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COLLEGE ON MEDICAL PHYSICS

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COMPUTER MANAGEMENT OF PREVENTIVE MAINTENANCE

Program documentation

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C M P M

(Computer Management of Preventive Maintenance)

Program documention

C. Taylor
Vienna
September 1988

Program documentation for CMPM

by

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1. Introduction

The computer program CMPM ("Computerised Management of Preventive Maintenance") is designed to help maintenance workers in hospitals or universities. With its aid one can make an inventory of instruments, set time-tables for regular preventive maintenance, stock-keep spare parts, generate records of finished repair jobs, and so on.

The program was developed in an IAEA Research Programme for the maintenance of nuclear medicine equipment. The work was done by IAEA staff members, IAEA Experts, and those taking part in the RP. The result is a program, recorded on diskette, which can be run on any IBM-compatible PC. Each participant in the IAEA RP has a copy of the diskette and it is freely available to others with similar interests.

It would be useful to extend the application of CMPM to other fields, and perhaps to develop it further, and translate its screen messages into other languages. The present version of the diskette is designed for a nuclear research laboratory. There has however been a lack of documentation about how CMPM works and how its parts are inter-related. This note outlines the structure of CMPM and presents data about its programs which should be useful to anyone who wants to work on it. Although it is not a "User's Guide", or a discussion of how to manage maintenance, it has Appendices which give extracts from earlier reports which discussed the maintenance philosophy on which it is based.

2. Running CMPM

CMPM works with the well-known proprietory database program dBase III. It is written in dBase III programming language. To use it the operating system

of the computer should be configured to FILES=20, BUFFERS=15, and all the files on the CMPM diskette should be loaded into a directory along with the working files of dBase III.

To start CMPM, get into this directory and enter:

DBASE

This loads dBase III and brings up its dot prompt at the bottom of the screen.

Enter: DO CMPM

CMPM is now loaded and its title screen comes up. This says "ENTER YOUR PASSWORD".

Enter: CMPM

CMPM's main menu now appears (Appendix 1). From here on one can explore the use of the program by following text on the screen.

3. Purpose and history of CMPM

The purpose of CMPM is to:

- Build up a detailed inventory of equipment.
- Group instruments according to where they are and who maintains them.
- Distribute preventive maintenance and QC work evenly throughout the year.
- Generate work programmes for each maintenance person and week.
- Give descriptions of maintenance tasks for each instrument.
- Specify special tools or test equipment needed.
- Indicate where precise instructions can be found.
- Record answers to preset questions about checks carried out.
- Record the results of repair work.
- Manage stocks of spare parts.
- Calculate the cost of repairs.
- Generate written and graphical reports which assist the Maintenance Manager in running his Section.

A program written in Basic and achieving some of these aims was developed in the early 1980s by Mr P. Ambro, IAEA expert, but this approach could not handle the large amounts of data needed by some users. There were also

problems of portability (use on PCs using different versions of Basic). Both problems were solved by rewriting in dBase III programming language. The present version is largely due to Mr A. Patankar, IAEA expert from BARC, India, working in Southeast Asia with members of the IAEA Research Programme referred to above.

4. Program structure

The program is modular, each choice from its Main Menu (Appendix 1) leading to a separate group of subprograms. These refer to a common set of dBase data files.

A sketch by Mr Patankar showing the main lines of information flow in CMPM is given in Appendix 2.

Interrelationships between dBase and the programs and data files of CMPM are outlined diagrammatically in Appendix 3.

Appendix 4 gives directory printouts showing all files on the current diskette. There are 71 program files, 15 data files, 21 index files, one memory file and two format files. They total 242kB, but some 60kB of this is due to a few unnecessary files, referred to below, which could be deleted.

5. Program files

Appendix 5 lists all the program (PRG) files, grouped according to theMain Menu choice to which they refer. Their reference numbers show the group to which each belongs. Against each file is a comment indicating its function.

6. Data files

Appendix 6 lists all CMPM'S data (DBF) files, with the PRG programs in which each is used. Appendix 7 shows the structures of the data files, including the names given to their data fields. These names appear scattered

throughout the PRG programs, and it is not always evident to which data file they belong. Appendix 8 lists all field names alphabetically together with the reference number of the data file or files in which each appears.

7. Index files

Appendix 9 lists the index (NDX) files, each with the data file it indexes. It will be noted at the foot of this Appendix that there are two very large index files on the current diskette, COPY.NDX and SORT.NDX, which are not used with any data file. These appear to be collections of obsolete index files, and should be deleted.

8. Utility programs and auxiliary files

Appendix 10 lists all remaining files, with comments indicating their purpose.

9. Program relationships in CMPM

Appendix 11 is a summary of the above data. The first column lists the program (PRG) files, ordered as in Appendix 5. The other columns show the program, data, index, or other files called by each PRG program.

10. Maintenance philosophy underlying CMPM

Peter Vuister, IAEA Staff Member, formulated many of the ideas on which CMPM is based. Appendix 13 is his summary expression of these ideas.

Implicit in this approach is the need for well-defined levels and types of preventive maintenance work, with properly qualified people nominated to carry them out at regular intervals. These requirements, which were developed further in the IAEA Research Programme, are summarised in Appendix 14. Preventive Maintenance Levels 2 and 3, as there defined, are the main subject of CMPM's scheduling programs.

11. Use of CMPM

Mr Patankar has written a useful introduction to CMPM. It is given here in Appendix 12 but without the 50 or so examples of CMPM display screens included in his original report.

Of particular interest are his comments on the coding system for groups of instruments of various types, and on the importance of the "policy matrix" datafile PLCYMTRX.DBF.

This file stores two kinds of pre-set data used for scheduling. Its field structure, and the pre-set data entered into it on the current diskette, are given as printouts in Appendix 15.

The field structure of PLCYMTRX relates to the classification of instruments as used in CMPM, see Appendix 1 of Patankar's report (included here in Appendix 12). The 10 groups of instruments which CMPM numbers 0, 10, 20...90 correspond to records 1, 11, 21...91 in PLCYMTRX. The 90 types of instrument which CMPM numbers 1-09, 11-19, 21-30...91-99 correspond to the records numbered 2-10, 12-20, 22-30...92-100 in PLCYMTRX. Each instrument type record in PLCYMTRX shows the length of time needed for servicing one type of instrument. These times are in fields 3-5, in units of 0.1 hour. But records 1, 11, 21...91 are not needed for use in this way, as in CMPM they correspond to instrument groups, not to instrument types, see Patankar's Appendix 1. They can therefore be used to store another type of information.

