Research Note 84-6

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MAINTENANCE PERFORMANCE SYSTEM (ORGANIZATIONAL) DESIGN SPECIFICATION FOR THE NEW INFORMATION AND EVALUATION SYSTEM (I&ES)

Volume 1: I&ES Description

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The I&ES is one component of the Maintenance Performance System-Organizational (MPS-O) which is an integrated system designed to monitor and evaluate the performance of Army organizational level maintenance. This document (Vol 1) is a specification for the management information system of MPS-O. It provides a system description, including procedures for data entry, report generation, data base editing, and features and use of utility programs. Volume 2 is a supporting document that contains samples of data entry forms, task lists, and report formats.

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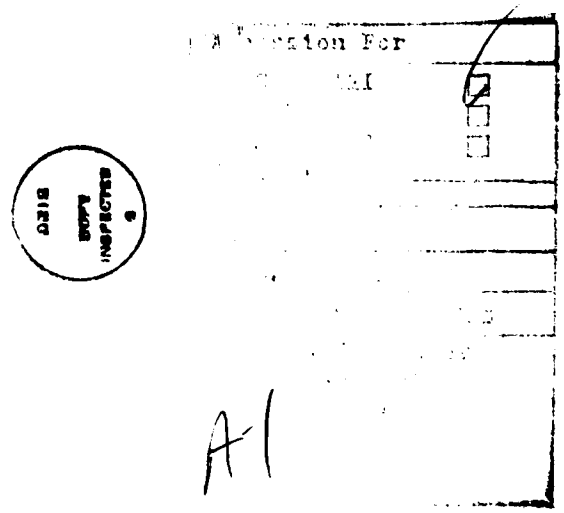

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SCOPE OF WORK

- A maintenance management information system will be developed that encompasses four general types of programs:

  1. Data entry
  2. Report generation
  3. Data base editing
  4. Utilities (e.g., data base initialization, data copy, and hard copy printing of data base)

- Several of the required programs are derivative of Anacapa's current I&ES (Information and Evaluation System). Maximum use is to be made of I&ES programs in developing the new system.

- Programs are to be written in BASIC for IBM 5120 computer with 64K memory, two disk drives, and SORT feature.

- The contractor will be required to design, develop, debug, document, and support the software system. It is anticipated that Anacapa will maintain a close working relationship with the contractor during program development. During this relationship, Anacapa will develop and conduct program tests to assure that correct outputs are generated from inputs, that program is easy to use, and that it poses minimum potential for operator, procedural or data entry errors.

- The specific type and amount of documentation will include, as a minimum, an overall system description, comment/remark lines in code, file descriptions, and definitions of functions, arrays, and variables. Modified and/or additional documentation elements may be proposed by the contractor.

- The program is to include a built-in capability for expansion. Adequate file space is to be allotted for the expansion. Programs are to be provided to permit the operator to modify existing MOS, equipment, and task lists; and to define new lists that will in turn be reflected in data entry, data base edit, and report generation programs.

GENERAL REQUIREMENTS

MODULARITY

Programs must be modular.

The program disk will use drive 1. Data will be kept on a separate disk, to be used in drive 2.

The system will be used to handle data for the equivalent of up to six different entities (e.g., companies) within a battalion. Programs are to be designed to handle data for any single company. The same program will then be used for all companies of the battalion by substituting data base disks in drive 2. Sufficient identification information must be kept on each data disk to prevent inputs from going to the wrong data base, and to identify reports by company (or section) and battalion name.

ERROR-PROOFING

The eventual system operators will be Army enlisted personnel with limited computer background. They could be Army supply clerks with basic typing skills and an IQ in the 100-110 range. The system must be designed with these operators in mind. It must be a "turn-key" system that does not require special expertise or detailed knowledge of computer operations. The following are some of the specific ways in which the program must reflect these operator limitations.

- Program execution must not halt if the operator makes an erroneous input.
- All operator inputs must be error-checked for range, type, and in some cases, for compatibility with prior inputs.
- In making a series of related inputs (e.g., entering a data entry form with several fields), the operator must be able to change earlier entries before entering the entire series. He must be able, for example, to change field 1 of the form before entering fields 1 through 10 into the data base. He must also have the option to abort the entire series of inputs. Similar checks must be made on operator inputs for other programs.
- Extensive prompting of operator inputs is required. All operator interaction with the computer is to be made as simple as possible. Computer queries are to be clear and specific, and avoid the use of abbreviations, computer jargon, or other information that may confuse the operator.

TABLE 1

EQUIPMENT, MOS, AND MAINTENANCE-LEVEL RELATIONSHIPS

	CREW-LEVEL MAINTENANCE			MECHANIC LEVEL MAINTENANCE			
	MOS			MOS			
EQUIPMENT	11C/19D	12F	19E/F	31V	45N	63B/S	63N/T
M60			X		X		X
AVLB		X					X
M113	X						X
M88							X
M578							X
M151						X	X
M35						X	X
M561						X	X
GOER						X	
Radio				X			

therefore divided into two categories: (1) corrective maintenance tasks, and (2) preventive maintenance tasks.

Future Expansion of MPS(O) to Cover Additional Equipment, MOS's, and Tasks

It is anticipated that the system will eventually be expanded to provide coverage of additional equipment, MOS's, and maintenance tasks. The system will be designed to permit this expansion without subsequent programming. It is anticipated that up to five additional equipment items may be added and up to three additional MOS's. Each MOS will have a corresponding task list of up to 52 tasks.

Task lists contained in Appendix B may be modified later. It must therefore be possible to add, modify, and delete tasks on existing task lists.

MISSING DATA AND ZERO SUPPRESSION

I&ES reports will sometimes be generated from incomplete data. Missing data points must be recognized when data entry forms are entered into data files. Appropriate programming techniques must be used to prevent these missing data from being added to files as zeros and used later in calculations that will distort report outputs. Report outputs must be calculated only from data that are actually entered. Reports generated from incomplete data should print blank spaces rather than zeros in periods of missing data.

