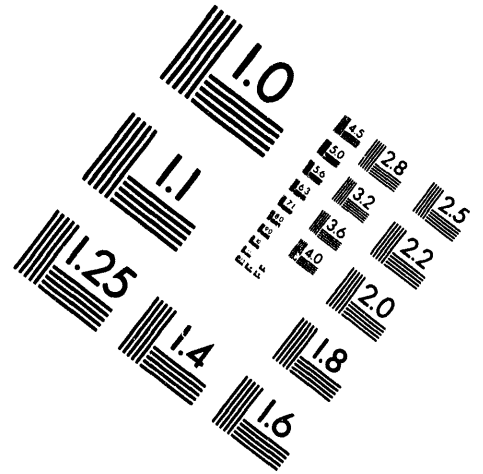
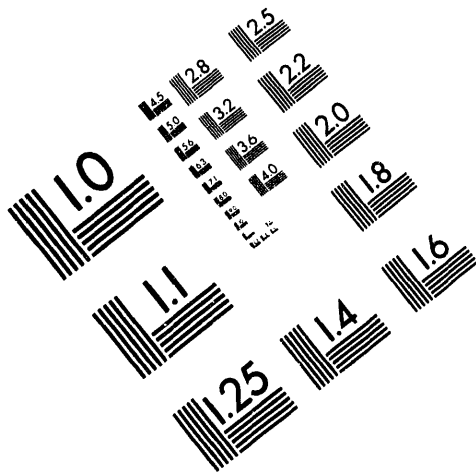




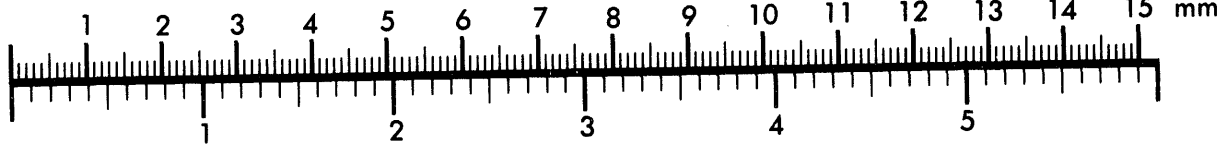
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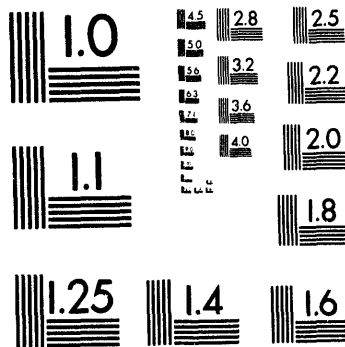
1100 Wayne Avenue, Suite 1100
Silver Spring, Maryland 20910
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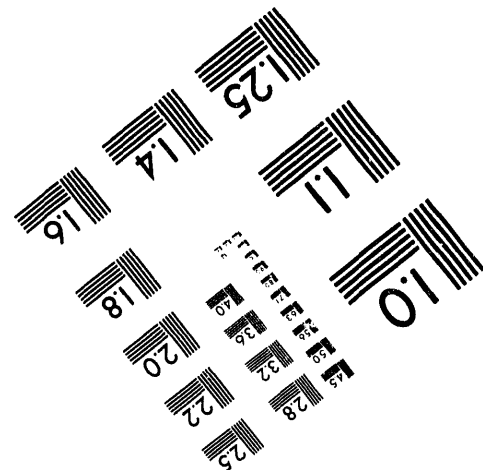
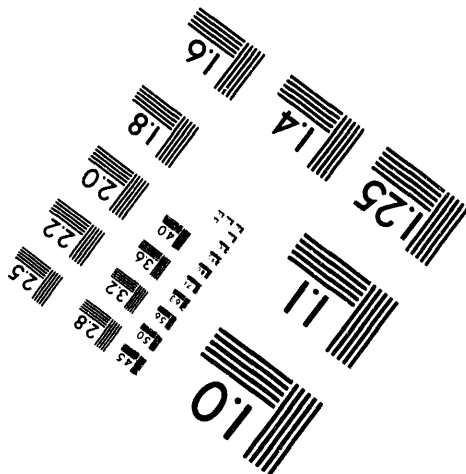
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**A DATABASE SYSTEM FOR CHARACTERIZATION OF MUNITIONS ITEMS
IN CONVENTIONAL AMMUNITION DEMILITARIZATION STOCKPILES**