In these ten records only, fields 1-3 represent the time intervals between preventive maintenance servicings, in weeks, for the three levels of service. Ten general schemes for servicing can thus be entered in this way into CMPM (more than necessary, four or five would be enough). This allows CMPM to schedule more frequent checks for critical instruments and less frequent checks for others.

One of the ten servicing schemes, which are identified as 1, 2, 3...10, is attributed to each type of instrument by the entry in field 2 of its record in PLCYMTRX. The fieldname for this field, PM_SCH_NO, signifies "Preventive Maintenence Schedule Number".

The intervals between services in the ten servicing schemes, and the time units for the three levels of servicing for each type of instrument, can be modified by the user. To do this return from CMPM to dBase and enter:

USE PLCYMTRX

Then enter:

BROWSE

The policy matrix will be displayed and then be edited using standard dBase commands.

12. Working on CMPM

The wordprocessor of dBase III (MODIFY COMMAND) offers a convenient way to develop CMPM, but this is not easy as there are no explanatory remarks in the current version of CMPM's programs. Some of these have many lines of logic and are not easy to follow. Fortunately the modular construction of CMPM makes it possible to work on only one Main Menu function at a time.

One can enter DO CMPMPRIN from dBase III to print out a complete set of CMPM program files. This is preceded by a list showing the order in which they will be printed: they appear grouped as in Appendix 5 but with the groups in a different order. Cut the printout paper to separate the programs and mark them with the reference numbers in Appendix 5. Staple together the programs in each group.

Two short subroutines CNF.PRG and PD.PRG, the only PRG files used in more than one program group, are printed out among the other files. Separate them and staple them with CMPM.PRG and MAINMENU.PRG.

The purpose of PD is evident (Print or Display a report) but that of CNF (Choose Number of Function) is not. It is used in almost every program, after a choice or menu selection, and follows a standard set of nine program lines beginning with the definition of a text variable P. See for example DIGRSCHE.PRG (program 105) for illustrations of this. The nine standard lines accept the choice or menu selection, but only after checking that it is legitimate. CNF then holds the choice in view and available for correction until it is confirmed by pressing ENTER.

Identifying and marking all blocks of lines beginning with P and ending DO CNF will be found to simplify many programs. Little may then remain apart from a menu and a few lines of logic.

13. Further development of CMPM

A useful exercise for trainees learning to use CMPM would be to work through a group of its programs, figure out the purpose of each set of lines, and enter this in the program as a "remark" (a text line preceded by an asterisk).

In the present version of CMPM some choices or menu selections respond correctly to an entry in upper case but respond unpredictably to lower case. This could be corrected. Meanwhile it is best to set Caps Lock "on" when working with the program.

CMPM's screen messages are in English. It would be useful to produce French or other versions, and this would not be difficult to do. Pieces of text needing translation always appear in the programs between quotation marks and follow P=, ?, SAY, WAIT, or ACCEPT. This could be another job for trainees.

The usefulness of CMPM in real-life maintenance management has been confirmed by those who are using it in the countries in which it was created. Many hospitals in the advanced countries use a similar but more sophisticated program HECS (Hospital Equipment Control System) produced and distributed by the nonprofit organisation ECRI (Equipment Control Research Institute). HECS could be a source of ideas for the further development of CMPM.

Consideration should also be given to simplifying CMPM. A cut-down version, with shorter questionnaires and report forms, or limited to inventory functions only, could be attractive to smaller institutions. Some of CMPM's complexity is a consequence of its use as a training exercise in the IAEA's Research Programme. Other training exercises could produce simplified versions, using information provided in this note.

14. Conclusion

Although it has great utility, a computerised system cannot replace the written records on which maintenance systems have hitherto been based. Written records, and the dates and signatures they carry, are especially useful if something goes seriously wrong. But a program such as CMPM is a great help for keeping order in a written system, and its daily use can offer some protection to the maintenance manager against troubles which may be lying, hitherto undetected, in his paperwork.

