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DEFINITION OF ALTERNATIVES FOR A BW/CW DEFENSE DATABASE

BY
JAMES J. McNEELY
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FRANK A. FORSTER

JULY 1985

FINAL REPORT JULY 1983 TO DECEMBER 1983

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This analysis provides a set of alternatives, along with the associated advantages and disadvantages, for establishing an automated database related to biological and chemical warfare (BW/CW) defense. This analysis focuses upon the preliminary considerations involved in developing and operating a database--either a stand-alone database or one integrated with other existing databases, employing personnel for either Natick, other DoD facilities, a contractor facility, or a combination of any of the three to develop and maintain the database.

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Adequate computer resources for maintaining the database were found to be available at the Army Research and Development Center (ARDC), INFOCEN at the Air Force Aeronautical Systems Division Computer Center, and certain contractor facilities. The staffs at ARDC and at certain contractor facilities were determined to be available to develop and operate the database, to have technical expertise in the subject areas of interest, and to have established a proven capability in the development and operation of databases.

SUMMARY

The purpose of this analysis was to provide the Natick Research and Development Center with a set of alternatives and the associated advantages and disadvantages for establishing an automated database containing information related to biological and chemical warfare (BW/CW) defense. The goal of establishing the database is to facilitate and structure research and development programs by providing a means to locate and retrieve information from completed research efforts and to identify knowledge gaps.

The analysis focused upon those alternatives associated with the preliminary considerations involved in developing and operating the database. Those preliminary considerations included determining:

- whether the database should be stand-alone or integrated;
- where the database should be located;
- who should develop the database; and
- who should operate and maintain the database.

Integration of the Natick database with existing databases would provide the best means of consolidating information within the BW/CW research community and facilitate the identification of previously performed research efforts and knowledge gaps. Integration, however, was not found to be a practical alternative since the existing databases are structured differently and each is maintained with a different database management system (DBMS).

The facilities evaluated as potential host sites for the database included Natick, the Army Materials and Mechanics Research Center (AMMRC), the Army Research and Development Center (ARDC), Information Central (INFOCEN) at the U. S. Air Force Aeronautical Systems Division Computer Center located at Wright-Patterson Air Force Base, and a contractor facility. The qualifications of the staffs at the potential host facilities for developing and operating databases were also evaluated.

The computer resources, both software and hardware, were found to be more reliable and easier to use at ARDC, INFOCEN, and a contractor facility (depending upon the contractor selected). The staffs at both Natick and AMMRC do not have experience developing and maintaining databases. Although

the staff at INFOCEN was found to have established a proven capability in developing and operating automated databases, they were not found to have the technical expertise in the areas of BW/CW that could lead to an improved design and easier operation of the database while reducing the level of effort that would be required of Natick or contractor-supported personnel.

The staffs at both ARDC and a contractor facility (depending upon the contractor selected) have technical and data processing expertise as well as a proven capability for developing and operating databases. The staff at a contractor facility may provide expertise in a broader range of disciplines, but may also be more expensive to employ than the staffs at DoD facilities.

Once the location of the database and the personnel to develop and operate it have been selected, a staff member from Natick should be appointed as the database administrator to coordinate the development and operation of the database and insure that the requirements of the potential users are satisfied. The establishment of a prototype database before the final design is implemented could serve as an additional means of insuring that the users' interests are incorporated.

PREFACE

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DEFINITION OF ALTERNATIVES FOR A BW/CW DEFENSE DATABASE

INTRODUCTION

The U. S. Army Natick Research and Development Center (Natick) desires to establish an automated database containing information and data on biological and chemical warfare (BW/CW) defense. It is desired that such a database be compatible with similar databases in operation or being established at other facilities, but not necessarily duplicative of them. Specifically, databases in operation or being developed at the Army Research and Development Center (ARDC) and the Army Materials and Mechanics Research Center (AMMRC) are of interest. Properly implemented, such a database will:

(1) facilitate establishment of long-range R&D program plans;

(2) avoid duplication of completed research efforts;

(3) serve as an indicator of research gaps;

(4) provide a common reference source within Natick for individuals conducting research in BW/CW defense.

Personnel at Natick have defined numerous categories of data and information which will serve as a starting point for the range of information that may be included in the database. Additionally, Natick has defined a general requirement for the database. This study was designed to provide the definition of several alternative approaches for developing a BW/CW database that satisfies the Natick requirement and at the same time is compatible with the databases of interest at AMMRC and ARDC.

OBJECTIVE

The primary objective of this effort was to provide prospective database users at Natick with a set of alternatives from which they may choose the most attractive course in developing an automated CW/BW information system that satisfies their requirements and is compatible with databases at AMMRC and ARDC.

APPROACH TO THE PROBLEM

The general approach to this problem was to obtain an understanding of the Natick database requirements and resources available and an understanding of the databases in operation or being developed at AMMRC and ARDC. This was accomplished through meetings with technical personnel at each organization responsible for the development and/or operation of each of the databases and through review of technical reports describing the scope and capabilities (i.e., file contents, structure, size) of the existing databases. Descriptions of the ARDC and AMMRC databases are provided in later sections of this report. Definitions of data fields and records contained in those databases are provided in Appendix A.

A questionnaire was developed and sent to AMMRC, to ARDC, and to other Government organizations having databases related to subject areas of interest to Natick personnel (e.g., BW/CW, physical properties of materials, hazardous materials/materials interactions, test methods, IR spectra, etc.). The purpose of this questionnaire was to solicit information on the scope, capabilities, availability, developmental and operational requirements (i.e., time and manpower), and the associated costs of each database. The questionnaire and the responses received are contained in Appendix B of this report. Additional information on the database management systems (DBMSs) employed at the host facilities as well as those compatible with existing Natick hardware was also obtained. The information included the capabilities, hardware requirements, costs, and vendor of the DBMS. The additional DBMS information is included in Appendix C of this report.

Following this information-gathering activity, the information was analyzed and synthesized into three potential alternatives for the Natick BW/CW database. Briefly, the three alternatives defined are:

(1) develop and host a stand-alone DBMS at Natick;

(2) develop and host the Natick database at another facility (AMMRC, ARDC, other);

(3) integrate the Natick database into the AMMRC and/or ARDC databases.

For each of the three alternatives the developmental and operational costs, as well as calendar time required for development, were estimated and the advantages and disadvantages of each were provided. A single alternative was not recommended. Rather, each alternative was defined so that Natick personnel could select the most appropriate alternative consistent with their requirements and available resources.

The overall approach to the study is summarized in Figure 1.

NATICK DATABASE REQUIREMENTS AND AVAILABLE RESOURCES

The following sections describe the requirements for the Natick BW/CW defense database as identified by Natick personnel. Lists of the resources that are potentially available for development and support of the database are also included.

Natick Database Requirements

Personnel at Natick have defined the following as requirements for a potential BW/CW database:

- it must be automated;
- it must include friendly, easy-to-learn interfaces for potential users;
- it must include both bibliographic references as well as numeric data abstracted from those references;

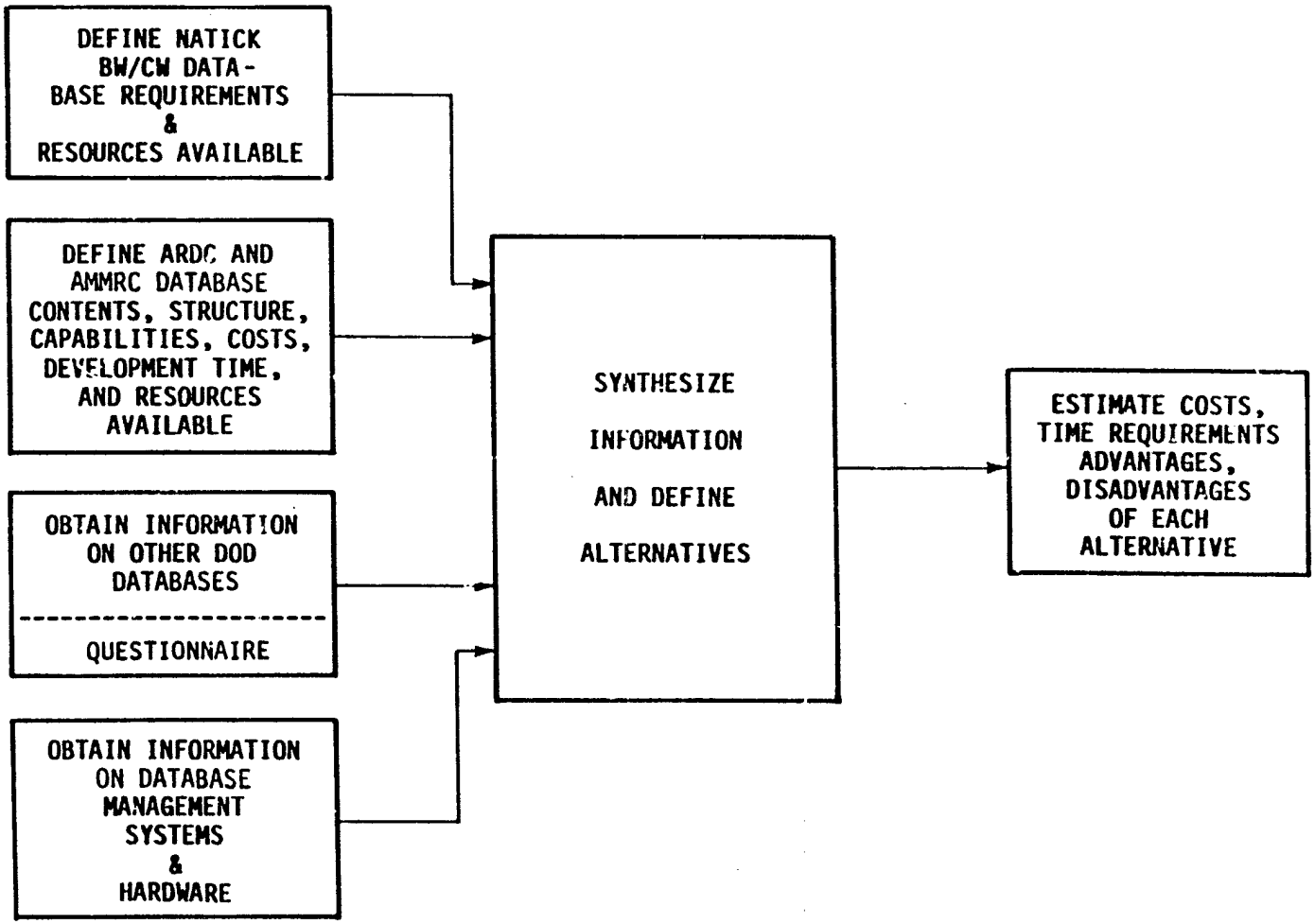

Figure 1. Summary of study approach.

- it must be compatible with DoD-affiliated databases, such as those at AMMRC and ARDC, whose subject area is related to BW/CW defense and/or properties of materials.

In addition to the primary requirements listed above, Natick personnel have also expressed a desire for a database that:

- allows a user to perform concurrent searches of alternate databases and/or is capable of referring a user to other pertinent databases;
- contains a graphics capability;
- insures data integrity.

The database should also be structured to meet the needs of approximately 35 users who are:

- Operations Research Analysts
- Systems Analysts
- Engineers
- Psychologists
- Chemists
- Technical Researchers performing research and development in the physical, biological, and engineering sciences.

The research and development performed is primarily related to military commodity items such as clothing and personal equipment, field shelters and equipage, field organizational equipment, food and food systems, and containers and packaging materials.

The potential users of the Natick database have made an initial determination of the types of information that they feel should be included in the database. The types of information initially identified as relevant include:

- mass spectral data of toxic and chemical-defense-related compounds;

- pyrolysis pattern data and spectroscopic data for pyrolyzates for biological agents;
- scanning electron microscope (SEM) analysis of structures (i.e., materials) designed or developed for chemical defense protection;
- Fourier transform IR spectral data for simulants, agents, and metabolites;
- ability to compare chemical and physical properties of simulants and agents;
- permeability data on fabrics, films, and elastomers including sorption, solubility, and desorption characteristics with agents and decontaminants;
- permeability test methodologies for various types of materials;
- effects of decontaminants on polymeric materials;
- interactions and reactions of chemical agents with polyurethane-based paints;
- toxin data concerning routes of action, toxicity, persistence, and decontamination means;
- toxic limits for chemical agents in water;
- toxic limits of mycotoxins in water and analytical methods for their recovery;
- persistence of chemical agents in water;
- simulants for agents and analytical methods for each;
- application of genetic and physiological methods to synthesize antiagent microbial enzymes;
- organisms or enzymes which inactivate, neutralize, or degrade organophosphorous pesticides and nerve agents and their application;
- the biochemistry and molecular biology dealing with carboxylesterase, acetylcholinesterase, cholinesterase, carbon-nitrogen hydrolase, diisopropylfluorophosphate fluorohydrolase, phosphorylphosphatase. and phosphorylthiophosphalase;
- information on Bacillus macerans;

- types of organophosphorous compounds being used as CW agents and methods of deployment;
- physiological effects of agents on humans;
- psychological stresses of NBC warfare;
- human factor aspects of NBC protection.

Natick Development and Support Resources

Natick currently does not have a staff experienced in the development of databases in the BW/CW defense or materials properties subject areas. It is assumed, however, that the Management Information Systems (MIS) group at Natick does have experience developing applications with the Natick DBMS and would be able to lend support, if needed, to the development and operation of the database. Also, although the technical staff at Natick has sufficient knowlege of and experience in the various subject areas that are to be included in the database, they may not be available to provide the time and effort required to develop and maintain the database without additional support.

Natick Computer Resources

Natick currently has two general-purpose computer systems: an IBM 4341 L10 and a UNIVAC 1106. The IBM is currently used only for business applications and the UNIVAC for both scientific/engineering (70 percent of utilization) and business applications (30 percent of utilization). Future plans of the MIS group of Natick dictate that eventually all applications will be supported on the IBM and only scientific/engineering applications will be supported on the UNIVAC. Business applications currently supported on the UNIVAC are to be transferred to the IBM.

The IBM, with 4 million bytes of memory, runs the OS/VS (under VM) operating system and has the following peripherals:

- 4 disk drives with a total storage capacity of 3,276,000,000 bytes
- 4 nine-track tape drives

- 2 card readers
- 1 card punch
- 2 direct-wire terminals
- 2 operator's consoles
- 1 high-speed printer

The UNIVAC, with two CPUs and 524K words of memory, runs the EXEC 8 Level 33R1 operating system and has the following peripherals:

- 12 disk drives with a total storage capacity of 120,000,000 words
- 2 drums with a total storage capacity of 2,883,584 words
- 2 seven-track tape drives
- 10 nine-track tape drives
- 1 Communications Terminal Module Controller
- 1 9300 subsystem with:
  - high-speed printer
  - card reader/punch
  - paper-tape reader/punch
- 1 1004 subsystem with:
  - high-speed printer
  - card reader/punch
- Operator's console and pagewriter
- A variety of remote dial-up terminals, both hardcopy and display.

The UNIVAC hosts the System 2000 DBMS whereas no DBMS is currently hosted on the IBM. A description of System 2000 and its associated features is included in Appendix C.

DESCRIPTION OF THE DATABASES AND RESOURCES AVAILABLE AT AMMRC

The mission of AMMRC is to provide technical information regarding the properties (e.g., chemical, mechanical) of various materials to the defense community. In order to support research in the area of polymeric materials, a database is currently being developed for AMMRC by The Analytic Sciences Corporation (TASC). Approximately one year of a two-year development program has been completed with the establishment of a prototype database that is currently operational. Future development work will include a continuation of the input of data to the database and a possible modification of the prototype structure before the final database design is achieved.

The database, the AMMRC Laboratory Information Support System (ALISS), is a numeric database containing research-oriented data for the use of personnel of AMMRC. For this analysis, research-oriented data are defined to be information that is reported in the database as found in the literature with little modification or qualification. Research-oriented data are distinguished from engineering-oriented data in which the information has been either qualified or modified to facilitate the subsequent use of the information in specific applications. Those applications may include the design of systems or selection of materials of construction of a system. Engineering-oriented data would be presented in such a fashion that an engineer could use the information quickly with limited need of inferences or modifications.

The future availability of the database to outside users is not currently known.

File Contents and Structure

ALISS serves as a means by which the results of laboratory tests performed on polymeric materials, either at AMMRC or at other facilties, can be easily retrieved by AMMRC personnel to complement ongoing work and prevent the duplication of previously performed research. The information contained in the database can be categorized into one of the following areas:

- Laboratory test method
- Material/Group
- Identification
- Property
- Value/Observations.

One or more record types are associated with each of the subject areas listed above. A record is a collection of data items or fields and a record type represents a collection of records containing the same data fields. A data field is the descriptor associated with a value contained in the database. For example, time, temperature, pressure, and material type may all be data fields and the respective values could be 5:00, 25°C, 14.7 psi, and elastomer. In ALISS, however, almost all record types contain one data field, and therefore there is no distinction between records and fields.

The ALISS conceptual model is presented in Figure 2. The conceptual model represents the logical organization of the record types contained in the database. The results of laboratory tests are qualified by the type of test performed, the organization and/or individual performing the test, and the type of material on which the test was performed. Each of the three different groups of record types is hierarchically organized in paths in which descriptions become more specific as one moves down the path. In Figure 2, the records associated with the origin of each of the three major paths are labeled TEST, ID, and GROUP/MATERIAL, respectively. Information from the three paths is combined to form a unique record, PROPERTY, for each individual test recorded. The VALUE and the OBSERVATION record types are associated with each PROPERTY record (i.e., test recorded). The VALUE record contains quantitative test results and the OBSERVATION record contains qualitative results offered by the researcher performing the experimentation. Examples of the typical values associated with each of the records are presented in Appendix A.

Operating Procedures

The operating procedures are defined to include the methods employed to:

- retrieve data from various sources;
- evaluate data;

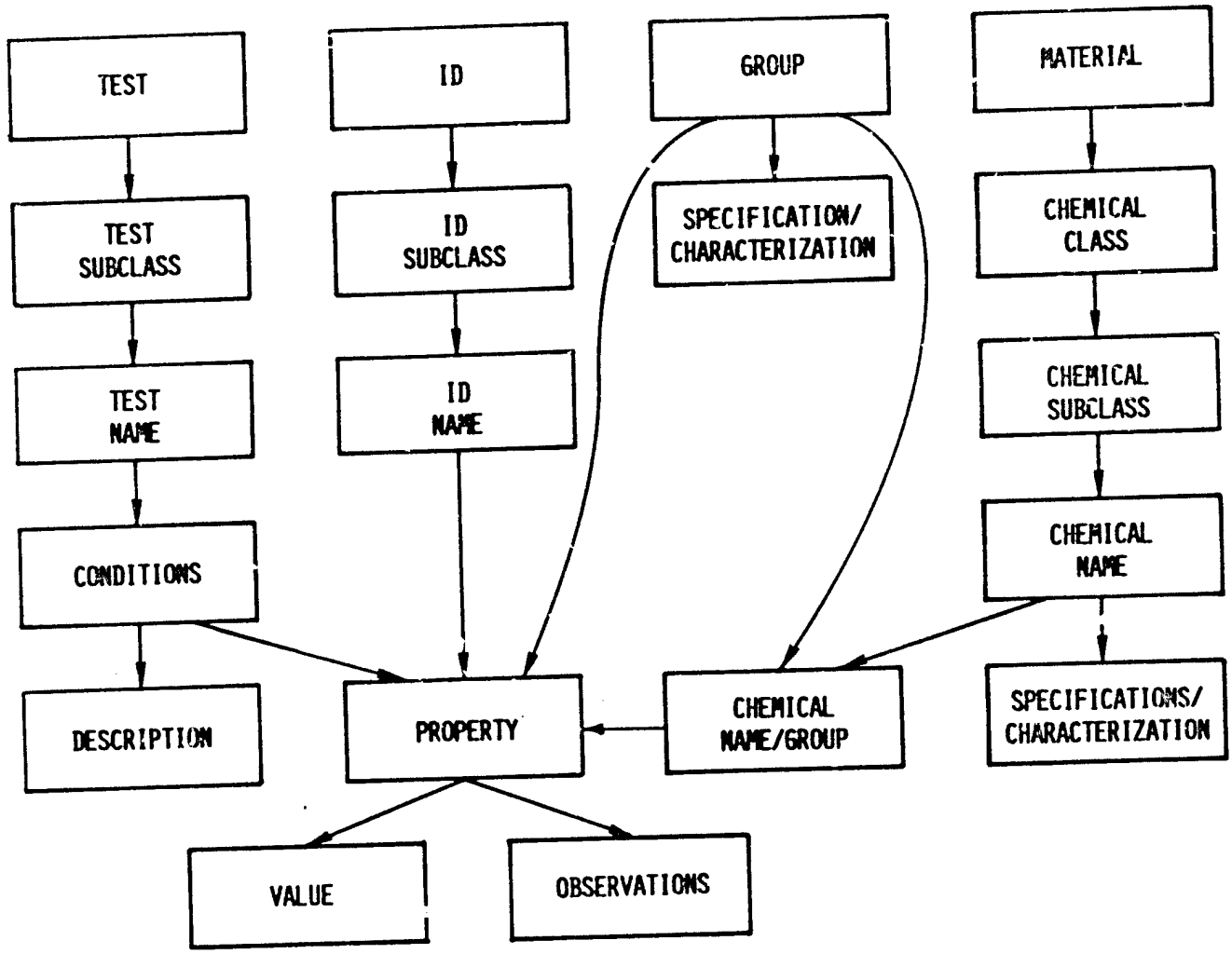

Figure 2. ALISS conceptual model.

