which makes the system easier to trace and maintain. [Ref. 3:p. 44] Figure 2.3 is an example of a frame.

E. LANGUAGES AND TOOLS

Most high level languages are best suited to specific applications. The two high level languages most commonly used for AI programming are LISP and PROLOG. There are also very high level programming languages that are used to develop very specialized applications. In the area of expert system development these languages are known as

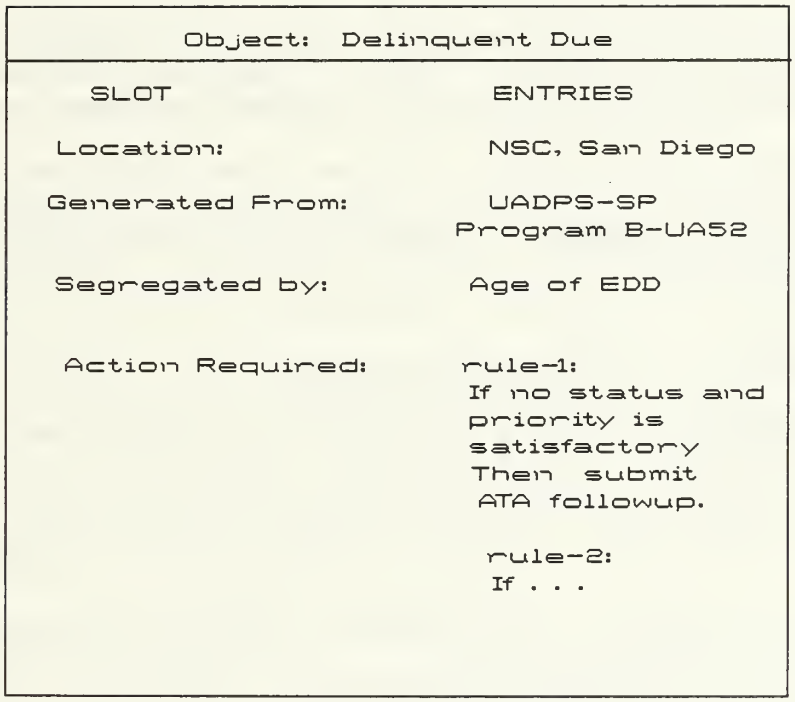

Figure 2.3
Frame of Delinquent Due

expert system building tools. Expert systems can be written in high-level languages like LISP or PROLOG. For speed and convenience, however, most expert systems are developed by entering knowledge into an expert system building tool. [Ref. 4:pp. 29-31]

Symbolic languages such as LISP and PROLOG manipulate knowledge as opposed to conventional languages which manipulate numbers. Knowledge implies a relationship between pieces of information and it is this knowledge that allows a person to make a decision. Symbolic languages are therefore good for programming logical problems. They allow the programmer to manipulate knowledge more easily.

Early large expert systems were developed in LISP. LISP deals with symbols. Primarily these symbols are alphanumeric strings. Computing is done with these symbolic expressions rather than numbers.

PROLOG (PROgramming in LOGic) implements a simplified version of predicate calculus. When you write a PROLOG program you are programming in logic. An element of PROLOG called procedural programming considers the specific problem solving behavior the computer will exhibit. Most knowledge engineers building expert systems concentrate on procedural details of PROLOG. [Ref 4:P. 36]

Languages are more flexible than tools, however, languages are also much more time demanding to use in building an expert system. It requires a well trained

programmer to build a knowledge system using AI languages such as LISP or PROLOG. Even nonprogrammers by contrast can use many tools to build small useful expert systems.

Many expert system development tools are commercially available. The major categories of the current crop of commercially available tools are as follows:

- **Inductive Tools:** Inductive tools generate rules from examples. A developer enters a large number of examples for the machines data base. To make a recommendation, the tool uses an algorithm to convert the examples into a rule. These tools are good for simple tasks, but cannot be used to develop complex knowledge representations.

- **Simple Rule-Based Tools:** These tools use if-then rules to represent knowledge. They run on personal computers and are good for systems containing less than 500 rules.

- **Structured Rule-Based Tools:** Structured rule-based tools offer features like context trees, multiple instantiation, confidence factors, and more powerful editors.

- **Hybrid Tools:** Hybrid tools represent the most complex expert systems development environment currently available. They are designed to build systems that contain 500 to several thousand rules. They are very powerful; however, they are justified only when the target problems are complex enough to be worth the cost and effort of development.

- **Domain Specific Tools:** These tools are specifically designed to be used only to develop expert systems for a particular domain. They allow development of an expert system in a particular domain considerably faster than the tools listed above. [Ref. 4:pp. 47-48]

A major concern when selecting a tool is the ability to identify the proper problems within an organization where an expert system would be most valuable. An expert system

developer must learn to analyze expertise and convert this knowledge into a form that tools can use.

F. DEVELOPING EXPERT SYSTEMS

1. Knowledge Engineering

A knowledge engineer works with a human expert to identify and refine the knowledge needed to solve a particular type of problem. He obtains information from a human expert during detailed interviews and then works with the expert to study the system. Finally, he determines how to improve the system. The three major tasks of the knowledge engineer are knowledge acquisition, knowledge modeling and knowledge encoding. [Ref. 4:p. 163]

Knowledge acquisition includes all activities in obtaining information from experts. It is the transferring of problem-solving expertise from some knowledge source to a program. Knowledge engineers work with experts throughout the entire development process, constantly acquiring new knowledge and integrating it into the system.

Knowledge modeling is the process of organizing the information acquired from experts. This process becomes increasingly more important as the size of the expert system grows.

Knowledge encoding is the process of actually entering facts, rules, objects and relationship information into an expert system. In the case of using an expert

system tool, this involves specifying the knowledge in the syntax of the particular tool.

All three of these functions require close contact with the human expert. It is this prolonged interaction with the human expert that distinguished knowledge engineers from conventional computer programmers.

2. Phases of Expert System Development

Harmon, Maus and Morrissey [Ref. 4] suggest seven phases of expert system development. Those phases can be summarized as follows:

a. Front End Analysis

This is the phase where selection of the appropriate problem the system will resolve is made. The establishment of management support is critical in this phase. Selection of what personnel will be employed on the project is also determined at this time. The project team must determine if the task is appropriate for expert system development. It is important to clearly define the goals of the system. In other words a clear statement of what the expert system is supposed to do is needed. This is required to provide information to use as a benchmark of comparison for the eventual development of the prototype system.

b. Task Analysis

This phase begins by studying how the target task is currently performed. Meetings are held with human experts to develop criteria to ensure that the resulting

system is successful. It also includes a study of how the new system would best fit into the organizational environment.

c. Prototype Development

In this phase a small version of the expert system is developed to demonstrate the overall feasibility of the proposed system. The information gathering strategy is finalized and coordinated with software and hardware requirements of the system. The knowledge engineer starts to identify and document the reasoning process of the human expert. This phase allow experimentation with a scaled-down version of the system and the anticipation of possible problems when the full-scale development is started.

d. System Development

The majority of knowledge is added to the system in this phase. The user interface is tailored and the system's performance is monitored and compared to established benchmarks. Rules that embody the human experts knowledge are refined by reorganizing the knowledge in the knowledge base.

e. Field Testing

The system must be tested in the user environment again by comparing its operation against established benchmarks. In this phase the system is modified and polished until it performs as desired. The prototype continues to be checked against the human expert.

A common method of testing is to give a problem to the human expert and to the expert system and compare the results. Any needed major modifications are performed during this phase.

f. Implementation

This phase is where the expert system is fielded in a real-world user environment. User acceptance in this phase can dictate success or failure. An expert system is useless if people don't use it. Implementation plans should be well organized and offer full training support and documentation.

g. Maintenance

Maintenance of an expert system is never complete; it continues for the life of the system. New information might require the reformulation of the knowledge base. The system must be continually revised and updated.

III. DUES MANAGEMENT

A. INTRODUCTION

Navy inventory managers at retail stock points are responsible for managing a large number (often 2000-3000) of individual National Stock Numbers (NSNs) to meet customer demand from a specific geographic area. The inventory manager's responsibility may encompass a wide range of cognizance symbols, or "cogs", the supply system's indicator of the particular NSN's ICP and material type [Ref. 1:p. 7]. In order to properly manage these cogs, inventory managers may be required to liaison with numerous defense supply agencies and hence to know the unique procedures required by each agency [Ref. 2:p. 21].

Replenishment is an essential part of the management of a NSN. This replenishment is the process of the inventory manager reordering new stock to replace that which has been issued. The item manager is responsible for ensuring that assets are arriving in the logistics pipeline to replace issues to fleet customers. One of the goals of retail stock points is to minimize their response time to fleet demands. Replenishment is therefore a critical concern of inventory managers in meeting those fleet demands.

Requisitions for replenishment stock which have not yet been received are known as dues, because they are "due-in"

at some future time. The effective management of dues is a complex process that requires a thorough understanding of many factors that influence overall replenishment control. The validity of outstanding dues is a continual concern of the item manager. The purging of no longer valid requisitions for stock helps ensure improved customer support and accurate financial records. Carrying requisitions as outstanding when the material will never be received, needlessly ties up scarce stock fund dollars. A combination of factors such as the category of the due, dollar value of the material, and status age may indicate that the due is no longer valid and should be cancelled. [Ref. 1:p. 14]

A goal of this thesis is to develop prototype improvements for the system developed by Schill [Ref. 2]. Schill's system demonstrated the basic feasibility of integrating expert system technology with the retail stock point environment. This study continues to research the design and development of expert systems by adding more problem solving capabilities and improving the user friendliness of the prototype.

This chapter begins with an overview of the dues management techniques of delinquent dues processing and system cancellations processing. It then discusses the initial expert system prototype developed by Schill. Finally, the resulting revised dues management expert system

developed as a result of this thesis is presented and discussed.