OPERATOR-DEFINED PARAMETERS

Vehicle Bumper Numbers

Many of the reports call for summaries by individual vehicle. This means that separate files must be maintained for each vehicle. Certain data entry forms require that the vehicle be identified by bumper number. Bumper numbers vary from unit to unit. The lowest possible number is 1; the highest possible is 150. Many of the numbers between 1 and 150 will not be used. Nonetheless, in order for the program to be completely general, it must be possible to enter any bumper number between 1 and 150, and to establish files on the basis of bumper numbers entered. Form 10 (see Appendix A, Volume 2) is provided to permit definition of valid bumper numbers for a company.

Personnel Names

The system must track individual soldiers and so a file must be maintained for each one. In a given company, the maximum number of personnel in any single MOS will be 120. The maximum number of personnel overall will not exceed 240.

Each soldier will be assigned a unique code number by the computer. Form 6 (see Appendix A, Volume 2) is provided to permit names to be added to a "roster" file with computer-assigned code numbers and other soldier information.

PROGRAM GENERALIZABILITY

MOS's and equipment will vary from company to company. For the program to be generalizable across all companies, it must permit any company's data files to accept data for any MOS or equipment. However, in a specific company, data for certain MOS's and equipments will never actually be entered. Many of the reports are general, capable of showing information for all MOS's and equipment. When such a report is generated, it should not present labels for information that is not present in the files. For example, the Roster report (Ref #1--see Appendix C, Volume 2) is capable of presenting information for all seven MOS's in the battalion. In an actual company, only a subset of these seven MOS's will be present and the labels and headers for only these MOS's should print.

SPECIFIC REQUIREMENTS

OVERVIEW

This section discusses the new I&ES programs in the following order:

1. Main and utilities menus
2. Data input
3. Report generation
4. Data base editing
5. Utilities

1. MAIN AND UTILITIES MENUS

The new I&ES will employ the same menus as the current I&ES. There a two key menus. The MAIN MENU lists programs frequently used. The UTILITI MENU lists programs infrequently (or rarely) used. The main menu is shown below.

MAIN MENU

1. ENTER/EDIT FORMS
2. GENERATE REPORTS
3. SWITCH TO NEW COMPANY
4. UTILITIES MENU
5. END PROGRAM

The **UTILITIES MENU** is shown below.

UTILITIES MENU

1. COPY DATA BASE
2. CREATE NEW DATA BASE
3. PRINT DATA BASE
4. FILE STATUS REPORT
5. PURGE DATA BASE
6. RETURN TO MAIN MENU

2. DATA INPUT

General

The data input sequence is to be identical to that of the current I&ES, as described below.

Data input programs are to be selectable from option 1 of the main menu.

There are 11 different data entry forms, designated by numbers 1 through 11. Copies of each form are contained in Appendix A, Volume 2, of this specification. Form numbers precede the title of each form.

When the data input option is picked from the main menu, the program is to prompt a form number input and then go to the appropriate data input program.

The data input program itself is to present on the screen a replica of the data entry form, to the extent that it is possible.

As entries are made, they are to be error-checked for range and type. For example, numeric/character inversion may occur and must be protected against.

After the last field of a particular form has been entered, the operator must be able to edit (add, modify, delete) earlier form entries. He must also be able to approve the form for entry or order entries aborted.

Data Entry Forms

Ten of the 11 data entry forms are derived from the current I&ES. Some of these forms are identical to current forms and others have additional fields or other modifications. The relationship between current and new I&ES data entry forms is summarized in Table 2.

The data entry forms are discussed in this section in terms of their content as they relate to a specific data input program. Line numbers are referred to as "L1," "L2," etc. Each line/field is described in terms of input data type, range, and where applicable, logic checks.

Valid Julian dates -- Many of the forms require entry of Julian date. Valid Julian dates are those for the decade 1980-1989, i.e., 0001-9365. The computer is to check all Julian dates for range and for the presence of four digits.

TABLE 2

RELATIONSHIP BETWEEN CURRENT AND NEW
I&ES DATA ENTRY FORMS

Current I&ES Form	New Upgraded I&ES Form	Remarks
1 PMCS	1 Preventive Maintenance Checks and Services (PMCS)	Changed data requirements.
2 PM Service	2 Preventive Maintenance Service	Changed data requirements.
3 Corrective Maintenance Status		Deleted—data not required.
4 Corrective Maintenance Tasks	3 Corrective Maintenance	Changed data requirements.
5 Interpretation Comments	4 Interpretation Comments	No change.
6 Training Cycle Definition	5 Training Cycle Definition	No change.
7 Roster Update	6 Roster Update	"Modify" section added.
8 Task Experience History	7 Task Experience History	New task lists.
9 Mission Capable Status		Deleted—data not required.
10 TO&E Authorized Strength		Deleted--data not required.
11 PLL		Deleted--data not required.
12 Open Requisition/ Zero Balance	Deleted--data not required.	
13 Evacuation Status	Deleted--data not required.	
14 Serviceability Check	8 Serviceability Check	No change.
15 Vehicle Mileage	9 Vehicle Mileage	Changed data requirements.
16 Vehicle Bumper Number	10 Vehicle Bumper Number	Changed data requirements.
	11 Mechanic Qualification	New data requirement.

Valid name code numbers -- Many of the forms require entry of soldier's names. Names are entered as code numbers. These code numbers are assigned by the computer following entry of a Form " (Roster Update) for the soldier. Whenever a soldier's code number is entered, the computer is to check it for validity against two criteria: (1) code number must exist in the roster file, and (2) number must be consistent with equipment, tasks, and maintenance level represented by the data entry form. For example, M60 maintenance tasks can only be performed by MOS's 19E, 45N, or 63N. If a code number for a soldier whose MOS is 11C/19D is entered, then the code number is invalid.