From Reference 1.

- input data to the database;
- update or edit data;
- restructure the database;
- retrieve data from the database;
- manipulate data using applications programs.

At AMMRC, researchers using ALISS are capable of entering data from their own experimental work or the results of worked performed by others. There are currently no limitations on the data input other than that the formats employed must be consistent with those defined for the records and fields as defined in the conceptual model. No one individual or group of individuals has been assigned the task of evaluating the data to insure the integrity of the database. Staff members who have been given permission to input data also have the capability to edit data within the database.

Restructuring the database is defined to be modification of the records, fields, or conceptual model. Only one person, the database administrator, has the authority to perform any restructuring of the database. All restructuring of the database is performed in the batch mode.

Retrieval of data is accomplished through the employment of user-friendly, menu-driven, interactive programs. A menu-driven program allows users to retrieve data by selecting from a series of alternatives presented to them by the system. A menu-driven approach is attractive to inexperienced or infrequent users of the database since a methodology does not have to be learned or memorized. A similar approach is used for input and update of data.

No applications programs, such as statistical or graphics packages, are currently used to manipulate data within the database. The only tool currently used to manipulate data is a report generator. The report generator prints summaries of information in the database in a fixed, predetermined format.

Resources Available at AMMRC

The technical staff members of AMMRC are currently working to develop ALISS in addition to performing tasks related to other research projects. Since the primary responsibilities of the technical staff are not related to the development or operation of the database, they are assumed to be unavailable to

perform such tasks to assist in the establishment of the Natick database. Even if available, the technical staff has not established a proven capability in the development or operation of databases. The availability or qualifications of the data processing staff of AMMRC are not known.

The computer resources at AMMRC include the Harris 125/6 computer and the TOTAL DBMS. Both are adequate for maintaining a database, but they may not be available to support a second database in addition to ALISS. A description of TOTAL is included in Appendix C.

DESCRIPTION OF THE DATABASES AND RESOURCES AVAILABLE AT ARDC

Three automated databases are currently hosted at ARDC. These databases are part of the Plastics Technical Evaluation Center (PLASTEC), which is assigned to ARDC in Dover, New Jersey. PLASTEC is one of approximately 20 information analysis centers sponsored by the DoD. The mission of PLASTEC is to provide the defense community with technical information on current development, engineering, and application work in the field of plastics, reinforced plastics, adhesives, and organic-matrix composites.

In order to perform better the above mission, three databases were developed and are currently maintained by PLASTEC personnel. More specifically, the databases were established to facilitate the design and operation of munitions productions facilities. The databases contain both numeric and bibliographic data pertaining to the interactions between the materials of construction of munitions-producing systems or the munitions themselves and the energetic materials with the munitions or the environments found in the facilities.

The data are engineering-oriented and are currently available to the entire U. S. scientific and technical community for a minimal fee. Users of the database can retrieve data either directly themselves using telecommunications links to the ARDC computer, or indirectly by having PLASTEC personnel perform the necessary information searches.

File Contents and Structure

The three databases currently maintained at ARDC are the Materials Deterioration Data Program (DETER), the Hazard Analysis Data Program (HAZARD), and the Energetic Materials Compatibility Data Program (COMPAT). DETER contains data describing the effects of environments found in munitions production facilities on materials of construction. The database was implemented in 1978 and currently contains approximately 8,000 records. COMPAT, developed in 1974, contains data on the compatibility of various inert materials with various energetic materials. HAZARD was developed in 1981 to supplement COMPAT and has data concerning the hazards that may be encountered in the production of energetic materials with various types of equipment. There are currently 1,600 COMPAT and 5,000 HAZARD records.

DETER contains deterioration data such as the deterioration rate, weight change, and strength change of various materials when exposed to various atmospheric conditions (including temperature), chemicals, stress, mechanical actions, such as the impingement of liquids or solid particles, or when in contact or used with materials of construction. The materials considered include metals, plastics, elastomers, inorganics, and organics.

Production equipment considered includes, but is not limited to, the following:

- Reactors
- Pipes
- Pumps
- Compressors
- Heat exchangers
- Distillation columns
- Condensers
- Scrubbers
- Towers
- Stacks.

The DETER conceptual model is illustrated in Figure 3. The records are hierarchically organized with information from the chemical, material, and document records included in the deterioration records. Deterioration data are described

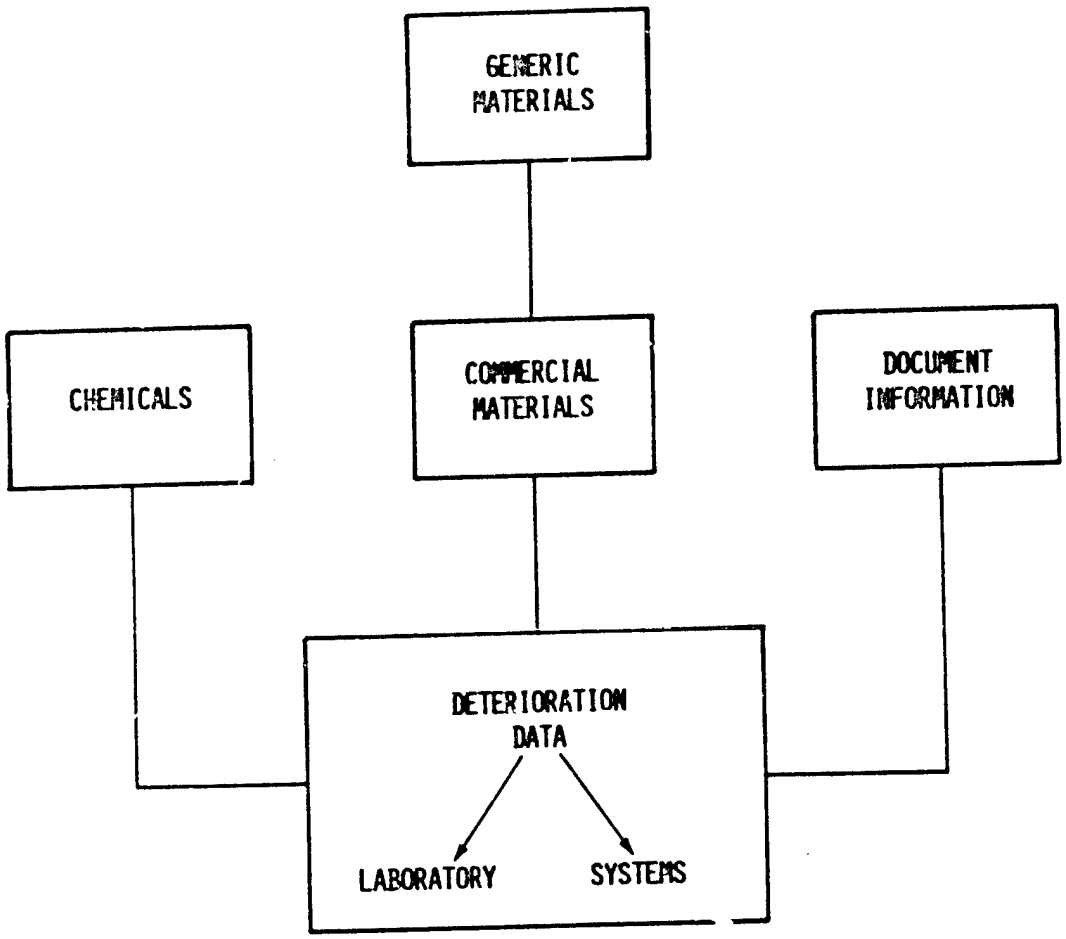

Figure 3. DETER conceptual model.

From Reference 2.

by two record types: laboratory and systems. The laboratory records contain results of experimental efforts on materials of construction, whereas the systems records contain information that has been extracted from actual experiences involving the production equipment. The description of the data fields associated with each of the record types is provided in Appendix A.

In addition to data describing the hazards that may be encountered when processing energetic material with specific types of equipment, HAZARD includes data describing the sensitivity of energetic materials as determined by laboratory experimental methods. The energetic or hazardous materials included in the database are explosives, propellants, and some chemicals considered hazardous when processed. The measures of hazards include, but are not limited to, the probabilities of explosion and burning. The types of equipment considered are similar to those considered in DETER but may also include:

- Belts
- Conveyors
- Feeders
- Agitators
- Mixers
- Separators
- Centrifuges
- Extractors
- Extruders.

The HAZARD conceptual model is illustrated in Figure 4. The laboratory and equipment analysis records both contain information that is also found in the records describing the hazardous materials and the references from which the information was derived. The data fields and descriptors of these fields are included in Appendix A.

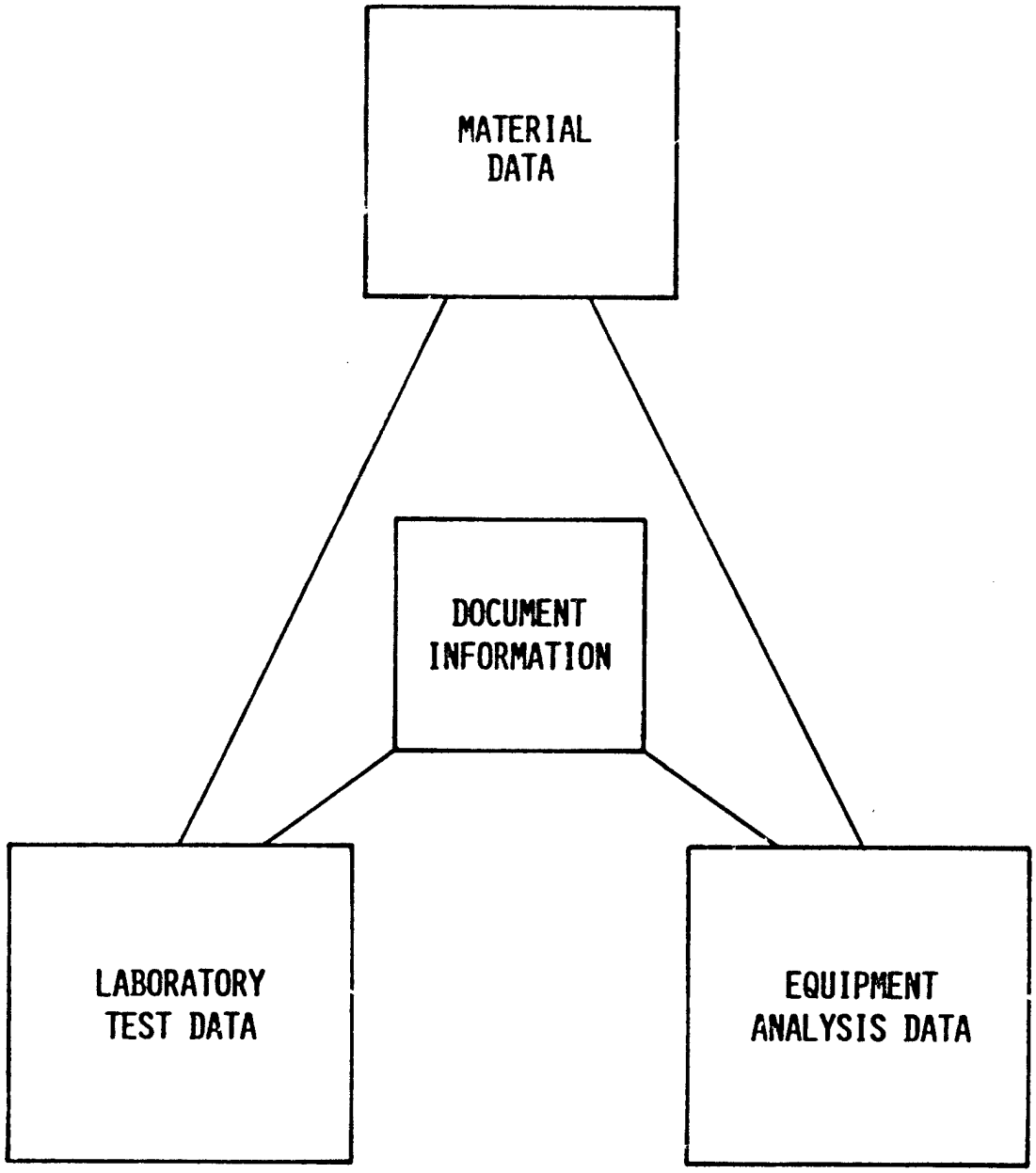

Figure 4. HAZARD conceptual model.

From Reference 3.

COMPAT is the least sophisticated of the three databases. The database is comprised of lists of:

- energetic materials compatible or incompatible with a given inert material;
- inert materials compatible or incompatible with a given energetic material;
- the 610 inert materials in the data bank;
- the 485 energetic materials in the data bank.

Operating Procedures

The information stored in the ARDC databases is taken from various sources including the literature, interviews with technical experts, and discussions with personnel at munitions production facilities. Data can be extracted from the sources listed above by personnel with varying backgrounds and levels of expertise. A standardized format has been established for the extraction of data to be used in each of the databases. Once data have been extracted, their validity is assessed by a technical expert before they are entered. The extraction and evaluation of data are the most time-consuming processes involved in the operation of the database.

At ARDC, only selected individuals may specify information to be added to the database. Nontechnical staff members perform the actual input/update/edit procedures, but all inputs or changes to the data are first approved by technical personnel. The restructuring of the database is also limited. Only the database administrator has the authority to restructure the database. Restructuring can be performed interactively with user-friendly interfaces.

The procedures that can be employed to retrieve data are the command or the menu-driven approach or a combination of these. Users can perform the beginning of their searches by selecting alternatives from the menus presented to them, but in many instances the latter portions of searches must be completed by inputting commands or information that must either be learned or retrieved from a user manual. Work is currently being performed to develop more user-friendly procedures for retrieving data. More experienced users have the option for retrieving data using only commands.

Data manipulation capabilities, such as graphics and computation packages, are available but not currently employed.

Resources Available at ARDC

Data processing and technical staff members are available at ARDC to develop and operate a database for Natick. Both groups have established capabilities in the development and operation of numeric databases containing engineering-oriented data related to properties of materials. In addition, two chemical engineers may also be available to assist in the acquisition and assessment of data.

The computer resources at ARDC are a VAX 11/780 and the DRS DBMS. DRS is a flexible and easy-to-use DBMS. A description of DRS is included in Appendix C. The ARDC computer resources are available to support a database for Natick.

DESCRIPTION OF THE DATABASES AND RESOURCES AVAILABLE AT INFOCEN

As a result of distributing a questionnaire to facilities maintaining Government-sponsored databases, it was found that an organization located at Wright-Patterson Air Force Base (WPAFB) develops and maintains databases for both the Air Force and other branches of the DoD. The organization, Information Central (INFOCEN), is a division of the computer center of the Aeronautical Systems Division (ASD) of the Air Force.

INFOCEN is different from AMMRC and ARDC in that its mission is limited to the data processing considerations associated with developing and maintaining a database. The personnel at INFOCEN are concerned with providing the services necessary to support the needs of organizations other than itself. INFOCEN originated in the late 1960s and currently maintains over 70 databases. BASIS is the DBMS used by INFOCEN.

File Contents and Structure

The file contents and structures of the databases at INFOCEN vary according to the applications for which those databases were developed. In general, the types of databases can be divided into two general categories: those developed to support research activities and those developed to assist in record-keeping. The databases of INFOCEN contain both numeric and bibliographic data.

Operating Procedures

The operating procedures employed at INFOCEN are variable and dependent upon the database under consideration. In general, database users have the capability to employ user-friendly, menu-driven interfaces to generate and restructure the database, input data, update or edit data, retrieve data, and manipulate data. The DBMS, BASIS, also allows for the easy generation of the menus employed in tutorial approaches and formats in which data are to be output. The data manipulation capabilities include graphics and computation packages as well as interfaces for specialized application programs. The staff at INFOCEN is currently in the process of acquiring a sophisticated graphics package that is more powerful than the one associated with BASIS.

Resources Available at INFOCEN

The staff at INFOCEN has established a proven capability for the development and operation of databases. The staff consists of nine data processing/systems analyst personnel who are dedicated solely to the development and support of INFOCEN databases. Although the INFOCEN staff has experience in the development and operation of databases, they do not have technical experience in the BW/CW or materials properties areas and would not be available to perform any technical assessment functions.

INFOCEN currently has four VAX 11/780 computers that are dedicated totally to the support of databases. In addition, four versions of BASIS have been purchased for each of the computers. BASIS is a flexible and easy-to-use DBMS. A brief description of BASIS in included in Appendix C.

ALTERNATIVES FOR THE ESTABLISHMENT OF THE NATICK DATABASE

Before the development of the Natick database can commence, Natick management will need to direct attention to some preliminary considerations. These considerations will lead to the determination of:

- where the database should be hosted;
- who should develop the database;
- who should operate and maintain the database;
- whether the database should be stand-alone or integrated.

In order to make these determinations, available alternatives must be identified and analyzed. The alternatives for a host site considered in this analysis were Natick, other DoD facilities, and contractor facilities. The development and operation of the database could feasibly be performed by Natick staff, the staff of other DoD facilities, by contractor staff, or a combination of these groups. The database could be designed to contain only the files developed for Natick (stand-alone) or could be a consolidation of the files from other databases in the BW/CW community (integrated). The advantages and disadvantages of each approach are discussed in the following sections.

Alternatives will also be available to Natick staff during the development and operational phases, such as those associated with defining data contents, structures, and the operational procedures available. This analysis, however, is limited to defining the advantages and disadvantages associated with alternatives available at the present time.

Development of a Stand-Alone System at Natick

The first alternative considered for establishing the database was the development and operation of a stand-alone system at Natick. Since a stand-alone system at Natick would not necessarily need to meet the research

needs of personnel at other facilities, its design could be tailored to meet the specific needs of Natick researchers. The needs of the Natick users could be considered in defining both the content and the operating procedures for the database.

The procedural needs of Natick users may be dependent upon their experience with and skill in the use of automated systems. For example, a menu-driven or tutorial type of user-system interface is easiest for users with little experience with automated systems. A menu-driven interface could be combined with a command-driven interface for more sophisticated users. A command-driven interface allows experienced users to retrieve data more quickly than does a menu-driven interface, which requires responses to a succession of lists of options.

Although a stand-alone database could be specially tailored to meet the needs and skill levels of the Natick users, it may fall short in achieving the goal of identifying knowledge gaps and reducing the duplication of research efforts within the BW/CW community. The stand-alone system would not serve as the best means for collecting and organizing information scattered throughout the research community into one, central repository. An integration of existing databases may be an improved means for accomplishing this goal and will be discussed later.

Despite not being the best alternative for organizing information within the entire community, the stand-alone system would serve as a means for achieving that goal for the smaller research community at Natick. In addition, Natick researchers could obtain information from other organizations by developing the capability to perform separate searches of other existing databases. In order to perform searches of the other databases, Natick personnel would be required to learn the additional procedures associated with using these other systems. In order to minimize this learning time, the procedures for using the Natick database could be designed to be compatible with databases that are most likely to be searched by Natick personnel.

