



IH Interface

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Development and Use of a Database Program To Control Inventory of a Field Support Equipment Laboratory

Marjorie A. Edmonds and Paul A. Heintz

Introduction

The authors are located in the Engineering Control Technology Branch (ECTB) in the Division of Physical Sciences and Engineering at the National Institute for Occupational Safety and Health, Centers for Disease Control and Prevention. The ECTB is responsible for developing, evaluating, and disseminating control technology information to prevent occupational disease and injury. Part of this research involves industrial hygiene and engineering surveys at industrial, agricultural, medical, and other field locations. The engineering and industrial hygiene equipment necessary for these surveys may vary widely and can include sampling pumps and accessories, detector tubes and accessories, sampling media, calibration equipment, particulate sampling equipment, gas and vapor sampling equipment, ventilation measuring equipment, ambient condition measuring equipment, electrical equipment, tools, personal protective equipment, photographic equipment, computer and data logging equipment, packaging material, and miscellaneous items.

All of this equipment is stored in ECTB's field support equipment laboratory. In the past, any survey team needing equipment was responsible for completing a written equipment request.¹ The team and the laboratory coordinator would then search through the laboratory, locate each item, and cross it off the checklist as it was packed into the transportation cases utilized for field surveys. The laboratory coordinator retained a copy of this checklist. Upon the survey team's return from the field survey, the equipment was unpacked. The laboratory coordinator ensured that all the

items on the checklist were returned to the laboratory. The laboratory coordinator also was responsible for maintaining adequate levels of expendable equipment such as detector tubes. This was usually done by an occasional visual check of the inventory levels.

With about 20 researchers in ECTB and the occasional loaning of equipment to other branches, divisions, and separate organizations, it was clear that a more efficient method was needed for the tracking of the field equipment. It was decided that a database system should be utilized in the laboratory, and that the inventory control program should be managed and operated by the laboratory coordinator. The programming language chosen was dBase III Plus[®], Version 1.1 (Ashton-Tate 1985, 1986) due to its availability to ECTB, and this was supplemented with the word processing package PFS: Professional Write[®] (1986 Software Publishing Corporation, 1986 SoftArt, Inc.). This word processing package was chosen as it provided more advanced editing capabilities than did the dBase III editor. Any ASCII word processor could have been used for this purpose. The database program is bar code driven, so an individual bar code was needed for every item in the inventory. A label generating program (Utility I, LabelRIGHT, Worthington Data Solutions, 1992) was utilized to generate a bar code for each item.

The objectives of the inventory control program were as follows:

1. provide a computerized process for the loaning out of equipment;
2. provide a computerized process for the return of equipment;
3. provide an on-going assessment of expendable equipment levels and

indicate when stock quantity is too low;

4. maintain a list of all the expendable and nonexpendable laboratory equipment;
5. maintain a list of authorized users; and
6. maintain vendor information for each expendable item for reordering.

Programming Information

The inventory control program is set up to use four database files: USAGE.DBF, USERS.DBF, EXPEND.DBF, and EXPOUT.DBF. The USAGE.DBF file contains the records of the nonexpendable equipment in the laboratory and tracks the equipment on loan. If the equipment is out of the laboratory, this file contains information concerning who has the equipment, when it was checked out of the laboratory, and where it is being used. The USERS.DBF file contains information on each user. This includes everyone in ECTB and outsiders to whom equipment is loaned. The EXPEND.DBF file contains records of the expendable equipment. Besides containing vendor information, this file also tracks the current amount of stock in the laboratory and the minimum amount of stock allowed for each piece of expendable equipment. The EXPOUT.DBF tracks who has expendable items on loan and when they were checked out.

These database files can quickly be sorted according to bar code number, item description, or user name by using the associated index files. Other files which make up the inventory control database program include program files (subroutines) which run the database procedures, report form files which contain information for prepar-

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LABORATORY EQUIPMENT USAGE PROGRAM - MAIN MENU
-----
1.  Update User File
2.  Update Equipment File
3.  Begin Checkout Procedure
4.  Begin Return Procedure
5.  List/Print Equipment Currently Out
6.  List/Print User or Equipment Files
7.  Stop Program
8.  Exit dBase

```

FIGURE 1. Main menu screen of inventory program.

```

USER FILE SUBMENU
1.  Add User Record(s)
2.  Delete User Record(s)
3.  Edit User Record(s)
4.  List/Print User File
5.  Return to Main Menu

```

FIGURE 2. "1. Update user file."