Valid bumper numbers/vehicle types -- Several forms require entry of equipment bumper numbers. These are entered as numbers between 1 and 150. During data input, each bumper number must be checked for validity. To be valid, the number must exist in the bumper number file. On all such forms, there will also be a later entry for vehicle type, M60 or M113. The vehicle type entry must be a number 1 through 9 and must be consistent with the vehicle type represented by the bumper number. (Bumper numbers are not used with equipment type 10, Radio.)

Form 1 Through Form 3: General

Forms 1 through 3 are a logically related set.

Form 1 is used for recording preventive maintenance performed by either crew or mechanic.

Form 2 is used for recording preventive maintenance services performed by mechanics.

Form 3 is used for recording corrective maintenance man-hours and tasks for either crew or mechanic (but not both in combination).

Form 1: PMCS

L1: A valid Julian date.

L2: A valid bumper number.

L3: A valid vehicle type (1-5).

L4: A valid MOS (1-5).

L5: This line contains two fields, NAMES and MAN-HOURS. Name will be entered as a valid code number. Code number is to be checked against the MOS the Form 1 represents. Form MOS is determined from L4. Although this is technically a "crew" form, names and code numbers of two mechanic MOS's--45N, 63N/T--can be entered. These two MOS's sometimes serve as crew members on certain unique vehicles.

It must be possible to enter up to five sets of code numbers/man-hours.

One entry must be made on lines 1-4 of this form. L5 must have at least one entry but can accept up to five entries.

Form 2: PM Services

Form 2 is similar to Form 1, but is for PM services tasks.

L1: A valid Julian date.

L2: A valid bumper number.

L3: A valid vehicle type; vehicle type checked must be consistent with bumper number entry on L2.

L4: Acceptable entries are 1 or 2 or 3. Checked MOS must be consistent with vehicle type checked on L3.

L5: A valid task number (1-5). Task number must be consistent with equipment type. Valid equipment/task combinations are given in Table 3. Multiple entries are permissible.

L6. This line contains two fields, NAMES and MAN-HOURS. Name is entered as a code number. Code number must be valid for MOS on L4. Acceptable man-hour entries are values greater than or equal to zero.

It must be possible to enter up to five sets of code numbers/man-hours.

One entry must be made on lines 1-4 of this form. Lines 5 and 6 must have at least one entry but can accept more entries.

Form 3: Corrective Maintenance

L1: A valid Julian date.

L2: A valid bumper number, unless radio. Radios have no bumper number.

TABLE 3

VALID PM SERVICE TASKS FOR EQUIPMENT COVERED BY I&ES

TASK	EQUIPMENT TYPE (NUMBER)								
	1 M60	2 AVLB	3 M113	4 M88	5 M578	6 M151	7 M35/ M54	8 M561/ M792	9 GOER
1. PERFORM 'Q' SERVICE	X	X		X					
2. PERFORM 'S' SERVICE			X		X				
3. PERFORM 'A' SERVICE						X	X	X	X
4. PERFORM 'L' SERVICE	X	X	X	X	X	X	X	X	X
5. OTHER	X	X	X	X	X	X	X	X	X

L3: A valid equipment type (1-9). Must be consistent with bumper number on L2 (unless Radio).

L4: An acceptable entry is a single number between 1 and 7. MOS checked must be consistent with equipment type on L3.

L5: Task number for crew or mechanic corrective maintenance tasks. Acceptable entries depend upon MOS and equipment type. Acceptable MOS/equipment/task number combinations are given in Table 4.

L6 and L7 are handled differently, depending upon MOS. If a crew MOS (1-3) is checked on L4, then no entries are required on L6. For data entry, the cursor should skip L6 and jump immediately to L7 to collect personnel code numbers and man-hours by task. In this case, the Form 3 is a "crew" Form 3 and man-hours by task by name should be maintained in permanent computer records.

If a mechanic MOS (4-7) is checked on L4, then entries are required on L6 and optional on L7. For data entry, the cursor should go from L5 to L6 and, after completion of L6 entries, to L7. However, in this case, the Form 3 is considered to be a "mechanic" Form 3, and it is not necessary to keep track of code numbers of crew personnel assisting in the work, although it is necessary to keep track of the man-hour totals by task number.

L6: This line contains a field for name and up to five fields for Task number. Name is entered as a code number. Code number must be valid for MOS on L4.

The entries are broken down by task. Man-hour entries should be prompted for the number of tasks entered on L5. Acceptable man-hour entries are values greater than or equal to zero.

It must be possible to enter up to five sets of code numbers/man-hours.

L7: For "crew" Form 3's, entries are made and records kept in the same manner as for L6 on "mechanic" Form 3's (see above). For "mechanic" Form 3's, code numbers are not required. Only man-hour entries by task are required.

L8: One or more entries may be made on this line for the dollar cost of repair parts used. The line may be left blank. If entries are made, they should be summed for a cost total when data input is completed.

At least one entry must be made on L1-5 and L6 or L7 of this form.

TABLE 4

ACCEPTABLE MOS/EQUIPMENT/CORRECTIVE MAINTENANCE TASK NUMBER COMBINATIONS

MOS	EQUIPMENT	HIGHEST TASK NO.
11C/19D	M113	14
12F	AVLB	29
19E	M60	33
31V	RADIO	21
45N	M60	37
63B/S	M151	35
	M35	47
	M561	33
	GOER	13
63N/T	M60	44
	AVLB	44
	M113	46
	M88	52
	M578	40
	M151	52
	M35	47
	M561	33

Form 4: Interpretation Comment

Form 4 is used to enter comments reflecting unit activities that may affect interpretation of reports. The program is to permit entry of comments on a one-by-one basis.

JULIAN DATE must pass the usual tests.

The COMMENT may range between 0 and 128 characters in length.

Form 4 data entry and record-keeping should be identical to those for Form 5 of the current I&ES.