Stand-alone development by Natick personnel would require a joint effort between the database administrators, potential users, and the Natick MIS group. Although development of the database solely by Natick personnel is feasible, a better database design could be achieved with assistance of more experienced personnel, particularly those knowledgeable in the areas

of BW/CW defense and/or properties of materials. Experienced assistance could be obtained either from contractors or from personnel at other DoD facilities. It is estimated, based on previous database development work at AMMRC, ARDC, and Battelle, that development of an operational database with experienced assistance could be accomplished in six months to one year. Additional tuning of the system, dependent upon the desires of Natick personnel, could be completed within one to two years after the initial development work commenced.

Development could be accomplished in 1/2 to 1 worker-year provided by one experienced person. If outside support is used to develop the database, the Natick staff time required for development would be minimal; potential Natick users would have to work briefly with developers to finalize requirements and one Natick staff member would be required to spend between 1/4 to 1/2 worker-year fulfilling the duties of a database administrator. The function of the database administrator would be primarily to coordinate the development effort by serving as the interface between the developer and potential users. More specifically, he or she would be responsible for determining the interests and needs of the various user groups (preferably with their consent) and insuring that those interests and needs are incorporated into the database design by the developer. The manpower costs for the development of the database would range from $20,000 to $40,000 for Natick personnel and $50,000 to $100,000 for contractor personnel. These costs are estimated on a basis of $80,000 per worker-year for DoD personnel and $100,000 per worker-year for contractor personnel.

Development of the database by Natick personnel, who have experience, would take longer and as a result would be more costly. Development could be achieved within twice the time required for development with outside support. The development is estimated to require one to three worker-years of effort by at least two persons--the database administrator and a representative from the Natick MIS group with experience in implementing databases using System 2000.

If personnel are available, a well-designed database could be operated and maintained by Natick personnel without any outside assistance. The most time-consuming aspect of the operation of the database would be the acquisition and assessment of data. Acquisition is defined here as the

gathering of information from various sources such as literature or laboratory notebooks. Assessment is defined to be the evaluation of data and is the most important phase of maintaining a database in which the integrity of the data can be insured. Data integrity could be maintained by either eliminating data that were judged to be unsatisfactory or by including qualitative assessments of the data within the database. Performing an assessment of data after they have been input to the database may facilitate the process since comparisons and evaluations of data sets could be made quickly using the automated system. In all cases, however, data should be qualified in some manner to insure integrity. These qualifications may be as simple as labeling the data as either "approved" or "not yet evaluated".

Data acquisition could be performed by any of the personnel from each of the research groups interested in the use of the database. An individual with a strong technical background and knowledge of the subject areas included in the database should be responsible for data assessment. If no single individual is knowledgeable in all areas, a group of individuals may be required to perform data assessment.

In addition to data acquisition and assessment, staff members will be needed to input the data. Input of the data could be performed by a nontechnical staff member. The effort involved for data input could be reduced if a user-friendly system input interface is developed. Also, a staff member would be required to coordinate and manage all of the database activities described above.

Based on estimates provided by personnel from ARDC approximately 1/4 to 1/2 of a worker-year would be required for data acquisition, assessment, and input. It is assumed that approximately 1/8 of a worker-year would be required for system management. If this manpower is provided by Natick, assuming a charge of $80,000 per worker-year, the costs for data assessment, input, and management would be $30,000 to $50,000 per year. If Natick personnel are not available, outside support could be obtained to operate the database. Charges may be comparable, but would vary depending upon choice of supporting organization. Assuming a contractor was tasked to perform data acquisition, assessment, and input at a charge of $100,000 per worker-year and a Natick staff member was responsible for coordination of activities and management of the system, the manpower costs would range between $35,000 and $60,000 annually.

TABLE 1. Estimated Resources Required and Costs for Establishing the Database at Natick.

RESOURCE	DEVELOPMENT	OPERATIONS
TIME	6 MONTHS TO 2 YEARS	--
PERSONNEL (WORK-YEARS)		
NATICK	1/4 TO 1/2 / $20,000 TO $40,000	1/8 / $10,000
OTHER (CONTRACTOR)	1/2 TO 1 / $50,000 TO $100,000	1/4 TO 1/2 / $25,000 TO $50,000
COMPUTER RESOURCES		
USE AND STORAGE	$3,500 TO $4,500	$3,500 TO $4,500
RANGE OF TOTAL COSTS	$73,500 TO $144,500	$38,500 TO $64,500

In addition to costs associated with data acquisition, assessment and input, operating costs would include those incurred for the use of the computer resources of Natick. Charges for use of computer resources can be broken down to those associated with computer time (connect and CPU), and storage.

Estimating the amount of computer resources that will be used during data input or retrieval is difficult since it may vary considerably for each individual session. In an attempt to estimate the costs associated with use of computer resources at Natick, it was assumed that the users, during normal operations, would be connected to the system for approximately one hour a day. During that hour, the CPU time required was assumed to be 30 seconds. A database storage requirement, similar to that of ARDC, of 10 megabytes (Mbytes) was also assumed. Based on the current charges for Natick computer resources ($0.03/CPU second and $1.02/Mbytes-day), the charges estimated for annual use were approximately $4,200. The estimate was based on a 250-day year for use of the system and a 365-day year for storage. The estimate of annual charges is comparable to that provided for operating a database at ARDC--between $3,500 and $4,500 annually. Also, based on information provided by personnel from ARDC, the charges for use of computer resources during the development phase of the database were assumed to be approximately the same as those for normal operation of the database. Although more CPU time would be needed during development, the added expense would be negated by a decrease in the charges for storage. Significant storage charges would not begin to accrue until most of the data had been input to the system.

A summary of the costs and resources required for developing and operating the database at Natick is included in Table 1. For the calculation of the figures in the table, it was assumed that Natick personnel would not be available to perform the major portions of the development and operations work required and contractor assistance would be employed. Also, the figures reflect the assumption that the database could be maintained on the computer resources currently available at Natick.

The probability of establishing a successful and supportable database on the computer resources currently available at Natick appears to be very low. The IBM 4341 is unavailable for nonbusiness applications and the UNIVAC 1106 is old. In order to host a database at Natick, it would be imperative either to update the UNIVAC 1106 or host the database on the IBM 4341.

In the event that the UNIVAC could be updated, additional programming work might be required to modify the DBMS, System 2000, in order to incorporate the capabilities desired by Natick personnel. In order to maintain a flexible database, the DBMS should at least have a restructuring too. The DBMS should also have the capability to generate user-friendly interfaces to retrieve, input, update, and manipulate data. Although System 2000 does have the basic features desired, it is not as easy to work with as newer software products. Experienced data processing personnel might be required to assist in the development and operation of the database or to write additional software before less experienced personnel could perform generating, restructuring, and data inputting tasks.

Since there is currently no DBMS on the IBM 4341, purchase of a new DBMS would be required to host the database on that system. Costs for purchasing a new DBMS with the associated packages necessary for providing features desired by Natick personnel would range between $50,000 and $130,000. Costs for DBMS packages are included in Appendix C. While the central database package often costs less than $50,000, it usually does not include all of the features desired by Natick personnel. Additional costs would be incurred to obtain packages needed to increase the flexibility and ease of use of the DBMS.

Hosting the Database at Other Facilities

The second alternative for establishing the Natick database would be to host an independent database at another facility. Potential host organizations could include other DoD facilities or contractor facilities such as those at which DoD-affiliated databases have been hosted . The DoD facilities investigated for this study were AMMRC, ARDC, and INFOCEN. Hosting the database at another facility would potentially allow Natick personnel to take advantage of staffs that have more database experience. At some facilities, both data processing personnel and technical personnel are available. Having personnel from the host facility operate and maintain the database may free Natick technical personnel from performing the time-consuming tasks of data acquisition and assessment. In addition to

the benefits that could be gained from using experienced staff members to develop and maintain the database, another advantage to hosting the database at another facility is that the hardware and DBMS may be more reliable, flexible, and easier to learn and use.

Hosting the Database at AMMRC

A stand-alone database could possibly be hosted at AMMRC. Developing and hosting the Natick database at AMMRC would facilitate the establishment of a database compatible with ALISS since the same software would be employed. A similar conceptual model and similar operational procedures could be employed, if desired. Compatibility of operational procedures would require Natick personnel to learn only one set of procedures in order to be able to perform alternate searches of the two databases; however, the advantages of concurrent searching available with an integrated system could not be exploited. Moreover, since the databases at AMMRC and ARDC are currently not compatible, developing a system compatible with ALISS would result in users being required to learn additional procedures to use the ARDC databases.

Although it may be feasible to develop and host the database at AMMRC if permitted, the staff at AMMRC has not established a proven capability in developing or operating databases and would not have the time to support the Natick effort. Therefore, if the decision were made to host the database at AMMRC, Natick personnel or personnel from another facility would be required to develop and operate the database system.

The computer resources of AMMRC, if available, may offer a slight advantage over those at Natick. The Harris 125/6 at AMMRC is a more reliable system than the UNIVAC 1106. Although currently adequate for the support of ALISS, the system may not have the capacity to support a second database. Moreover, use of the AMMRC DBMS (TOTAL) may provide little advantage over using System 2000. Applications programs were written to modify TOTAL to meet the needs of AMMRC users and additional programming would be required to meet the needs of Natick users.

The cost, time, and manpower requirements would be essentially the same as those presented for developing and operating the stand-alone system

at Natick with contractor assistance. Although the system would be accessed remotely and coordination of activities might be more difficult, the time required for management of the system by Natick personnel was assumed to be the same as for on-site management. Also, although the exact charges for use of the computer resources of AMMRC by Natick were not made available, they were assumed to be the same as those estimated for the use of the resources at Natick and ARDC. The only difference between resources required and costs associated with the establishment of the database at either of Natick and AMMRC would be additional data communications costs if the database were hosted at AMMRC. The communications costs would range between $0 associated with use of the AUTOVON system to approximately $1,400 for use of the public phone system or for dedicated phone lines. The use of the AUTOVON system, although attractive due to its zero cost, may not provide the level of quality required for data transmission. Use of the public phone system or dedicated phone lines, although more costly, would increase the quality of transmission. If the system were used for only one hour per day (250 days/year), the charges for either the public or dedicated lines would be approximately the same. If use of the system were to exceed one hour per day, use of dedicated lines would be more cost-effective. Since the use of computer resources has been assumed to be approximately the same during development and normal operations of the database, the assumption has also been made that the charges for data communications would also be the same during those periods. A summary of the resources required and costs for developing and maintaining the database at AMMRC are presented in Table 2.

The equipment currently available at Natick, modems and remote terminals, would be adequate for accessing a database maintained at AMMRC.

Hosting the Database at ARDC

All primary resources required for establishing a database are available at the PLASTEC facility located at ARDC. Experienced personnel are available for developing and maintaining databases. Furthermore, the computer resources are more than adequate for hosting the Natick database.

The major advantages of developing and hosting the Natick database at ARDC are that the staff of ARDC have experience in developing databases

TABLE 2. Estimated Resources Required and Costs for Establishing the Database at AMMRC.

RESOURCE	DEVELOPMENT	OPERATION
TIME	6 MONTHS TO 2 YEARS	--
MANPOWER (WORK-YEARS)		
NATICK	1/4 TO 1/2 / $20,000 TO $40,000	1/8 / $10,000
AMMRC	-0-	-0-
OTHER (CONTRACTOR)	1/2 TO 1 / $50,000 TO $100,000	1/4 TO 1/2 / $25,000 TO $50,000
COMPUTER RESOURCES		
USE AND STORAGE	$1,000 TO $2,000	$1,000 TO $2,000
DATA COMMUNICATIONS	$0 TO $1,400	$0 TO $1,400
RANGE OF TOTAL COSTS	$71,000 TO $143,400	$36,000 TO $63,400

in related subject areas and have shown a desire to develop and maintain the database. All three databases developed and maintained at ARDC (DETER, HAZARD, COMPAT) deal with properties of materials and the effects of interactions between those materials and environmental parameters. In addition, the databases contain numeric data presented in a fashion that is amenable to engineering applications, such as design and materials selection. In a sense, the data stored in the databases could be defined as "second generation" data. This means that data are not merely reported as abstracted from various sources but have been evaluated with regard to technical validity and are presented in a way that facilitates application by engineers. Not only does the ARDC staff have experience developing comparable databases, but they have been operating and maintaining automated databases for nearly 10 years.

Another advantage of hosting the database at ARDC would be that the database could easily be designed to be compatible with existing databases at ARDC, if desired. Compatibility with the databases at ARDC may be desirable since the Natick database probably would be structured similarly; however, it may preclude compatibility with ALISS, which contains information more pertinent than ARDC's to the research efforts at Natick.

In addition to having experience in developing and operating databases similar to one Natick is interested in developing, the technical staff at ARDC may also be available to participate in the time-consuming tasks of data acquisition and assessment. If personnel from ARDC were to develop and operate the database, the time and manpower requirements would be approximately the same as those estimated for a contractor to develop and operate the database at Natick. The only differences would be that less time might be required of Natick personnel during development and both development and operating costs might be lower. Natick manpower requirements might be lower since ARDC personnel have experience with similar applications. Costs would be lower since ARDC personnel might be available at lower rates than contractor personnel.

If all development and operations were to be performed by ARDC personnel, the Natick staff time required would be for executive-level management responsibilities. If desired, however, some or all of the database administration, operations, and maintenance duties could be performed by

Natick personnel. Data acquisition and assessment could be performed at Natick and data input to the database could be accomplished by remote connections.

The use of the ARDC computer resources, both hardware and software, would offer advantages over using the resources currently available at either Natick or AMMRC. The hardware (VAX 11/780) and the DBMS (DRS) are newer and easier to use than those available at the other facilities. DRS has many of the features desired by Natick users already built into the software and thus a minimal amount of special programming would be required to tailor the software. Specifically, DRS includes packages that would allow personnel with little or no previous computer programming experience to generate and restructure databases after receiving some initial training. Personnel with little previous experience would also be able to generate output formats and user-friendly interfaces for the input and retrieval of data. Interfaces for applications programs are also available with DRS.

The costs associated with the use of computer resources, based on estimates provided by personnel of ARDC, would be approximately $1,000 to $2,000 annually. The costs are comparable to those for uses of resources at Natick and AMMRC. As was the case for developing the system at Natick or AMMRC, charges for use of the computer resources during the development period were assumed to be comparable to charges during normal operations. The Assumption was confirmed as being acceptable by personnel of ARDC.

The annual costs for data communications between Natick and ARDC would range between $0 for use of the AUTOVON system to approximately $7,000 for use of a dedicated phone line. A dedicated phone line would become cost effective only if the system use exceeded one hour per day or 250 hours annually.

A summary of the resources required and costs associated with developing and hosting the database at ARDC is presented in Table 3.

Computer hardware currently available at Natick would be adequate to support operations if the database were hosted at ARDC. The addition of terminals with video displays might further facilitate the maintenance of the database since a software package designed to simplify data input via the use of video display terminals is available with DRS.

If a decision were made to maintain (i.e., input and update data) the database remotely, investment in terminals with diskettes might be worth while. Inputs and updates could be recorded on the diskette without being

TABLE 3. Estimated Resources Required and Costs for Establishing the Database at ARDC.

RESOURCE	DEVELOPMENT	OPERATIONS
TIME	6 MONTHS TO 2 YEARS	--
MANPOWER (WORK-YEARS)		
NATICK	1/4 / $20,000	1/8 / $10,000
ARDC	1/2 TO 1 / $40,000 TO $80,000	1/4 TO 1/2 / $20,000 TO $40,000
COMPUTER RESOURCES		
USE AND STORAGE	$1,000 TO $2,000	$1,000 TO $2,000
DATA COMMUNICATIONS	$0 TO $7,200	$0 TO $7,200
RANGE OF TOTAL COSTS	$61,000 TO $109,200	$31,000 TO $59,200

connected to the computer. When inputs or changes had been completed, the contents of the diskette could be transmitted to the computer remotely. Input and update of data via the diskette would be much quicker than if performed interactively and would thus reduce data transmission and computer-use costs. Costs of diskette units range between approximately $4,000 and $5,000.

Hosting the Database at INFOCEN

The INFOCEN staff could feasibly develop a database for Natick. However, due to INFOCEN's lack of technical expertise in the BW/CW and materials areas and the lack of experience and availability of the Natick staff, a well-designed database might require outside assistance from a group with experience in both database development and the technical subject matter. The development would require approximately the same Natick personnel level of effort as estimated for the other alternatives in which the database development was performed by a contractor. The manpower requirements for the developer probably would be evenly divided between the contractor and the INFOCEN staff. The contractor would need to devote an estimated 1/4 to 1/2 worker-year working with Natick personnel to develop the conceptual model, input-output formats, and the user-friendly menus. The INFOCEN staff would perform the data-processing functions needed to implement the requirements established by the Natick and contractor staffs. One analyst from the INFOCEN staff would be assigned to the development task and would devote an estimated 1/4 worker-year to the effort.

This development period is estimated at six months calendar time. The development period would be shorter than that estimated for the other alternatives since the INFOCEN staff does not develop prototype databases with the intent of evaluating and redesigning them at a later date. Although developing prototype databases is not the standard practice of the INFOCEN staff, INFOCEN does not preclude restructuring a database if the customer believes it necessary; however, major modifications at the request of the customer usually result in additional charges.

INFOCEN has established a very flexible method for charging customers for use of services. Customers estimate, annually, the staff time and computer resources they will require in the coming year. A contract is then negotiated,

requiring the customer to make regular, fixed payments. If his use of INFOCEN resources is significantly above or below that projected, the customer must meet with INFOCEN staff in advance of the regularly scheduled meeting to renegotiate the contract for the remainder of the contract period. If the original design of the Natick database required modification, the INFOCEN charges would reflect the amount of resources that would be utilized to perform the modifications. If only minor modifications were required, Natick might not be charged in addition to the annual charges incurred for maintenance and operation of the database. Extensive modifications, requiring INFOCEN resources in excess of those outlined in the existing contract would require a renegotiation of the contract resulting in additional charges.

The primary tasks for operating and maintaining the database would be evenly divided between the INFOCEN staff and the contractor staff. The INFOCEN staff would need to provide an estimated 1/4 worker-year to perform data processing tasks such as inputting data, providing assistance to users with questions pertaining to the use of the DBMS, and routine maintenance of equipment. The cost of such service, based on a contractor charge rate, would be approximately $25,000 per year. Assuming that Natick staff would not be available to perform the time-consuming tasks of data acquisition and assessment, a 1/4-worker-year effort would be required from a contractor at a charge of $25,000 per year.

The capabilities of the computer resources at INFOCEN are comparable to those at ARDC. The hardware is the same and the DBMS, BASIS, has many of the same features as DRS.

Charges for the use of computer resources at INFOCEN might be slightly higher but comparable to those expected at Natick, AMMRC, or ARDC. Charges for the use of computer resources are difficult to estimate and compare since actual use of resources varies for each search of a database and it is difficult to predict an average use of these resources. Also, some of the charges at different facilities either were not well defined or were not provided. Assuming a use rate for the system of one hour per day (250 days per year) with a corresponding use of 30 CPU seconds per hour and a storage requirement of 10 Mbytes (365 days per year), the annual charges for use of computer resources of INFOCEN would be approximately $3,700. Based on the information provided by staff members of ARDC, the estimated charges incurred for use

of computer resources during the development of the database would be approximately the same as those incurred on an annual basis for operation.

Since the development phase of INFOCEN would not be defined to include a prototype test and evaluation period, no charges would be incurred for data communications during development. The AUTOVON system could be used free of charge or a dedicated phone line between Natick and WPAFB could be leased for approximately $12,000 per year. Another alternative would be simply to use public telephone lines to access the database. Based on a one-hour-per-day (250 days per year) use rate of the database, long-distance charges would be approximately $6,000 per year. A dedicated line would be a viable alternative only if the average use of the system exceeded two hours per day. The resource requirements and costs associated with developing and operating the database at INFOCEN are summarized in Table 4.