B. DELINQUENT DUES PROCESSING

The delinquent dues listing is generated from the UADPS-SP program B-UA52. It is a monthly report which is manually reviewed by the item manager. The report is segregated by age categories which are determined by the most recent estimated delivery date (EDD). This date is a revised EDD or the original EDD if a revised date has not been received. The age group categories (AGC) are defined as follows:

CATEGORY	DAYS OVERDUE
1	1-30
2	31-60
3	61-90
4	91-120
5	121-180
6	180-UP

The item manager must focus his/her attention on dues in the older categories. Those dues in categories 1 and 2 usually have not received enough supply system response time to be of concern. In practice they are not normally reviewed.

The item manager, in processing the delinquent dues listing, attempts to classify the requisition as an invalid due when a combination of factors such as age and supply status convinces him/her that further efforts to expedite the document will be futile. There are no documented criteria to determine exactly when this point has been

reached. The rule base of the expert system prototype attempts to capture the thought process and decision rules used by the expert in dealing with the information about a specific delinquent due.

The initial step in processing the delinquent due listing is to obtain the latest supply status on the outstanding due. Status information is available from several sources. Status can be obtained from a UADPS-SP Receipt Due File real time query. DLA remote terminals provide the latest status for 9 cog items managed by DLA ICPs [Ref. 1:p. 18]. These are separate terminals with communication links to DLA activities and are not part of the UADPS-SP system.

If recent supply status is available, a number of questions and decisions are possible. These questions and decisions are very much dependent on what that status is. BA status or AS status is good news as long as the status is not over-aged. BA status means the item is available and is being processed for shipment. AS status means that the item has been shipped. If the item manager determines the requisition to be over-aged, an AF1 follow-up request is submitted.

If a follow-up has been previously submitted and an appropriate amount of time has elapsed with no response, the item manager determines the due to be invalid. At this point financial information is required prior to a decision

being made on this particular due. A Z67 record, obtained from a UADPS-SP retrieval, provides this financial information.

The status of funds in accounting ledgers provides valuable information to the item manager in the formulation of a decision. The Obligations, Accounts-payable, and Material in Transit (MIT) accounts are mutually exclusive fund categories. Each category has a specific meaning, in combination with other factors, for the item manager reviewing the requisition.

When the status received is other than BA or AS, the status of funds becomes a key factor. If the funds are in Obligations, it means that the material has neither been received nor billed. If funds are in Accounts Payable, it means the material has been received, but a bill for the material has not. If funds are in MIT, it means that a bill has been received and paid without a matching receipt of stock. The most likely conclusion for funds in MIT is that the actual shipment will never be received.

If recent shipping status is received in response to a follow-up, a revised EDD is normally received also which will cause the document to drop off the next delinquent dues listing.

If partial or substitute shipments have been provided more complications arise. Partial shipments (indicated by a suffix code at the end of the document number) often leave

the stock point with more or less than what was originally ordered. A greater quantity can be received when the same document is inadvertently passed to two different activities. Care is required in cleaning up these partial and substitute shipment dues.

A report of discrepancy (ROD) is sent to the shipping activity to request financial credit for non-received material. A $100 threshold determines whether the stock point finds it worthwhile to process a ROD. If the item is classified, pilferable, or controlled, a ROD is prepared, regardless of dollar value. Further research including a spot inventory is always called for when sensitive material is missing. A spot inventory involves an actual physical count of the NSN under consideration at the stock point warehouse location. A spot inventory may show that the material was received, but the receipt was not processed. With noncontrolled material valued at less than $100, the final action is to "store to zero" which means that the requisition is cleared from financial files by recording its receipt with a zero quantity. This action has the effect of automatically cancelling the due.

C. SYSTEM CANCELLATIONS PROCESSING

System cancellations occur when the supply source that the document was passed to, rejects the requisition for a reason specified in the cancellation status. System

cancellations are handled by processing individual supply status cards with a variety of reasons for system rejection. For the most part this includes gathering information inherent to a specific cancellation status and making a decision, based on that information, as to the appropriate action to be taken.

CG status is received when the supply source activity is unable to identify the requested item. This occurs when an invalid NSN is furnished on the requisition. The process of evaluating this status includes verifying that the correct NSN was ordered and if the NSN on local files is correct. Action is based on the outcome of this verification and, if the item is still required, based on demand. If the NSN is determined to be invalid, it should be deleted from local files. If the NSN is valid, a new requisition should be submitted if the item is still required based on demand.

CJ status means the item has been coded (or is being coded) obsolete or inactivated. If the item in the stock number field is different from the item requested, this means the new NSN can be furnished as a substitute. If the original item is desired only (no substitutes are acceptable) then a new requisition should be submitted citing a 2B advice code. A 2B advice code means "do not substitute". Additional research may be required to determine why a demand based stock item has been coded obsolete.

CA status normally comes with a narrative message stating the reason for rejection. This message should be reviewed to determine further action. The most frequent case when this status is received is that the NSN on local files is invalid and should be deleted.

CS status means that the supply source activity is unable to procure the item ordered, that no substitute or interchangeable item is available. This status is not normally pursued further at the retail stock point level. It is usually recommended that the fleet activity seek procurement by building a kit or ordering the next higher assembly. Fabrication or cannibalization is also a possible course of action and is recommended in cases when the item cannot be procured.

CE status is received when the unit of issue ordered does not agree with the ICP specified unit of issue and cannot be converted. This status requires research to verify the correct unit of issue.

The handling of system cancellation status, at first glance, seems fairly straight forward. It is possible, however, for a complex combination of factors to play a significant role in determining the correct item manager action. System cancellations are therefore a substantial concern in the overall view of dues management.

D. INITIAL DELINQUENT DUES PROTOTYPE

Knowledge acquisition for the initial delinquent dues expert system prototype was accomplished through the research efforts of Westfall [Ref. 1]. The basic decision rules were written to be used in the development of a prototype expert system.

With the decision rules developed, the next objective was to refine those rules and to design and develop an expert system prototype for delinquent dues management. This prototype was developed by Schill [Ref. 2] using the Arity/Expert Development Package.

The prototype was tested by the experts at NSC San Diego who provided the initial knowledge for the system. The expert system conclusions were compared to conclusions derived manually. Reasoning processes were reviewed and analyzed to ensure that accurate conclusions were being derived by the expert system.

It was found that the system displayed language was not very "user friendly". It was determined that this problem could be corrected by more extensive use of system control options.

E. REVISED DUES MANAGEMENT PROTOTYPE

This thesis continued to research the design and development process of this expert system prototype. An emphasis on improving the "user friendliness" of the system

was initiated. Prototype revision techniques, which include the reformulation of concepts and redesign of representations by adding more solving capabilities to the previously developed prototype, were also examined.

The prototype developed in reference 2 was translated into the syntax required for the M.1 Knowledge system software tool. M.1 can be learned and put to effective use in a relatively short time. M.1 can also be interfaced to existing software such as database management systems and communication networks. It is easy to update and modify the M.1 knowledge base syntax. The system user interface of the M.1 Knowledge system is much more user friendly than other expert system tools. For these reasons the M.1 Knowledge system was chosen to further develop the initial prototype.

The prototype was expanded to include additional questions and rules as the result of a verification process with expert inventory managers at NSC, San Diego. It was determined that many of the rules were recommending inaccurate conclusions which were not exactly correct across the entire spectrum of age group categories (AGC). To solve this problem more rules were added which provided improved recommendations for courses of action.

In an effort to develop a more complete dues management package, an additional module covering system cancellations status was added to the system. This module deals with CG, CJ, CA, CS, Ck and CE status. The first question the system

asks a user during a consultation is which module is desired with Delinquent Dues Management and System Cancellations being the two responses.

The user interface was greatly improved with the development of a more functional menu driven system. The computer monitor screen is divided into three major windows. One window displays system responses during a consultation. This is where explanation clauses and system conclusions are displayed. One window displays the system questions and another displays the possible responses. The user selects answers to questions with the keyboard cursor. No typing of answers to questions is required. The system takes full advantage of color monitors. These features combine to produce a much more friendly interface environment.

Another major addition to the expert system was the inclusion of explanation clauses to all system rules. The system is attempting to verify the premises of a rule during a consultation process. In doing so, a series of questions are asked to determine if a rule is true so a conclusion can be recommended. At anytime the user can ask why a certain question is being asked and the system will give a plain English explanation of the current rule being envoked. This feature greatly assists in the clarification of the system's reasoning process.

It was also decided that more descriptive system recommendations were required. The original prototype, for

example, would recommend "conclusion = ama". The revised system gives a complete sentence; "conclusion = Send an AMA document modifier to raise the priority".

Appendix A is a complete listing of the revised Dues Management Expert System. The file contains all system questions and rules with their corresponding explanation clauses. Appendix B is a working users' manual for the expert system presented in Appendix A.

F. SAMPLE SYSTEM CONSULTATIONS

M.1 allows the user to save a hard copy of a consultation for later review. This copy lists all system generated questions, user responses to questions, any explanation clauses envoked and the system conclusion generated during a consultation. This information is valuable in reviewing the system reasoning process.

Three sample consultations of the Dues Management Expert System are listed below. For these, the explanation clause feature was frequently envoked using the WHY command. The WHY command is executed by the user at any time he wishes to know why a certain question is being asked. After each consultation, the rule that determined the conclusion is listed along with the corresponding explanation clause. In the following examples, the label U: refers to a user supplied command or response. The label S: refers to a system generated question or response. These labels are not

provided by the system, but have been added manually to assist in following the sequence of the consultation process. The confidence factors (cf) are automatically appended by the system. The default value is cf 100 unless the user specifies a lower factor in answering a question.