```

PLEASE BEGIN ENTERING USER INFORMATION:

User Record #:      x
-----
User First Name  :  xxxxxxxxxxxxxxxx
User Last Name   :  xxxxxxxxxxxxxxxx
User ID Number   :  xxxxx
User Phone Number :  xxxxxxxxxxxxxxxx
User Room Number :  xxxxx
-----

{EDIT} Edits record just inputted
{SAVE} Saves record, returns to user submenu
{DELETE} Deletes record, returns to user submenu
{CONTINUE} Saves record, brings up next input screen

SCAN ONE OF THE ABOVE CHOICES:

```

FIGURE 3. Input screen for adding new user records.

ing report forms, and text files which are used to print report forms to the screen.

Using the Inventory Control Program

After loading the program onto the computer, the dBase III title screen will appear. The laboratory coordinator can then access the inventory control program's main menu. The main menu has eight options to choose from, as depicted in Figure 1. An option can be selected by using the up and down arrow keys and then pressing enter, or by simply pressing the option number.

The capabilities of each main menu option follow.

Option 1: Update User File

This option will bring up the user file submenu (see Figure 2), allowing the operator to access the user database (USERS.DBF) to add, delete, or edit a user record. The submenu also will allow the operator to print a listing of all user records in the database to the screen or to the printer. The users will be listed alphabetically. The final option in this submenu allows the operator to return to the main menu. Again, an option can be selected by using the up and down arrow keys and then pressing enter, or by simply pressing the option number.

When adding a new user record, the input screen shown in Figure 3 will appear. It is important to note that a unique user ID number must be assigned to each user when adding user records to the database. The four "digit" user ID can be made up of letters or numbers (for example, the user's three initials and a number). The user ID is used by the program to locate specific records.

It is also important to note that when deleting a user record, the operator has the option of merely marking (flagging) the record for deletion, or permanently erasing the record from the database memory. It may be useful to merely flag a record if a listing of all past and present users is needed in the future.

Option 2: Update Equipment File

This option will bring up the equipment file submenu (see Figure 4), allowing the operator to access the nonexpendable equipment database (USAGE.DBF) to add or delete records. The operator can also access the expendable equipment database (EXPENDDBF) to add, delete, or edit records. Expendable and nonexpendable equipment lists can also be printed to the screen or to the printer. The lists will be indexed alphabetically by the equipment item descriptions. As always, an option can be selected by using the up and down arrow keys and then pressing enter, or by simply pressing the option number.

All expendable items must have bar codes that begin with the letter "S." This allows the program to quickly distinguish between nonexpendable and expendable equipment. A label-generating program can be used to generate bar codes beginning with the letter "S" for all the expendable items.

When adding a new nonexpendable equipment record, the input screen shown in Figure 5 will appear. When adding a new expendable equipment record, the input screen shown in Figure 6 will appear.

When deleting an equipment record, the operator again has the option of merely marking (flagging) the record for deletion or permanently erasing the record from the database memory.

Option 3: Begin Checkout Procedure

This option will allow the operator to begin checking (loaning) equipment from the laboratory. Before any equipment can be checked out, the operator will be asked to input the user ID number of the person using the equipment, the date the equipment will be taken out of the laboratory, and where the equipment will be used (field, laboratory, or loan). All three of these items must be entered before the program will continue.

After input of this information, the operator can begin scanning (or typing in) the bar codes of the equipment being checked out of the laboratory. The program is specially designed to

handle requests for expendable items in that the operator will be prompted to enter the number of items/units to be checked out for that specific expendable. For instance, if the operator scans the bar code for charcoal tubes, and a request for 25 tubes has been made, the operator would type in 25 as the number of units being checked out. Checks are also in place to notify the operator when the number of expendable items in stock is less than the number requested, and when the

quantity remaining in stock falls below the minimum stocking quantity. The minimum stocking quantity can be initially specified when adding each expendable equipment record. If the number of items/units checked out for a particular expendable equipment bar code causes the level in stock to drop below the minimum stocking quantity, the operator will have the option of printing out vendor information associated with that item to aid in reordering.

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EQUIPMENT FILE SUBMENU

1. Add Equipment Record(s)
2. Delete Equipment Record(s)
3. Edit Expendable Equipment Record(s)
4. List/Print Equipment File(s)
5. Return to Main Menu

FIGURE 4. "2. Update equipment file."

```

PLEASE BEGIN ENTERING NONEXPENDABLE EQUIPMENT INFORMATION:

Equipment Record #:      x
-----
Equipment Barcode #      : xxxxxxxx
Equipment Serial #       : xxxxxxxxxx
Equipment Model #        : xxxxxxxxxx
Equipment Description     : xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
-----

{EDIT} Edits record just inputted
{SAVE} Saves record, returns to equipment submenu
{DELETE} Deletes record, returns to equipment submenu
{CONTINUE} Saves record, brings up next input screen

SCAN ONE OF THE ABOVE CHOICES:

```

FIGURE 5. Input screen for adding new nonexpendable equipment records.