The computer hardware currently available at Natick would be adequate to support operations if the database were hosted at INFOCEN, but additional terminals with video displays might facilitate use of the database, especially if the decision is made to operate the system (i.e., input data) remotely from Natick. Also, diskettes probably would reduce data communications costs associated with remote operation.

Hosting the Database at a Contractor Facility

The resources available for developing and maintaining a database at a contractor facility will vary among contractors, but may be the best alternative discussed in this report. Contractor facilities may be capable of providing a mixture of personnel with experience in data processing, materials properties, and BW/CW defense. A group of personnel with expertise in these areas, all located at the same facility, could work together to develop a database that could potentially be more successful at meeting the needs of Natick personnel.

The computer resources, both hardware and software, could be comparable to the better systems and packages at the other facilities discussed. Although the resources available at a contractor facility may provide for the establishment of a well-designed and easily operated database, the costs associated with contractor services would probably be higher than those for services provided by DoD organizations.

TABLE 4. Estimated Resources Required and Costs for Establishing the Database at INFOCEN.

RESOURCE	DEVELOPMENT	OPERATIONS
TIME	6 MONTHS	--
MANPOWER (WORK-YEARS)		
NATICK	1/4 TO 1/2 / $20,000 TO $40,000	1/8 / $10,000
INFOCEN	1/4 / $25,000	1/4 / $25,000
OTHER (CONTRACTOR)	1/4 TO 1/2 / $25,000 TO $50,000	1/4 / $25,000
COMPUTER RESOURCES		
USE AND STORAGE	$3,000 TO $4,000	$3,000 TO $4,000
DATA COMMUNICATIONS	-0-	$0 TO $12,000
RANGE OF TOTAL COSTS	$73,000 TO $119,000	$63,000 TO $76,000

Dependence upon the developing contractor may be a drawback to this option. On the other hand, the procurement process may disallow awarding of a follow-on database maintenance contract to the developing contractor, even if he is best suited to do the work.

The manpower requirements and associated costs for developing and operating the database at a contractor facility are estimated to be the same as those for having a contractor develop and operate the database at either Natick or AMMRC. The same level of effort would be required by both Natick and contractor personnel regardless of the site chosen to implement the database.

Hosting a database at a contractor facility probably would be more expensive than hosting the database at the other facilities discussed due to the estimated increase in costs for use of the computer resources. As was discussed earlier in this report, estimation and comparison of charges for use of computer resources are difficult tasks. Assuming the same rate and storage requirements used to estimate computer resource costs of Natick and INFOCEN, an approximation of costs can be made if the charges for use of contractor resources are known. For the purposes of this study, the charges for use of contractor resources are assumed to be approximately three to four times those at INFOCEN. The approximation is based on typical charges for the remote use of BASIS supported on Battelle computer resources. Using the factors above, the charges would be between $10,000 and $15,000 per year. As was the case for other alternatives, the charge for computer resources during the development phase was assumed to be approximately the same as the annual operation charge.

The primary means for data communications between Natick and a contractor facility would be either via public telephone or a commercial network such as Tymnet, Uninet or Telenet. The charges for use of a network are billed to the facility maintaining the host computer and are generally passed on to the users under the direction of the management of the host facility. Assuming a network use charge of $13.80/per hour, based on Battelle charges, and a one-hour-per-day use rate, the annual charges for network communications would be approximately $3,500.

The choice between establishing a dedicated phone line or using public telephone lines would be largely dependent upon the expected use of the system. The break-even point for public telephone use versus a dedicated line can be computed. Public telephone would be advised if the expected use of the system is less than the break-even value.

The computer resources currently at Natick would be adequate for hosting the database, but use of the system could be improved with the purchase of video-display terminals. The resources required and costs that would be associated with developing and hosting a database at a contractor facility are summarized in Table 5.

Integration of the Database

Integration of the Natick database with other previously established databases within the BW/CW or materials properties/interactions communities, if it could be accomplished, would mutually benefit research personnel within both communities. Integrating information could provide a means by which researchers from different technical areas within the community could combine their information into one central repository. Such a pooling of information would be a major achievement since it could lead to accomplishing the goal of providing an easy means for identifying data gaps and reducing duplication of effort within the research community. Integration could be achieved by maintaining the additional files at Natick or at the facility hosting the database into which the files are to be integrated.

In addition, integration of databases within the community would limit to one the number of data access procedures with which users would need to become familiar. Having to learn a set of procedures for each database could become time consuming and burdensome and could lead to a situation where acquiring the information via an automated process would not be worthwhile to some individuals.

Although researchers throughout the community could benefit from an integration of all information, such an integration might impose limitations that would not exist in a stand-alone system designed specifically for Natick personnel. In particular, the final product of database integration may not be tailored to meet the information needs of Natick personnel or match

TABLE 5. Estimated Resources Required and Costs for Establishing the Database at a Contractor Facility.

RESOURCE	DEVELOPMENT	OPERATIONS
TIME	6 MONTHS TO 2 YEARS	
MANPOWER (WORK-YEARS)		
NATICK	1/4 TO 1/2 / $20,000 TO $40,000	1/8 / $10,000
CONTRACTOR	1/2 TO 1 / $50,000 TO $100,000	1/4 TO 1/2 / $25,000 TO $50,000
COMPUTER RESOURCES		
USE AND STORAGE	$10,000 TO $15,000	$10,000 TO $15,000
DATA COMMUNICATIONS	$3,500 TO $12,000	$3,500 TO $12,000
RANGE OF TOTAL COSTS	$83,500 TO $167,000	$48,500 TO $87,000

their experience or skill levels associated with automated systems. To gain the benefits of integration, Natick personnel might be forced to sacrifice the content, amount, and format of data of interest to their specific needs.

The records of a potential Natick database could be integrated with those of a number of existing databases. This study was limited to determining the feasibility of integrating Natick records with those of AMMRC and/or ARDC. Although it might be possible to integrate the records from all three databases to form one, it is highly improbable that such a task would be accomplished. First, the conceptual models of the databases of AMMRC and ARDC are quite different and probably could not be combined as they currently exist. One or both of the existing models would have to be restructured to be compatible. Second, it would be nearly impossible to integrate databases that are operated with different DBMSs. Integration of databases supported by dissimilar DBMSs requires an intensive development program that could not be guaranteed to be successful. A much easier and potentially more successful approach would be to switch the DBMS of one of the existing databases to that supporting the other database. Although a DBMS can be costly (between $50,000 to $130,000), purchase of a new DBMS probably would be less expensive than the development program that would be required to integrate the databases with dissimilar DBMSs.

If the management of AMMRC or ARDC were unwilling to restructure their database(s) and adopt the DBMS used by the other facility, establishment of one central database resulting from the integration of the records from each of the three facilities would not be possible. If AMMRC or ARDC were not willing to restructure its database(s), Natick management would still have the option to integrate AMMRC or ARDC records with one of the existing databases if acceptable to management of the other organization(s).

Integration of Natick records with those of a database at one of the other facilities could be accomplished by storing Natick files at Natick or at the other facility. If stored at another facility, Natick management most likely would have to purchase of lease the same DBMS as that of the host facility for the reasons stated above. A decision to maintain integrated records at Natick would result in the additional development cost associated with purchasing or leasing software. As mentioned earlier, purchase costs of a DBMS with packages needed to establish a flexible and ease-to-use database could range between approximately $50,000 and $130,000.

Except for the costs associated with purchasing or leasing a DBMS, the time requirements, manpower requirements, and costs for operation and development would be approximately the same as those for developing and operating a stand-alone system at Natick. The major shortcoming of a stand-alone system is the inability to exploit the advantages of integrating all information from the BW/CW community. If the decision is made not to integrate all information in the BW/CW community, Natick personnel would, potentially, still have the capability of searching other databases individually if desired and permitted. Designing Natick's database to be compatible with other databases would facilitate the process by reducing the number of procedures that users would need to learn.

A less expensive means of developing an integrated database would be to maintain the Natick files at the facility hosting the database with which integration is desired. The time requirements, manpower requirements, and costs for developing and hosting the integrated database at another facility would be approximately the same as those estimated for developing and maintaining a stand-alone system at another facility.

CONCLUSIONS

There are several alternatives available to Natick for the establishment of a database. This analysis has focused upon the alternatives available for the preliminary considerations to which attention must be directed prior to establishing the database. These initial considerations include determining whether the database should be stand-alone or integrated, where it should be hosted, who should develop it, and who should operate and maintain it.

Integrating the Natick files with those of other organizations within the BW/CW community would be, theoretically, the best means to achieve the overall goal of organizing and structuring research within the community. Integrating files would facilitate the identification of knowledge gaps and would help reduce the duplication of research efforts. Although this alternative is a means to achieving the overall goal, it is not likely that integration of existing files could be performed since the existing databases considered are structured differently and operated with different DBMSs.

Another alternative for establishing a database that would help achieve the overall goals would be to establish a stand-alone system that would be compatible with others within the community. Developing a compatible database would enable users to retrieve data from databases within the community, if permitted, after becoming familiar with a minimum number of operating procedures. Since not all databases within the community are currently compatible, the database could be designed to be compatible with those databases that contain information most useful to Natick personnel. The establishment of a stand-alone system would also be advantageous since it could be specially tailored to meet the needs, both informational and operational, of Natick personnel.

A stand-alone system, compatible with other databases if desired, could be established at Natick or at one of the other facilities considered in the analysis. If the decision is made to establish the database at Natick, the UNIVAC must be updated or the IBM used to insure a reliable and easily operated product. Using the IBM would incur an additional expense associated with purchasing a DBMS. Also, contractor support would be needed to assist in development and operation due to the inexperience and unavailability of Natick personnel.

The only advantage of establishing the database at AMMRC would be the increased reliability of the Harris 125/6 over Natick's UNIVAC. The Harris, however, may not be available to host a database in addition to ALISS. Also, contractor support would be required to assist in development and operation since AMMRC staff members would not be available to perform those tasks.

Establishing the database at either INFOCEN, ARDC, or a contractor facility would permit the use of more reliable hardware and a more flexible and easier-to-use DBMS. All three facilities would offer staffs with experience and proven capabilities in the development and operation of databases. The staff of INFOCEN, however, does not have technical expertise in the areas of BW/CW or materials properties. For this reason and because of unavailability of staff at Natick, development and operation of the database at INFOCEN would require outside support from a contractor.

The staff at ARDC and at certain contractor facilities would be available and would have the experience required both to develop and operate a database for Natick. These personnel would be able to provide the technical

knowledge and assistance that could lead to a better design of the database and reduce the level of effort that would otherwise be required from Natick personnel.

Establishing the database at a contractor facility may allow for technical assistance from personnel with expertise in a broader range of disciplines than could be achieved at ARDC. An added expense, however, may be incurred with the employment of the additional resources available at a contractor facility. A summary of the estimated costs associated with establishing a stand-alone system at Natick, AMMRC, ARDC, INFOCEN, or a contractor facility is provided in Table 6.

RECOMMENDATIONS

Although an integrated database would serve to structure the research activities of the entire BW/CW community, Battelle recommends that Natick develop a stand-alone database since the difficulties that would be encountered in developing and managing an integrated database make the successful implementation of that alternative unlikely.

The facility at which the database is hosted should have a reliable computer system and a flexible, easy-to-use DBMS. The DBMS should at least have a restructuring tool that would facilitate future additions or changes to the database conceptual model. The DBMS should also have the capability to easily generate user-friendly interfaces in menu format for retrieving, inputting, editing, updating, and manipulating data.

In order to insure that the database will contain useful information, and be well-designed and easy to operate, a staff with both data processing and technical expertise should be selected to develop and operate the database.

Once the decisions have been made on where the database will be located and who will develop and maintain it, the actual development of the database can begin. The following approach is recommended for developing the database:

- appoint a database administrator;
- consult with users to finalize requirements;

TABLE 6. Summary of Development and Operating Costs.

ALTERNATIVE	DEVELOPMENT COST	OPERATING COST
NATICK	$71,000 TO $142,000	$36,000 TO $62,000
AMMRC	$71,000 TO $143,400	$36,000 TO $63,400
ARDC	$61,000 TO $109,200	$31,000 TO $59,200
INFOCEN	$73,000 TO $119,000	$63,000 TO $76,000
CONTRACTOR	$83,500 TO $167,000	$48,500 TO $87,000

- develop operating procedures;
- develop a prototype database;
- test performance;
- request user appraisal;
- restructure database as required.

Regardless of where the database is hosted or who develops and maintains it, a staff member from Natick should be appointed to serve as the database administrator. The database administrator should be responsible for coordinating all development and operational activities. The major concern of the administrator will be to insure that the needs of the users, both information and operational, are addressed by the developer during the design phase.

In order to insure that the users' needs are addressed, the database administrator should consult with a select group of users to finalize their requirements. This group should include members from each of the potential user groups (i.e., operations research analysts, systems analysts, engineers, psychologists, chemists, and other technical researchers). If some conflicts of interest arise between the groups, the database administrator should make the final judgment on the requirements and convey them to the developer.

The database administrator should also determine the operating procedures that will be employed. The procedures of primary importance will be those related to maintaining the integrity of the database: procedures employed to determine from what sources data will be extracted, who will extract the data, how the data will be evaluated and selected for input, and wno will have the authority to input data and perform modifications.

After the operating procedures have been defined, a prototype database should be built, tested, and evaluated. The building and operation of a prototype will present the opportunity to incorporate the opinions of the users into the final design of the database, and thus increase the probability of acceptance and subsequent use of the database by the various user groups at Natick. A prototype test period of one year should be sufficient to achieve the desired results.

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APPENDIX A

DATABASE RECORDS, FIELDS, AND DESCRIPTIONS OF FIELDS

APPENDIX A

DATABASE RECORDS, FIELDS, AND DESCRIPTIONS OF FIELDS

The following tables present the records and the data fields associated with them for the databases established at AMMRC and ARDC. Descriptions of data fields are also included. The following information was excerpted from References 1, 2, and 3 listed on page 47.

TABLE A-1. ALISS Records and Fields.

RECORD	ITEM
TEST CLASS	TEST CLASS
TEST SUB-CLASS	TEST SUB-CLASS
TEST NAME	TEST NAME
TEST CONDITIONS	TEST CONDITIONS
TEST DESCRIPTION	TEST DESCRIPTION
MATERIAL	MATERIAL
CHEMICAL CLASS	CHEMICAL CLASS
CHEMICAL SUB-CLASS	CHEMICAL SUB-CLASS
CHEMICAL NAME	CHEMICAL NAME
CHEMICAL NAME SPECIFICATION	CHEMICAL NAME SPECIFICATION
GROUP NAME	GROUP NAME
CHEMICAL NAME/ GROUP	PROPORTION
GROUP COMMENTS	GROUP COMMENTS
IDENTIFICATION	IDENTIFICATION
IDENTIFICATION SUB-CLASS	IDENTIFICATION SUB-CLASS
IDENTIFICATION NAME	IDENTIFICATION NAME
PROPERTY NAME	PROPERTY NAME
PROPERTY VALUE	PROPERTY VALUE
	PROPERTY DATE
OBSERVATION	OBSERVATION
	OBSERVATION DATE

TABLE A-2. ALISS Field Descriptions.

TEST CLASS - Allowable values: chemical; mechanical

TEST SUB-CLASS - Examples: characterization; physical

TEST NAME - Examples: MWD MN, Ultimate Tensile, Absorption

TEST CONDITIONS - 6 character code which uniquely identifies a test method.

TEST DESCRIPTION - Description of test conditions (maximum of 10 lines).

MATERIAL - Examples: elastometer, thermosetting

CHEMICAL CLASS - Examples: polyurethane, polyethylene

CHEMICAL SUB-CLASS - Examples: LD polyethylene, HD polyethylene

CHEMICAL NAME - Examples: Estane, Neoprene W

CHEMICAL NAME SPECIFICATION - General comments about specific chemicals, unlimited number for each chemical name record.

GROUP NAME - A name assigned to one or more chemicals tested as a unit: compounded rubber, composite.

PROPORTION - Proportion ($0<P\leq 1$) of each chemical in group.

GROUP COMMENTS - General comments about group, unlimited number for each group record.

IDENTIFICATION - Examples: AMMRC, CSL

IDENTIFICATION SUB-CLASS - Researcher name, author.

IDENTIFICATION NAME - Lab book number and page, journal volume and page.

PROPERTY NAME - Concatenation of test name, group name, and code identifying test condition code.

PROPERTY VALUE - Quantitative test result

PROPERTY DATE - Date on which property value was measured.

OBSERVATION - Qualitative test result

OBSERVATION DATE - Date on which observation was made.

TABLE A-3. Materials Deterioration Data.

RECORD	FIELDS	
LABORATORY DATA	APPEARANCE	MATERIAL CODE
	CHEMICAL CODE	METHOD OF LOADING
	CHEMICAL TRADE NAME	MODULUS CHANGE
	CLIMATE	NUMBER OF CYCLES
	COMMENTS	NUMBER TESTED
	COMPOSITION	OTHER DATA
	CONCENTRATION	PROPERTIES
	CONDITIONING	RATING
	DATA TYPE	RELATIVE HUMIDITY
	DATE OF FABRICATION	SOLUTION PH
	DATE OF TEST	STRENGTH CHANGE
	DETERIORATION RATE	STRESS/STRAIN LEVEL
	DIMENSIONS	TEMPERATURE
	DOCUMENT CODE	TEST METHOD
	ELONGATION CHANGE	TEST VARIABLES
	EROSION RATE	THICKNESS CHANGE
	EXPOSURE TIME	TRADE DESIGNATION
	FABRICATION METHOD	TYPE OF DETERIORATION
	FINISHING	TYPE OF SPECIMEN
	HARDNESS CHANGE	WEIGHT CHANGE
	LENGTH CHANGE	WIDTH/DIAMETER CHANGE
	LOCATION	VOLUME CHANGE
CHEMICALS	CHEMICAL	CLASSIFICATION
	COMMON NAME	COMMENTS
	CHEMICAL CODE	FORMULA
	CHEMICAL TRADE NAME	SUPPLIER NAME

TABLE A-3. Materials Deterioration Data. (cont'd)

RECORD	FIELDS	
SYSTEMS DATA	APPEARANCE	EXPOSURE TIME
	CHEMICAL	FABRICATION DATA
	CLIMATE	FACILITY TYPE
	COMMAND	LOCATION
	COMMENTS	MATERIAL CODE
	COMPONENT	NUMBER OF UNITS
	COMPOSITION	OTHER DATA
	CONCENTRATION	OTHER VARIABLES
	DATA TYPE	PART NUMBER
	DATE IDENTIFIED	PROPERTIES
	DATE OF FABRICATION	PROPERTY CHANGE
	DETERIORATION RATE	RATING
	DIMENSIONAL CHANGE	RELATIVE HUMIDITY
	DIMENSIONS	SUBSYSTEM
	DOCUMENT CODE	SYSTEM
	EQUIPMENT MANUFACTURER	TEMPERATURE
	EQUIPMENT TYPE	TRADE DESIGNATION
	EROSIONS RATE	TYPE OF DETERIORATION
DOCUMENT INFORMATION	AUTHOR	DOCUMENT CODE
	AVAILABILITY	PAGES
	COMMENTS	PUBLISHER
	CONTRACT NUMBER	REPORT NUMBER
	DATE PUBLISHED	TITLE
	DESCRIPTION	
GENERIC MATERIALS	ATMOSPHERIC COMMENTS	END USE COMMENTS
	CHEM RESISTANCE COMMENTS	FAMILY
	DESCRIPTION	MATERIAL

TABLE A-3. Materials Deterioration Data. (cont'd)

RECORD	FIELDS	
GENERIC MATERIALS	MATERIAL CODE	STRESS-THERMAL COMMENTS
	MATERIAL COMPOSITION	TYPE OF MATERIAL
	SPECIFICATION	

TABLE A-4. Materials Deterioration Data Program Field Descriptions.

APPEARANCE (AP) - General appearance of the material after the period of exposure. Descriptors include no change, discoloration, warping, flaking, pitting, swelling or other apparent condition that resulted.

ATMOSPHERIC COMMENTS (AC) - A summary of the material's general behavior in varied outdoor environments, such as a rural, industrial, or marine climates. These comments include advisements and precautions in use.