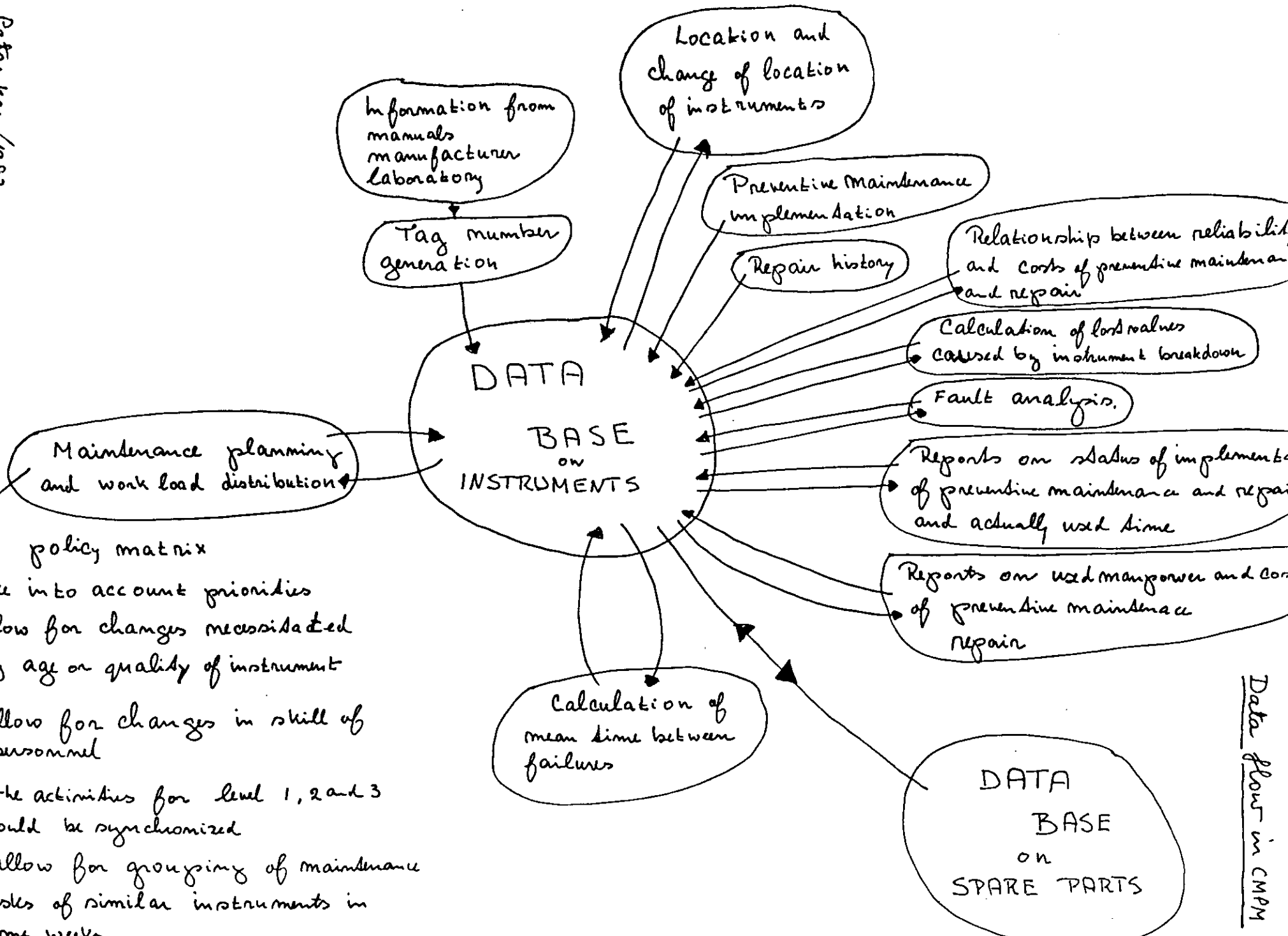
CMPM Main Menu

CMPM FUNCTION MENU

NO	FUNCTION
**	********
0	ENTTER INSTRUMENT INFORMATION
1	SCHEDULE/RESCHEDULE INSTRUMENTS FOR QC+PM
2	EDIT/DELETE/LOOK INSTRUMENT INFORMATION
3	EDIT PARAMETERS OF SCHEDULE FOR QC+PM(LOCATION,PERSON)
4	EDIT/ENTER QUESTION FORM FOR PREVENTIVE MAINTENANCE
5	ENTER EXECUTED FINDINGS OF PREVENTIVE MAINTENANCE & QC
6	ENTER REPAIR DETAILS
7	ENTER/UPDATE/SEARCH SPARE PARTS
8	INFORMATION SEARCH
9	GENERATE REPORTS
G	GRAPHICS REPRESENTATION
S	SUMMARY OF PREVENTIVE MAINTENANCE
I	INITIALISE CMPM DATABASE
X	EXIT FROM PROGRAM

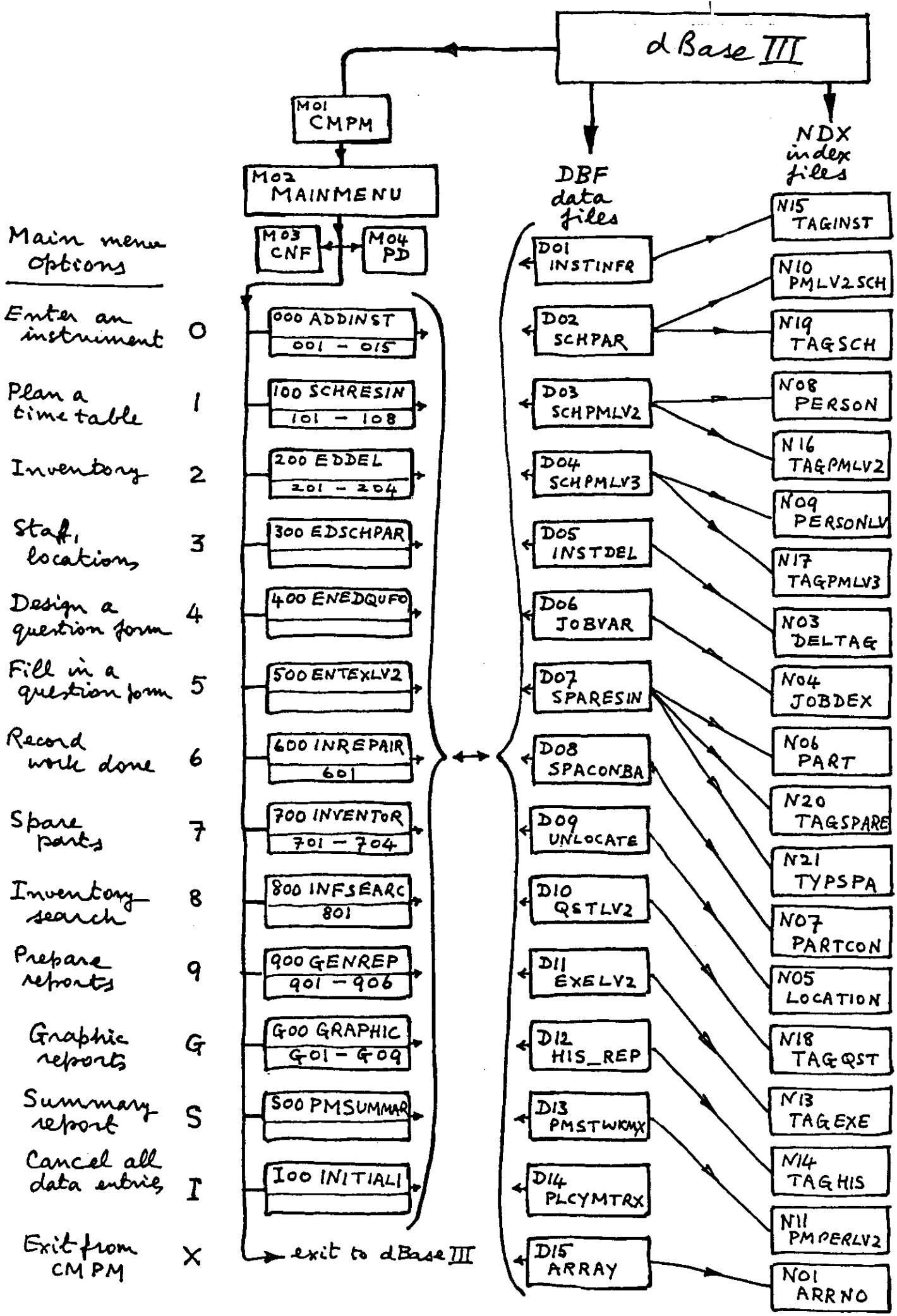
ENTER NUMBER AS REQUIRED FUNCTION :

Patankar/1982



1. use policy matrix
2. take into account priorities
3. allow for changes necessitated by age or quality of instrument
4. allow for changes in skill of personnel
5. the activities for level 1, 2 and 3 should be synchronized
6. allow for grouping of maintenance tasks of similar instruments in same weeks.