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A DATABASE SYSTEM FOR CHARACTERIZATION OF MUNITIONS ITEMS IN CONVENTIONAL AMMUNITION DEMILITARIZATION STOCKPILES

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INTRODUCTION

The MIDAS (Munition Items Disposition Action System) database system is an electronic data management system capable of storage and retrieval of information on the detailed structures and material compositions of munitions items designated for demilitarization. The types of such munitions range from bulk propellants and small arms to projectiles and cluster bombs. The database system is also capable of processing data on the quantities of inert, PEP (propellant, explosives and pyrotechnics) and packaging materials associated with munitions, components, or parts, and the quantities of chemical compounds associated with parts made of PEP materials.

Development of the MIDAS database system has been undertaken by the U.S. Army to support disposition of unwanted ammunition stockpiles. The inventory of such stockpiles currently includes several thousand items, which total tens of thousands of tons, and is still growing. Providing systematic procedures for disposing of all unwanted conventional munitions is the mission of the MIDAS Demilitarization Program. To carry out this mission, all munitions listed in the Single Manager for Conventional Ammunition inventory must be characterized, and alternatives for resource recovery and recycling and/or disposal of munitions in the demilitarization inventory must be identified.

Information on the characteristics of the unwanted munitions, including the quantities of recoverable materials and hazardous materials that may be released to the environment during and/or after disposal, is needed to (1) satisfy the environmental compliance requirements for various demilitarization operations; (2) provide data for estimating optimal operating and control parameters for such operations; and (3) provide data for resource recovery planning. However, the munitions composition data currently are scattered across a wide variety of source materials and are not readily available. Therefore, collection of complete munitions composition data by individuals is difficult and time-consuming. Without a centralized database system that is well publicized and easily accessible, individual efforts would be duplicated, and information compiled by individuals from different sources could be inconsistent. The system and procedures for data entry in MIDAS have been designed to obviate these problems.

The MIDAS database system is managed by the MIDAS team, located at the U.S. Army Defense Ammunition Center and School in Savanna, Illinois. The MIDAS database system will be available for external access via a modem and an IBM-compatible personal computer (PC). Its menus and search options allow users to retrieve information in various formats, including user-defined reports. Expected users are installation and command demilitarization and disposition planners, headquarters program managers and personnel working in environmental and safety offices, research and development personnel, and personnel in U.S. Department of Defense (DOD) services, other government agencies, and private industry.

SYSTEM DESCRIPTION

Overview

The MIDAS database system (hereinafter called "MIDAS" or simply "the System") is a PC-based information system that contains detailed data on the contents of munitions and an easy-to-use program that lets users store and retrieve these data. MIDAS organizes the data for each component and part of a munition into a hierarchical list so users can quickly and clearly discern the structure of that munition. For a selected munition, MIDAS displays all of its primary components and parts. Then, for each primary component, it displays all of its subcomponents and parts; for each subcomponent, it displays all of its respective subcomponents and parts, and so on. This breakdown enables users to view the structure of components and parts within a munition and display detailed data associated with these components and parts.

MIDAS also stores data on weight and material specifications for each part, so users can obtain information on the total weight and material composition of a munition, component, or part. For detailed component and part information, MIDAS also provides users with direct access to the components and parts libraries. This capability is particularly valuable to users trying to define a specific class of components or parts.

Finally, MIDAS enables users to extract comprehensive information on all the munitions in the System. By using the Standard Reports and User-Defined Reports options, users can quickly compute and retrieve total weight and composition statistics for all or selected munitions in the MIDAS database.

Database Structure

The MIDAS central database stores data on munitions and their contents. It consists of the following data libraries: Munitions, Components, Parts, Materials, Compounds, and Bulk Items. Each library consists of basic data fields that identify the item (such as a munition) and appropriate references that link the item to other items in the database. Figure 1 shows the MIDAS database structure and how the data libraries are linked to each other.