AUTHOR (AU) - The name or names of those responsible for preparation of the document.

AVAILABILITY (AV) - A statement which reflects the general availability of the document (restricted distribution, unlimited use) and the organization from which the document may be obtained.

CHEMICAL (CH) - The name commonly accepted to describe a chemical reagent or compound as listed in general reference tests. (Example: methyl alcohol, calcium chloride, etc.).

CHEMICAL CODE (C2, C5) - A computer code for each chemical generally consisting of four alpha characters. The code links the chemical record to the data record by use of mnemonics C2 and C5, respectively.

CHEMICAL COMMENTS (CC) - Remarks which are pertinent to the chemical reagent or compound. These comments include advisements on the chemical's use with materials.

CHEMICAL RESISTANCE COMMENTS (CE) - A summary of the material's general resistance to chemical attack. These comments include advisements and precautions in use.

CLASSIFICATION OF CHEMICAL (CF) - The classification of the chemical reagent or compound based on common or general chemical groups, e.g., acid, alcohol and alkali. Other descriptions are used to further categorize the type of chemical or its reactivity.

CLIMATE (CL) - The general type of atmosphere encountered at the facility in which the material is used. Descriptors include urban, industrial,

rural, marine, arctic, tropic or combinations of these. Also, terms, as plant interior or plant exterior may be used as appropriate.

COMPOSITION OF MATERIAL (CP) - The description of the material in terms of its basic elements. For metals the nominal composition by percent will be listed as described in the SAE/ASTM unified numbering system guide. For all other materials the composition is in terms of its chemical elements with percent composition as appropriate.

COMPOSITION OF SPECIMEN (CM) - The identification of the actual material that has undergone testing in terms of its basic elements. This implies that an independent analysis was performed for identification purposes.

CONCENTRATION OF CHEMICAL (CO) - The percent (%) by weight of a chemical in an aqueous solution unless otherwise specified. For solid chemicals and pure compounds the concentration value would be 100%.

CONDITIONING OF SPECIMEN (CS) - The treatment of the material preceding exposure in the test environment. Pretest treatment may include heat treating, annealing, moisture conditioning, or cleaning. Data include technical parameters as temperature, relative humidity, and time, as appropriate.

CONTRACT NUMBER (CN) - An alphanumeric reference number associated with government contracts. It identifies the contract effort normally described in a formal document.

CORROSION RATE (CR) - The degree of material loss described as mils (thousandths of an inch) per year or MPY. It principally applies to the deterioration rate for metals.

DATA TYPE (DP) - An alphabetical code which refers to the type of deterioration data that is contained within the record. The type is used in the program strategy for searching data. Combinations of the following codes are used, each separated by a slash (/).

ATMOSPHERIC	- ATM or ATMO	STRESS	- STR
CHEMICAL	- CHE or CHEM	COMPATIBILITY	- COMP
EROSION	- ERO	TEMPERATURE	- TEM or TEMP

TABLE A-4. Materials Deterioration Data Program Field Descriptions. (cont'd)

DATE OF FABRICATION (DF) - The date the material was formed into the configuration for use or test purposes. The month is abbreviated using its first three letters followed by the day and year, as appropriate.

DATE OF PUBLICATION (DA) - The date of document publication. The month is abbreviated using its first three letters followed by the day and year, as appropriate.

DATE OF TEST (DT) - The date the conditioning of the material was evaluated or the date that a failure was noted. The month is abbreviated using its first three letters followed by the day and year, as appropriate.

DESCRIPTION OF DOCUMENT (DE) - The classification of the document as to its type; e.g., a technical report, letter report, text, journal, brochure, conference, or handbook.

DESCRIPTION OF MATERIAL (DM) - A series of terms which will describe each material in general terms. These include common names used in the trade, process oriented features and pertinent facts associated with composition or chemical makeup.

DIMENSIONS OF SPECIMEN (DS) - The average dimensions of the specimen or component (length, width, diameter, or thickness) taken prior to exposure in the test environment. It is used as the basis for determining dimensional change and to provide the relative size.

DOCUMENT CODE (D4, D5) - A numeric computer code for the document, generally consisting of four numeric characters. The code links the document record to the data record by means of the mnemonic D4 and D5, respectively.

DOCUMENT COMMENTS (CD) - Remarks which are pertinent to the document reference.

ELONGATION CHANGE (EC) - The percentage (%) elongation change in a material as determined by comparison of the average ultimate elongation after exposure to the average ultimate elongation from initial control specimens.

END USE COMMENTS (CU) - Remarks which generally describe uses of the material. These comments include advisements or precautions dealing with design, processing and maintenance.

TABLE A-4. Materials Deterioration Data Program Field Descriptions. (cont'd)

EQUIPMENT TYPE (EQ) - Refers to the type of equipment or component in which the material was used.

EROSION RATE (ER) - The degree of material loss as applied to the erosive action of a fluid on the material in terms of mils (thousandths of an inch) per year or MPY. It principally applies to the deterioration rate for metals.

EXPOSURE TIME (ET) - The period time (DAYS) the material was exposed to the test environment.

FABRICATION METHOD (FM) - The primary method by which the test specimen or component was manufactured. Descriptions used include molded, case, extruded, hot rolled, or forged. Secondary methods such as machined or welded are used as appropriate.

FACILITY TYPE (FT) - The general designation of the facility or plant complex in which the material and/or equipment type are used.

FAMILY (FA) - Refers to the grouping of materials under each type.

FINISHING OF SPECIMEN (FS) - The procedure used to modify the material into its end use form. Descriptors include anodizing, painting, etching, or plating.

FORM OF MATERIAL (FR) - The form of a material as identified by the trade designation, e.g., sheet, adhesive, etc.

FORMULA OF CHEMICAL (FC) - A simplified presentation of the basic elements describing the chemical nature of the chemical reagent. The formulas for complex compounds are not included.

HARDNESS CHANGE (HC) - The percentage (%) hardness change in a material determined by comparison of the average hardness after exposure to the average hardness prior to exposure.

LENGTH/DIAMETER CHANGE (LD) - The percentage (%) length or diameter change in a material determined by comparison of the average dimension after exposure to the average dimension before exposure.

LOCATION (LO) - The city or town and state where the test was conducted.

MATERIAL (MA). - The generic or common name of the material as generally

TABLE A-4. Materials Deterioration Data Program Field Descriptions. (cont'd)

used in the trade; e.g., 1020 Steel, 5052 Aluminum, polytetrafluoroethylene, and epoxy.

MATERIAL CODE (M1, M3, M5) - A computer code for each material. The code links the material record, the material supplier record and data record by use of mnemonics M1, M3, and M5, respectively. For the metals the code will be that designation developed in the SAE/ASTM unified numbering system manual. For the other materials, the code will be based on the material's abbreviation or devised from its name.

MATERIAL SUPPLIER COMMENTS (CB) - Remarks which are pertinent to the specific material provided by the supplier. These comments include advisements on the material's use.

METHOD OF LOADING (ML) - A description of the method of loading (tensile, compression, shear of flexure), as appropriate.

NUMBER OF CYCLES (NC) - Pertains to fatigue testing in an environment, and is the number of cycles at which failure of the material occurred and the test was terminated.

NUMBER TESTED (NT) - The number of specimens or components that were evaluated, associated with specific technical data described.

OTHER DATA (D1) - Property data generated during the test of the type that does not conform to the established fields. The property and its value are to be given; e.g., tensile modulus, -9%.

PAGES (PA) - Refers to a page(s) containing technical data or the total pages of the document.

PROPERTIES OF SPECIMEN (PS) - Measured characteristics for the material prior to undergoing a test. The properties most widely reported are in the form of mechanical properties as strength, elongation, hardness, or density.

PUBLISHER (PU) - The name of the publisher of the reference document.

RATING (RA) - A qualitative assessment of a material's response to an environment. The ratings used are in terms of performance being satisfactory (SAT), conditional (COND), or unsatisfactory (UNSAT). The rating is used in the program strategy for searching data.

TABLE A-4. Materials Deterioration Data Program Field Descriptions. (cont'd)

RELATIVE HUMIDITY (RH) - The relative humidity of the surrounding environment to which the material is exposed. The relative humidity expressed in percent (%) may be a constant value maintained with a laboratory or the average value encountered over a period of time in an outdoor location or climate.

REPORT NUMBER (RN) - The alphanumeric designation which identifies the document in accordance with the publisher's format.

SOLUTION pH (PH) - The pH of the chemical solution that was maintained or measured during the exposure period.

SPECIFICATION (SP) - The specification number that is associated with the material. This will include the alphanumeric designations for both military and commercial specifications.

STRENGTH CHANGE (SC) - The percentage (%) strength change determined by comparison of the average ultimate strength after exposure to the average ultimate strength from initial control specimens.

STRESS/STRAIN LEVEL (SL) - The value of the constant stress or strain on the material that is maintained for the exposure period.

SUPPLIER OF CHEMICAL (SR) - The company which either manufactures and/or supplies a chemical reagent or compound for which the test data are derived.

SUPPLIER OF MATERIAL (SU) - The company which either manufactures and/or markets a specific material for which the test data are derived.

TEMPERATURE (TE) - The average temperature (C) of the environment to which the material is subjected during the period of evaluation.

TEST DATA COMMENTS (CT) - Remarks pertaining to any of the test data, not covered by unique fields. Also used to clarify or provide other pertinent test information.

TEST VARIABLES (TV) - Applies to test parameters not covered by unique fields. For chemical tests it includes conditions as agitation, aeration, fluid flow rate, or oxygen concentration. Also used to clarify test conditions and provide other pertinent test information.

TEST METHOD (TM) - The test method(s) used in the evaluation of material. Where no ASTM or other standardized method is specified, the word laboratory or end use are used to describe the type of data.

TABLE A-4. Materials Deterioration Data Program Field Descriptions. (cont'd)

THICKNESS CHANGE (TC) - The percentage (%) thickness change in a material determined by comparison of the average thickness after exposure to the average thickness before exposure.

TITLE OF DOCUMENT (TL) - The title of the reference document.

TRADE DESIGNATION OF CHEMICAL (H2, H5) - The proprietary designation given to a chemical by the supplier which uniquely identifies the source, grade or other special characteristic, e.g., Freon 12, duPont. The designation links the chemical record and the data record by use of mnemonics H2, and H5, respectively.

TRADE DESIGNATION OF MATERIAL (T3, T5) - The proprietary designation given to a material by the supplier which uniquely identifies the grade and composition of material. The designation links the material supplier record and the data record by use of mnemonics T3 and T5, respectively.

TYPE OF DETERIORATION (TR) - The form of material deterioration that was evidenced for the exposure period.

TYPE OF MATERIAL (TY) - Refers to a basic or general category of material; metallic or nonmetallic. The nonmetallics have been further subdivided for convenience, resulting in five distinct categories of material types: metal, plastic, elastomer, inorganic, and wood.

TYPE OF SPECIMEN (TS) - A description of the specimen defined by its physical shape (disk, bar, rectangular, etc.) or the intended use (tensile, flexure, etc.). The associated ASTM designation shall be used where appropriate. (Examples: Tensile bar, Type I, ASTM D638).

WEIGHT CHANGE (WC) - The percentage (%) weight change in a material determined by comparison of average weight after exposure to the average weight before exposure.

WIDTH/DIAMETER CHANGE (WD) - The percentage (%) width or diameter change in a material determined by comparison of the average dimension after exposure to the average dimension before exposure.

TABLE A-5. HAZARD Records and Fields.

RECORD	FIELDS	
MATERIALS INFORMATION	COMMENTS	PHYSICAL STATE
	COMPOSITION	SPECIFICATION
	MATERIAL	TYPE
	MATERIAL CODE	
EQUIPMENT ANALYSIS DATA	BURNING PROBABILITY	INITIATION MODE
	COMMENTS	INITIATION PROBABILITY
	COMPOSITION	LOCATION
	DIMENSIONS	MANUFACTURER OF EQUIPMENT
	DOCUMENT CODE	MATERIAL CODE
	END ITEM	MATERIAL RESPONSE
	EQUIPMENT	MATERIALS OF CONSTRUCTION
	EVENT PROBABILITY	PAGE NUMBER
	EXPLOSION PROBABILITY	PRESENCE OF COMBUSTIBLE
	FACILITY	PROCESS OPERATION
	FACILITY SUBSYSTEM	PROCESS POTENTIAL
	FIRE PROBABILITY	PROCESS STATE
	FREQUENCY OF OPERATION	SAFETY MARGIN
	HAZARD CATEGORY	TRANSITION PROBABILITY .
DOCUMENT INFORMATION	AUTHOR	DOCUMENT CODE
	AVAILABILITY	PAGES
	COMMENTS	PUBLISHER
	CONTRACT NUMBER	REPORT NUMBER
	DATE PUBLISHED	TITLE
	DESCRIPTION	

TABLE A-5. HAZARD Records and Fields. (cont'd)

RECORD	FIELDS	
LABORATORY TEST DATA	COMMENTS	MATERIAL CODE
	CONTAINER DESCRIPTION	MATERIAL DATA
	DETECTION METHOD	PAGE NUMBER
	DIMENSIONS	PHYSICAL CONDITION
	DOCUMENT CODE	PROCESS STATE
	END ITEM	TEST METHOD
	FORMULATION	TEST VARIABLES
	HAZARD CLASSIFICATION	THRESHOLD LEVEL
	INITIATION CODE	

TABLE A-6. HAZARD Field Descriptions.

AUTHOR - The name of the individual(s) cited as the writer of the document.

AVAILABILITY - A statement which indicates where the document may be obtained and/or any restrictions placed on the distribution of the document; e.g., for government use only or limited distribution. No restrictive clause would indicate availability only from the publisher.

BURNING PROBABILITY - The probability of sustained burning (S_p) is the probability of transition from initiation to burning. Where the potential hazard is in the presence of quantities of combustible, the most severe condition is taken; that is, $S_p = 1$.

COMMENTS - Pertinent remarks used to amplify, enhance, clarify, or qualify any of the technical data or information contained within the program.

COMPOSITION - The composition of the energetic material or the hazardous material as it exists in the production process state. The composition may be expressed in terms of basic elements or as the percentage of each ingredient. The percentage of each compound is normally expressed in percent by weight and is contained within the parenthesis that follow the compound designation. For example, COMP B is composed of 60% RDX and 40% TNT and is expressed as RDX(60), TNT(40).

CONTAINER DESCRIPTION - A description of the container used for packaging the hazardous material either for storage or transportation. References to drawings or specifications will be used as appropriate.

CONTRACT NUMBER - The number that appears on the document reference which identifies the contract by which the reported work was accomplished.

DATE PUBLISHED - The date that the document was published as it appears on the title page.

DESCRIPTION (OF DOCUMENT) - The classification of the document reference as to its type; e.g., a technical report, letter report, text, journal, brochure, conference, or handbook.

DETECTION METHOD - The method used to detect the threshold initiation level of the combustible during the laboratory test.

DIMENSIONS - The dimensions of the hazardous material specimen used in

the evaluation in terms of length, width, diameter, thickness, or other descriptive means.

DOCUMENT CODE - A code used to identify the document, generally consisting of four numeric characters. The code is used to access detailed information for the document.

END ITEM - The designation of the product in which the hazardous material is used.

EQUIPMENT - The process equipment or physical hardware which is being addressed in the hazard.

EVENT PROBABILITY - The probability of event (E_p) is the probability of the hazardous event occurring and is numerically equal to one for normally occurring events, and is established from the appropriate equipment or human failure rate for abnormal events.

EXPLOSION PROBABILITY - The probability of explosion (X_p) is the product of the fire probability and transition probability ($F_p \times T_p$).

FACILITY - The types of plant or major entity within an Army ammunition production complex for which a hazard analysis study has been performed.

FACILITY SUBSYSTEM - Any subsystem within the facility which further delineates a major process area.

FIRE PROBABILITY - The probability of fire (F_p) is the product of the frequency and probabilities of event, material present, initiation, and sustained burning ($f \times E_p \times C_p \times I_p \times S_p$).

FORMULATION - Formulation is comparable to the field name COMPOSITION. It is used uniquely to describe the laboratory data.

FREQUENCY OF OPERATION - The frequency (f) at which the unit operation is performed. It is usually based on continuous operation and is normally 1.

HAZARD CATEGORY - The potential hazard is classified in accordance with MIL-STD-882A to reflect hazard level. The designations are as follows:

a. Category I - Catastrophic. May cause death or system loss.

b. Category II - Critical. May cause severe injury, severe occupational illness, or major system damage.

c. Category III - Marginal. May cause minor injury, minor occupational illness, or major system damage.

d. Category IV - Negligible. Will not result in injury, occupational illness, or system damage.

To further delineate each hazard's association with either equipment or people, a suffice code has been developed as described in MPBMA OSM 385-1. The suffices α or β are used to indicate equipment or personnel, respectively. Since the data file cannot handle these characters, the letters A and B are used. Therefore, for the hazard category the suffice A denotes equipment or system relevancy, and B denotes personnel. Thus IIIA/B would denote minor system and temporary disablement or loss time to persons.

HAZARD CLASSIFICATION - The classification of the hazard presented for the packaged configuration. The classification may be defined by the joint services, DOT, or other regulatory group.

INITIATION CODE - A four letter code assigned to the mode of initiation of the hazardous material. It is used in the program for the selection of laboratory data only.

INITIATION MODE - A word which describes the potential mode of initiation of the hazardous material. It is associated in the program with the hazard analysis data for plant equipment. Typical descriptors include detonation, electrostatic, fire, friction, impact, and thermal. For laboratory data an initiation code is used for the selection of data.

INITIATION PROBABILITY - The probability of initiation (I_μ) is determined statistically comparing material response and process potential. Safety margins and probit plots are used for this determination.

LOCATION - The name of the facility (Radford AAP, Sunflower AAP, etc.) which identifies the location of the plant for which the hazard analysis data was developed.

MANUFACTURER OF EQUIPMENT - The name of the manufacturer of the equipment with associated model numbers and technical parameters to identify commercial equipment sources.

MATERIAL - The common label for the hazardous material also known as the energetic or combustible material. The material is described by

the chemical name or that name derived for a mixture of chemical compounds.

MATERIAL CODE - An alpha and/or numeric designation for the hazardous material. The code is used for data access and is based on conventional terminology, abbreviations, or a logical descriptor.

MATERIAL DATA - Data for the hazardous material in its packaged configuration principally the unit weight used in transportation.

MATERIAL RESPONSE - The material response in terms of the threshold initiation level established from initiation tests for a given combustible.

MATERIALS OF CONSTRUCTION - The materials of construction; (1020 steel, Neoprene rubber, 304 stainless steel) associated with the equipment identified in the hazard analysis data.

PAGE NUMBER - The page of the source document from which the technical data was abstracted.

PAGES - The total pages of the source document.

PHYSICAL CONDITION - The physical form of the hazardous material; e.g., granules, flake, dust. The term is associated with the laboratory test data.

PHYSICAL STATE - The physical state of the hazardous material, e.g., solid or liquid. The term is associated with the energetic materials information.

PRESENCE OF COMBUSTIBLE - The probability of material present (C_p) is the probability of the combustible material being present where and when the potential hazard occurs. The sequence of events necessary for the combustible to be present is considered in establishing the probability.

PROCESS OPERATION - A term which describes the process operation being performed for the potential hazard is identified and analyzed.

PROCESS POTENTIAL - The process stimuli or energy that can be generated by the potential hazard. This is determined by direct measurement, laboratory simulation, or calculation.

PROCESS STATE - The state of the hazardous material that exists when a potential hazard is identified for a manufacturing process and/or for which a laboratory test is performed.

TABLE A-6. HAZARD Field Descriptions. (cont'd)

PUBLISHER - The name of the publisher of the document referenced.

REPORT NUMBER - The alphanumeric designation which identifies the document in accordance with the publisher's format.

SAFETY MARGIN - The safety margin is equal to the process or material response (MR) divided by the process potential (PP) less one (SM=MR/PP -1).

SPECIFICATION - The specification(s) identifying the composition, characteristics, and acceptance criteria for the hazardous material.

TEST METHOD - The laboratory test method used in the evaluation of the hazardous material. The test method is denoted in the program by a code, which consists of three alphabetical characters. A summary of the code, the test method name, and the mode of initiation is listed below. For the shipping/storage data the test method data will contain the letters PKG to indicate the packaged form of the data.