Data flow in CMPM


dBase III
M01 CMPM
M02 MAINMENU
M03 CNF
M04 PD
DBF data files
NDX index files
Main menu Options
Enter an instrument 0
Plan a time table 1
Inventory 2
Staff, locations 3
Design a question form 4
Fill in a question form 5
Record work done 6
Spare parts 7
Inventory search 8
Prepare reports 9
Graphic reports G
Summary report S
Cancel all data entries I
Exit from CM PM X
000 ADDINST
001 - 015
100 SCHRESIN
101 - 108
200 EDDEL
201 - 204
300 EDSCHPAR
400 ENEDQUFO
500 ENTEXLV2
600 INREPAIR
601
700 INVENTOR
701 - 704
800 INFSEARC
801
900 GENREP
901 - 906
G00 GRAPHIC
G01 - G09
S00 PMSUMMAR
I00 INITIALI
exit to dBase III
D01 INSTINFR
D02 SCHPAR
D03 SCHPMLV2
D04 SCHPMLV3
D05 INSTDEL
D06 JOBVAR
D07 SPARESIN
D08 SPACONBA
D09 UNLOCATE
D10 QSTLV2
D11 EXELV2
D12 HIS_REP
D13 PMSTWKMX
D14 PLCYMTRX
D15 ARRAY
N15 TAGINST
N10 PMLV2SCH
N19 TAGSCH
N08 PERSON
N16 TAGPMLV2
N09 PERSONLV
N17 TAGPMLV3
N03 DELTAG
N04 JOBDEX
N06 PART
N20 TAGSPARE
N21 TYPSPA
N07 PARTCON
N05 LOCATION
N18 TAGQST
N13 TAGEXE
N14 TAGHIS
N11 PMPERLV2
N01 ARRNO

ADDINST	PRG	4251
AEMENU	PRG	583
AIMENU	PRG	621
ARRTEST	PRG	140
CALLOST	PRG	2212
CALTAG	PRG	4954
CMPM	PRG	1806
CMPMPRIN	PRG	142
CNF	PRG	235
DELINST	PRG	4821
DICHSCHE	PRG	2004
DIGRSCHE	PRG	1108
DILOSCHE	PRG	821
DIPMPESC	PRG	546
DOCUMENT	PRG	2678
EDDEL	PRG	1010
EDINSTIN	PRG	3071
EDSCHPAR	PRG	4715
EDTEMP	PRG	2770
ENEDQUFO	PRG	3183
ENTEXLV2	PRG	3698
ENTSPA	PRG	1888
FILDIS	PRG	781
GENREP	PRG	4623
GRAPH	PRG	2257
GRAPH1	PRG	2280
GRAPHIC	PRG	1668
HISPMLV2	PRG	2763
INFSEARC	PRG	513
INITIAL1	PRG	2755
INREPAIR	PRG	4841
INVENTOR	PRG	1152
INWKPMP2	PRG	1744
JOBPRINT	PRG	2102
JOBREP	PRG	2162
KEYSEARC	PRG	2101
LISSCHIN	PRG	1687
LOOKINFR	PRG	3810
MAINMENU	PRG	2090
MEMENU	PRG	642
MIMENU	PRG	610
MOINGR	PRG	2526
MOINSLOC	PRG	2354
MSMENU	PRG	657
PD	PRG	439
PMSUMMAR	PRG	2412
POSENTRY	PRG	259
PRMENU	PRG	622
QFORM	PRG	1544
QTEMP	PRG	1042
RECTANGL	PRG	244
REMENU	PRG	574
REPAIRHI	PRG	3847
RESCHEDU	PRG	1708
RIMENU	PRG	612
SCHEDULE	PRG	4873
SCHRESIN	PRG	1338
SEARCH	PRG	1253
SHOWPMPE	PRG	1292
SPAREP	PRG	1050
SPASEA	PRG	2389
SPAUP	PRG	3319
SSMENU	PRG	587
STARTWK	PRG	210
STMENU	PRG	606
TOWKLDV2	PRG	1171
TOWKLDV3	PRG	1082
UPDATE	PRG	1898
WEEKSEL	PRG	518
WKLDLV2	PRG	1998
WKLDLV3	PRG	1749

ARRAY	DBF	755
EXELV2	DBF	1787
HIS_REP	DBF	5743
INSTDEL	DBF	137
INSTINFR	DBF	8911
JOBVAR	DBF	217
PLCYMTRX	DBF	1991
PMSTWKMX	DBF	2657
QSTLV2	DBF	1759
SCHPAR	DBF	1357
SCHPMLV2	DBF	1024
SCHPMLV3	DBF	523
SPACONBA	DBF	517
SPARESIN	DBF	512
UNLOCAT	DBF	498
EXELV2	DBT	1565
MESG	MEM	303
LOADLV2	FRM	1990
LOADLV3	FRM	1990

ARRNO	NDX	2560
COPY	NDX	33328
DELTAG	NDX	1025
JOBDEX	NDX	1025
LOCATION	NDX	1536
PART	NDX	1536
PARTCON	NDX	1536
PERSON	NDX	1025
PERSONLV	NDX	1025
PMLV2SCH	NDX	1536
PMPERLV2	NDX	1536
SORT	NDX	16664
TAGEXE	NDX	1536
TAGHIS	NDX	1536
TAGINST	NDX	1024
TAGPMLV2	NDX	1025
TAGPMLV3	NDX	1025
TAGQST	NDX	1025
TAGSCH	NDX	1536
TAGSPARE	NDX	1025
TYPSPA	NDX	1536