Form 5: Training Cycle Definition

Form 5 is used to enter a short character string (up to three characters in length) that is associated with the one-week date blocks presented on some reports. However, unlike Form 4, only one character string can be entered per date block.

JULIAN DATE must pass the usual tests.

TRAINING CYCLE is a character string ranging between zero and three characters in length.

Form 5 data entry and record-keeping should be identical to those for Form 6 of the current I&ES.

Form 6: Roster Update

Form 6 consists of three separate forms, one for adding names to the roster, one for deleting them, and one for modifying them.

The ADD NAMES portion of the form has four lines.

L1: A single number between 1 and 7.

L2: A character string with a maximum length of 24 characters. A soldier's name, for entry, consists of three pieces of information: (1) name, (2) primary MOS (may differ from assigned MOS), and (3) paygrade. The "name" will be entered in the following format:

Jones (63H-E4)
Smith (45K-E1)

After the name has been entered, the program is to check for presence of a paygrade number (the number following the final "E" after the MOS). This number must be between 1 and 7. Paygrade number must be present for the character string to be valid.

Paygrade is to be extracted and stored separately in the roster file.

L3: A valid Julian date.

L4: A valid Julian date. This date must be equal to or greater than the date on L3.

An entry must be made on every line.

The DELETE names portion of Form 6 is used to remove names from the roster. This does not mean that the names are actually purged from the files. It means that they are suppressed from display. Further, the soldier's file becomes "inactive" in the sense that his name is no longer listed on reports.

The roster file is to be capable of holding up to 240 names. When a name is deleted, it remains in the file until such time as the file fills and a new name is added at the top. When this happens, the name with the oldest delete date in the file is dropped.

The DELETE portion of Form 6 contains two fields, CODE NUMBER and EFFECTIVE JULIAN DATE. To delete a name from the roster, the soldier's code number and date of departure are entered. Both entries are required. After one name has been deleted, the operator is to be able to delete another name or discontinue the program.

The MODIFY portion of the form is used to identify changes to soldier name/paygrade.

Form 6 data entry and record-keeping should be identical to those for Form 7 of the current I&ES, except that the new I&ES will not keep track of platoon assignments.

Form 7: Maintenance Task Experience History

Form 7 is based on the task lists contained in Appendix B, Volume 2, of this specification. There is a different task list for each MOS, for a total of seven different Form 7's.

Form 7 is used to start a soldier's experience history file. A form cannot be entered until a soldier has been added to the roster with a Form 6 and been assigned a code number.

The top line of the form lists name, primary MOS, and paygrade; this is for manual record-keeping. All that will actually be entered from this line is the soldier's code number. After a code number has been entered, the computer is to check the soldier's file to determine whether or not a Form 7 has previously been entered for that code number. If so, an error message is to appear and data entry is to be blocked.

After a valid code number has been entered, the computer is to determine the soldier's MOS, based upon his file, and call up the appropriate Form 7 data entry program for that MOS. After it has received a valid code number and identified the soldier's MOS, the program is to present a prompt asking whether or not the operator wants to enter "ZERO HISTORY?" If he responds "Y" (Yes), then all entries in the task list are set to 0 and data entry terminates. If the operator responds "N" (No), then prompts are presented to permit the operator to enter the number of times the soldier has performed each task.

Once the form has been entered, the program is to attach a flag to the soldier's name in the roster file to indicate that a history has been entered for that soldier. Until a Form 7 has been entered, the computer is to exclude the soldier's name from reports.

The operator makes an entry for each task on the list. The entry for each task represents the number of times the soldier has performed the task. The only invalid entry is a value less than zero.

Task lists include corrective maintenance tasks (all MOS's) and PM service tasks (mechanic MOS's). Task lists do not include PMCS tasks.

Tasks are numbered sequentially within the sublists of each task list. For example, MOS 19E corrective maintenance tasks are numbered 1 through 32.

Note that Form 7's do not include the "OTHER" tasks that appear at the end of each of the task sublists in Appendix B of Volume 2.

The actual entries will be integers that represent the number of times each task has been performed. Any number greater than 99 is to be set equal to 99 (the maximum number of repetitions).

Required entries on this form are L1 and L2.

Form 7 data entry and record-keeping should be modeled on those for Form 8 of the current I&ES.

Form 8: Serviceability Check

L1: A valid Julian date.

L2: The number 1 or 2.

L3: The number 1 or 2 or 3.

L4: The character "Y" or "N".

Entries are required on all lines.

Form 8 data entry and record-keeping should be identical to those of Form 14 of the current I&ES.

Form 9: Vehicle Mileage

L1: A number between 1 and 8.

L2-L15: Each line consists of two fields. The left field is for vehicle bumper number, the right for vehicle mileage. Bumper number must be valid. Vehicle mileage is an integer between 0 and 99999.

One mileage figure is to be retained for each vehicle. This will be updated monthly. The new entry is to overwrite the old entry.

Form 9 data entry and record-keeping should be identical to those for Form 16 of the current I&ES with the exception of additional vehicle types on L1.

Form 10: Vehicle Bumper Number

Form 10 actually consists of three forms: (1) a form for adding a new bumper number, (2) a form for modifying an existing bumper number, and (3) a form for deleting an existing bumper number. This form and its corresponding data entry and editing programs are similar to those for Form 6, which is used for handling the roster file.

The ADD portion of the form is used to define valid bumper numbers for a particular vehicle type.

The L2-L9 data entry fields should iterate under operator control.

L1: A valid vehicle type (1-8).

L2-L9: These lines contain two fields, one for specifying a date, the other for entering bumper number. The add date defines the point in time at which the bumper number is valid for data entry. Data entry forms that contain the bumper number can only be accepted for data entry if the date on the form is equal to or greater than the bumper number date. To be valid for adding on Form 10, a bumper number must be between 1 and 150 and not duplicate another currently active bumper number.