U: go

S: Which Module of Dues Management do you want to work with?

U: 'Delinquent Dues' cf 100

S: What is the supply status?

U: why

S: When no status has been received and the priority is determined to be not satisfactory, an AMA document modifier is used to upgrade the priority and to establish a requisition if ICP has no record of it.

S: What is the supply status?

U: ba cf 100

S: Is the age of the most recent supply status more than 30 days or less?

U: more cf 100

S: Has a follow-up been previously submitted?

U: why

S: When BA status has been received, and the status age is more than 30 day old and no follow-up has been sent (or if it is not known if a follow-up has been sent) then you should send an AF1 follow-up to request updated status.

S: Has a follow up been previously submitted?

U: yes cf 100

```
S: Has a revised/extended EDD been received?

U: no cf 100

S: Is the material classified,pilferable, or controlled?

U: why

S: If BA status is over 30 days old with no revised/extended
   EDD received, the material is classified, pilferable or
   controlled and the category of the due is 3 or higher
   then you should cancel the due, request a spot inventory
   and submit a ROD.


S: Is the material classified,pilferable, or controlled?

U: no cf 100

S: What is the category of the delinquent due?

U: why

S: If BA status is over 30 days old, no revised or extended
   EDD has been received, the material is not classified,
   pilferable or controlled and the category of the due is
   1, then no action is required at this time.


S: What is the category of the delinquent due?

U: 2 cf 100

S: conclusion = Send an AF1 follow-up. (100%) because rule-
   11.

U: list rule-11

S: rule-11:
    if module = 'Delinquent Dues' and
       status = ba and
       status-age = more and
       rev-edd = no and
       classified = no and
       edd = no and
       (category = 2 or
        category = 3 or
        category = 4)
    then conclusion = 'Send an AF1 follow-up.'.

U: list explain-11
```

S: explain-11:
explanation(rule-11) =
'If BA status is more than 30 days old, no revised or extended EDD has been received, the material is not classified, pilferable or controlled, and the category of the due is 2, 3 or 4, then you should send an AF1 follow-up to request updated status.'

U: go

S: Which Module of Dues Management do you want to work with?

U: 'System Cancellations' cf 100

S: What is the system cancellation status?

U: cg cf 100

S: Does the document number match the NSN ordered?

U: yes cf 100

S: Is the NSN valid on the status card?

U: why

S: If original NSN ordered is the same as NSN on CG status card, an invalid NSN has been established on local files (MISR).

S: Is the NSN valid on the status card?

U: yes cf 100

S: Is the item still required based on demand?

U: why

S: If document number matches original NSN ordered and NSN on CG status card is valid, reorder original NSN if item is still required.

S: Is the item still required based on demand?

U: no cf 100

S: conclusion = No action required. (100%) because rule-67.

```
U: list rule-67

S: rule-67:
    if module = 'System Cancellations' and
       c-status = cg and
       doc-num = yes and
       nsn-val = yes and
       req-dem = no
    then conclusion = 'No action required.'.

U: list explain-67

S: explain-67:
    explanation(rule-67) =
    'If item is no longer required based on demand, then no
    action is required.  Do not re-order.'


U: go

S: Which Module of Dues Management do you want to
   work with?

U: 'Delinquent Dues' cf 100

S: What is the supply status?

U: as cf 100

S: What is the category of the delinquent due?

U: why

S: If the status is AS and the category of the due is less
   than 4, then no action is required.  The goods are in the
   mail.


S: What is the category of the delinquent due?

U: 5 cf 100

S: Are funds in MIT?

U: why

S: If the status is AS, the funds are in MIT, the disbursed
   quantity is not equal to the MIT quantity, a partial
   shipment was received, the value of the material is more
   than $100.00, and the category of the due is 5 or 6 then
```

you should cancel the due and submit a ROD for the MIT quantity.

S: Are funds in MIT?

U: no cf 100

S: Are funds in accounts payable?

U: why

S: If the status is AS, funds are in accounts payable and the category of the due is 5 or 6, then you should cancel the due, but do not cancel the obligation.

S: Are funds in accounts payable?

U: no cf 100

S: Are funds in obligations?

U: why

S: If the status is AS, funds are in obligations and the category of the due is 5 or 6, then you should cancel the due but do not cancel the obligation.

S: Are funds in obligations?

U: yes cf 100

S: conclusion = Cancel due, but do not cancel obligation. (100%) because rule-57.

U: list rule-57

S: rule-57:

```
 if module = 'Delinquent Dues' and
    status = as and
    obligations = yes and
    (category = 5 or
     category = 6)
 then conclusion = 'Cancel due, but do not cancel
 obligation.'.
```

U: list explain-57

S: explain-57:

```
explanation(rule-57) =
'If the status is AS, funds are in obligations and the
category of the due is 5 or 6, then you should cancel
the due but do not cancel the obligation.'
```

System labels, such as rule-1: and explain-1:, were included on each rule and explanation clause. The WHY command, which lists the explanation clause for a specific rule, is only available to the user during a consultation. If the user wishes to list the rule or explanation clause after a system recommendation has been made, he/she must use the LIST command followed by the appropriate label. For example, the system will make a recommendation based on a certain rule. If the user wishes to list this rule it must be referred to it by a label. The same is true with the explanation clauses. Without these labels a user cannot uniquely identify a specific knowledge base entry. This feature facilitates final review of the determining factors of the system recommendation.

IV SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

A. SUMMARY

The objective of this thesis was to revise the initial prototype expert system for use by inventory managers at retail stock points. An emphasis was placed on improving the user friendliness of the system via menus and explanation clauses. A goal was to make the system I/O appear more natural to the user.

Chapter II presented backround information on expert systems including concepts and techniques crucial to an understanding of the theory of problem solving and the representation of knowledge. A review of the phases of expert system development was covered.

Aspects of the critical inventory management function of Dues Management were presented in Chapter III. The major tasks implemented in the revised prototype were "Delinquent Dues Processing" and "System Cancellations Processing".

The initial prototype was translated into the syntax required for the M.1 Knowledge System software tool. The revision of delinquent dues rules knowledge base and the addition of system cancellation rules were combined to establish the current revised prototype written with M.1. The initial impression of expert inventory managers was that

the improved interface created a system much more likely to be used by inventory managers in practice.

The reasoning process was reviewed with experts at NSC, San Diego. Although a thorough testing of the system was not completed, initial reaction is that the system is generating accurate recommendations.

This revised prototype expert system can be distributed on a single floppy disk and installed on any IBM PC or fully compatible microcomputer. The end-user knowledge system consists of the M.1 inference engine, the knowledge base file (Appendix A) and an M.1 configuration file.

B. CONCLUSIONS

The improved interface developed with the M.1 Knowledge System software greatly enhanced the user friendliness of the system. The addition of enhanced problem solving capabilities to the initial prototype was a relatively effortless task from a development point of view.

Although verification of the reasoning process with experts is time consuming, the physical maintenance of the expert system is not difficult. To maintain a standard updated version of the expert system, this maintenance should be performed by a single person or team and then distributed to all Naval Supply Centers.

Further development of an inventory manager expert system is definitely feasible and the potential for improved productivity is great.

C. RECOMMENDATIONS

The addition of enhanced problem solving capabilities to the prototype was comparatively simple once the prototype had been translated to M.1. The M.1 tool is very easy to use and requires little time to learn. The next major concern of this project should be in the area of integration of expert system technology with existing hardware and data bases. M.1 is clearly targeted at programmers who want to develop expert systems that can easily be integrated into a conventional computer environment [Ref. 4:p. 107]. Compatibility with the Navy's enhanced ADP operating environment through projects like SPLICE and SPAR should be seriously considered.

The initial feasibility of improved productivity via the application of expert system technology has been demonstrated. Research done as a result of this thesis has shown that revision and maintenance of existing expert systems is not difficult. It is therefore recommended that subsequent research on this project be directed towards the integration of this technology with existing ADP assets. Areas such as PC local area networks with communication links to UADPS-SP facilities should be considered.