```

PLEASE BEGIN ENTERING EXPENDABLE EQUIPMENT INFORMATION:

Equipment Record #:      x
-----
Equipment Barcode #      : xxxxxxxx
Description of Expendable: xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
Stocking Quantity       : xxx
Vendor Name             : xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
Vendor Address          : xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
Vendor City             : xxxxxxxxxxxxxxxxx
Vendor State            : xx
Vendor Zip              : xxxxx
Vendor Phone #          : xxxxxxxxxxxxxxxxx
Minimum Quantity Allowed : xxx
-----

{EDIT} Edits record just inputted
{SAVE} Saves record, returns to equipment submenu
{DELETE} Deletes record, returns to equipment submenu
{CONTINUE} Saves record, brings up next input screen

SCAN ONE OF THE ABOVE CHOICES:

```

FIGURE 6. Input screen for adding new expendable equipment records.

When the operator has scanned all the equipment to be checked out, a hard copy can be obtained listing the user ID, the date the equipment was checked out, the location where the equipment will be used (field, laboratory, or loan), and a complete listing of all the expendable and nonexpendable equipment checked out for that particular user ID and date. The borrower can check this list to ensure that the equipment needed has been checked out of the laboratory. Printed at the bottom of the list is a signature block for the borrower to acknowledge responsibility for the equipment while on loan. There is also a space for the

equipment return date which is entered by the laboratory coordinator to indicate the equipment has been returned to the laboratory. Once the checkout procedure is complete, the operator can access the main menu. An example of a blank equipment checkout list is shown in Figure 7.

Option 4: Begin Return Procedure

This option allows the operator to return loaned equipment to the laboratory. The operator merely scans (or types in) the bar code of the item being returned, and the program acknowledges its return to the laboratory. If the item being returned is an expendable

item, the operator will be prompted to input the actual number of items/units being returned. This will automatically update the actual quantity in stock. Once all the equipment has been returned, the operator can access the main menu.

Option 5: List/Print Equipment Currently Out

This option will allow the operator to list all the equipment out, all the equipment out for a specific user, or all the equipment out for a specific type item (for example, all the sampling pumps that are currently out of the laboratory). Currently, these choices will only list the nonexpendable equipment out. The program may be modified in the future to include the expendable equipment out as well.

The lists can be printed to the screen or to the printer. If all the equipment out is to be printed, the list will display each equipment's bar code, model number, serial number, item description, user ID, and the date the equipment was checked out. If needed, the operator can obtain more information on any equipment item listed including the full name of the borrower, his or her phone and room numbers, and where the item is being used.

If the operator chooses to list all the equipment being used by a single person, the user ID of that person must be entered. A printout will display all the equipment that the user has received, including the equipment bar code, model number, serial number, item description, and the date it was checked out.

If the operator chooses to list all the equipment out for a specific item, a prompt will ask for the item's model number. A printout will display the bar code, serial number, item description, user ID, date out, and location of each of the items currently out for that model number. For example, in the ECTB laboratory all the identical personal sampling pumps of a particular brand may have the same model number (their bar codes and serial numbers may be different). If this model number is typed in, a list of all the pumps currently out, and corresponding in-

```

Items checked out for:
  xxxx

Date items needed:
  xx/xx/xx

Location of items:
  FIELD, LAB, or LOAN

=====
EXPENDABLE EQUIPMENT
=====

Item Description      Barcode      Quantity Out
-----
=====

NON-EXPENDABLE EQUIPMENT
=====

Item Description      Barcode
-----

SIGNATURE _____ DATE _____
DATE RETURNED ____/____/____

```

FIGURE 7. Equipment checkout list.

formation, will be listed. This facilitates locating where all the pumps are currently being used.

Option 6: List/Print User or Equipment Files

This option allows the operator to quickly print out (to the screen or to the printer) a complete user list, expendable equipment list, or nonexpendable equipment list.

Option 7: Stop Program

This option is only to be used by the person in charge of maintaining the database inventory program. Choosing this option will kick the operator out of the inventory control program to an information screen which displays parameter settings and programmed function keys. From this screen, the database programmer can enter commands to modify the database programs and files. The operator can also return to the main menu or exit from the database system and return to

DOS. If program safety is a concern, commands can easily be added to the labmain.prg to prevent unauthorized entry to the information screen.

Option 8: Exit dBase

This option will release the user from the inventory database program and automatically return the user to the DOS prompt.

Conclusions

This program provides a basic inventory control system useful in laboratory settings where there is a need to maintain control of equipment usage and stock. The program can be modified to suit the specific needs of individual locations. ECTB uses a scanning gun (Worthington Data Solutions, Santa Cruz, California) to read the bar codes; however, the bar codes may also be typed in. The most time consuming task of the database program is the initial need to input information on

equipment items and users, as well as generating bar codes for each piece of equipment. Once set up, the program should work rather simply. The inventory control database is a useful tool for those who need such a program but who do not have the time or personnel available to write one. Also, these groups may not have money budgeted to buy one of the more deluxe versions currently on the market. A copy of this program and a corresponding help manual (which details the use and construction of the database program) are available from the authors by sending a diskette of any type with a self-addressed, postage-paid mailer. The program and help manual can also be found in the Safetynet Forum® on CompuServe® (Columbus, Ohio).

Acknowledgments

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Disclaimer

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Reference

1. ECTB Field Operations Procedures, Internal Document of the Engineering Control and Technology Branch, National Institute for Occupational Safety and Health, Centers for Disease Control and Prevention, Public Health Service, U.S. Department of Health and Human Services, Washington, DC.

Editorial Note: Marjorie A. Edmonds and Paul A. Hentz are with the U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, Division of Physical Sciences and Engineering, 4676 Columbia Parkway, R5, Cincinnati, OH 45226-1998.