The MODIFY portion of the form is used to change an existing bumper number to a new bumper number. When such a change is made, all files concerning the vehicle should be re-labeled with the new number.

The DELETE portion of the form is used to drop a bumper number that was entered in error or following vehicle de-activation. Date and bumper number must both be entered.

Form 10 data entry and record-keeping should parallel those of Form 15 of the current I&ES, with the exception of additional vehicle types and the maintenance of date information.

Form 11: Mechanic Qualification

This form is similar to Form 3. It has no equivalent in the current I&ES.

L1: A valid Julian date.

L2: A valid equipment type (1-9).

L3: A single number between 1 and 4.

L4: A valid mechanic's code number. Must be consistent with L3.

L5: Up to five valid corrective maintenance task numbers.

L6: The letter "Q," "A," "S," and/or "L." The letters must be valid for the types of services indicated on L2 and may be entered in combination.

L7: A blank or character string up to three characters in length. The entry will appear beneath the "BMP CERT" heading on Table 6.

3. REPORT GENERATION

Report Generation Program

The report generation program is to be called via main menu option 2 (Generate Reports). The program should work in the same manner as the corresponding program in the current I&ES. The current report generation program permits the operator to generate any single report by entering its reference number, a group of reports by entering a number pair, and several groups of reports by entering combinations of number pairs. After reference numbers have been entered, they may be edited, new numbers may be added, or the report generation sequence may be aborted.

While the computer is processing data to generate reports, the following message should appear on the screen:

GENERATING TABLE X
DO NOT TOUCH COMPUTER

Overview of the MPS(O) Reports

There is a total of 64 I&ES reports. They include a set of Interpretation Comments, a Roster, and 10 different generic types of tables. Interpretation Comments (Ref number1) and Roster (Ref number2) consist of one report each. All remaining reports consist of two or more similar or essentially identical reports. Differences among reports of a particular generic type are based on equipment type or MOS.

One example of each report type is contained in Appendix C, Volume 2, of this specification.

General Format Guidelines

All reports are to be printed on 9.5-inch width tractor-feed printer paper with an actual display width of 8.5 inches. Paper length will be 11 inches. One-inch top and bottom margins are to be maintained. A one-inch left margin is to be maintained. Right margin will vary according to the amount of information presented on the report. In a few cases, it may be difficult to format a report with

these left and right margin limitations; if there is insufficient room, left and right margins can be reduced to less than one inch and report content can be centered.

All reports are to have similar format and appearance:

- All header and report information begins at the left margin.
- The top line identifies company and battalion or battalion only. Tables 8 and 9--battalion only.
- Line 2 gives title.
- Line 3 gives reporting period.
- Report content begins two spaces below the header block.
- Report reference number and distribution appear one inch from the left margin and one inch up from the bottom of every report, under the dashed line.

Most reports can be printed on a single page. If a report runs to a second or third page, the header is not to be repeated, although identifier information is to be printed one inch below the top of subsequent pages. The information is to identify table number and page, e.g., "Table 9--Page 2." Report information content is to begin two spaces below the identifier.

Report Reference Numbers

Every new I&ES report has a unique reference number that is used to identify it during report generation. The roster and interpretation comments have reference numbers 1 and 2. Other reports have reference numbers that are based on table number and the particular version of the report being generated.

Every table number has three digits.

The first digit is the same as the table number. The last two digits identify the version of the table. Table versions are determined by the MOS or equipment coverage of the table. Table versions can be determined from the following breakdown.

Table Version	MOS Covered	Equipment Covered
1	11C/19D	M60
2	12E	AVLB
3	19E	M113
4	31V	M88
5	45N	M578
6	63B/S	M151
7	63N/T	M35
8	—	M561
9	—	GOER
10	—	Radio

For example, Reference number 103 is the 19E version of Table 1; Reference number 208 is the M561 version of Table 2. (As a given table is either MOS or equipment-oriented, there is no possibility of MOS/equipment confusion.)

Relationships Among Current I&ES and New I&ES Reports

Table 5 summarizes the relationships among current and new I&ES reports. Nine of the 12 new reports are based on current reports.

Relationships Among New I&ES Data Entry Forms and Reports

Table 6 summarizes the relationships among new I&ES reports and data entry forms.

DESCRIPTION OF REPORTS

This section describes each of the new I&ES reports, its underlying data entry forms, and how the information in the report is calculated.

Interpretation Comments (Ref # 1)

The interpretation comments report contains descriptive information highlighting local conditions that system users should consider when interpreting I&ES reports.

Interpretation comments are generated from Forms 4 and 5.

TABLE 5

RELATIONSHIPS AMONG CURRENT I&ES
AND NEW I&ES REPORTS

NEW REPORT #	CURRENT REPORT #
Interp Comments	Interp Comments
Roster	Roster
Table 1	Table 10
Table 2	Table 14
Table 3	Table 4
Table 4	Table 6
Table 5	New
Table 6	Table 15
Table 7	Table 16
Table 8	New
Table 9	New
Table 10	Table 9

TABLE 6

RELATIONSHIPS AMONG NEW I&ES DATA
ENTRY FORMS AND REPORTS

Table #	FORM #										
	1	2	3	4	5	6	7	8	9	10	11
Roster						X	X				
Interp Comments				X	X						
1	X	X	X		X	X					
2			X								
3	X	X	X						X	X	
4		X	X							X	
5		X	X							X	
6		X	X			X	X				X
7		X	X			X	X				X
8	X	X	X								
9											X
10								X			

Records in the interpretation comments files are sorted by date and presented on the report in date order. Each new comment is preceded by a "less than" sign ("<") and terminated by a "greater than" sign (">").

This report is identical to the interpretation comments report in the current I&ES.

Roster (Ref #2)

The roster is used to maintain an up-to-date accounting of unit personnel. It has a secondary purpose of indicating how much remaining time each soldier has in the unit.