APPENDIX A

DUES MANAGEMENT EXPERT SYSTEM LISTING

```
/*
     This program was translated  from Arity-Expert to the
M.1 Knowledge System software tool.  The program represents
a revised prototype which includes more problem solving
capabilities and an improved user interface.  The system has
two main modules.  One covering an expanded version of the
intial expert system prototype of Delinquent Dues processing
and another covering the addition of System Cancellations
processing.  Features such as automatic menu generation,
enumerated answers, and explanation clauses for each rule
has been added.  Labels for each of the major knowledge base
entires has been added.  These include labels for question,
rules, and explanations.  This feature assists in the
location of a specific knowledge base entry when tracing the
reasoning process or verifying a conclusion.

Author of program:  Captain Albert F. Potwin, USMC

Date:  March, 1988

*/

goal = conclusion.

/*

The following section of the Expert System is the listing of
the questions which solicit information required by the
rule-base

*/

             automaticmenu(all).
             enumeratedanswers(module).
question-1:  question(module) =
'Which Module of Dues Management do you want to work with?'.
             legalvals(module) = ['Delinquent Dues', 'System
Cancellations'].


             enumeratedanswers(status).
question-2:  question(status) =
```

```
                'What is the supply status?'.
                legalvals(status) = [none,ba,as,other].


                enumeratedanswers(status-age).
question-3:     question(status-age) =
                'Is the age of the most recent supply status
                more that 30 days or less?'.
                legalvals(status-age) = [more,less].


                enumeratedanswers(pri-sat).
question-4:     question(pri-sat) =
                'Is the priority satisfactory?'.
                legalvals(pri-sat) = [yes, 'No, should be
upgraded.'].

                enumeratedanswers(follow-up).
question-5:     question(follow-up) =
                'Has a follow up been previously submitted?'.
                legalvals(follow-up) = [yes,no].

                 enumeratedanswers(rev-edd).
question-6:      question(rev-edd) =
                 'Has a revised/extended EDD been received?'.
                 legalvals(rev-edd) = [yes,no].

                enumeratedanswers(classified).
question-7:     question(classified) =
    'Is the material classified,pilferable, or controlled?'.
                legalvals(classified) = [yes,no].

                enumeratedanswers(value).
question-8:     question(value) =
    Is the dollar value of the material more than $100.00?'.
                legalvals(value) = [yes,no].

                enumeratedanswers(z67).
question-9:     question(z67) =
                'Is there a z67 record?'.
                legalvals(z67) = [yes,no].

                enumeratedanswers(mit).
question-10:    question(mit) =
                'Are funds in MIT?'.
                legalvals(mit) = [yes,no].

                enumeratedanswers(accounts-payable).
question-11:    question(accounts-payable) =
                'Are funds in accounts payable?'.
                legalvals(accounts-payable) = [yes,no].
```

```
              enumeratedanswers(obligations).
question-12:  question(obligations) =
              'Are funds in obligations?'.
              legalvals(obligations) = [yes,no].

              enumeratedanswers(dla).
question-13:  question(dla) =
              'Is the requisition for the
              material in DLA files?'.
              legalvals(dla) = [yes,no].


              enumeratedanswers(category).
question-14:  question(category) =
              'What is the category of the delinquent due?'.
              legalvals(category) = [1,2,3,4,5,6].


               enumeratedanswers(needed).
question-15:   question(needed) =
               'Is the material still needed?'.
               legalvals(needed) = [yes,no].

               enumberatedanswers(canc-subm).
question-16:   question(canc-subm) =
          'Has a cancellation request been submitted? (AC1)'.
               legalvals(canc-subm) = [yes,no].

               enumeratedanswers(canc-ackn).
question-17:   question(canc-ackn) =
'Has the submitted cancellation request been acknowledged?'.
               legalvals(canc-ackn) = [yes,no].

               enumeratedanswers(disb-qty).
question-18:   question(disb-qty) =
    'Is the disbursed quantity equal to the MIT quantity?'.
               legalvals(disb-qty) = [yes,no].


               enumeratedanswers(part-ship).
question-19:   question(part-ship) =
               'Is there a partial shipment?'.
               legalvals(part-ship) = [yes,no].

               enumeratedanswers(sub).
question-20:   question(sub) =
               'Has a substitute been received?'.
               legalvals(sub) = [yes,no].

               enumeratedanswers(fund-code-26).
```

```
question-21:  question(fund-code-26) =
              'Is the document a fund code 26 item?'.
              legalvals(fund-code-26) = [yes,no].

              enumeratedanswers(nine-cog).
question-22:  question(nine-cog) =
              'Is the item a 9 cog item?'.
              legalvals(nine-cog) = [yes,no].

              enumeratedanswers(c-status).
question-23:  question(c-status) =
              'What is the system cancellation status?'.
              legalvals(c-status) = [cs,ca,ck,cj,cg].

              enumeratedanswers(doc-num).
question-24:  question(doc-num) =
     'Does the document number match the NSN ordered?'.
              legalvals(doc-num) = [yes,no].

              enumeratedanswers(nsn-val).
question-25:  question(nsn-val) =
              'Is the NSN valid on the status card?'.
              legalvals(nsn-val) = [yes,no].

              enumeratedanswers(req-dem).
question-26:  question(req-dem) =
              'Is the item still required based on demand?'.
              legalvals(req-dem) = [yes,no].

              enumeratedanswers(val-sub).
question-27:  question(val-sub) =
              'Is the item a valid substitute in the MLN?'.
              legalvals(val-sub) = [yes,no].

              enumeratedanswers(tech-val).
question-28:  question(tech-val) =
              'Did the technical dept (of NSC, San Diego)
              determine the item to be a valid substitute?'.
              legalvals(tech-val) = [yes,no].

              enumeratedanswers(sub-prov).
question-29:  question(sub-prov) =
   'Was a substitute NSN provided on the CJ status card?'.
              legalvals(sub-prov) = [yes,no].

              enumeratedanswers(pre-ad).
question-30:  question(pre-ad) =
    'Was item previously ordered with a 2b advice code?'.
              legalvals(pre-ad) = [yes,no].

              enumeratedanswers(qty-excess).
```

```
question-31:  question(qty-excess) =
   'Is the quantity ordered excessive based on demand?'.
              legalvals(qty-excess) = [yes,no].

              enumeratedanswers(current-ui).
question-32:  question(current-ui) =
              'Is the current unit of issue on MISR valid?'.
              legalvals(current-ui) = [yes,no].

/*

The following section is the rule-base of the expert system

 */


rule-1:  if module = 'Delinquent Dues'
         and status = none
         and pri-sat = 'No, should be upgraded.'
         then conclusion =
         'Send an AMA document modifier to raise the
priority'.

explain-1:  explanation(rule-1) =

'When no status has been received and the priority is
determined to be not satisfactory, an AMA document modifier
is used to upgrade the priority and to establish a
requisition if ICP has no record of it.

'.


rule-2:  if module = 'Delinquent Dues'
         and status = none
         and pri-sat = yes
         then conclusion =
         'Send an ATA follow-up'.

explain-2:  explanation(rule-2) =

'When no status has been received and the priority is
determined to be satisfactory, an ATA follow-up should be
sent on the requisition. An ATA is processed as requisition
if original requisition is not received.

'.

rule-3:  if module = 'Delinquent Dues'
         and status = ba
         and status-age = less
```

```
          then conclusion =
          'No action is required.'.

explain-3:  explanation(rule-3) =

'When BA status has been received, but the status age is
less than 30 days old, no action is yet necessary.  It is
too early to take additional action. BA status denotes item
is being processed for release and shipment.

'.

rule-4:   if module = 'Delinquent Dues'
          and status = ba
          and status-age = more
          and follow-up = no
          or follow-up = unknown
          then conclusion =
          'Send an AF1 follow-up'.

explain-4:  explanation(rule-4) =

'When BA status has been received, and the status age is
more than 30 day old and no follow-up has been sent (or if
it is not known if a follow-up has been sent) then you
should send an AF1 follow-up to request updated status.

'.

rule-5:   if module = 'Delinquent Dues'
          and status = ba
          and status-age = more
          and rev-edd = yes
          then conclusion =
          'Update the Revised-EDD'.

explain-5:  explanation(rule-5) =

'When BA status has been received and the status age is more
than 30 days old and a revised EDD is received in response
to a follow-up, then update the Revised-EDD because the
document is no longer delinquent.

'.

rule-6:   if module = 'Delinquent Dues'
          and status = ba
          and status-age = more
          and rev-edd = no
          and classified  = yes
          and category = 3
```

```
          or category = 4
          or category = 5
          or category = 6
          then conclusion =
          'Cancel, request spot inventory, and submit ROD.'.

explain-6:  explanation(rule-6) =

'If BA status is over 30 days old with no revised/extended
EDD received, the material is classified, pilferable or
controlled and the category of the due is 3 or higher, then
you should cancel the due, request a spot inventory and
submit a ROD.

'.

rule-7:  if module = 'Delinquent Dues'
          and status = ba
          and status-age = more
          and rev-edd = no
          and classified = yes
          and category = 1
          or category = 2
          then conclusion =
          'Send an AF1 follow-up.'.

explain-7:  explanation(rule-7) =

'If BA status is over 30 days old with no revised/extended
EDD received, the material is classified, pilferable or
controlled and the category of the due is less than 3, then
you should send an AF1 follow-up to request updated status
on the requisition.

'.

rule-8:  if module = 'Delinquent Dues'
          and status = ba
          and status-age = more
          and follow-up = yes
          and classified = yes
          and value = no
          and category = 3
          or category = 4
          or category = 5
          or category = 6
          then conclusion =
          'Cancel, request spot inventory, and submit ROD.'.

explain-8:  explanation(rule-8) =
```

```
'If BA status is over 30 days old and a follow-up has been
sent, the material is classified, pilferable or controlled,
the value of the material is less than $100.00 and the
category of the due is 3 or higher, then you should cancel,
request a spot inventory, and submit a ROD.

'.

rule-9:  if module = 'Delinquent Dues'
         and status = ba
         and status-age = more
         and follow-up = yes
         and classified = yes
         and value = no
         and category = 1
         or category = 2
         then conclusion =
         'Send an AF1 follow-up.'.

explain-9:  explanation(rule-9) =

'If BA status is over 30 days old, a follow-up has been
sent, and the material is classified, pilferable or
controlled, the value of the material is less than $100.00
and the category of the due is less than 3, then you should
send an AF1 follow-up to request updated status.

'.

rule-10: if module = 'Delinquent Dues'
         and status = ba
         and status-age = more
         and rev-edd = no
         and classified = no
         and category = 1
         then conclusion =
         'No action is required.'.

explain-10:  explanation(rule-10) =

'If BA status is over 30 days old, no revised or extended
EDD has been received, the material is not classified,
pilferable or controlled and the category of the due is 1,