TEST VARIABLES - Pertinent parameters used to describe variables in the laboratory test procedure.

THRESHOLD LEVEL - The Threshold Initiation Level (TIL) is that point at which a combustible material has reached a level of initation in the form of fire, explosion, or other response.

TITLE (OF DOCUMENT) - The title of the reference document.

TRANSITION PROBABILITY - The transition probability (T_p) is the probability of transition from sustained burning to an explosion and is either one or zero, depending on whether the critical height to explosion is exceeded.

TYPE (OF MATERIAL) - The classification of the combustible material as to its type. The descriptors are explosive, propellant, pyrotechnic, chemical, and others as appropriate. Appropriate modifiers can be used as single or double base.

APPENDIX B

RESPONSES TO AUTOMATED DATABASE QUESTIONNAIRE

APPENDIX B

RESPONSES TO THE AUTOMATED DATABASE QUESTIONNAIRE

Introduction

Responses to the Automated Database Questionnaire that was distributed to facilities hosting DoD-affiliated databases are included in this appendix. The facilities that responded are:

- The Army Materials and Mechanics Research Center, Watertown, MA;
- Plastics Technical Evaluation Center, Dover, NJ;
- Air Force Aeronautical Systems Division Computer Center; Wright-Patterson Air Force Base, OH;
- Office of Deputy Undersecretary of Defense Research and Advanced Technology, Washington, D. C.

In addition, a list of facilities to which the questionnaire was sent but from which no response was received is provided.

AUTOMATED DATABASE QUESTIONNAIRE

I. General

Full name of database. AMMRC Laboratory Information Support System (ALISS)

Owner of database or technical monitor (name, address, primary contact).

The Army Materials and Mechanics Research Center

Arsenal Street

Watertown, MA 02172

General subject area(s) of the database (e.g., tactical warfare, properties of materials).

Identify the primary use of the system.

Used to support activities of internal staff X

Used remotely to support activities of personnel at other facilities ____

Both of the above ____

Type of data in the database (check one).*

Bibliographic ____ Numeric X Both ____

Size of database.

Total number of records ____

→ Core memory for software (megabytes) ____

Secondary memory for data storage (megabytes) ____

Is the database integrated (i.e., data is stored in more than one geographic location? (Y/N)

Status of system. Prototype established

In use X Defunct ____

Under active development X Inactive but revivable ____

* Bibliographic identifies source of reference from which pertinent information can be retrieved and numeric actually contains the pertinent data, or both.

II. Data Contents and Structure

Provide a listing of the record types found in the database.

_____

_____

Attach a listing of the field names, as may be found in a data dictionary or thesaurus, associated with each of the above record types.

Identify the structure of the relationships between record types.

Flat file _____ Relational _____

Hierarchical _____ Other _____

Other (please specify) _____

_____

III. Database Management System (DBMS)

Indicate the type of database management system employed.

Off-the-shelf-package X

Unique system developed for your application _____

If using an off-the-shelf package, give version and manufacturer (name, address and point of contact).

TOTAL

Changing over to RIM Version 5

If system was implemented by a contractor other than the vendor, please identify contractor (name, address, and point of contact).

TASC The Analytic Sciences Corporation

One Jacob Way

Reading, Massachusetts 01867

IV. DBMS Features

Identify features included with or capabilities of DBMS.

- Database dictionary _____
- A query facility that allows personnel with little or no programming experience to access data _____
- Interactive query/search _____
- Off-line query/search _____

Query/search methods available:

- Structured (e.g., menu-driven) _____
- Unstructured (e.g., command-driven) _____
- Other (please specify) _____
- Boolean operators available _____

On-line aids available:

- Tutorials _____
- Error messages _____
- System status _____
- "Help" responses _____
- Other (please specify) _____

Algorithms for loading/updating data _____

Algorithms for indexing and sorting data _____

Algorithms for generating and/or restructuring format of data fields records _____

Algorithms for generating and/or restructuring format of database architecture (e.g., relational, hierarchical, network relationships) _____

Algorithms for generating and/or restructuring of user/views (e.g., menus, output formats) _____

Algorithms for validating and checking consistency of data _____

Screen-aided editing or format generation _____

Graphics capability _____

IV. DBMS Features (Continued)

Computational algorithms _____

Other (Please attach a list of additional features.)

V. Database Availability

Would the system be available for access by personnel at a government facility such as Natick Laboratories? (Y/N)

Is your system available for direct access (e.g., by telephone) from a remote source? (Y/N)

If yes, give medium and baud rate. _____

If yes, estimate charges for service. _____

If your system cannot be accessed directly, can access be obtained through an intermediary information specialist? (Y/N)

If yes, identify specialist. _____

_____

If yes, estimate charges for service. _____

Is your system presently part of a network (e.g., Dialog, Orbit, Tymshare)? (Y/N)

If yes, estimate charges for service. _____

Is database accessible on a trial basis without charge? (Y/N)

Can the software and data be purchased? (Y/N)

If yes, give price. _____

Can the software and data be leased? (Y/N)

If yes, give price. _____

Would your system be available for integration with a database containing similar records and structure? (Y/N)

Would your system and staff be available for hosting and maintaining the database of a government facility such as Natick Laboratories? (Y/N)

If yes, estimate charges. _____

VI. Data Sources & Applications

Types of sources from which data are derived.

Journals	_____	Handbooks	_____
Reports	_____	Interviews	_____
Published texts	_____	Laboratory experiments	X

Other (please specify)_____

_____

Are sources of data identified? (Y/N) ?

Are data reliability indicators provided? (Y/N)

Identify the primary applications of data support engineering.

Support engineering related tasks (e.g., design, materials selection) _____

Support R&D related tasks _____

*VII. Development/Implementation/(Operation) of DBMS

Indicate how system was developed and implemented.

In-house personnel developed and implemented unique system _____

Contractor developed and in-house staff implemented unique system _____

Contractor developed and implemented unique system _____

Purchased off-the-shelf package and in-house staff implemented system _____

Contractor implemented off-the-shelf package X

Other (please specify)_____

_____

*Estimate the staff-hours invested in the development and implementation of the DBMS.

	In-house Staff	Contractor Support
~~Staff-hours~~ Years	1 staff-year	1 staff-year

VII. Development/Implementation/Operation of DBMS (Continued)

Estimate the costs incurred to develop and implement the DBMS.

Purchased cost of software package _____

Development and implementation costs $100K

Time (calendar) required to develop and implement the system. 2 years

Year system was implemented. 1982

Estimate the ~~staff-hours~~ staff-years required (on an annual basis) to operate and maintain the database. If possible, distinguish between technical and non-technical staff.

	In-house Staff (tech/non-tech)	Contractor Support (tech/non-tech)
Staff-hours	1-1/2 staff-years	1

Estimate the costs required to operate and maintain the database.

In-house Staff	Contractor Support
_____	_____

Estimate size of system (no. of records) at inception of database. _____

Estimate growth rate of system (no. of new records added a year). _____

How often are data updated and reviewed (no. of times per year). _____

VIII. Computer Support Systems

Manufacturer and model of hardware (e.g., IBM's 4341 L10).

Harris 125/6 New: Harris 100? → Harris 800

Operating system (e.g., EXEC8 Level R331).

VULCAN

AUTOMATED DATABASE QUESTIONNAIRE

I. General

Full name of database. Materials Deterioration Data Program

Owner of database or technical monitor (name, address, primary contact).

Plastics Technical Evaluation Center (PLASTEC)

Armament R&D Center, Picatinny Arsenal, Dover, NJ 07801

John Nardone (201) 724-5859 AV 880-5859

General subject area(s) of the database (e.g., tactical warfare, properties of materials).

Material behavior in natural and induced environments

Identify the primary use of the system.

Used to support activities of internal staff _____

Used remotely to support activities of personnel at other facilities _____

Both of the above X

Type of data in the database (check one).*

Bibliographic _____ Numeric X Both _____

Size of database.

Total number of records 1600

Core memory for software (megabytes) Virtual

Secondary memory for data storage (megabytes) 5

Is the database integrated (i.e., data is stored in more than one geographic location? (Y/N)

Status of system.

In use X Defunct _____

Under active development _____ Inactive but revivable _____

* Bibliographic identifies source of reference from which pertinent information can be retrieved and numeric actually contains the pertinent data, or both.

II. Data Contents and Structure

Provide a listing of the record types found in the database.

Generic materials, commercial materials, chemicals, document information, laboratory data, systems data

Attach a listing of the field names, as may be found in a data dictionary or thesaurus, associated with each of the above record types.

Identify the structure of the relationships between record types.

Flat file _____ Relational _____

Hierarchical X Other _____

Other (please specify) Associative network

III. Database Management System (DBMS)

Indicate the type of database management system employed.

Off-the-shelf-package X

Unique system developed for your application _____.

If using an off-the-shelf package, give version and manufacturer (name, address and point of contact).

DRS Version 3.1 Advanced Data Management

15-17 Main Street

Kingston, NJ 08528 Evan Gray (609) 799-4600

If system was implemented by a contractor other than the vendor, please identify contractor (name, address, and point of contact).

IV. DBMS Features

Identify features included with or capabilities of DBMS.

Database dictionary	X
A query facility that allows personnel with little or no programming experience to access data	X
Interactive query/search	X
Off-line query/search	X
Query/search methods available:	
Structured (e.g., menu-driven)	X
Unstructured (e.g., command-driven)	X
Other (please specify)	
Boolean operators available	X
On-line aids available:	
Tutorials	X
Error messages	X
System status	X
"Help" responses	X
Other (please specify)	
Algorithms for loading/updating data	X
Algorithms for indexing and sorting data	X
Algorithms for generating and/or restructuring format of data fields records	X
Algorithms for generating and/or restructuring format of database architecture (e.g., relational, hierarchical, network relationships)	X
Algorithms for generating and/or restructuring of user/views (e.g., menus, output formats)	X
Algorithms for validating and checking consistency of data	X
Screen-aided editing or format generation	X
Graphics capability	X

IV. DBMS Features (Continued)

Computational algorithms X

Other (Please attach a list of additional features.)

V. Database Availability

Would the system be available for access by personnel at a government facility such as Natick Laboratories? (Y/N)

Is your system available for direct access (e.g., by telephone) from a remote source? (Y/N)

If yes, give medium and baud rate. 300-1200 baud/telephone

If yes, estimate charges for service. $xxx/year subscription, not priced at this time

If your system cannot be accessed directly, can access be obtained through an intermediary information specialist? (Y/N) Yes/ access option

If yes, identify specialist. PLASTEC specialists

If yes, estimate charges for service. $100 per inquiry minimum

Is your system presently part of a network (e.g., Dialog, Orbit, Tymshare)? (Y/N)

If yes, estimate charges for service. _____

Is database accessible on a trial basis without charge? (Y/N)

Can the software and data be purchased? (Y/N)

If yes, give price. _____

Can the software and data be leased? (Y/N)

If yes, give price. _____

Would your system be available for integration with a database containing similar records and structure? (Y/N)

Would your system and staff be available for hosting and maintaining the database of a government facility such as Natick Laboratories? (Y/N)

If yes, estimate charges. Cost plus fixed fee

VI. Data Sources & Applications

Types of sources from which data are derived.

Journals	X	Handbooks	X
Reports	X	Interviews	X
Published texts	X	Laboratory experiments	

Other (please specify)_____

Are sources of data identified? (Y/N)

Are data reliability indicators provided? (Y/N)

Identify the primary applications of data support engineering.

Support engineering related tasks (e.g., design, materials selection)	Design/material ~~selection~~
Support R&D related tasks	

VII. Development/Implementation/Operation of DBMS

Indicate how system was developed and implemented.

In-house personnel developed and implemented unique system	
Contractor developed and in-house staff implemented unique system	X
Contractor developed and implemented unique system	
Purchased off-the-shelf package and in-house staff implemented system	X
Contractor implemented off-the-shelf package	

Other (please specify)_____

Estimate the staff-hours invested in the development and implementation of the DBMS.

	In-house Staff	Contractor Support
Staff-hours	700	40

VII. Development/Implementation/Operation of DBMS (Continued)

Estimate the costs incurred to develop and implement the DBMS.

Purchased cost of software package $70,000

Development and implementation costs $35,000

Time (calendar) required to develop and implement the system. 3 months

Year system was implemented. 1978

Estimate the staff-hours required (on an annual basis) to operate and maintain the database. If possible, distinguish between technical and non-technical staff. -- Data acquisition, assessment, and addition

	In-house Staff (tech/non-tech)	Contractor Support (tech/non-tech)
Staff-hours	450/100	0/

Estimate the costs required to operate and maintain the database.

In-house Staff	Contractor Support
200	($2000) est. 70 hrs/yr

Estimate size of system (no. of records) at inception of database. 400

Estimate growth rate of system (no. of new records added a year). 300

How often are data updated and reviewed (no. of times per year). Bi-monthly (6)

VIII. Computer Support Systems

Manufacturer and model of hardware (e.g., IBM's 4341 L10).

DEC V/* 11/780

Operating system (e.g., EXEC8 Level R331).

DEC VMS V3.4

AUTOMATED DATABASE QUESTIONNAIRE

I. General

Full name of database. Hazard Analysis Data Program

Owner of database or technical monitor (name, address, primary contact).

Plastics Technical Evaluation Center (PLASTEC)

Armament R&D Center, Picatinny Arsenal, Dover, NJ 07801

John Nardone (201) 724-5859 AV 880-5859

General subject area(s) of the database (e.g., tactical warfare, properties of materials).

Equipment hazards analysis and laboratory test data for energetic materials

Identify the primary use of the system.

Used to support activities of internal staff ____

Used remotely to support activities of personnel at other facilities ____

Both of the above X

Type of data in the database (check one).*

Bibliographic ____ Numeric X Both ____

Size of database.

Total number of records 5000

Core memory for software (megabytes) Virtual

Secondary memory for data storage (megabytes) 5

Is the database integrated (i.e., data is stored in more than one geographic location? (Y/N)

Status of system.

In use X Defunct ____

Under active development ____ Inactive but revivable ____

* Bibliographic identifies source of reference from which pertinent information can be retrieved and numeric actually contains the pertinent data, or both.

II. Data Contents and Structure

Provide a listing of the record types found in the database.

Energetics materials information, document information,

equipment analysis data, laboratory test data

Attach a listing of the field names, as may be found in a data dictionary or thesaurus, associated with each of the above record types.

Identify the structure of the relationships between record types.

Flat file _____ Relational _____

Hierarchical X Other _____

Other (please specify) Associative network

III. Database Management System (DBMS)

Indicate the type of database management system employed.

Off-the-shelf-package X

Unique system developed for your application _____

If using an off-the-shelf package, give version and manufacturer (name, address and point of contact).

DRS Version 3.1 Advanced Data Management

15-17 Main Street

Kingston, NJ 08528 Evan Gray (609) 799-4600

If system was implemented by a contractor other than the vendor, please identify contractor (name, address, and point of contact).

IV. DBMS Features

Identify features included with or capabilities of DBMS.

Database dictionary	X
A query facility that allows personnel with little or no programming experience to access data	X
Interactive query/search	X
Off-line query/search	X
Query/search methods available:	
Structured (e.g., menu-driven)	X
Unstructured (e.g., command-driven)	X
Other (please specify)	X
Boolean operators available	X
On-line aids available:	
Tutorials	X
Error messages	X
System status	X
"Help" responses	X
Other (please specify)	X
Algorithms for loading/updating data	X
Algorithms for indexing and sorting data	X
Algorithms for generating and/or restructuring format of data fields records	X
Algorithms for generating and/or restructuring format of database architecture (e.g., relational, hierarchical, network relationships)	X
Algorithms for generating and/or restructuring of user/views (e.g., menus, output formats)	X
Algorithms for validating and checking consistency of data	X
Screen-aided editing or format generation	X
Graphics capability	X

IV. DBMS Features (Continued)

Computational algorithms X

Other (Please attach a list of additional features.) XBS -FORTRAN Interface

V. Database Availability

Would the system be available for access by personnel at a government facility such as Natick Laboratories? (Y/N)

Is your system available for direct access (e.g., by telephone) from a remote source? (Y/N)

If yes, give medium and baud rate. 300-1200 baud/telephone

If yes, estimate charges for service. $xx/year subscription. No price at this time.

If your system cannot be accessed directly, can access be obtained through an intermediary information specialist? (Y/N) Yes/access option

If yes, identify specialist. PLASTEC specialists

If yes, estimate charges for service. $100 per inquiry minimum

Is your system presently part of a network (e.g., Dialog, Orbit, Tymshare)? (Y/N)

If yes, estimate charges for service. _____

Is database accessible on a trial basis without charge? (Y/N)

Can the software and data be purchased? (Y/N)

If yes, give price. _____

Can the software and data be leased? (Y/N)

If yes, give price. _____

Would your system be available for integration with a database containing similar records and structure? (Y/N)

Would your system and staff be available for hosting and maintaining the database of a government facility such as Natick Laboratories? (Y/N)

If yes, estimate charges. Cost plus fixed fee

VI. Data Sources & Applications

Types of sources from which data are derived.

Journals	_____	Handbooks	_____
Reports	X	Interviews	_____
Published texts	X	Laboratory experiments	X

Other (please specify)_____

_____

Are sources of data identified? (Y/N)

Are data reliability indicators provided? (Y/N)

Identify the primary applications of data support engineering.

Support engineering related tasks (e.g., design, materials selection)	Plant design/ material assessmer
Support R&D related tasks	_____

VII. Development/Implementation/Operation of DBMS

Indicate how system was developed and implemented.

In-house personnel developed and implemented unique system	_____
Contractor developed and in-house staff implemented unique system	_____
Contractor developed and implemented unique system	_____
Purchased off-the-shelf package and in-house staff implemented system	X
Contractor implemented off-the-shelf package	_____

Other (please specify)_____

_____

Estimate the staff-hours invested in the development and implementation of the DBMS.

	In-house Staff	Contractor Support
Staff-hours	1800	0

VII. Development/Implementation/Operation of DBMS (Continued)

Estimate the costs incurred to develop and implement the DBMS.

Purchased cost of software package $70,000

Development and implementation costs $70,000

Time (calendar) required to develop and implement the system. 12 months

Year system was implemented. 1981

Estimate the staff-hours required (on an annual basis) to operate and maintain the database. If possible, distinguish between technical and non-technical staff.

	In-house Staff (tech/non-tech)	Contractor Support (tech/non-tech)
Staff-hours	100/	350/100

Estimate the costs required to operate and maintain the database.

In-house Staff	Contractor Support
100	($2000) est. 70 hrs/yr

Estimate size of system (no. of records) at inception of database. 2000

Estimate growth rate of system (no. of new records added a year). 2000

How often are data updated and reviewed (no. of times per year). 6

VIII. Computer Support Systems

Manufacturer and model of hardware (e.g., IBM's 4341 L10).

DEC VAX 11/780

Operating system (e.g., EXEC8 Level R331).

DEC VMS V3.4

AUTOMATED DATABASE QUESTIONNAIRE

I. General

Full name of database. Energetics Materials Compatibility Data

Owner of database or technical monitor (name, address, primary contact).

Plastics Technical Evaluation Center (PLASTEC)

Armament R&D Center, Picatinny Arsenal, Dover, NJ 07801

Harry Pebly (201) 724-4222 AV 880-4222

General subject area(s) of the database (e.g., tactical warfare, properties of materials).

Compatibility data between energetics materials and materials of construction

Identify the primary use of the system.

Used to support activities of internal staff _____

Used remotely to support activities of personnel at other facilities _____

Both of the above X

Type of data in the database (check one).*

Bibliographic _____ Numeric X Both _____

Size of database.

Total number of records 8000

Core memory for software (megabytes) 0.25

Secondary memory for data storage (megabytes) 2.3

Is the database integrated (i.e., data is stored in more than one geographic location? (Y/N)

Status of system.

In use X Defunct _____

Under active development _____ Inactive but revivable _____

* Bibliographic identifies source of reference from which pertinent information can be retrieved and numeric actually contains the pertinent data, or both.

II. Data Contents and Structure

Provide a listing of the record types found in the database.