PRG file	Ref	Function
Group M		Miscellaneous program files.
CMPM	M01	Title screen. Asks for and checks password.
MAINMENU	M02	Menu for choosing one of the 13 main functions of CMPM.
CNF	M03	Short routine called by many programs (Choose No of Function).
PD	M04	Short routine for report printing (Print or Display).
Group 0		Add data for a new instrument.
ADDINST	000	Menu for choosing group of instruments
NSMENU	001	Menu for type in a group: Nuclear safety (dosemeter etc)
PRMENU	002	Preservation (UPS, CVT, etc)
STMENU	003	Standardisation (standard meter etc)
NIMENU	004	Nuclear instruments (MCA etc)
REMENU	005	Recorders (pen, printer, etc)
AIMENU	006	Analytical (pH meter etc)
RIMENU	007	Repair (CRO, pulse generator, etc)
AEMENU	008	Auxiliary equip (centrifuge etc)
NDMENU	009	Nuclear detectors (GeLi, GM, etc)
SSMENU	010	Special systems (reactor control etc)
POSENTRY	011	Select group/type
RECTANGL	012	Draws rectangle around group menu
CALTAG	013	Enter details of a new instrument
UPDATE	014	Enter names of people who will maintain the instrument
STARTWK	015	(STARTWK is not used, it has been built into 014)
Group 1		Schedule or reschedule maintenance for an instrument.
SCHRESIN	100	Want to see instrument lists ? Schedule or reschedule ?
LISSCHIN	101	Lists instruments in the system
RESCHEDU	102	Reschedules maintenance for an instrument
SCHEDULE	103	Schedules maintenance for an instrument
DICHSCHE	104	Menu: choose type of scheduling
DIGRSCHE	105	Menu: choose an instrument group for rescheduling
DILOSCHE	106	Menu: choose a location for rescheduling
DIPMPESC	107	Want to change instruments/week for a maintenance person ?
SHOWPMPE	108	Shows instr/wk for a maintenance person, allows changes
Group 2		Edit/delete/display information about an instrument.
EDDEL	200	Choose edit, delete, or search for information
SEARCH	201	Displays lists so tag number can be found
EDINSTIN	202	Edit information about an instrument
DELINST	203	Delete an instrument
LOOKINFR	204	Displays information recorded for an instrument
Group 3		Edit parameters (location, mtce person) for an instrument.
EDSCHPAR	300	Accepts changes for rescheduling the system

Group 4 Create or edit a question form for maintenance results.

ENEDQUFO	400	Accepts questions for questionnaire form

Group 5 Enter results of preventive maintenance.

ENTEXLV2	500	Accepts results

Group 6 Enter details of repair work.

INREPAIR	600	Presents form for entering repair data
CALLOST	601	Calculates cost of the repair

Group 7 Enter/update/search for information about spare parts.

INVENTOR	700	Choose: enter, update, or search
ENTSPAR	701	Enter stock of spare parts for an instrument
SPAUP	702	Enter parts used - from stock or from outside ?
SPAREP	703	Reports availability of spare parts
SPASEA	704	Investigates availability of spare parts

Group 8 Search for information about an instrument.

INFSEARC	800	Search for more instruments ?
KEYSEARC	801	Choose key for search (type of instrument, manufacturer, etc)

Group 9 Generate and print out reports.

GENREP	900	Menu: type of report. Generates report types 0/1/2/3/8/9
QFORM	901	Generates report type 4
JOBREP	902	Generates report type 5
WEEKSEL	903	Choose week to which report type 9 refers
JOBPRINT	904	Prints report type 5
REPAIRH1	905	Generates report type 7
HISPMLV2	906	Generates report type 6

Group G Generate graphic displays.

GRAPHIC	G00	Menu: choose type of graph
GRAPH	G01	Generates graph: 1. Time per instrument on Level 2
GRAPH1	G02	2. Time per instrument on Level 3
WKLDLV2	G03	4. Yearly load per person, Level 2
WKLDLV3	G04	5. Yearly load per person, Level 3
TOWKLDV2	G05	6. Weekly load, Level 2
TOWKLDV3	G06	7. Weekly load, Level 3
NOINGR	G07	3. Number of instruments in each group
INWKPMP2	G08	8. Instruments per week/person, Level 2
NOINSLOC	G09	9. Instruments per location

Group S	Prepare summary of preventive maintenance work.	
PMSUMMAR	S00	Generates summary (workloads of staff, number of instruments, total time, total cost, downtime, etc)
Group I	Initialise databases (cancel all recorded data).	
INITIALI	I00	Empties all databases (DELETE ALL and PACK)

DBF file	Ref	Fields		Programs in which used	Ref	Content of DBF file
INSTINFR	D01	53	*	CALTAG	013	Full information about each instrument. Includes address of supplier, when received, spares held, etc.
				SEARCH	201	
				EDSCHPAR	300	
				ENTEXLV2	500	
				INREPAIR	600	
				ENTSPAR	701	
				SPASEA	704	
				INFSEARC	800	
				GENREP	900	
				JOBPRINT	905	
				REPAIRHI	906	
				HISPML2	907	
				PMSUMMAR	S00	
				INITIALI	I00	
SCHPAR	D02	9		CALTAG	013	Scheduling parameters. Location, condition, maintenance personel, for each instrument.
				LISSCHIN	101	
				RESCHEDU	102	
				SCHEDULE	103	
				SEARCH	201	
			*	EDSCHPAR	300	
				ENEDQUFO	400	
				JOBREP	903	
				INITIALI	I00	
SCHPMLV2	D03	16		RESCHEDU	102	PM Level 2 scheduling data for each instrument.
				SCHEDULE	103	
				EDSCHPAR	300	
				GENREP	900	
				JOBREP	903	
				GRAPH	G01	
				WKLDLV2	G03	
				TOWKLDV2	G05	
				PMSUMMARY	S00	
				INITIALI	I00	
SCHPMLV3	D04	11		RESCHEDU	102	PM Level 3 scheduling data for each instrument.
				SCHEDULE	103	
				DELINST	203	
				EDSCHPAR	300	
				GENREP	900	
				GRAPH1	G02	
				WKLDLV3	G04	
				TOWKLDV3	G06	
				PMSUMMAR	S00	
				INITIALI	I00	
INSTDEL	D05	1		CALTAG	013	Record of allocated Tag Nos.
				DELINST	203	
				INITIALI	I00	

* Data entered directly from keyboard.
In other cases, automatically by CMPM.