then no action is required at this time.

'.

rule-11: if module = 'Delinquent Dues'
         and status = ba
         and status-age = more
         and rev-edd = no
```

```
          and classified = no
          and category = 2
          or category = 3
          or category = 4
          then conclusion =
          'Send an AF1 follow-up.'.

explain-11:  explanation(rule-11) =

'If BA status is more than 30 days old, no revised or
extended EDD has been received, the material is not
classified, pilferable or controlled, and the category of
the due is 2, 3 or 4, then you should send an AF1 follow-up
to request updated status.

'.

rule-12: if module = 'Delinquent Dues'
          and status = ba
          and status-age = more
          and rev-edd = no
          and classified = no
          and category = 5
          or category = 6
          then conclusion =
          'Cancel and submit an AC1.'.

explain-12:  explanation(rule-12) =

'If BA status is more than 30 days old, no revised or
extended EDD has been received, the material is not
classified, pilferable or controlled and the category of
the due is 5 or 6 then you should cancel and submit an AC1.

'.


rule-13: if module = 'Delinquent Dues'
          and status = ba
          and status-age = more
          and rev-edd = no
          and follow-up = yes
          and classified = no
          and value = no
          and category = 5
          or category = 6
          then conclusion =
          'Store to zero.'.

explain-13:  explanation(rule-13) =
```

```
'If BA status is more than 30 days old and no revised or
extended EDD has been received, a follow-up has been sent,
the material is not classified, pilferable or controlled
and the value is less than $100.00 and the category of the
due is 5 or 6, then you should store to zero.

'.

rule-14:  if module = 'Delinquent Dues'
          and status = ba
          and status-age = more
          and rev-edd = no
          and follow-up = yes
          and classified = no
          and value = no
          and category = 1
          or category = 2
          or category = 3
          or category = 4
          then conclusion =
          'Send an AF1 follow-up.'.

explain-14:  explanation(rule-14) =

'If BA status is more than 30 days old, no revised or
extended EDD has been received, a follow has been sent, the
material is not classified, pilferable or controlled, the
value is less than $100.00 and the category of the due is
less than 5, then you should Send an AF1 follow-up to
request updated status.

'.

rule-15:  if module = 'Delinquent Dues'
          and status = ba
          and status-age = more
          and rev-edd = no
          and follow-up = yes
          and value = yes
          and category = 1
          or category = 2
          or category = 3
          or category = 4
          then conclusion =
          'Send an AF1 follow-up.'.

explain-15:  explanation(rule-15) =

'If BA status is more than 30 days old, no revised or
extended EDD has been received, a follow-up has been sent,
the value of the material is greater than $100.00 and the
```

```
category of the due is less than 5, then you should send an
AF1 follow-up to request updated status.

'.

rule-16:  if module = 'Delinquent Dues'
          and status = ba
          and status-age = more
          and rev-edd = no
          and follow-up = yes
          and value = yes
          and category = 5
          or category = 6
          then conclusion =
          'Cancel and submit ROD.'.

explain-16:  explanation(rule-16) =

'If BA status is more than 30 days old, a revised EDD has
not been received, a follow-up has been sent, the value of
the material is greater than $100.00, and the category of
the due is 5 or 6 then you should cancel the due and submit
a ROD.

'.

rule-17:  if module = 'Delinquent Dues'
          and status = other
          and rev-edd = no
          and z67 = no
          and dla = no
          then conclusion =
          'Cancel.'.

explain-17:  explanation(rule-17) =

'If the status is other than BA or AS, no revised/extended
EDD has been received, there is no Z67 record and no record
in DLA files, the material may have been received and paid
for already or the requisition was canceled by the ICP.  You
should cancel the due.

'.


rule-18:  if module = 'Delinquent Dues'
          and status = other
          and accounts-payable = yes
          then conclusion =
          'Cancel the due, but do not cancel the
obligation.'.
```

```
explain-18:  explanation(rule-18) =

'If the status of the requisition is other than BA or AS
and funds are in accounts payable it is possible the
material has been received, but has not been billed for
yet. Therefore you should cancel the due, but not the
obligation.

'.

rule-19:  if module = 'Delinquent Dues'
          and status = other
          and mit = yes
          and value = yes
          and category = 5
          or category = 6
          then conclusion =
          'Cancel and submit ROD.'.

explain-19:  explanation(rule-19) =

'If the status of the requisition is other than BA or AS
and funds are in MIT, the value of the material is greater
than $100.00 and the category of the due is 5 or 6 then you
should cancel the due and submit a ROD.

'.

rule-20:  if module = 'Delinquent Dues'
          and status = other
          and mit = yes
          and value = yes
          and category = 1
          or category = 2
          or category = 3
          or category = 4
          then conclusion =
          'Send an AF1 follow-up.'.

explain-20:  explanation(rule-20) =

'If the status is other than BA or AS, the funds are in MIT,
the value of the material is over $100.00 and the category
of the due is less than 5, then you should send an AF1
follow-up requesting updated status.

'.

rule-21:  if module = 'Delinquent Dues'
          and status = other
```

```
          and mit = yes
          and value = no
          and classified = no
          and category = 1
          or category = 2
          or category = 3
          or category = 4
          then conclusion =
          'Send and AF1 follow-up.'.

explain-21:  explanation(rule-21)=

'If the status is other than BA or AS, the funds are in MIT,
the value of the material is less than $100.00, the material
is not classified, pilferable or controlled and the category
of the due is less than 5, then you should send an AF1
follow-up to request updated status.

'.

rule-22:  if module = 'Delinquent Dues'
          and status = other
          and mit = yes
          and value = no
          and classified = no
          or category = 5
          or category = 6
          then conclusion =
          'Store to zero.'.

explain-22:  explanation(rule-22) =

'If the status is other than BA or AS, the funds are in MIT,
the value of the material is less than $100.00, the material
is not classified, pilferable or controlled, the the
category of the due is 5 or 6, then you should store to
zero.

'.

rule-23:  if module = 'Delinquent Dues'
          and status = other
          and mit = yes
          and value = no
          and classified = yes
          and category = 3
          or category = 4
          or category = 5
          or category = 6
          then conclusion =
          'Cancel, request spot inventory, and submit ROD.'.
```

```
explain-23:  explanation(rule-23) =

'If the status is other than BA or AS, the funds are in MIT,
the value of the material is less than $100.00, the material
is classified, pilferable or controlled, and the category of
the due is 3 or greater, then you should cancel the due,
request a spot inventory, and submit a ROD.

'.

rule-24:  if module = 'Delinquent Dues'
          and status = other
          and mit = yes
          and value = no
          and classified = yes
          and category = 1
          or category = 2
          then conclusion =
          'Send an AF1 follow-up.'.

explain-24:  explanation(rule-24) =

'If the status is other than BA or AS, the funds are in MIT,
the value of the material is less than $100.00, the material
is classified, pilferable or controlled and the category  of
the due is 1 or 2, then you should send an AF1 follow-up
requesting updated status.

'.

rule-25:  if module = 'Delinquent Dues'
          and status = other
          and obligations = yes
          and needed = no
          and canc-subm = no
          then conclusion =
          'Submit an AC1 cancellation request'.

explain-25:  explanation(rule-25) =

'If the status is other than BA or AS, the funds are in
obligations, the material is no longer needed and an
AC1 cancellation request has not been sent, then you should
submit an AC1 cancellation.

'.

rule-26:  if module = 'Delinquent Dues'
          and status = other
          and obligations = yes
```

```
          and needed = no
          and canc-subm = yes
          and canc-ackn = no
          then conclusion =
          'Submit another AC1 cancellation request.'.

explain-26:  explanation(rule-26) =

'If the status is other than BA or AS, the funds are in
obligations, the material is no longer needed, an AC1
cancellation request has been submitted but not
acknowledged, then you should submit another AC1
cancellation request.

'.

rule-27:  if module = 'Delinquent Dues'
          and status = other
          and obligations = yes
          and needed = no
          and canc-subm = yes
          and canc-ackn = yes
          then conclusion =
          'No action is necessary at this time.'.

explain-27:  explanation(rule-27) =

'If a cancellation has been submitted and acknowledged
the requisition should drop off the delinquent dues
listing soon, no action is required

.'.

rule-28:  if module = 'Delinquent Dues'
          and status = other
          and obligations = yes
          and needed = yes
          then conclusion =
          'Send an AF1 follow-up, or send message requesting
           shipping status'.

explain-28:  explanation(rule-28) =

'If the status is other than BA or AS, the funds are in
obligations and the material is still needed, then send an
AF1 follow-up requesting updated status or send a message
requesting shipping status.

'.

rule-29:  if module = 'Delinquent Dues'
```

```
          and status = other
          and obligations = yes
          and needed = yes
          and pri-sat = yes
          and category = 5
          or category = 6
           then conclusion =
          'Cancel and submit an AC1.'.

explain-29:  explanation(rule-29) =

'If the status is other than BA or AS, the funds are in
obligations, the material is still needed, the priority is
determined to be satisfactory and the category of the due
is 5 or 6, then you should cancel the due and submit an
AC1 system cancellation request.

'.

rule-30:  if module = 'Delinquent Dues'
          and status = other
          and z67 = no
          and dla = yes
          and needed = yes
          then conclusion =
          'Further research is required.'.

explain-30:  explanation(rule-30) =

'If the status is other than BA or AS, there is no z67
record, the requisition is in DLA files, the material
is still needed, then further research is required.
Possibly paid for but not received, should conduct
financial audit to find what was paid for.

'.

rule-31:  if module = 'Delinquent Dues'
          and status = other
          and z67 = no
          and dla = yes
          and needed = yes
          and sub = yes
          then conclusion =
          'Cancel.'.

explain-31:  explanation(rule-31) =

'If the status is other than BA or AS status, there is no
z67 record, the requisition is in DLA files, the material
is still needed but a substitute was received, then you
```

```
should cancel the due.  The material has been received under
a substitute NSN.

'.

rule-32:  if module = 'Delinquent Dues'
          and status = other
          and z67 = no
          and dla = no
          and needed = yes
          and sub = no
          then conclusion =
          'Cancel, and reorder.'.

explain-32:  explanation(rule-32) =

'If the status is other than BA or AS, there is not a z67
record, the requisition is not in DLA files, the material
is still needed and a substitute was not received, then you
should cancel the due and reorder.

'.

rule-33:  if module = 'Delinquent Dues'
          and status = other
          and z67 = no