Engineering materials list, energetic materials list, compatible and non-compatible lists, specific data output

Attach a listing of the field names, as may be found in a data dictionary or thesaurus, associated with each of the above record types.

Identify the structure of the relationships between record types.

Flat file X Relational ____

Hierarchical ____ Other ____

Other (please specify) ____

III. Database Management System (DBMS)

Indicate the type of database management system employed.

Off-the-shelf-package ____

Unique system developed for your application X

If using an off-the-shelf package, give version and manufacturer (name, address and point of contact).

If system was implemented by a contractor other than the vendor, please identify contractor (name, address, and point of contact).

IV. DBMS Features

Identify features included with or capabilities of DBMS.

Database dictionary	____
A query facility that allows personnel with little or no programming experience to access data	____
Interactive query/search	X
Off-line query/search	X
Query/search methods available:	
Structured (e.g., menu-driven)	X
Unstructured (e.g., command-driven)	____
Other (please specify)	____
Boolean operators available	____
On-line aids available:	
Tutorials	____
Error messages	____
System status	____
"Help" responses	____
Other (please specify)	____
Algorithms for loading/updating data	X
Algorithms for indexing and sorting data	X
Algorithms for generating and/or restructuring format of data fields records	____
Algorithms for generating and/or restructuring format of database architecture (e.g., relational, hierarchical, network relationships)	____
Algorithms for generating and/or restructuring of user/views (e.g., menus, output formats)	____
Algorithms for validating and checking consistency of data	____
Screen-aided editing or format generation	____
Graphics capability	____

IV. DBMS Features (Continued)

Computational algorithms _____

Other (Please attach a list of additional features.)

V. Database Availability

Would the system be available for access by personnel at a government facility such as Natick Laboratories? (Y/N)

Is your system available for direct access (e.g., by telephone) from a remote source? (Y/N)

If yes, give medium and baud rate. Telephone @ 300 baud

If yes, estimate charges for service. $400/year subscription

If your system cannot be accessed directly, can access be obtained through an intermediary information specialist? (Y/N) Yes/optional access

If yes, identify specialist. PLASTEC personnel

If yes, estimate charges for service. $400 per year, $100 per search

Is your system presently part of a network (e.g., Dialog, Orbit, Tymshare)? (Y/N)

If yes, estimate charges for service. _____

Is database accessible on a trial basis without charge? (Y/N)

Can the software and data be purchased? (Y/N)

If yes, give price. _____

Can the software and data be leased? (Y/N)

If yes, give price. _____

Would your system be available for integration with a database containing similar records and structure? (Y/N)

Would your system and staff be available for hosting and maintaining the database of a government facility such as Natick Laboratories? (Y/N)

If yes, estimate charges. Cost plus fixed fee

VI. Data Sources & Applications

Types of sources from which data are derived.

Journals	_____	Handbooks	_____
Reports	X	Interviews	_____
Published texts	X	Laboratory experiments	X

Other (please specify)_____

_____

Are sources of data identified? (Y/N)

Are data reliability indicators provided? (Y/N)

Identify the primary applications of data support engineering.

Support engineering related tasks (e.g., design, materials selection)	Design/material selection
Support R&D related tasks	Production facilities

VII. Development/Implementation/Operation of DBMS

Indicate how system was developed and implemented.

In-house personnel developed and implemented unique system	X
Contractor developed and in-house staff implemented unique system	_____
Contractor developed and implemented unique system	_____
Purchased off-the-shelf package and in-house staff implemented system	_____
Contractor implemented off-the-shelf package	_____

Other (please specify)_____

_____

Estimate the staff-hours invested in the development and implementation of the DBMS.

	In-house Staff	Contractor Support
Staff-hours	800	0

VII. Development/Implementation/Operation of DBMS (Continued)

Estimate the costs incurred to develop and implement the DBMS.

Purchased cost of software package	0
Development and implementation costs	$20,000 (FY74)

Time (calendar) required to develop and implement the system. One year

Year system was implemented. 1974

Estimate the staff-hours required (on an annual basis) to operate and maintain the database. If possible, distinguish between technical and non-technical staff. Data acquisitio assessment & addition

	In-house Staff (tech/non-tech)	Contractor Support (tech/non-tech)
Staff-hours	450/150	0/

Estimate the costs required to operate and maintain the database.

In-house Staff	Contractor Support
100	0

Estimate size of system (no. of records) at inception of database. 500

Estimate growth rate of system (no. of new records added a year). 1000

How often are data updated and reviewed (no. of times per year). Once

VIII. Computer Support Systems

Manufacturer and model of hardware (e.g., IBM's 4341 L10).

CDC 6600/74-28/825

Operating system (e.g., EXEC8 Level R331).

NOS/BE

AUTOMATED DATABASE QUESTIONNAIRE

I. General

Full name of database. Chemical Defense Bibliography

Owner of database or technical monitor (name, address, primary contact).

AFAMRL/HET

Wright-Patterson AFB, OH 45433

Richard E. McNally

General subject area(s) of the database (e.g., tactical warfare, properties of materials).

Chemical defense environments (agents, toxicology, chemical effects, munitions, doctrine, policy, training) airbase operations

Identify the primary use of the system.

Used to support activities of internal staff ____

Used remotely to support activities of personnel at other facilities ____

Both of the above X

Type of data in the database (check one).*

Bibliographic X Numeric ____ Both ____

Size of database.

Total number of records 5000

Core memory for software (megabytes) ____

Secondary memory for data storage (megabytes) ____

Is the database integrated (i.e., data is stored in more than one geographic location? (Y/N)

Status of system.

In use X Defunct ____

Under active development ____ Inactive but revivable ____

---

* Bibliographic identifies source of reference from which pertinent information can be retrieved and numeric actually contains the pertinent data, or both.

II. Data Contents and Structure

Provide a listing of the record types found in the database.

_____

_____

Attach a listing of the field names, as may be found in a data dictionary or thesaurus, associated with each of the above record types.

Identify the structure of the relationships between record types.

Flat file _____ Relational _____

Hierarchical _____ Other _____

Other (please specify) _____

_____

III. Database Management System (DBMS)

Indicate the type of database management system employed.

Off-the-shelf-package ___X___

Unique system developed for your application _____

If using an off-the-shelf package, give version and manufacturer (name, address and point of contact).

Battelle Columbus Laboratory BASIS Production System (Release H)

Columbus, OH

_____

If system was implemented by a contractor other than the vendor, please identify contractor (name, address, and point of contact).

_____

_____

_____

IV. DBMS Features

Identify features included with or capabilities of DBMS.

Database dictionary	X
A query facility that allows personnel with little or no programming experience to access data	X
Interactive query/search	X
Off-line query/search	
Query/search methods available:	
Structured (e.g., menu-driven)	
Unstructured (e.g., command-driven)	X
Other (please specify)	
Boolean operators available	X
On-line aids available:	
Tutorials	X
Error messages	X
System status	
"Help" responses	X
Other (please specify)	
Algorithms for loading/updating data	X
Algorithms for indexing and sorting data	X
Algorithms for generating and/or restructuring format of data fields records	X
Algorithms for generating and/or restructuring format of database architecture (e.g., relational, hierarchical, network relationships)	
Algorithms for generating and/or restructuring of user/views (e.g., menus, output formats)	X
Algorithms for validating and checking consistency of data	Optional
Screen-aided editing or format generation	Optional
Graphics capability	

IV. DBMS Features (Continued)

Computational algorithms X

Other (Please attach a list of additional features.)

V. Database Availability

Would the system be available for access by personnel at a government facility such as Natick Laboratories? (Y/N)

Is your system available for direct access (e.g., by telephone) from a remote source? (Y/N)

If yes, give medium and baud rate. Telephone/Tymenet up to 1200 baud

If yes, estimate charges for service. _____

If your system cannot be accessed directly, can access be obtained through an intermediary information specialist? (Y/N)

If yes, identify specialist. _____

_____

If yes, estimate charges for service. $30,000 initial plus connect time

Is your system presently part of a network (e.g., Dialog, Orbit, Tymshare)? (Y/N)

If yes, estimate charges for service. _____

Is database accessible on a trial basis without charge? (Y/N)

Can the software and data be purchased? (Y/N)

If yes, give price. _____

Can the software and data be leased? (Y/N)

If yes, give price. _____

Would your system be available for integration with a database containing similar records and structure? (Y/N)

Would your system and staff be available for hosting and maintaining the database of a government facility such as Natick Laboratories? (Y/N)

If yes, estimate charges. <$5,000 per year

VI. Data Sources & Applications

Types of sources from which data are derived.

Journals	X	Handbooks	X
Reports	X	Interviews	
Published texts	X	Laboratory experiments	

Other (please specify)_____

Are sources of data identified? (Y/N)

Are data reliability indicators provided? (Y/N) Sometimes

Identify the primary applications of data support engineering.

Support engineering related tasks (e.g., design, materials selection) _____

Support R&D related tasks X

VII. Development/Implementation/Operation of DBMS

Indicate how system was developed and implemented.

In-house personnel developed and implemented unique system _____

Contractor developed and in-house staff implemented unique system _____

Contractor developed and implemented unique system _____

Purchased off-the-shelf package and in-house staff implemented system _____

Contractor implemented off-the-shelf package _____

Other (please specify)_____

Estimate the staff-hours invested in the development and implementation of the DBMS.

	In-house Staff	Contractor Support
Staff-hours		

VII. Development/Implementation/Operation of DBMS (Continued)

Estimate the costs incurred to develop and implement the DBMS.

Purchased cost of software package _____

Development and implementation costs _____

Time (calendar) required to develop and implement the system. _____

Year system was implemented. _____

Estimate the staff-hours required (on an annual basis) to operate and maintain the database. If possible, distinguish between technical and non-technical staff.

	In-house Staff (tech/non-tech)	Contractor Support (tech/non-tech)
Staff-hours	_____	_____

Estimate the costs required to operate and maintain the database.

In-house Staff	Contractor Support
_____	_____

Estimate size of system (no. of records) at inception of database. _____

Estimate growth rate of system (no. of new records added a year). _____

How often are data updated and reviewed (no. of times per year). _____

VIII. Computer Support Systems

Manufacturer and model of hardware (e.g., IBM's 4341 L10).

VAX 11-780

Operating system (e.g., EXEC8 Level R331).

VAX VMS Version 3.3

AUTOMATED DATABASE QUESTIONNAIRE

I. General

Full name of database. Defense Materials System (DMS)

Owner of database or technical monitor (name, address, primary contact).

Joint Aeronautical Materials Activity (AFSC/PMDM)

Area B, Bldg. 22B, Wright-Patterson AFB, OH 45433

Georgia V. Reichenbach

General subject area(s) of the database (e.g., tactical warfare, properties of materials).

Controlled materials

Identify the primary use of the system.

Used to support activities of internal staff X

Used remotely to support activities of personnel at other facilities ____

Both of the above X

Type of data in the database (check one).*

Bibliographic ____ Numeric X Both ____

Size of database.

Total number of records 3,000

Core memory for software (megabytes) 120K

Secondary memory for data storage (megabytes) ____

Is the database integrated (i.e., data is stored in more than one geographic location? (Y/N)

Status of system.

In use X Defunct ____

Under active development ____ Inactive but revivable ____

* Bibliographic identifies source of reference from which pertinent information can be retrieved and numeric actually contains the pertinent data, or both.

II. Data Contents and Structure

Provide a listing of the record types found in the database.

Up-to-date balance, manufacturer's report, address listing, DX report

Attach a listing of the field names, as may be found in a data dictionary or thesaurus, associated with each of the above record types.

Identify the structure of the relationships between record types.

Flat file _____ Relational _____

Hierarchical X Other _____

Other (please specify) _____

III. Database Management System (DBMS)

Indicate the type of database management system employed.

Off-the-shelf-package _____

Unique system developed for your application X

If using an off-the-shelf package, give version and manufacturer (name, address and point of contact).

If system was implemented by a contractor other than the vendor, please identify contractor (name, address, and point of contact).

IV. DBMS Features

Identify features included with or capabilities of DBMS.

- Database dictionary ____
- A query facility that allows personnel with little or no programming experience to access data ____
- Interactive query/search ____
- Off-line query/search ____

Query/search methods available:

- Structured (e.g., menu-driven) ____
- Unstructured (e.g., command-driven) ____
- Other (please specify) ____
- Boolean operators available ____

On-line aids available:

- Tutorials ____
- Error messages ____
- System status ____
- "Help" responses ____
- Other (please specify) ____

Algorithms for loading/updating data ____

Algorithms for indexing and sorting data ____

Algorithms for generating and/or restructuring format of data fields records ____

Algorithms for generating and/or restructuring format of database architecture (e.g., relational, hierarchical, network relationships) ____

Algorithms for generating and/or restructuring of user/views (e.g., menus, output formats) ____

Algorithms for validating and checking consistency of data ____

Screen-aided editing or format generation ____

Graphics capability ____

IV. DBMS Features (Continued)

Computational algorithms

Other (Please attach a list of additional features.)

V. Database Availability

Would the system be available for access by personnel at a government facility such as Natick Laboratories? (Y/N)

Is your system available for direct access (e.g., by telephone) from a remote source? (Y/N)

If yes, give medium and baud rate. _____

If yes, estimate charges for service. _____

If your system cannot be accessed directly, can access be obtained through an intermediary information specialist? (Y/N)

If yes, identify specialist. _____

_____

If yes, estimate charges for service. _____

Is your system presently part of a network (e.g., Dialog, Orbit, Tymshare)? (Y/N)

If yes, estimate charges for service. _____

Is database accessible on a trial basis without charge? (Y/N)

Can the software and data be purchased? (Y/N)

If yes, give price. _____

Can the software and data be leased? (Y/N)

If yes, give price. _____

Would your system be available for integration with a database containing similar records and structure? (Y/N)

Would your system and staff be available for hosting and maintaining the database of a government facility such as Natick Laboratories? (Y/N)

If yes, estimate charges. _____

VI. Data Sources & Applications

Types of sources from which data are derived.

Journals	_____	Handbooks	_____
Reports	_____	Interviews	_____
Published texts	_____	Laboratory experiments	_____

Other (please specify) Forms _____

_____

Are sources of data identified? (Y/N)

Are data reliability indicators provided? (Y/N)

Identify the primary applications of data support engineering.

Support engineering related tasks (e.g., design, materials selection) _____

Support R&D related tasks _____

VII. Development/Implementation/Operation of DBMS

Indicate how system was developed and implemented.

In-house personnel developed and implemented unique system X

Contractor developed and in-house staff implemented unique system _____

Contractor developed and implemented unique system _____

Purchased off-the-shelf package and in-house staff implemented system _____

Contractor implemented off-the-shelf package _____

Other (please specify) _____

_____

Estimate the staff-hours invested in the development and implementation of the DBMS.

	In-house Staff	Contractor Support
Staff-hours	_____	_____

VII. Development/Implementation/Operation of DBMS (Continued)

Estimate the costs incurred to develop and implement the DBMS.

Purchased cost of software package _____

Development and implementation costs _____

Time (calendar) required to develop and implement the system. _____

Year system was implemented. 1 Nov 1966

Estimate the staff-hours required (on an annual basis) to operate and maintain the database. If possible, distinguish between technical and non-technical staff.

	In-house Staff (tech/non-tech)	Contractor Support (tech/non-tech)
Staff-hours	80/160	

Estimate the costs required to operate and maintain the database.

In-house Staff	Contractor Support
100	

Estimate size of system (no. of records) at inception of database. 3,000

Estimate growth rate of system (no. of new records added a year). _____

How often are data updated and reviewed (no. of times per year). 16

VIII. Computer Support Systems

Manufacturer and model of hardware (e.g., IBM's 4341 L10).

Burroughs 3500

Operating system (e.g., EXEC8 Level R331).

AUTOMATED DATABASE QUESTIONNAIRE

I. General

Full name of database. Strategic Materials Data Base

Owner of database or technical monitor (name, address, primary contact).

Joint Aeronautical Materials Activity

Area B, Bldg. 22B, Wright-Patterson AFB, OH

M. Romero

General subject area(s) of the database (e.g., tactical warfare, properties of materials).

Critical materials

Identify the primary use of the system.

Used to support activities of internal staff X

Used remotely to support activities of personnel at other facilities _____

Both of the above _____

Type of data in the database (check one).*

Bibliographic _____ Numeric _____ Both Alphameric

Size of database.

Total number of records 181,000

Core memory for software (megabytes) _____

Secondary memory for data storage (megabytes) _____

Is the database integrated (i.e., data is stored in more than one geographic location? (Y/N)

Status of system.

In use X Defunct _____

Under active development _____ Inactive but revivable _____

* Bibliographic identifies source of reference from which pertinent information can be retrieved and numeric actually contains the pertinent data, or both.

II. Data Contents and Structure

Provide a listing of the record types found in the database.

_____

_____

Attach a listing of the field names, as may be found in a data dictionary or thesaurus, associated with each of the above record types.

Identify the structure of the relationships between record types.

Flat file _____ Relational _____

Hierarchical X Other _____

Other (please specify) _____

_____

III. Database Management System (DBMS)

Indicate the type of database management system employed.

Off-the-shelf-package X

Unique system developed for your application _____

If using an off-the-shelf package, give version and manufacturer (name, address and point of contact).

System 2000

_____

_____

If system was implemented by a contractor other than the vendor, please identify contractor (name, address, and point of contact).

_____

_____

IV. DBMS Features

Identify features included with or capabilities of DBMS.

Database dictionary	X
A query facility that allows personnel with little or no programming experience to access data	X
Interactive query/search	X
Off-line query/search	
Query/search methods available:	
Structured (e.g., menu-driven)	X
Unstructured (e.g., command-driven)	X
Other (please specify)	
Boolean operators available	X
On-line aids available:	
Tutorials	
Error messages	X
System status	
"Help" responses	
Other (please specify)	
Algorithms for loading/updating data	
Algorithms for indexing and sorting data	
Algorithms for generating and/or restructuring format of data fields records	
Algorithms for generating and/or restructuring format of database architecture (e.g., relational, hierarchical, network relationships)	
Algorithms for generating and/or restructuring of user/views (e.g., menus, output formats)	
Algorithms for validating and checking consistency of data	
Screen-aided editing or format generation	
Graphics capability	

IV. DBMS Features (Continued)

Computational algorithms _____

Other (Please attach a list of additional features.)

V. Database Availability

Would the system be available for access by personnel at a government facility such as Natick Laboratories? (Y/N)

Is your system available for direct access (e.g., by telephone) from a remote source? (Y/N)

If yes, give medium and baud rate. _____

If yes, estimate charges for service. _____

If your system cannot be accessed directly, can access be obtained through an intermediary information specialist? (Y/N)

If yes, identify specialist. _____

_____

If yes, estimate charges for service. _____

Is your system presently part of a network (e.g., Dialog, Orbit, Tymshare)? (Y/N)

If yes, estimate charges for service. _____

Is database accessible on a trial basis without charge? (Y/N)

Can the software and data be purchased? (Y/N)

If yes, give price. _____

Can the software and data be leased? (Y/N)

If yes, give price. _____

Would your system be available for integration with a database containing similar records and structure? (Y/N)

Would your system and staff be available for hosting and maintaining the database of a government facility such as Natick Laboratories? (Y/N)

If yes, estimate charges. _____

VI. Data Sources & Applications

Types of sources from which data are derived.

Journals	_____	Handbooks	_____
Reports	X	Interviews	_____
Published texts	_____	Laboratory experiments	_____

Other (please specify) Material specifications

Are sources of data identified? (Y/N)

Are data reliability indicators provided? (Y/N)

Identify the primary applications of data support engineering.

Support engineering related tasks (e.g., design, materials selection) _____

Support R&D related tasks _____

VII. Development/Implementation/Operation of DBMS

Indicate how system was developed and implemented.

In-house personnel developed and implemented unique system _____

Contractor developed and in-house staff implemented unique system X

Contractor developed and implemented unique system _____

Purchased off-the-shelf package and in-house staff implemented system _____

Contractor implemented off-the-shelf package _____

Other (please specify) _____

Estimate the staff-hours invested in the development and implementation of the DBMS.

	In-house Staff	Contractor Support
Staff-hours	_____	_____

VII. Development/Implementation/Operation of DBMS (Continued)

Estimate the costs incurred to develop and implement the DBMS.