The roster is generated from Forms 6 and 7.

The roster is divided into seven different sections, one for each MOS group in the I&ES. In an actual company, some subset of these MOS's will be present. When a soldier's name is added to the roster with Form 6, his MOS will be designated. The only MOS's that should be listed on the roster are those to which soldiers' names have been added with Form 6's.

MOS's are listed in order, from 11C/19D through 63N/T. Within each MOS, names are listed in alphabetical order.

CODE # (code number) is listed beside each name.

In this HIST (history) column, an "N" appears opposite the name if no Form 7 has been entered for the soldier; otherwise, there is a blank.

STRT DATE (start date) is the start date defined for the soldier on L3 of the Form 6 with which his name was added to the roster.

ETD DATE (estimated time of departure) is the ETD date defined for the soldier on L4 of his Form 6.

DAYS LEFT is the difference between the report date and the ETD date. Two asterisks appear to the right of this number if it is less than or equal to 45 days.

This report is identical to the current I&ES roster, except that the new report does not display platoon designator.

Table 1: Maintenance Man-Hours (Ref #101-107)

This report summarizes total assigned (i.e., potentially available) man-hours and the total number of these hours devoted to maintenance. It also shows maintenance man-hours averaged per man.

There are seven versions of this report, one for each MOS.

Table 1 is generated from Forms 1, 2, 3, 5, and 6.

ASSIGNED MAN-HRS is calculated from Form 6-based roster data. For a given MOS, the program must access the roster to determine the number of soldiers working in the specific MOS on each of the five working days (Monday-Friday) of each week covered. Each weekday counts; there are no holidays. Assigned man-hours for a period is calculated by multiplying the number of soldiers per day by eight hours per soldier per day and summing this up over the five working days of the interval.

TOTAL MAN-HRS is the total number of man-hours reported by the MOS during the reporting period on Forms 1, 2, and 3.

MAINT MAN-HRS/MAN (maintenance man-hours per man) is determined by dividing total maintenance man-hours by the average number of assigned men during the reporting period.

The "delta" column displays an inverted "v" symbol (e.g., $\wedge$) if the MAINT MAN-HRS PER MAN is $\geq$ 1.5 standard deviations above the long-term average, or a downward pointing "v" symbol (e.g., v) if the man hours are $\leq$ 1.5 standard deviations below the average.

This table is based on Table 10 of the current I&ES.

Table 2: Average Man-Hours Per Corrective Maintenance Task (Ref # 201-210)

This report shows the average man-hours required to perform each corrective maintenance task on each equipment.

There are 10 versions of this report, one for each equipment.

Table 2 is generated from Form 3.

Table 2 is divided into blocks, according to MOS, with the corrective maintenance tasks for each MOS listed beneath the MOS/TASK heading. The tasks listed beneath the MOS/TASK heading are the corrective maintenance tasks, excluding "OTHER" tasks, given for each MOS in Appendix B of Volume 2 of this specification.

The first two columns on the right side of the report summarize the average number of direct man-hours required to perform the task and the number of tasks on which the average was based during the past. The two right-hand columns represent all occurrences of the task during the last four weeks. The two left-hand columns represent all previous occurrences of the task within the files.

Past and current averages are calculated identically, though over different time intervals. Man-hours per task are calculated from the number of hours allocated to the task on Form 3's listing the task.

The "delta" column displays an inverted "v" if the CURR AVG is ≥ twice the PAST AVG, or a downward "v" if CURR AVG is ≤ one-half the PAST AVG.

This table is based on Table 14 of the current I&ES.

Table 3: Maintenance Man-Hours and Costs Per Vehicle (Ref #301-309)

This report provides a vehicle-by-vehicle summary of mileage, parts costs, and corrective and preventive maintenance performed.

There are nine versions of this report, one for each equipment (except radio).

Table 3 is generated from Forms 1, 2, 3, 9, and 10.

VEHICLE BUMPER NO. lists the bumper numbers of all vehicles defined using Form 10. Bumper numbers are listed in order.

AVG PARTS $ COST/PERIOD (average parts dollar cost per period for maintaining the vehicle) gives the weekly average of parts costs for maintaining the vehicle during the last 24 weeks. This amount is calculated by summing the amounts on L8 of all Form 3's completed for the vehicle during the last 24 weeks and dividing by 24.

AVG CM MAN-HRS/PERIOD (average corrective maintenance man-hours per period spent on the vehicle) gives the weekly average of corrective maintenance man-hours spent on the vehicle during the last 24 weeks. This is calculated by summing the total man-hours on all Form 3's for the vehicle during the last 24 weeks and dividing by 24.

AVG PM MAN-HRS/PERIOD (average preventive maintenance man-hours per period spent on vehicle) gives the weekly average of preventive maintenance man-hours spent on the vehicle during the last 24 weeks. This is calculated by summing the total man-hours on all Form 1's and 2's for the vehicle during the last 24 weeks and dividing by 24.

The right three columns of this report summarize a weekly average over a 24-week period. When the system is started, fewer than 24 weeks of data will be available. Therefore, the number of weeks over which the average is calculated should be based on the earliest reported data. For example, if the first Form 3 was completed four weeks ago, then the average parts cost per period should be calculated over a four-week period.

Each "delta" column displays an inverted "v" if the value in the column to the immediate left is $\geq$ 1.5 standard deviations above the long-term average, or a downward "v" if the value is $\leq$ 1.5 standard deviations below the average.

This table is based on Table 4 of the current I&ES.

Table 4: Vehicle Corrective Maintenance Histories (Ref #401-409)

This report provides a history of all corrective maintenance and PM service tasks on a vehicle-by-vehicle basis. It also permits determination of which tasks have been performed more than once. The report presents up to six months of vehicle corrective maintenance history.

There are nine versions of this report, one for each equipment (except radio).

Table 4 is generated from Forms 2, 3, and 10.