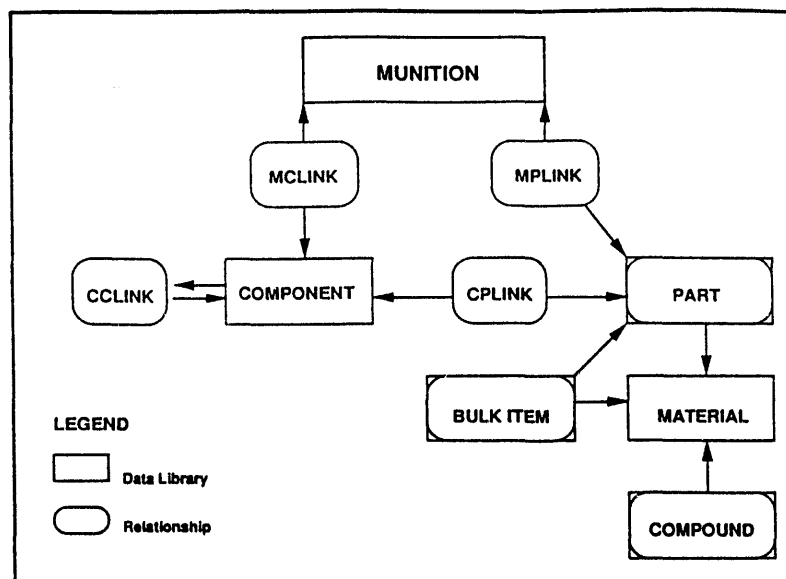


FIGURE 1 MIDAS Database Structure and Data Libraries

Munitions Library. A munition consists of all of the components, parts, and chemical constituents necessary to make up a complete round of ammunition. A part can be made of an inert material (such as an aluminum alloy or brass), a PEP material (such as TNT), or packaging material that really is not part of a munition but must be accounted for when disposing of a munition (such as a wood pallet). Components are subassemblies of parts (and possibly other components) that are identified independently. A part can be defined as the lowest-level item in the structural hierarchy of a munition. The following databases define a munition:

MUNITION	This database identifies a munition uniquely. It includes the munition's nomenclature, NSN (National Stock Number), DODIC (Department of Defense Identification Code), drawing number, and data collection status.
MCLINK	This database contains a reference to each of the first-level components that make up the munition and tells the number of identical components directly linked to the munition. They are called "first-level components" because they are the main components of the munition; the database does not list any subassemblies within these components. The detailed data on subassemblies for each individual component are in the Components Library.
MPLINK	This database contains a reference to each part directly linked to the munition and tells the number (or amount) of identical parts directly linked to the munition. (MIDAS recognizes the difference between parts associated directly with the munition and parts within components.) The detailed data on each part are in the Parts Library.

Components Library. A component is an assembly of parts and possibly of other components (i.e., subcomponents). A component is typically not a munition itself, but it may be a separate item of issue having its own DODIC (e.g., artillery fuzes). Components are identified as separate items because many of them are used in more than one munition. As the data on munitions are entered into the System, MIDAS builds a library of components. Therefore, for each new munition being entered, MIDAS may already contain the data on its components. The following databases define a component:

COMPONENT	This database identifies a component uniquely. It includes nomenclature, NSN (if available), DODIC (if available), drawing number, and data collection status.
CCLINK	This database contains a reference to each of the subcomponents within the component and tells the number of identical components directly linked to the components. The detailed data on subcomponents are in the Components Library.
CPLINK	This database contains a reference to each part in the component and tells the number (or amount) of identical parts directly linked to the components. Detailed data on each part are in the Parts Library.

A component is typically assigned a drawing number that diagrams the component. Certain packaging components do not have drawing numbers.

Parts Library. A part is a homogeneous material associated with either a munition or a component. As MIDAS collects munitions data, it establishes and maintains a library of all unique parts. When the data for new parts are entered, MIDAS checks the Parts Library for existing parts.