JOBVAR	D06	1	* INREPAIR	600	Tag No. of an instrument for which job history is to be entered.
			JOBPRINT	905	
			NOINGR	G07	
SPARESIN	D07	6	* ENTSPAR	701	Spare parts held for each instrument.
			SPASEA	704	
			GENREP	900	
			INITIALI	I00	
SPACONBA	D08	10	* SPAUP	702	Spares in stock and used. SPAUP calculates balances held.
			INITIALI	I00	
UNLOCATE	D09	2	UPDATE	014	Locations where there are instruments, how many at each place.
			DILOSCHE	106	
			DELINST	203	
			EDSCHPAR	300	
			NOINSLOC	G09	
			PMSUMMAR	S00	
			INITIALI	I00	
QSTLV2	D10	12	DELINST	203	Texts for questions about servicing results, for each instrument.
			ENEDQUFO	400	
			* ENTEXLV2	500	
			QFORM	902	
			HISPMLV2	907	
			INITIALI	I00	
EXELV2	D11	25	* DELINST	203	Answers to questions about servicing results, for each instrument.
			ENTEXLV2	500	
			INITIALI	I00	
HIS_REP	D12	52	* INREPAIR	600	PM history of each instrument.
			INITIALI	I00	
PMSTWKMX	D13	56	UPDATE	014	Capability (instruments/ week) off each mtce person. Schedule of each person for next 52 weeks.
			RESCHEDU	102	
			SCHEDULE	103	
			SHOWMPE	108	
			DELINST	203	
			EDSCHPAR	300	
			GENREP	900	
			INWKPMP2	G08	
			PMSUMMAR	S00	
			INITIALI	I00	
PLCYMTRX	D14	8	CALTAG	013	"Policy Matrix". Holds permanent data for scheduling each type of instrument.
			SCHEDULE	103	
			DIGRSCHE	104	
			DELINST	203	
			INREPAIR	600	
			NOINGR	G07	
			INITIALI	I00	
ARRAY	D15	3	RESCHEDU	102	Holds intermediate data for scheduling.
			SCHEDULE	103	
			DELINST	203	
			EDSCHPAR	300	
			GENREP	900	
			INWKPMP2	G08	

Structures of CMPM data files

D01 INSTINFR

Field	Field Name	Type	Width
1	TAGNO	Numeric	4
2	INST_NAME	Character	20
3	MODEL_NO	Character	10
4	SERIAL_NO	Character	10
5	INVT_NO	Character	10
6	YR_MNFRC	Numeric	4
7	MNFRC_NAME	Character	15
8	ADDR_MNFRC	Character	35
9	TLEX_MNFRC	Character	15
10	MNFRC_PHON	Character	15
11	SUPLR_NAME	Character	35
12	ADDR_SUPLR	Character	35
13	SUPLR_PHON	Character	15
14	PRICE_FC	Character	10
15	PRICE_LOC	Numeric	10
16	DT_ARRVL	Date	8
17	DT_COMMIS	Date	8
18	END_WARNTY	Date	8
19	RPIR_CONTR	Character	20
20	RPIR_PHON	Character	10
21	INST_LOC	Character	15
22	MAIN_USER	Character	25
23	MAIN_OPTR	Character	25
24	USER_PHON	Character	10
25	OPRT_MANL	Logical	1
26	SRVC_MANL	Logical	1
27	CKT_DIAG	Logical	1
28	MANL_LOC	Character	15
29	PARTS_LIST	Logical	1
30	ACCRS	Character	25
31	WATT_VA	Character	6
32	OPRT_VOLT	Character	12
33	RH	Character	12
34	TEMP	Character	12
35	STBLR_USED	Character	12
36	DOR_CAP	Character	12
37	PM_HEAD	Character	20
38	PMHEADPHON	Character	10
39	SP_TST_EQP	Character	20
40	SPARE_AVIL	Logical	1
41	PM_PER_LV2	Character	25
42	PM_PER_LV3	Character	25
43	CAL_VALU	Numeric	10
44	REAL_VALU	Numeric	10
45	CVAL_UP_YR	Numeric	4
46	RVAL_UP_YR	Numeric	4
47	PERIPHERAL	Character	25
48	PM_REF	Character	25
49	PARTNER	Character	25
50	TOT_LO_VAL	Numeric	10
51	TOT_RP_CST	Numeric	10
52	TOT_DN_TM	Numeric	10
53	INS_UND_RE	Logical	1

D02 SCHPAR

Field	Field Name	Type	Width
1	TAGNO	Numeric	4
2	INST_LOC	Character	15
3	PM_PER_LV2	Character	25
4	PM_PER_LV3	Character	25
5	INST_PRIOR	Logical	1
6	SCHEDULE	Logical	1
7	Q_FACTOR	Numeric	1
8	INST_NAME	Character	20
9	SKI_EXP_FA	Numeric	1

D03 SCHPMLV2

Field	Field Name	Type	Width
1	TAGNO	Numeric	4
2	LV2_1	Numeric	2
3	LV2_2	Numeric	2
4	LV2_3	Numeric	2
5	LV2_4	Numeric	2
6	LV2_5	Numeric	2
7	LV2_6	Numeric	2
8	LV2_M	Numeric	2
9	LV2_BW	Numeric	2
10	LV2_W	Numeric	2
11	LV2_D	Numeric	2
12	NO_OF_LV2	Numeric	2
13	TOT_TU_LV2	Numeric	4
14	TU_LV2	Numeric	3
15	INST_NAME	Character	20
16	PM_PER_LV2	Character	25

D04 SCHPMLV3

Field	Field Name	Type	Width
1	TAGNO	Numeric	4
2	LV3_1	Numeric	2
3	LV3_2	Numeric	2
4	LV3_3	Numeric	2
5	LV3_4	Numeric	2
6	LV3_M	Numeric	2
7	TU_LV3	Numeric	2
8	TOT_TU_LV3	Numeric	4
9	NO_OF_LV3	Numeric	2
10	INST_NAME	Character	20
11	PM_PER_LV3	Character	25

D05 INSTDEL

Field	Field Name	Type	Width
1	TAGNO	Numeric	4

D06 JOBVAR

Field	Field Name	Type	Width
1	TEMPVAR	Numeric	4

D07 SPARESIN

Field	Field Name	Type	Width
1	TAGNO	Numeric	4
2	PART_NO	Character	20
3	PART_NAME	Character	20
4	TYPE_NO	Character	15
5	QTY	Numeric	2
6	LAST_BAL	Numeric	2

D08 SPACONBA

Field	Field Name	Type	Width
1	PART_NO	Character	20
2	USER	Character	25
3	QTY_USED	Numeric	2
4	BALANCE	Numeric	2
5	DT_OF_USE	Date	8
6	TAGNO	Numeric	4
7	GEST_STOCK	Logical	1
8	TYPE_NO	Character	15
9	OUT_STOCK	Numeric	2
10	OWN_STOCK	Logical	1