          and dla = yes
          and needed = no
          then conclusion =
          'Cancel and submit an AC1'.

explain-33:  explanation(rule-33) =

'If the status is other than BA or AS, there is not a z67
record, the requisition is in DLA files, and the material is
not needed then cancel the due and submit an AC1 system
cancellation request.

'.

/*  This section of the rule base deals with AS status.  AS
status means the material has been shipped.  */


rule-34:  if module = 'Delinquent Dues'
          and status = as
          and category = 1
          or category = 2
          or category = 3
          then conclusion =
          'No action is required.'.
```

```
explain-34:  explanation(rule-34) =

'If the status is AS and the category of the due is less
than 4, then no action is required.  The goods are in the
mail.

'.

rule-35:  if module = 'Delinquent Dues'
          and status = as
          and  mit = yes
          and disb-qty = no
          and part-ship = yes
          and value = yes
          and category = 5
          or category = 6
          then conclusion =
          'Cancel and submit ROD for MIT quantity.'.

explain-35:  explanation(rule-35) =

'If the status is AS, the funds are in MIT, the disbursed
quantity is not equal to the MIT quantity, a partial
shipment was received, the value of the material is more
than $100.00, and the category of the due is 5 or 6 then you
should cancel the due and submit a ROD for the MIT quantity.

'.

rule-36:  if module = 'Delinquent Dues'
          and status = as
          and mit = yes
          and disb-qty = no
          and part-ship = yes
          and value = no
          and category = 5
          or category = 6
          then conclusion =
          'Store to zero the MIT quantity.'.

explain-36:  explanation(rule-36) =

'If the status is AS, the funds are in MIT, the disbursed
quantity is not equal to the MIT quantity, a partial
shipment was received, the value of the material is less
than $100.00 and the category of the due is 5 or 6, then
you should store to the zero the quantity in MIT.

'.
```

```
rule-37:  if module = 'Delinquent Dues'
          and status = as
          and mit = yes
          and disb-qty = no
          and part-ship = yes
          and category = 1
          or category = 2
          or category = 3
          or category = 4
          then conclusion =
          'No action required.'.

explain-37:  explanation(rule-37) =

'If the status is AS, the funds are in MIT, the disbursed
quantity is not equal to the MIT quantity, a partial
shipment was received and the category of the due is less
than 5, then no action is required yet.

'.

rule-38:  if module = 'Delinquent Dues'
          and status = as
          and mit = yes
          and disb-qty = no
          and part-ship = yes
          and sub = no
          and value = no
          and classified = yes
          and category = 3
          or category = 4
          or category = 5
          or category = 6
          then conclusion =
          'Cancel, request spot inventory and submit ROD
          for the MIT quantity.'.

explain-38:  explanation(rule-38) =

'If the status is AS, funds are in MIT, the disbursed
quantity is not equal to the MIT quantity, a partial
shipment was received, no substitutes were received,
the value of the material is less than $100.00, the
material is classified, pilferable or controlled and
the category of the due is 3 or greater, then you
should cancel the due, request a spot inventory and submit
a ROD for the mit quantity.

'.

rule-39:  if module = 'Delinquent Dues'
```

```
          and status = as
          and mit = yes
          and disb-qty = no
          and part-ship = yes
          and sub = no
          and value = no
          and classified = yes
          and category = 1
          or category = 2
          then conclusion =
          'No action is required.'.

explain-39:  explanation(rule-39) =

'If the status is AS, the funds are in MIT, the disbursed
quantity is not equal to the MIT quantity, a partial
shipment was received, no substitute was received, the
material is classified, pilferable or controlled and the
category of the due is less than 3, then no action is
required yet.

'.

rule-40:  if module = 'Delinquent Dues'
          and status = as
          and mit = yes
          and disb-qty = no
          and part-ship = yes
          and sub = no
          and value = no
          and classified = no
          and category = 5
          or category = 6
          then conclusion =
          'Store to zero.'.

explain-40:  explanation(rule-40) =

'If the status is AS, the funds are in MIT, the disbursed
quantity is not equal to the MIT quantity, a partial
shipment was received, no substitute was received, the value
of the material is less than $100.00 , the material is not
classified, pilferable or controlled and the category of the
due is 5 or 6, then you should store to zero.

'.

rule-41:  if module = 'Delinquent Dues'
          and status = as
          and mit = yes
          and disb-qty = no
```

```
          and part-ship = yes
          and sub = no
          and value = no
          and classified = no
          and category = 1
          or category = 2
          or category = 3
          or category = 4
          then conclusion =
          'No action required.'.

explain-41:  explanation(rule-41) =

'If the status is AS, the funds are in MIT, the disbursed
quantity is not equal to the MIT quantity, a partial
shipment was received, no substitute was received, the value
of the material is less than $100.00, the material is not
classified, pilferable or controlled and the category of the
due is less than 5, then no action is required yet.

'.

rule-42:  if module = 'Delinquent Dues'
          and status = as
          and mit = yes
          and disb-qty = no
          and part-ship = yes
          and sub = no
          and value = yes
          and category = 5
          or category = 6
          then conclusion =
          'Cancel and submit ROD.'.

explain-42:  explanation(rule-42) =

'If the status is AS, the funds are in MIT, the disbursed
quantity is not equal to the MIT quantity, a partial
shipment has been received, no substitute has been received,
the value of the material is less than $100.00 and the
category of the due is 5 or 6, then you should cancel the
due and submit a ROD.

'.

rule-43:  if module = 'Delinquent Dues'
          and status = as
          and mit = yes
          and disb-qty = no
          and part-ship = yes
          and sub = no
```

```
          and value = yes
          and category = 1
          or category = 2
          or category = 3
          or category = 4
          then conclusion =
          'No action required.'.

explain-43:  explanation(rule-43) =

'If the status is AS, funds are in MIT, the disbursed
quantity is not equal to the MIT quantity, a partial
shipment has been received, no substitute has been received,
the value of the material is over $100.00 and the category
of the due is less than 5, then no action is required yet.

'.

rule-44:  if module = 'Delinquent Dues'
          and status = as
          and mit = yes
          and disb-qty = no
          and part-ship = no
          and sub = yes
          then conclusion =
          'Cancel.'.

explain-44:  explanation(rule-44) =

'If the status is AS, funds are in MIT, the disbursed
quantity is not equal to the MIT quantity, no partial
shipment was received, but a substitute was received, then
you should cancel the due.

'.

rule-45:  if module = 'Delinquent Dues'
          and status = as
          and mit = yes
          and part-ship = no
          and sub = no
          and value = no
          and classified = no
          and category = 5
          or category = 6
          then conclusion =
          'Store to zero.'.

explain-45:  explanation(rule-45) =

'If the status is AS, funds are in MIT, no partial shipment
```

```
was received, no substitute was received, the material is
not classified, pilferable or controlled, and the category
of the due is 5 or 6, then you should store to zero.

'.

rule-46:  if module = 'Delinquent Dues'
          and status = as
          and mit = yes
          and part-ship = no
          and sub = no
          and value = no
          and classified = no
          and category = 1
          or category = 2
          or category = 3
          or category = 4
          then conclusion =
          'No action is required.'.

explain-46:  explanation(rule-46) =

'If the status is AS, funds are in MIT, no partial shipment
was received, no substitute was received, the value of the
material is less than $100.00, the material is not
classified, pilferable or controlled and the category of the
due is less than 5, then no action is required yet.

'.

rule-47:  if module = 'Delinquent Dues'
          and status = as
          and mit = yes
          and disb-qty = no
          and part-ship = no
          and sub = no
          and value = yes
          and category = 5
          or category = 6
          then conclusion =
          'Cancel and submit ROD.'.

explain-47:  explanation(rule-47) =

'If the status is AS, funds are in MIT, the disbursed
quantity is not equal to the MIT quantity, no partial
shipment was received, no substitute was received, the
value of the material is over $100.00 and the category of
the due is 5 or 6, then you should cancel the due and
Submit a ROD.
```

```
'.

rule-48:  if module = 'Delinquent Dues'
          and status = as
          and mit = yes
          and disb-qty = no
          and part-ship = no
          and sub = no
          and value = yes
          and category = 1
          or category = 2
          or category = 3
          or category = 4
          then conclusion =
          'No action required.'.

explain-48:  explanation(rule-48) =

'If the status is AS, the funds are in MIT, the disbursed
quantity is not equal to the MIT quantity, no partial
shipment was received, no substitute was received, the value
of the material is over $100.00 and the category of the due
is less than 5, then no action is required yet.

'.

rule-49:  if module = 'Delinquent Dues'
          and status = as
          and mit = yes
          and disb-qty = yes
          and value = no
          and classified = no
          and category = 5
          or category = 6
          then conclusion =
          'Store to zero.'.

explain-49:  explanation(rule-49) =

'If the status is AS, the funds are in MIT, the disbursed
quantity is equal to the MIT quantity, the value of the
material is less than $100.00, the material is not
classified, pilferable or controlled and the category of the
due is 5 or 6, then you should store to zero.

'.

rule-50:  if module = 'Delinquent Dues'
          and status = as
          and mit = yes
          and disb-qty = yes
```

```
          and value = no
          and classified = no
          and category = 1
          or category = 2
          or category = 3
          or category = 4
          then conclusion =
          'No action required.'.

explain-50:  explanation(rule-50) =

'If the status is AS, the funds are in MIT, the disbursed
quantity is equal to the MIT quantity, the value of the
material is less than $100.00, the material is not
classified, pilferable or controlled and the category of
the due is less than 5, then no action is required yet.

'.

rule-51:  if module = 'Delinquent Dues'
          and status = as
          and mit = yes
          and disb-qty = yes
          and value = no
          and classified = yes
          and category = 3
          or category = 4
          or category = 5
          or category = 6
          then conclusion =
          'Cancel, request spot inventory and submit ROD.'.

explain-51:  explanation(rule-51) =

'If the status is AS, funds are in MIT, the disbursed
quantity is equal to the MIT quantity, the value of the
material is less than $100.00, the material is classified
pilferable or controlled and the category of the due is 3
or greater, then you should cancel, request a spot inventory
and submit a ROD.

'.

rule-52:  if module = 'Delinquent Dues'
          and status = as
          and mit = yes
          and disb-qty = yes
          and value = no
          and classified = yes
          and category = 1
          or category = 2
```

```
          then conclusion =