The report is divided into blocks, with one block for each vehicle whose bumper number has been defined with a Form 10. Bumper numbers are listed in order beneath the VEHICLE BUMPER NUMBER heading.

MAINTENANCE TASK lists all corrective maintenance and PM service tasks that have been performed on the vehicle whose bumper number appears to the left. PM service tasks are indented three spaces. PM service tasks are determined from Form 2. Corrective maintenance tasks are determined from both crew and mechanic Form 3's.

JULIAN DATE is the date that the maintenance task listed to the left was performed. Tasks should be listed in sequential order, with oldest at the top, newest at the bottom, and crew and mechanic tasks intermixed.

The REPEATED TASK FLAG column highlights tasks that are listed on the report more than once for a particular vehicle. The dashed line under the heading is 10 spaces long. Symbols are printed beneath space 1, 3, 5, and 7 of this line, respectively, to flag the first, second, third, and fourth task that appears more than once in the task list for the particular vehicle. If five or more tasks show repeats, an "R" is printed beneath space 9 of the line.

The vehicle history shows up to six months of maintenance tasks. Any task performed more than six months before the date shown at the top of the report is not printed.

This table is based on Table 6 of the current I&ES.

Table 5: Monthly Maintenance Work Summary (Ref #501-509)

This report provides a four-week summary of all corrective maintenance and PM service tasks, personnel, and man-hours on a vehicle-by-vehicle basis. It is designed to parallel Table 5 and provide the additional information needed to answer questions raised based on Table 5.

There are nine versions of this report, one for each equipment (except radio.)

Table 5 is generated from Forms 2, 3, and 10.

The report is divided into blocks, with one block for each vehicle whose bumper number has been defined with a Form 10. Bumper numbers are listed in order beneath the VEHICLE BUMPER NUMBER heading.

The MAINTENANCE TASKS AND PERSONNEL column contains a date-ordered list of all maintenance tasks and the personnel who performed them on the vehicle during the last four weeks. This information is obtained from Forms 2 and 3.

The MAN-HRS column lists the number of maintenance man-hours for each name.

JULIAN DATE is the date the maintenance task listed to the left was performed.

This table does not exist in the current I&ES.

Table 6: Experience, Qualification, and Certification for Maintenance Tasks (Ref #601-607)

This report summarizes the experience and maintenance qualifications of personnel on maintenance tasks.

Table 6 is generated from Forms 2, 3, 6, 7, and 11.

There are two versions of this report: one for mechanics, the other for crews. The reports are identical except that the crew version is titled EXPERIENCE ON MAINTENANCE TASKS and does not have the BMP CERT or % TASKS QUAL columns.

The left column of the report--NAME/PAYGRADE--contains a top block that lists various paygrade subcategories and, beneath it, the names of personnel who hold the MOS.

For a soldier's name to be listed on this report, three conditions must be met: (1) his name must have been added to the roster with a Form 6, (2) the name's ETD date must be later than the date of the report, and (3) a Form 7 must have been entered for the name.

The BMP CERT column will contain the character string entered for the mechanic on L7 of a Form 11.

The % TASKS QUAL column lists the percentage of corrective maintenance and PM service tasks on which the mechanic has been qualified with Form 11. For

example, if he has qualified on 20 of the 30 tasks required for his MOS, then a 67 will appear in this column.

Calculation of EXPERIENCE INDEX is performed as follows:

- Given a soldier's code number, a Form 7 (task experience history) can be entered into the data base for each soldier. This history lists the number of times the soldier has performed each of the tasks specific to his MOS.

- Each time the soldier performs a task, it will be recorded on a form 2 or 3. Thus, the number of times a soldier has performed each task can be determined by summing the number of task performances shown on the Form 7 with additional task performances shown on Forms 2 and 3.

- To get a task "credit," the soldier must have performed the task at least three times. The maximum task credit possible for an MOS is the sum of the number of corrective maintenance tasks for that MOS (less the "OTHER" task category) and PM service tasks. For example, if the number of corrective maintenance tasks is 20 and the number of PM service tasks is 2, then maximum task credit is 22. The mechanic gets one credit for each task he has performed three or more times. If he has performed 11 of his 22 tasks three or more times, then his task credit is 11. His experience index is calculated by dividing task credits by total possible credits and then multiplying by 100, e.g., 11/22 * 100 = 50%.

Experience index is shown opposite each soldier's name both numerically and graphically. Names are listed in order of experience index, with soldiers with the highest experience indexes at the top, and those with the lower indexes below. The dashed lines extending to the right represent experience index graphically. A "+" appearing at the end of a line indicates that the soldier performed the maintenance task during the last four weeks.

The upper portion of the report summarizes experience and growth index for various paygrade subcategories. This part of the report should print only if there are 10 or more personnel listed on the lower part of the report. The bottom entry is ALL E1-E7, which represents the average experience and % task qualification for all holders of the MOS. A dashed line extends down from the end point of that line into the graphic portion of the report listing individual names. This line shows the average experience index for all personnel.

This table is based on Table 15 of the current I&ES.

Table 7: Individual Experience Profile (Ref #701-707)

Table 7 summarizes the qualifications and experience credits each soldier has received for each of his MOS tasks.

There are two versions of this report, one for mechanics, the other for crews. The reports are identical except that the crew version is titled INDIVIDUAL EXPERIENCE PROFILE and does not have the QUAL column.

Table 7 is generated from Forms 2, 3, 6, 7, and 11.

For a Table 7 to be generated for a soldier, three conditions must be met: (1) his name must have been added to the roster with a Form 6, (2) the name's ETD date must equal be to or later than the date of the report, and (3) a Form 7 must have been entered for the name. A sequence of tables is generated alphabetically (by name) within each MOS category.

In the QUAL column, a "Q" will appear if the mechanic has been qualified on the task with a Form 11.