Purchased cost of software package _____

Development and implementation costs _____

Time (calendar) required to develop and implement the system. _____

Year system was implemented. 1981

Estimate the staff-hours required (on an annual basis) to operate and maintain the database. If possible, distinguish between technical and non-technical staff.

	In-house Staff (tech/non-tech)	Contractor Support (tech/non-tech)
Staff-hours	_____	_____

Estimate the costs required to operate and maintain the database.

In-house Staff	Contractor Support
_____	_____

Estimate size of system (no. of records) at inception of database. _____

Estimate growth rate of system (no. of new records added a year). _____

How often are data updated and reviewed (no. of times per year). _____

VIII. Computer Support Systems

Manufacturer and model of hardware (e.g., IBM's 4341 L10).

NAS 7000

Operating system (e.g., EXEC8 Level R331).

MVS 3.8

AUTOMATED DATABASE QUESTIONNAIRE

I. General

Full name of database. Data Base 101 Lead Time Data System (AFSC/PMDM)

Owner of database or technical monitor (name, address, primary contact).

Joint Aeronautical Materials Activity (AFSC/PMDM)

Area B, Bldg. 22B, Wright-Patterson AFB, OH 45433

Georgia V. Reichenbach

General subject area(s) of the database (e.g., tactical warfare, properties of materials).

Contractor/Material Lead Time

Identify the primary use of the system.

Used to support activities of internal staff ____

Used remotely to support activities of personnel at other facilities ____

Both of the above ____

Type of data in the database (check one).*

Bibliographic X Numeric X Both ____

Size of database.

Total number of records 15,686

Core memory for software (megabytes) 5

Secondary memory for data storage (megabytes) 6,000

Is the database integrated (i.e., data is stored in more than one geographic location? (Y/N)

Status of system.

In use X Defunct ____

Under active development X Inactive but revivable ____

* Bibliographic identifies source of reference from which pertinent information can be retrieved and numeric actually contains the pertinent data, or both.

II. Data Contents and Structure

Provide a listing of the record types found in the database.

Lead time (average lead time in weeks, are maintained on 62 purchased material parts experienced by 23 major aerospace defense contractors.)

Attach a listing of the field names, as may be found in a data dictionary or thesaurus, associated with each of the above record types.

Identify the structure of the relationships between record types.

Flat file _____ Relational _____

Hierarchical X Other _____

Other (please specify) _____

III. Database Management System (DBMS)

Indicate the type of database management system employed.

Off-the-shelf-package X

Unique system developed for your application _____

If using an off-the-shelf package, give version and manufacturer (name, address and point of contact).

BASIS by Battelle

If system was implemented by a contractor other than the vendor, please identify contractor (name, address, and point of contact).

Battelle Columbus Laboratories

505 King Avenue

Columbus, OH 43201

IV. DBMS Features

Identify features included with or capabilities of DBMS.

Database dictionary	
A query facility that allows personnel with little or no programming experience to access data	X
Interactive query/search	X
Off-line query/search	X
Query/search methods available:	
Structured (e.g., menu-driven)	X
Unstructured (e.g., command-driven)	
Other (please specify)	
Boolean operators available	
On-line aids available:	
Tutorials	
Error messages	X
System status	
"Help" responses	X
Other (please specify)	
Algorithms for loading/updating data	
Algorithms for indexing and sorting data	
Algorithms for generating and/or restructuring format of data fields records	
Algorithms for generating and/or restructuring format of database architecture (e.g., relational, hierarchical, network relationships)	
Algorithms for generating and/or restructuring of user/views (e.g., menus, output formats)	
Algorithms for validating and checking consistency of data	
Screen-aided editing or format generation	
Graphics capability	

IV. DBMS Features (Continued)

Computational algorithms _____

Other (Please attach a list of additional features.)

V. Database Availability

Would the system be available for access by personnel at a government facility such as Natick Laboratories? (Y/N)

Is your system available for direct access (e.g., by telephone) from a remote source? (Y/N)

If yes, give medium and baud rate. 300/1200 bps dial up - full duplex

If yes, estimate charges for service. ARPANET - TYMNET & Other variable w/level of use

If your system cannot be accessed directly, can access be obtained through an intermediary information specialist? (Y/N)

If yes, identify specialist. _____

_____

If yes, estimate charges for service. _____

Is your system presently part of a network (e.g., Dialog, Orbit, Tymshare)? (Y/N)

If yes, estimate charges for service. variable with level of use

Is database accessible on a trial basis without charge? (Y/N)

Can the software and data be purchased? (Y/N)

If yes, give price. _____

Can the software and data be leased? (Y/N)

If yes, give price. _____

Would your system be available for integration with a database containing similar records and structure? (Y/N)

Would your system and staff be available for hosting and maintaining the database of a government facility such as Natick Laboratories? (Y/N)

If yes, estimate charges. _____

VI. Data Sources & Applications

Types of sources from which data are derived.

Journals	X	Handbooks	X
Reports	X	Interviews	X
Published texts	X	Laboratory experiments	X

Other (please specify) Tracking schedules - many other applications - see copy of DB & Files

Are sources of data identified? (Y/N)

Are data reliability indicators provided? (Y/N)

Identify the primary applications of data support engineering.

Support engineering related tasks (e.g., design, materials selection)	
Support R&D related tasks	X

VII. Development/Implementation/Operation of DBMS

Indicate how system was developed and implemented.

In-house personnel developed and implemented unique system	
Contractor developed and in-house staff implemented unique system	
Contractor developed and implemented unique system	
Purchased off-the-shelf package and in-house staff implemented system	X
Contractor implemented off-the-shelf package	

Other (please specify) _____

Estimate the staff-hours invested in the development and implementation of the DBMS.

	In-house Staff	Contractor Support
Staff-hours		

VII. Development/Implementation/Operation of DBMS (Continued)

Estimate the costs incurred to develop and implement the DBMS.

Purchased cost of software package _____

Development and implementation costs _____

Time (calendar) required to develop and implement the system. _____

Year system was implemented. 1 Jan 81

Estimate the staff-hours required (on an annual basis) to operate and maintain the database. If possible, distinguish between technical and non-technical staff.

	In-house Staff (tech/non-tech)	Contractor Support (tech/non-tech)
Staff-hours		

Estimate the costs required to operate and maintain the database.

In-house Staff	Contractor Support

Estimate size of system (no. of records) at inception of database. 0

Estimate growth rate of system (no. of new records added a year). 5,704

How often are data updated and reviewed (no. of times per year). Quarterly

VIII. Computer Support Systems

Manufacturer and model of hardware (e.g., IBM's 4341 L10).

VAX 11/780's

Operating system (e.g., EXEC8 Level R331).

AUTOMATED DATABASE QUESTIONNAIRE

I. General

Full name of database. The Nondestructive Testing Information Analysis Center

Owner of database or technical monitor (name, address, primary contact).
Office of Deputy Undersecretary of Defense Research and Advanced Technology, Washington, D.C. 20301

Jerome Persh, Technical Monitor, Staff Specialist for Materials and Structures

General subject area(s) of the database (e.g., tactical warfare, properties of materials).
Nondestructive testing

Identify the primary use of the system.

Used to support activities of internal staff _____

Used remotely to support activities of personnel at other facilities _____

Both of the above X

Type of data in the database (check one).*

Bibliographic X Numeric _____ Both _____

Size of database.

Total number of records 28,000

Core memory for software (megabytes) _____

Secondary memory for data storage (megabytes) _____

Is the database integrated (i.e., data is stored in more than one geographic location? (Y/N)

Status of system.

In use X Defunct _____

Under active development _____ Inactive but revivable _____

* Bibliographic identifies source of reference from which pertinent information can be retrieved and numeric actually contains the pertinent data, or both.

II. Data Contents and Structure

Provide a listing of the record types found in the database.

Bibliographic citations

Attach a listing of the field names, as may be found in a data dictionary or thesaurus, associated with each of the above record types.

Identify the structure of the relationships between record types.

Flat file _____ Relational _____

Hierarchical _____ Other _____

Other (please specify) _____

III. Database Management System (DBMS)

Indicate the type of database management system employed.

Off-the-shelf-package _____

Unique system developed for your application X

If using an off-the-shelf package, give version and manufacturer (name, address and point of contact).

If system was implemented by a contractor other than the vendor, please identify contractor (name, address, and point of contact).

IV. DBMS Features

Identify features included with or capabilities of DBMS.

- Database dictionary _____
- A query facility that allows personnel with little or no programming experience to access data _____
- Interactive query/search _____
- Off-line query/search _____

Query/search methods available:

- Structured (e.g., menu-driven) _____
- Unstructured (e.g., command-driven) _____
- Other (please specify) _____
- Boolean operators available _____

On-line aids available:

- Tutorials _____
- Error messages _____
- System status _____
- "Help" responses _____
- Other (please specify) _____

Algorithms for loading/updating data _____

Algorithms for indexing and sorting data _____

Algorithms for generating and/or restructuring format of data fields records _____

Algorithms for generating and/or restructuring format of database architecture (e.g., relational, hierarchical, network relationships) _____

Algorithms for generating and/or restructuring of user/views (e.g., menus, output formats) _____

Algorithms for validating and checking consistency of data _____

Screen-aided editing or format generation _____

Graphics capability _____

IV. DBMS Features (Continued)

Computational algorithms _____

Other (Please attach a list of additional features.)

V. Database Availability

Would the system be available for access by personnel at a government facility such as Natick Laboratories? (Y/N) (through DTIC)

Is your system available for direct access (e.g., by telephone) from a remote source? (Y/N) (through DTIC)

If yes, give medium and baud rate. _____

If yes, estimate charges for service. _____

If your system cannot be accessed directly, can access be obtained through an intermediary information specialist? (Y/N)

If yes, identify specialist. _____

_____

If yes, estimate charges for service. _____

Is your system presently part of a network (e.g., Dialog, Orbit, Tymshare)? (Y/N)

If yes, estimate charges for service. _____

Is database accessible on a trial basis without charge? (Y/N)

Can the software and data be purchased? (Y/N)

If yes, give price. _____

Can the software and data be leased? (Y/N)

If yes, give price. _____

Would your system be available for integration with a database containing similar records and structure? (Y/N)

Would your system and staff be available for hosting and maintaining the database of a government facility such as Natick Laboratories? (Y/N)

If yes, estimate charges. _____

VI. Data Sources & Applications

Types of sources from which data are derived.

Journals	X	Handbooks	X
Reports	X	Interviews	X
Published texts	X	Laboratory experiments	X

Other (please specify)_____

Are sources of data identified? (Y/N)

Are data reliability indicators provided? (Y/N) (no nonbibliographic data)

Identify the primary applications of data support engineering.

Support engineering related tasks (e.g., design, materials selection) _____

Support R&D related tasks _____

VII. Development/Implementation/Operation of DBMS

Indicate how system was developed and implemented.

In-house personnel developed and implemented unique system _____

Contractor developed and in-house staff implemented unique system _____

Contractor developed and implemented unique system _____

Purchased off-the-shelf package and in-house staff implemented system _____

Contractor implemented off-the-shelf package _____

Other (please specify)_____

Estimate the staff-hours invested in the development and implementation of the DBMS.

	In-house Staff	Contractor Support
Staff-hours	_____	_____

VII. Development/Implementation/Operation of DBMS (Continued)

Estimate the costs incurred to develop and implement the DBMS.

Purchased cost of software package _____

Development and implementation costs _____

Time (calendar) required to develop and implement the system. _____

Year system was implemented. _____

Estimate the staff-hours required (on an annual basis) to operate and maintain the database. If possible, distinguish between technical and non-technical staff.

	In-house Staff (tech/non-tech)	Contractor Support (tech/non-tech)
Staff-hours	_____	_____

Estimate the costs required to operate and maintain the database.

In-house Staff	Contractor Support
_____	_____

Estimate size of system (no. of records) at inception of database. _____

Estimate growth rate of system (no. of new records added a year). _____

How often are data updated and reviewed (no. of times per year). _____

VIII. Computer Support Systems

Manufacturer and model of hardware (e.g., IBM's 4341 L10).

_____

Operating system (e.g., EXEC8 Level R331).

_____

Nonresponding Facilities

Environmental Research Institute of Michigan
Box 8618
Ann Arbor, MI 48107

Re: Infrared Information and Analysis Center (IRIA)

Environmental Research Institute of Michigan
Box 8618
Ann Arbor, MI 48107

Re: DARPA Infrared Data Library

The Johns Hopkins University
Applied Physics Laboratory
Chemical Propulsion Information Agency
Johns Hopkins Road
Laurel, MD 20810

Re: Chemical Propulsion Information Agency

Rome Air Development Center
Griffiss Air Force Base, NY 13441

Re: Reliability Analysis Center (RAC)

CINDAS
Purdue University
2595 Yeager Road
West Lafayette, IN 47906

Re: Thermophysical and Electronic Properties Information Analysis Center (TEPIAC)

Hazardous Materials Technical Center (HMTC)
P.O. Box 8168
Rockville, MD 20856

Re: HMTC Data Base

APPENDIX C

DATABASE MANAGEMENT SYSTEMS (DBMS)

APPENDIX C

DATABASE MANAGEMENT SYSTEMS (DBMS)

Introduction

Descriptions of the DBMS employed at the various facilities discussed in the report are provided in the following sections. The DBMS and associated facilities are:

- System 2000 at Natick
- TOTAL at AMMRC
- DRS at ARDC
- BASIS at INFOCEN.

The descriptions include, but are not limited to, the organization responsible for the development and/or marketing of the DBMS, the hardware/operating systems with which the DBMS are compatible, the peripherals required to support the DBMS, the optional packages available with the DBMS, and the costs and terms associated with lease or purchase of the DBMS.

Information used to develop the following sections was procured from a publication of the DATAPRO Research Corporation[C-1] and/or publications, such as brochures, made available by the developers/vendors of the DBMS.

(C-1) "DATAPRO Directory of Software", DATAPRO Research Corporation, Delran, New Jersey (October 1983).

SYSTEM 2000

Company: Intel Systems Corp.
P.O. Box 9968
Austin, TX 78766

Hardware Systems: IBM: System 1370, 303X, 4300
Sperry Univac: 1100 Series
Control Data Corporation: 6000 Series, Cyber Series

Minimum Memory Requirement: IBM: 256K bytes
Univac: 32K
CDC: 22K

Operating System: IBM: DOS, OS, VS counterparts, EDOS/VS
Univac: OS/1100
CDC: NOS, NOS/BE

Time-Sharing Service: Available on many major networks; contact vendor for list

Source Language: Assembler

Source Listings: Not available

Pricing: Available upon request from the vendor

Maintenance: Contact vendor for terms

Documentation: Available with acquisition at no extra cost

Training: Included in cost of acquisition

The following generic description of the System 2000 DBMS was excerpted from Reference C-1:

> "System 2000 is an integral part of the Intel Information Resource Management family. It can be interfaced with Intel's Integrated Data Dictionary, the Data Communications facility, and a Data Base Hardware component for DBMS buffer processing. System 2000/80 incorporates the Quest English-like query/update language, and provides PLEX (Programming Language Extensions) that allow COBOL, FORTRAN, PL/1, or assembly language

programmers to combine the organization and storage benefits of the data base with procedural language of the host programs. System 2000's basic data management capabilities include Genius, an interactive report generator, designed for the non-DP end user, which allows for the generation of detailed reports with little or no familiarity with the data base structure."

TOTAL

Company: Cincom Systems, Inc.
2300 Montana Avenue
Cincinnati, OH 45211
(513) 662-2300

Hardware Systems:
IBM: System 1370, System 3, 303X, 308X, 4300
Honeywell: Series 200/2000
Sperry Univac: Series 70, 9400/9700
CDC: 3000 Series, Cyber Series
DEC: PDP-11, VAX 11
Harris: Series 80-800
Varian: V70 Series
Interdata: 7/32, 8/32

Operating System:
IBM: DOS, DOS/VS, OS, OS/VS
Honeywell: Mod 1 (MSR), Mod 2, OS/2000
Univac: TDOS, DOS
DEC: RSX-11D, RSTS/E, IAS
Interdata: OS/32 MT
Harris: Vulcan

Source Listings: Not available

Pricing: Purchase price ranges from $13.5K to $79.5K depending on hardware configuration. Rental ranges from $2K to $3.3K per month

Options: CICS Comprehensive Recovery $29K (purchase), $1.1K (lease)

Training: Systems engineering and education support are bundled for the first 60 days of product usage, with 6 to 8 workdays provided on-site at no additional cost

The following generic description of the TOTAL DBMS was excerpted from Reference C-1:

> "TOTAL provides facilities for generation of a complete database that permits automatic cross-referencing among data records. A facility is also provided for accessing the database from conventional application programs written in COBOL, PL/1, or FORTRAN. The TOTAL Database Management System is composed of three phases: one for generating the description of the database structure, one for pre-formatting the disk areas, and one for controlling the access to the database.

"Phases of TOTAL are dynamically located at execution time, permitting data read/write (no database structural maintenance), reading data only, and generating master record addresses only (which speeds the loading of the database). TOTAL permits the establishment of two types of records: a single-entry or master record, and a variable-entry record. Each group of records, of either type, forms a file (data set). Linkages can be set up that permit automatic retrieval of all variable-entry records associated with a particular single-entry record based on the linkage. A variable-entry record can be part of many linkage paths or chains.

"A TOTAL database is composed of multiple data sets or files. Linkages can exist between any master file and any variable-entry file. Multiple-file databases can be established. A particular master file or variable-entry file can be part of more than one database. The multiple paths of access allowed by a network structure simplify the logic of application programs using the data. In the case of TOTAL, they also reduce the amount of disk storage required to hold information by eliminating duplicate fields or records. Differences exist in the implementation of TOTAL on various computer systems. These differences are in such areas as physical structure and access, space management and reorganization, restart and recovery from system failures, handling of error messages, and on-line processing."

DRS

Company: Advanced Data Management
P.O. Box 601
Kingston, NJ 08528

Hardware System: DEC: PDP-11/23, -70, VAX
IBM: System 370, 303X, 43XX

Peripherals Required: Disk

Operating Systems: Systems associated with the above hardware

Time-Sharing Service: UCC, on-line systems, MA Ltd.

Source Language: FORTRAN, Assembler

Source Listings: Not available

Pricing: Beginning price--$30K; lease plans and OEM, educational and multiple site discounts available

Options: SIP-VDT data entry, retrieval, and transaction language; report-writer; PLOT database graphics: XBS host language interface

Maintenance: Two-year warranty and upgrades included: contract thereafter

Documentation: Included in price

Training: Eight days included in price

The following generic description of DRS was excerpted from Reference C-1:

> "DRS (Data Retrieval System) is a user-oriented database management, retrieval, and reporting system. It can be operated in batch mode, interactively through the console, or on a remote terminal in a dedicated or time-sharing environment. It can be used by either programmers or nonprogrammers to create, maintain, select, sort, and list data bases containing variable- or fixed-length records. The database record may contain any mixture of numeric, textual, or

calendar data. The system has calculation facilities for handling scientific or financial data and word/phrase extraction facilities for textual data."

BASIS

Company: Battelle-Columbus Laboratories
505 King Avenue
Columbus, OH 43201

Hardware Systems: DEC: VAX

Peripherals Required: FORTRAN compiler

Operating System: VMS

Number of Programs in Package: 6

Source Language: FORTRAN, Assembler

Source Listings: Not available

Pricing: Purchase--$29K (base system)

Options: Host language precompiler and interface--$4K
Query facility--$4K
Report writer--$5K

Customizing: Available

Maintenance: Provided for initial contract period; thereafter, 1 percent of the current module price monthly

Documentation: One copy included

Training: Four training positions provided

The following description of BASIS was excerpted from Reference C-1:

"BASIS-DM is a dictionary driven data base management system. It is designed to take advantage of the relational method of data base management, and allows for hierarchical, network, and multi-keyed access. The system supports both high-level user-friendly interfaces for end-users and host-language interfaces for programmers. BASIS-DM includes a terminal support-module that allows terminal oriented applications to be created. It supports variable-length data elements, variable-length records, and

on-line updating. The system also supports a nonprocedural language for describing the format of a report. Other features include recovery techniques, transaction processing, and a password and user ID security system."