          'No action required.'.

explain-52:  explanation(rule-52) =

'If the status is AS, funds are in MIT, the disbursed
quantity is equal to the MIT quantity, the value of the
material is less than $100.00, the material is classified,
pilferable or controlled and the category of the due is less
than 3, then no action is required yet.

'.

rule-53:  if module = 'Delinquent Dues'
          and status = as
          and mit = yes
          and disb-qty = yes
          and value = yes
          and category = 5
          or category = 6
          then conclusion =
          'Cancel and submit ROD.'.

explain-53:  explanation(rule-53) =

'If the status is AS, funds are in MIT, the disbursed
quantity is equal to the MIT quantity, the value of
the material is greater than $100.00 and the category
of the due is 5 or 6, then you should cancel the due and
submit a ROD.

'.

rule-54:  if module = 'Delinquent Dues'
          and status = as
          and mit = yes
          and disb-qty = yes
          and value = yes
          and category = 1
          or category = 2
          or category = 3
          or category = 4
          then conclusion =
          'No action is required.'.

explain-54:  explanation(rule-54) =

'If the status is AS, funds are in MIT, the disbursed
quantity is equal to the MIT quantity, the value of the
material is greater than $100.00 and the category of the
due is less than 5, then no action is required yet.
```

```
'.

rule-55:  if module = 'Delinquent Dues'
          and status = as
          and accounts-payable = yes
          and category = 5
          or category = 6
          then conclusion =
          'Cancel due, but do not cancel obligation'.

explain-55:  explanation(rule-55) =

'If the status is AS, funds are in accounts payable and
the category of the due is 5 or 6, then you should cancel
the due, but do not cancel the obligation.

'.

rule-56:  if module = 'Delinquent Dues'
          and status = as
          and accounts-payable = yes
          and category = 1
          or category = 2
          or category = 3
          or category = 4
          then conclusion =
          'No action is required.'.

explain-56:  explanation(rule-56) =

'If the status is AS, funds are in accounts payable and
the category of the due is less than 5, then no action is
required yet.

'.

rule-57:  if module = 'Delinquent Dues'
          and status = as
          and obligations = yes
          and category = 5
          or category = 6
          then conclusion =
          'Cancel due, but do not cancel obligation.'.

explain-57:  explanation(rule-57) =

'If the status is AS, funds are in obligations and the
category of the due is 5 or 6, then you should cancel the
due but do not cancel the obligation.
```

```
'.

rule-58:  if module = 'Delinquent Dues'
          and status = as
          and obligations = yes
          and category = 1
          or category = 2
          or category = 3
          or category = 4
          then conclusion =
          'No action is required.'.

explain-58:  explanation(rule-58) =

'If the status is AS, funds are in obligations and the
category of the due is less than 5, then no action is
required yet.

'.

rule-59:  if module = 'Delinquent Dues'
          and status = as
          and z67 = no
          and fund-code-26 = yes
          and nine-cog = yes
          and category = 5
          or category = 6
          then conclusion =
          'Cancel and re-establish under J3 fund code
           (stock-fund)'.

explain-59:  explanation(rule-59) =

'If the status is AS, there is no z67 record, the
requisition is a fund code 26 item and 9 cog and  the
category of the due is 5 or 6, then you should cancel and
re-establish under J3 fund code (stock fund).

'.

rule-60:  if module = 'Delinquent Dues'
          and status = as
          and z67 = no
          and fund-code-26 = yes
          and nine-cog = yes
          and category = 1
          or category = 2
          or category = 3
          or category = 4
          then conclusion =
          'No action is required.'.
```

```
explain-60:  explanation(rule-60) =

'If the status is AS, there is no z67 record, the item is
fund code 26 and 9 cog, and the category of the due is less
than 5, then no action is required yet.

'.

rule-61:  if module = 'Delinquent Dues'
          and status = as
          and z67 = no
          and fund-code-26 = yes
          and nine-cog = no
          and category = 5
          or category = 6
          then conclusion =
          'Store to zero.'.

explain-61:  explanation(rule-61)=

'If the status is AS, there is no Z67 record, the item is a
fund code 26 item and 9 cog, and the category of the due is
5 or 6, then you should store to zero.

'.

rule-62:  if module = 'Delinquent Dues'
          and status = as
          and z67 = no
          and fund-code-26 = yes
          and nine-cog = no
          and category = 1
          or category = 2
          or category = 3
          or category = 4
          then conclusion =
          'No action is required.'.

explain-62:  explanation(rule-62) =

'If the status is AS, the item is fund code 26, but not 9
cog and the category of the due is less than 5, then no
action is required at this time.

'.

rule-63:  if module = 'Delinquent Dues'
          and status = as
          and z67 = no
          and fund-code-26 = no
```

```
          then conclusion =
          'Cancel.'.

explain-63:  explanation(rule-63) =

'If the status is AS, there is no Z67 record, and the item
is not fund code 26, then cancel the due.

'.

/*

The following section of the rule base deals with System
Cancellations status.  This includes CG, CJ, CA, CS, CK and
and CE status.

 */


/*

  This section deals with CG status requisitions

 */

rule-64:  if module = 'System Cancellations'
          and c-status = cg
          and doc-num = no
          and nsn-val = no
          and req-dem = yes
          then conclusion =
          'Submit new requisition on original NSN.'.

explain-64:  explanation(rule-64) =

'If the document number does not match the original NSN
ordered and the NSN on the CG status card is not valid, then
you should reorder the original NSN.

'.

rule-65:  if module = 'System Cancellations'
          and c-status = cg
          and doc-num = yes
          and nsn-val = no
          then conclusion =
          'Delete invalid NSN from local files (MISR).'.

explain-65:  explanation(rule-65) =
```

```
'If original NSN ordered is the same as NSN on CG status
card, an invalid NSN has been established on local files
(MISR).

'.

rule-66:  if module = 'System Cancellations'
          and c-status = cg
          and doc-num = yes
          and nsn-val = yes
          and req-dem = yes
          then conclusion =
          'Submit new requisition on original NSN.'.

explain-66:  explanation(rule-66) =

'If document number matches original NSN ordered and NSN on
CG status card is valid, reorder original NSN if item is
still required.

'.

rule-67:  if module = 'System Cancellations'
          and c-status = cg
          and doc-num = yes
          and nsn-val = yes
          and req-dem = no
          then conclusion =
          'No action required.'.

explain-67:  explanation(rule-67) =

'If item is no longer required based on demand, then no
action is required.  Do not re-order.

'.

/*

 This section deals with CJ status on requisitions

 */

rule-68:  if module = 'System Cancellations'
          and c-status = cj
          and doc-num = no
          and nsn-val = yes
          and val-sub = yes
          then conclusion =
          "Input change notice to tie NSN's.".
```

```
explain-68:  explanation(rule-68) =

'If NSN on CJ status card is a valid substitute, input
change notice to establish the NSNs as valid substitutes in
the MISR file.

'.

rule-69:  if module = 'System Cancellations'
          and c-status = cj
          and doc-num = no
          and nsn-val = yes
          and val-sub = yes
          and tech-sub = yes
          then conclusion =
          'Input change notice to tie NSNs.'.

explain-69:  explanation(rule-69) =

'If NSN on CJ status card is a valid substitute, input
change notice to establish the NSNs as valid substitutes in
the MISR file.

'.

rule-70:  if module = 'System Cancellations'
          and c-status = cj
          and doc-num = no
          and nsn-val = yes
          and val-sub = no
          and tech-val = no
          and req-dem = yes
          then conclusion =
          'Submit new requisition citing 2b advice code.'.

explain-70:  explanation(rule-70) =

'If the substitute NSN provided on the CJ status card is
determined to be invalid, reorder with 2b advice code.

'.

rule-71:  if module = 'System Cancellations'
          and c-status = cj
          and sub-prov = no
          and req-dem = yes
          then conclusion =
          'Send Speedletter to FMSO requesting substitute
          NSN or alternate source of supply.'.

explain-71:  explanation(rule-71) =
```

```
'If a substitute NSN is not provided and the item is still
required based on demand, a Speedletter should be sent to
FMSO requesting a substitute NSN or alternate source of
supply.

'.

rule-72:  if module = 'System Cancellations'
          and c-status = cj
          and sub-prov = no
          and req-dem = no
          then conclusion =
          'Delete NSN from local files (MISR).'.

explain-72:  explanation(rule-72) =

'If item is no longer required based demand, then delete
obsolete NSN from local files (MISR).

'.

rule-73:  if module = 'System Cancellations'
          and c-status = cj
          and doc-num = no
          and nsn-val = yes
          and val-sub = no
          and tech-val = no
          and req-dem = yes
          and pre-ad = yes
          then conclusion =
          'Contact ICP and request verification of invalid
          substitute NSN.'.

explain-73:  explanation(rule-73) =

'If CJ status comes back with an invalid substitute NSN
after a requisition was submitted with a 2b advice code you
should contact the ICP and request verification of the
substitute NSN.

'.

rule-74:  if module = 'System Cancellations'
          and c-status = ca
          then conclusion =
          'Delete NSN from local files (MISR) or if after
          review, item is still determined to be a valid
          requirement, send speedletter requesting
          substitute or replacement item.'.
```

```
explain-74:  explanation(rule-74) =

'CA status normally comes with narrative message stating
reason for rejection.

'.

/*

  This section deals with CS status

*/

rule-75:  if module = 'System Cancellations'
          and c-status = cs
          and qty-excess = no
          then conclusion =
          'Submit new requisition with 2L advice code.'.

explain-75:  explanation(rule-75) =

 'If you determine quantity to not be excessive based on
your demand, submit a new requisition with a 2L advice code.

'.

rule-76:  if module = 'System Cancellations'
          and c-status = cs
          and qty-excess = yes
          then conclusion =
          'No action required.'.

explain-76:  explanation(rule-76) =

'Possibly ordered incorrect excessive quantity.  No action
is required.

'.

/*

 This section deals with CK status

 */

rule-77:  if module = 'System Cancellations'
          and c-status = ck
          then conclusion =
          'Delete NSN from local files (MISR).'.

explain-77:  explanation(rule-77) =
```

```
'Normally not pursued further at the NSC level, may be
uneconomical to procure.

'.

/*

  This section deals with CE status

 */

rule-78:  if module = 'System Cancellations'
          and c-status = ce
          and current-ui = yes
          then conclusion =
          'Submit new requisition with MISR unit of issue.'.

explain-78:  explanation(rule-78) =

'If status is CE and verification of the current unit of
issue in the MISR showed it to be correct, then you should
submit a new requisition with MISR unit of issue.

'.

rule-79:  if module = 'System Cancellations'
          and c-status = ce
          and current-ui = no
          then conclusion =
          'Input change notice to correct the unit of
issue.'.

explain-79:  explanation(rule-79) =

'If current unit of issue is incorrect on MISR, input change
notice to correct.  This will generate correct unit of issue
on next reorder.

'.
```