The NUMBER OF TIMES column shows the number of times the mechanic has performed the task, up to a maximum of 99, the maximum number of performances any soldier may have recorded for any task.

The NO. TIMES DONE scale ranges up to 20. If the mechanic has performed the task more than 20 times, the graph will show 20.

A "+" appearing at the end of a line indicates that the soldier performed work on that task during the last four weeks.

This table is based on Table 16 of the current I&ES.

Table 8: Battalion Maintenance Man-Hour Summary (Ref #801)

This report summarizes information contained in Table 1 across all mechanic MOS's for the entire battalion.

There is one version of this report.

Table 8 is generated from Forms 1, 2, and 3.

Calculation of ASSIGNED MAN-HRS, TOTAL MAN-HRS (called EXPENDED on Table 8), and MAINT MAN-HRS PER MAN is explained in the discussion of

Table 1. The calculations for Table 8 are performed identically, but information must be summed across MOS's within each company.

Generation of this report will require abstracting data from the data disk unique to each company. The program must provide the required prompts and error tests, and permit the operator to skip companies if he wishes.

Table 8 is a new report and there is nothing similar to it in the current I&ES.

Table 9: Battalion Maintenance Qualification Summary (Ref #901)

This report summarizes the information contained in Table 6 across all mechanic MOS's for the entire battalion.

There is one version of this report.

Table 9 is generated from Forms 1, 2, 3, 6, 7, and 11.

The % QUALS information is the same as that contained beneath the % TASKS QUAL (for ALL E1-E7) column of Table 6.

The NO. NEW QUALS entries show the number of tasks on which mechanics in the indicated MOS obtained new qualifications during the past four weeks, i.e., were able to qualify on tasks on which they were not previously qualified.

Generation of this report will require use of data disks for all companies as in Table 8. The program must provide required prompts and error tests, and permit the operator to skip companies if he wishes.

Table 9 is a new report and there is nothing similar to it in the current I&ES.

Table 10: Component Serviceability Check (Ref #1001, 1002)

This report shows the number of batteries, regulators, and generators that have been removed from vehicles, replaced, and found by support maintenance to be serviceable.

There are two versions of this report: one for M60, the other for M113.

The report is divided into three sets of three columns each, for battery, regulator, and generator.

NUMBER TESTED (total number of the component that was tested during the reporting period) is the total number of Form 8's completed during the reporting period for the particular vehicle and component type.

NO. SERV (number of batteries, regulators, or generators found to be serviceable) is the total number of Form 8's completed during the reporting period on which L4 was checked "yes."

PCT SERV (percent of tested components that were serviceable) is a percent calculated by dividing the number of serviceable components by the total number tested.

This table is identical to Table 9 of the current I&ES.

Report Generation and System Expansion

The reports described above are for seven MOS groups and 10 equipments. The system may eventually be expanded to include 10 MOS's and 15 equipment types. It must therefore be possible to generate additional reports to reflect this expansion. Each report is generic in nature and is generated based on some logical combination of MOS, equipment type, and list of maintenance tasks. There are no unique reports that require special coding.

Report reference numbers are specified in such a way that additional reports and logical reference numbers can be specified to fill in gaps in the existing numbering system. For example, the reference numbers for Table 1 run from 101 through 107. These seven reports correspond to the seven different MOS groups covered by the new I&ES. If one additional MOS were added, then one additional version of Table 1 would be required and its report reference number would be 108. Additional MOS's would also influence other MOS-determined tables--6 and 7—and would require additional rows on Tables 8 and 9 (if the MOS's were for crews). Similarly, addition of equipment would require that new versions of equipment-determined tables be generated, i.e., Tables 2, 3, 4, and 5.

Until further notice, Table 10 will be limited to two equipments and expansion capabilities do not need to be included for it.

4. DATA BASE EDITING

Data base editing programs are to be called from the main menu.

The program must provide access to the data base to permit modification or deletion of data entry forms.

These edit capabilities must be equal to those of the current I&ES, which permits the operator to call up each record on the CRT display. Once the file is accessed, the operator can move forward or backward through the file and edit or delete each record.

5. UTILITIES PROGRAMS

The new I&ES will have four infrequently used but very important programs that can be combined under the general heading of "utilities." These are the "switch to new company," "create data base," "copy data base," and "print data base" programs. These programs should work in the same way as corresponding programs in the current I&ES.

Switch to New Company

The switch to new company option is selected from the main menu. This program is used when the operator wants to change data disks without signing off and restarting the program.

When this program is called, the operator is prompted to enter the data disk. The computer then reads the disk and presents identification information on the screen. The operator is then given a chance to approve the data disk. If he disapproves, he is prompted to enter a new data disk and the above sequence is repeated. The program does not continue until the operator approves the data disk.

Create Data Base

The create data base program is selected from the utilities menu. This program is used to create a complete set of empty files for use by the program. In addition, it is used to assign company identification information to the data disk. This identification information is used for (1) generating report headers, and (2) for error-checking to assure that the correct data disk has been inserted into drive 2.

When this program is called, the operator is prompted to enter the company identification information, then prompted to remove the program disk from drive 1 and insert a blank data disk. Company identification information and empty files are then written to the blank disk. At the end of this sequence, an auditory alarm sounds and the operator is prompted to remove the newly created disk and to put the program disk back into drive 1.

Copy Data Base

The copy data base program is used to make copies of the data disk. It is to work with either an empty disk or with a disk on which created files already exis.. The main purpose of this program is to provide a fairly simple and foolproof method for backing up the data files.

Print Data Base

The purpose of this program is to permit the operator to print out portions of the data base to aid in identification of possible data-entry errors. The program will also be helpful during program debugging.

To use it, the operator identifies the number of the form he wants to print. He must also be able to enter additional information to narrow his specification: MOS(s), equipment type(s), and a time interval. The program then reads the file and sends records corresponding to the specification to the printer in record number order.

The I&ES program must be capable of generating hard copies of all data entry forms.