D09 UNLOCATE

Field	Field Name	Type	Width
1	INST_LOC	Character	15
2	NO_OF_INST	Numeric	3

D10 QSTLV2

Field	Field Name	Type	Width
1	TAGNO	Numeric	4
2	Q1LV2	Character	50
3	Q2LV2	Character	50
4	Q3LV2	Character	50
5	Q4LV2	Character	50
6	Q5LV2	Character	50
7	Q6LV2	Character	50
8	DC1	Character	6
9	DC2	Character	6
10	DC3	Character	6
11	DC4	Character	6
12	DC5	Character	6

D11 EXELV2

Field	Field Name	Type	Width	Dec
1	TAGNO	Numeric	4	
2	DATE	Date	8	
3	PM_PER_LV2	Character	25	
4	ANS1_1LV2	Numeric	5	2
5	ANS1_2LV2	Numeric	3	
6	ANS1_3LV2	Numeric	5	2
7	ANS1_4LV2	Numeric	3	
8	ANS1_5LV2	Numeric	5	2
9	ANS1_6LV2	Numeric	3	
10	ANS1_7LV2	Numeric	5	2
11	ANS1_8LV2	Numeric	3	
12	ANS1_9LV2	Numeric	5	2
13	ANS1_10LV2	Numeric	3	
14	ANS2LV2	Character	10	
15	ANS3LV2	Character	10	
16	ANS4LV2	Character	10	
17	ANS5LV2	Character	1	
18	ANS6LV2	Character	1	
19	ANS7LV2	Character	1	
20	ANS8LV2	Character	20	
21	M1	Character	1	
22	M2	Character	1	
23	M3	Character	1	
24	M4	Character	1	
25	M5	Character	1	

D14 PLCYMTRX

Field	Field Name	Type	Width
1	EXP_SER_YR	Numeric	2
2	PM_SCH_NO	Numeric	2
3	TU_LV1	Numeric	2
4	TU_LV2	Numeric	2
5	TU_LV3	Numeric	2
6	NO_OF_INST	Numeric	2
7	ROW_NO	Numeric	2
8	NOINSTDEL	Numeric	2

D15 ARRAY

Field	Field Name	Type	Width
1	NO	Numeric	2
2	WK	Character	4
3	LV2S	Character	5
## Total ##			12

D12 HIS_REP

Field	Field Name	Type	Width
1	TAGNO	Numeric	4
2	FLT_DATE	Date	8
3	FLT_RP_DT	Date	8
4	CAUSE	Character	30
5	FLT_TYPE	Character	30
6	MALF1	Character	20
7	MALF2	Character	20
8	MALF3	Character	20
9	DIAG_MAN	Character	25
10	DIA_MN_HR	Numeric	3
11	WAGE_HR1	Numeric	5
12	DIAG_COST	Numeric	8
13	REP_MAN	Character	25
14	REP_MN_HR	Numeric	3
15	WAGE_HR2	Numeric	5
16	REP_COST	Numeric	8
17	NM_PART1	Character	20
18	MDL1	Character	15
19	QNTY1	Numeric	3
20	NM_PART2	Character	20
21	MDL2	Character	15
22	QNTY2	Numeric	3
23	NM_PART3	Character	20
24	MDL3	Character	15
25	QNTY3	Numeric	3
26	NM_PART4	Character	20
27	MDL4	Character	15
28	QNTY4	Numeric	3
29	TM_GET_PT	Numeric	3
30	TOT_PT_CST	Numeric	8
31	SYS_COND	Character	30
32	WHY_DLY	Character	30
33	REMARKS	Character	40
34	DIA_DATE	Date	8
35	END_DATE	Date	8
36	PART1_NO	Character	10
37	PART2_NO	Character	10
38	PART3_NO	Character	10
39	PART4_NO	Character	10
40	END_DIA_DT	Date	8
41	STA_REP_DT	Date	8
42	END_REP_DT	Date	8
43	QC_CHE_BY	Character	25
44	OVERHEAD	Numeric	3
45	COST1	Numeric	10
46	COST2	Numeric	10
47	COST3	Numeric	10
48	COST4	Numeric	10
49	OVE_HEA_CO	Numeric	10
50	LA_RP_CST	Numeric	10
51	LOST_VALU	Numeric	10
52	LA_DN_TM	Numeric	10

D13 PMSTWKMX

Field	Field Name	Type	Width
1	PM_PER_LV2	Character	25
2	STRTWEEK	Numeric	2
3	MAX_INS_WK	Numeric	1
4	WK1	Numeric	1
5	WK2	Numeric	1
6	WK3	Numeric	1
7	WK4	Numeric	1
8	WK5	Numeric	1
9	WK6	Numeric	1
10	WK7	Numeric	1
11	WK8	Numeric	1
12	WK9	Numeric	1
13	WK10	Numeric	1
14	WK11	Numeric	1
15	WK12	Numeric	1
16	WK13	Numeric	1
17	WK14	Numeric	1
18	WK15	Numeric	1
19	WK16	Numeric	1
20	WK17	Numeric	1
21	WK18	Numeric	1
22	WK19	Numeric	1
23	WK20	Numeric	1
24	WK21	Numeric	1
25	WK22	Numeric	1
26	WK23	Numeric	1
27	WK24	Numeric	1
28	WK25	Numeric	1
29	WK26	Numeric	1
30	WK27	Numeric	1
31	WK28	Numeric	1
32	WK29	Numeric	1
33	WK30	Numeric	1
34	WK31	Numeric	1
35	WK32	Numeric	1
36	WK33	Numeric	1
37	WK34	Numeric	1
38	WK35	Numeric	1
39	WK36	Numeric	1
40	WK37	Numeric	1
41	WK38	Numeric	1
42	WK39	Numeric	1
43	WK40	Numeric	1
44	WK41	Numeric	1
45	WK42	Numeric	1
46	WK43	Numeric	1
47	WK44	Numeric	1
48	WK45	Numeric	1
49	WK46	Numeric	1
50	WK47	Numeric	1
51	WK48	Numeric	1
52	SLIDE	Numeric	2
53	WK49	Numeric	1
54	WK50	Numeric	1
55	WK51	Numeric	1
56	WK52	Numeric	1

List of CMPM database field names

In this documentation each database (DBF file) in CMPM is referred to by a D No. (D01, D02....D15) as shown at the bottom of this page. In the list of field names given below the number shown against each field name is the D No. of the DBF, or DBFs, in which it occurs. Field names used in more than one DBF are marked with a vertical bar.