APPENDIX B

DUES MANAGEMENT EXPERT SYSTEM USERS MANUAL

1. INTRODUCTION

This guide will give you a brief overview of how to use the Dues Management Expert System. You will be provided with information on how to start the consultation process of the system and basic commands used during the consultation.

2. TERMINOLOGY

Words or letters in the angle brackets, < > correspond to a key on the keyboard. The following keys are referred to in this guide:

Carriage return key (or enter)	**<CR>**
Alternate key	**<ALT>**

Keys that you must press simultaneously will be presented with a hyphen in between.

For example when you need to press the **alternate** and **g** keys together, you will find the instructions presented as follows:

<ALT>-<g>

3. STARTING THE SYSTEM

A batch file has been set up to start the Dues Management Expert System with one command. After turning on the PC and waiting for the system to boot-up, simply type the following:

NPS <CR>

It takes a few seconds to load, so be patient. When the system is ready to run, the standard application display will be on the screen and the word READY will be in the lower right hand corner.

4. RUNNING A CONSULTATION

To run a consultation, type the following command:

<ALT>-<g>

The system will ask you the first question in the lower left hand window on the screen. You answer the question by moving the cursor in the lower right hand window up or down to highlight the desired response. To register your answer type a **<CR>**. The system will move on to the next relevant question and you continue to answer as before. The Dues Management Expert System will eventually come up with a conclusion based on your responses to questions. This conclusion will be displayed in the upper application window. To run another consultation simply type **<ALT>-<g>** again.

5. ASKING WHY

At any time during a consultation you may wish to ask the system why a particular question is being asked. To do this you type the following:

<ALT>-<W>

This will cause the system to display an explanation of the current knowledge base rule being envoked. This should assist greatly in explaining why a specific element of information is required. To continue with the consultation simple continue to answer the questions.

6. OTHER COMMANDS

The following are other common system commands you need to know:

ABORT A CONSULTATION	**<ALT>-<A>**
EXIT SYSTEM AND RETURN TO DOS	**<ALT>-<Q>**

7. HELP

General help is available for other system commands. To access the help feature type **<F10>**. A pop-down menu will appear. Use the down cursor to highlight the word help, then hit **<CR>**. Hitting **<CR>** again will give you a M.1 command summary. You can obtain help on an individual command by typing the name of the command followed by a **<CR>**.

8. CONCLUSION

The information provided here is enough to effectively use the Dues Management Expert System. When you are finished running consultations, exit the system by typing **<ALT>-<q>** and then turn off the PC.

To assist in locating the information requested by the expert system questions, the following guide is provided which explains where to find specific data elements:

accounts-payable: z67

canc-ackn: If Receipt Due File record is no longer available, or you receive a "no locate" on inquiry file.

canc-subm: If in doubt submit another cancellation.

classified: MSIR (Master Stock Item Record) XVK inquiry security codes found in NAVSUP-437, APP 17, section R: Security Codes

disb-qty: z67

dla: DLA terminals

followup: computer generated followups from Receipt Due File (if unsure assume followup not submitted)

fund-code-26: Receipt Due File, Delinquent Due Listing and z67

mit: z67

needed: From XVK, make judgment based on demand.

nine-cog: XVK, Receipt Due File, z67

obligations: z67

part-ship: Receipt Due File (will show up as suffix code) and History File (inventory causative research)

priority: Delinquent Dues Listing

rev-edd: Delinquent Due Listing under rev-edd or edd

status-age: Receipt Due File

status: Receipt Due File, KB90, DLA terminals

sub: History File, ZRE, AE1 w/bh status card (gives substitute NSN)

value: Receipt Due File has unit price x total due in; Delinquent Dues Listing under EMV (Extended Money Value).

APPENDIX C

DUES MANAGEMENT DATA DICTIONARY

AC1: System cancellation request document.

accounts-payable: Expression to determine if funds are in accounts payable.

AF1: Follow-up document to request updated status.

AMA: Document modifier, process as requisition if original not received.

as: Supply status meaning item has been shipped.

ATA: Follow-up, to be processed as requisition if original requisition not received.

ba: Supply status meaning item is being processed for shipment.

c-status: Expression to determine system cancellation status.

ca: Supply status meaning the requisition was rejected. This status comes with narrative message stating the reason for the rejection.

canc-ackn: Expression to determine if a cancellation request has been acknowledged.

canc-subm: Expression to determine if a cancellation request has been previously submitted.

category: Expression to determine the age category of the delinquent due.

cg: Supply status meaning the requisition was rejected because holding activity was unable to identify requested item.

cj: Supply status meaning the requisition was rejected because the item is coded (or being coded) obsolete or inactivated. Item in stock number field, if different from the item requisitioned, can be furnished as a substitute.

ck: Supply status meaning the requisition was rejected because the item can not be procured. No substitute/interchangeable item is available.

classified: Expression to determine if an item is classified, pilferable or controlled.

cs: Supply status meaning the requisition was rejected because the quantity is suspect of error or indicates excessive quantity.

current-ui: Expression to determine if the current unit of issue on MISR files are valid.

Delinquent Dues: Module of expert system dealing with delinquent dues processing.

disb-qty: Expression to determine if the disbursed quantity is equal to the MIT quantity.

dla: Expression to determine if the requisition for the material is in Defense Logistics Agency (DLA) files.

doc-num: Expression to determine if the document number matches the NSN ordered.

Expression: An expression in the terms of this expert system is a symbolic expression that denotes aspects of a situation, such as a characteristic. Expressions have values associated with them that are also symbolic structures. M1's basic operation is to find or accumulate evidence for or against the values of expressions. The values of these expressions are evaluated by the rules of the system in determining the recommended conclusion.

follow-up: Expression to determine if a follow-up has been submitted or not.

fund-code-26: Expression to determine if the requisition is for a fund code 26 item.

less: The age of the most recent supply status is less than 30 days.

MISR: Master Item Stock Record. Local stock record.

mit: Expression to determine if funds are in Material In Transit (MIT).

MLN: Master List Navy. Listing of material in the navy supply system with pertinent information.

module: Expression to determine which module of the Dues Management Expert System the user wishes to envoke.

more: The age of the most recent supply status is more than 30 days.

needed: Expression to determine if the material is still needed.

nine-cog: Expression to determine if the requisition is for a 9 cog item.

none: Response to supply status question meaning no supply status has been received.

nsn-val: Expression to determine if the NSN is valid on the status card.

obligations: Expression to determine if funds are in obligations.

other: Any supply status other than ba or as.

part-ship: Expression to determine if there has been a partial shipment.

pre-ad: Expression to determine if the item was previously ordered with a 2B advice code.

pri-sat: Subjective judgment of the inventory manager if the requisition priority is satisfactory or not.

qty-excess: Expression to determine if the quantity ordered was excessive based on demand.

req-dem: Expression to determine if the item is still required based on demand.

rev-edd: Expression to determine if a revised/extended EDD has been received.

ROD: Report Of Discrepancy.

status-age: The age (in days) of the most recent supply status

status: The most recent supply status of the requisition.

sub-prov: Expression to determine if a substitute NSN was provided on the CJ status card.

sub: Expression to determine if a substitute has been received.

System Cancellations: Module of expert system dealing with system cancellation status.

tech-val: Expression to determine if the technical dept (of NSC San Diego) concluded that the item under consideration is a valid substitute.

val-sub: Expression to determine if the substitute item on the status card is a valid substitute in the MLN.

value: Expression to determine if the extended money value of a requisition is greater than $100.00.

z67: Expression to determine if a Z67 financial record exists.

APPENDIX D

NSC SAN DIEGO POINTS OF CONTACT

LCDR Harry Ornelas (code 101)	autovon	958-3131
Mary J. Fesnock (code 101A)		958-3131
Tony LaBorin (code 1011A)		958-3751

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Attn: Captain Albert. F. Potwin

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