Data for each part include its nomenclature, drawing number, material specification, and data collection status. There are three types of parts:

- | | |
|-----------|--|
| Inert | These parts are non-PEP items used in a munition, such as bodies, washers, grommets, and casings. They are made from inert materials such as metal or plastic. An inert part has an actual or estimated weight. |
| PEP | These parts are propellants, explosives, or pyrotechnics, consisting of one or more chemical compound. The amount of the material (weight) is specified where it is used in the munition (MPLINK and CPLINK databases). |
| Packaging | These parts are the materials used to ship or store a munition (e.g., a wood crate). Although they are not actually part of the munition, packaging must be accounted for when disposing of munitions. Munitions are cased in units of one or more. Because a munition "package" may consist of a number of munitions, a portion of the packaging is assigned to each munition. For example, for a munition that is cased in units of four, MIDAS will assign 0.25 unit of packaging for that munition. If a munition is packaged in different quantities, MIDAS will have a separate munition entry for each packaging configuration. (Each munition entry is assigned a unique NSN.) |

Materials Library. A material is a combination of one or more compounds. The Materials Library is an index of all the materials that are used in parts. Data for each material consist of its nomenclature, specifications, and other descriptors. Since a munition (or component) will typically use different amounts of a specific material, this library does not contain weights of material.

Compounds Library. A compound is a combination of chemical elements that can be described by a chemical formula. The Compounds Library contains data on the compounds used in materials. Data consist of each compound's nomenclature, specifications, and other descriptors. The weight of a compound is not directly specified. Rather, the percentage of its weight in the total material weight is specified. Therefore, for each material, the percent weights of each of the compounds in the material always total 100%. When needed, MIDAS calculates the actual weight of a compound used in a part by multiplying the weight percent by the actual weight of the part.

Bulk Items Library. The Bulk Items Library contains data on coatings, adhesives, and other small quantities of materials that are associated with a part and may be important in the disposal of that part, but are not identified by a drawing number or as a separate part.

System Fields. MIDAS closely tracks when and by whom the data are entered. When a piece of data is entered for the first time, MIDAS completes the following data fields: Creation Installation; Creation Person; Creation Date; and Creation Time. When any data entry is updated, MIDAS updates the following fields: Update Installation; Update Person; Update Date; and Update Time. Only the last update information is stored; that is, if a specific entry is updated many times, only the last update will be noted.

When MIDAS is installed onto a PC, the installation code is identified. Every time someone executes MIDAS, it requires a user I.D. (USERID) and password. The USERID is then used to uniquely stamp all data entries created or updated.

System Features

The MIDAS has the following four main functions: (1) View/Update Data; (2) Standard Reports; (3) User-Defined Reports; and (4) System Administration.

View/Update Function. This function enables one to (1) view, change, or delete any of the data existing in MIDAS, including the data for munitions as well as their components, parts, and materials, and (2) add new data. By using this function, one can also access the official Demil Inventory listing and scroll through a list of all the items in the inventory. After selecting a munitions data option, one can search for specific munitions in the System, display a diagram of a munition, add a new munition to the System, or delete a munition from the System. In addition, one can select a particular munition datum and then view and modify different kinds of data for the selected munition, such as its structure (with all its components and parts), digitized image, or first-level components and parts. Summaries of all parts and all compounds in the selected munition may also be viewed.

The features available in the Components and Parts data options are almost exactly like those in the Munitions data option. The difference is that the Components or Parts data option allows one to view and modify the data for individual components or parts independently from the munitions or components in which they are used. In other words, one can find the data for a component or part directly rather than having to find a munition or a component that contains the particular component or part. Moreover, modifications made to the data for a particular component or part under these options are reflected universally in all the munitions or components that contain the particular component or part throughout the system. Under the Parts data option, once the data for a particular part is displayed for view, the bulk items associated with that part can be viewed and modified.

The Materials data option allows one to locate, view, or modify the data for an individual material. This function also allows one to add or delete a material, search for a specific material, and view, modify, add, or delete chemical compounds within a specific material.

Standard Reports Function. This function allows one to generate a number of preformatted reports that list preselected data fields by simply selecting the desired one from a list on the Standard Reports menu. Two general report options are available: Detailed Reports and Column-Oriented Reports. The basic difference between these two categories is that Detailed Reports pertains to reports on single records of munitions, components, parts, etc., and Column-Oriented Reports pertains to a group of data records in the entire MIDAS database.

User-Defined Reports Function. This function lets one create customized, column-oriented reports that list the specific data fields selected and arrange them in a specified order. The custom report formats created can be saved so the same report can be generated later without having to define it again.

System Administration Function. The System Administration function options include Import/Export Data, Backup/Restore Database, and User Access Control. The Export Data option allows one to copy any data in the database to a disk, and the Import Data option allows these data to be added to another PC running MIDAS. The Backup Database option enables one to store a copy of all the data in the System on the disk to save as a backup file, and the Restore Database option allows the data stored on the disk as a backup file to be transferred back to a PC running MIDAS. The User Access Control function allows a user with the highest access level (Superuser) to add or delete the user's name and modify the user's access level. Three access levels are available: View (can view data and generate reports, cannot modify any data in the System); Update (can view data, generate reports, and modify data); and Superuser (can use all functions of the System).

Computer Requirements

It is recommended that MIDAS be run on an IBM-compatible PC with an 80486-based processor and DOS 5.0 (or later version) with 8 megabytes of memory. Currently, MIDAS requires about 20 megabytes of disk space. As the database of munitions grows, disk space requirements will increase

accordingly. The MIDAS software is completely self-contained. (Version 2.0 of dBase IV was used to develop MIDAS, but MIDAS does not require dBase software to run.) The System Administration function options (Export/Import/Backup/Restore) use the PKZIP file compression (and uncompression) utilities to minimize the size of files written to disks. (PKZIP, developed by PKZIP, Inc., is a widely used file compression utility; MIDAS has an application license to use PKZIP on any machine on which MIDAS has been installed.) The User-Defined Reports function assumes that reports will be printed on a Hewlett-Packard Laserjet printer. It includes the control characters to set the printer to the landscape, compressed-character mode.

CURRENT STATUS OF SYSTEM DEVELOPMENT

The current status of the MIDAS database system is as follows. The System is operated on IBM-compatible PCs without any linkage to each other, and the data entered into the System being run on an individual PC can be transferred by disk to other PCs running MIDAS through the export and import functions. The Compounds Library is connected to the PEP portion of the Parts Library only, so the information on material composition is available only for PEP parts. For bulk items (surface coatings and finishes) that contain constituents of interest (such as toxic compounds) and for certain parts of munitions, weight data are not available because they are not reported in the information sources used to collect the data entered into the MIDAS database. To date, several Standard Reports have been developed, and data for 46 munitions have been entered into the System.

PLANS FOR SYSTEM ENHANCEMENT

Planned enhancements of MIDAS include (1) developing a PC-based computer network system for efficient field operation of MIDAS with a number of installations simultaneously involved in data storage, retrieval, and processing; (2) expanding the database structure for composition data (Compounds Library) to inert materials and bulk items; (3) developing procedures for estimating weights of selected bulk items and parts, including algorithms to calculate surface areas of odd and complex shapes of munitions parts and volumes of parts for which weight data are not available; and (4) developing a number of additional Standard Reports to meet various needs to support demilitarization operations, including reports to support Resource Conservation and Recovery Act and other permit applications; and (5) entering additional munitions data into the System at various participating DOD installations.

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Before joining Argonne National Laboratory, Dr. Chun worked as an Environmental Engineer at Commonwealth Edison Company; Director of Engineering, Midwestern Region of Equitable Environmental Health, Inc.; Supervisor of Meteorology and Air Quality at Sargent & Lundy Engineers; and Air Program Manager at TenEch Environmental Engineers.

During 22 years of continuous practice in environmental engineering, Dr. Chun's work has covered many aspects of environmental pollution. His air-related work has included emission source characterization, air quality modeling, air quality and meteorological monitoring, and air quality and noise impact assessments. He has also been involved in water and wastewater characterization, water quality and thermal pollution monitoring and modeling, resource recovery from municipal wastes, and solid waste disposal facility design.

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