ACCRS	01	END_DIA_DT	12	MAIN_USER	01	PM_PER_LV2	11	SYS_COND	12	WK17	13
ADDR_MNFRC	01	END_REP_DT	12	MALF1	12	PM_PER_LV2	13	TAGNO	01	WK18	13
ADDR_SUPLR	01	END_WARNTY	01	MALF2	12	PM_PER_LV3	02	TAGNO	02	WK19	13
ANS1_10LV2	11	EXP_SER_YR	14	MALF3	12	PM_PER_LV3	04	TAGNO	03	WK2	13
ANS1_1LV2	11	FLT_DATE	12	MANL_LOC	01	PM_REF	01	TAGNO	04	WK20	13
ANS1_2LV2	11	FLT_RP_DT	12	MAX_INS_WK	13	PM_SCH_NO	14	TAGNO	05	WK21	13
ANS1_3LV2	11	FLT_TYPE	12	MDL1	12	PRICE_FC	01	TAGNO	07	WK22	13
ANS1_4LV2	11	GEST_STOCK	08	MDL2	12	PRICE_LOC	01	TAGNO	08	WK23	13
ANS1_5LV2	11	INST_LOC	01	MDL3	12	Q2LV2	10	TAGNO	10	WK24	13
ANS1_6LV2	11	INST_LOC	02	MDL4	12	Q3LV2	10	TAGNO	11	WK25	13
ANS1_7LV2	11	INST_LOC	09	MNFRC_NAME	01	Q4LV2	10	TAGNO	12	WK26	13
ANS1_8LV2	11	INST_NAME	01	MNFRC_PHON	01	Q5LV2	10	TEMP	01	WK27	13
ANS1_9LV2	11	INST_NAME	02	MODEL_NO	01	Q6LV2	10	TEMPVAR	06	WK28	13
ANS2LV2	11	INST_NAME	03	NM_PART1	12	QC_CHE_BY	12	TLEX_MNFRC	01	WK29	13
ANS3LV2	11	INST_NAME	04	NM_PART2	12	Q1LV2	10	TM_GET_PT	12	WK3	13
ANS4LV2	11	INST_PRIOR	02	NM_PART3	12	QNTY1	12	TOT_DN_TM	01	WK30	13
ANS5LV2	11	INS_UND_RE	01	NM_PART4	12	QNTY2	12	TOT_LD_VAL	01	WK32	13
ANS6LV2	11	INVT_NO	01	NO	15	QNTY3	12	TOT_PT_CST	12	WK33	13
ANS7LV2	11	LAST_BAL	07	NOINSTDEL	14	QNTY4	12	TOT_RP_CST	01	WK34	13
ANS8LV2	11	LA_DN_TM	12	NO_OF_INST	09	QTY	07	TOT_TU_LV2	03	WK35	13
BALANCE	08	LA_RP_CST	12	NO_OF_INST	14	QTY_USED	08	TOT_TU_LV3	04	WK36	13
CAL_VALU	01	LOST_VALU	12	NO_OF_LV2	03	Q_FACTOR	02	TU_LV1	14	WK37	13
CAUSE	12	LV2S	15	NO_OF_LV3	04	REAL_VALU	01	TU_LV2	03	WK38	13
CKT_DIAG	01	LV2_1	03	OPRT_MANL	01	REMARKS	12	TU_LV2	14	WK39	13
COSR2	12	LV2_2	03	OPRT_VOLT	01	REP_COST	12	TU_LV3	04	WK4	13
COST1	12	LV2_3	03	OUT_STOCK	08	REP_MAN	12	TU_LV3	14	WK40	13
COST3	12	LV2_4	03	OVERHEAD	12	REP_MN_HR	12	TYPE_NO	07	WK41	13
COST4	12	LV2_5	03	OVE_HEA_CO	12	RH	01	TYPE_NO	08	WK42	13
CVAL_UP_YR	01	LV2_6	03	OWN_STOCK	08	ROW_NO	14	USER	08	WK43	13
DATE	11	LV2_BW	03	PART1_NO	12	RPIR_CONTR	01	USER_PHON	01	WK44	13
DC1	10	LV2_D	03	PART2_NO	12	RPIR_PHON	01	WAGE_HR1	12	WK45	13
DC2	10	LV2_M	03	PART3_NO	12	RVAL_UP_YR	01	WAGE_HR2	12	WK46	13
DC3	10	LV2_W	03	PART4_NO	12	SCHEDULE	02	WATT_VA	01	WK47	13
DC4	10	LV3_1	04	PARTNER	01	SERIAL_NO	01	WH31	13	WK48	13
DC5	10	LV3_2	04	PARTS_LIST	01	SKI_EXP_FA	02	WHY_DLY	12	WK49	13
DIAG_COST	12	LV3_3	04	PART_NAME	07	SLIDE	13	WK	15	WK5	13
DIAG_MAN	12	LV3_4	04	PART_NO	07	SPARE_AVIL	01	WK1	13	WK50	13
DIAG_MN_HR	12	LV3_M	04	PART_NO	08	SP_TST_EQP	01	WK10	13	WK51	13
DIA_DATE	12	M1	11	PERIPHERAL	01	SRVC_MANL	01	WK11	13	WK52	13
DOR_CAP	01	M2	11	PMHEADPHON	01	STA_REP_DT	12	WK12	13	WK6	13
DT_ARRVL	01	M3	11	PM_HEAD	01	STBLR_USED	01	WK13	13	WK7	13
DT_COMMIS	01	M4	11	PM_PER_LV2	01	STRTWEEK	13	WK14	13	WK8	13
DT_OF_USE	08	M5	11	PM_PER_LV2	02	SUPLR_NAME	01	WK15	13	WK9	13
END_DATE	12	MAIN_OPTR	01	PM_PER_LV2	03	SUPLR_PHON	01	WK16	13	YR_MNFRC	01

Reference Nos (D Nos) for DBF files

D01	INSTINFR	D06	JOBVAR	D11	EXELV2
D02	SCHPAR	D07	SPARESINF	D12	HIS_REP
D03	SCHPMLV2	D08	SPACONBA	D13	PMSTWKMX
D04	SCHPMLV3	D09	UNLOCATE	D14	PLCYMTRX
D05	INSTDEL	D10	QSTLV2	D15	ARRAY

All database (DBF) files in CMPM except PLCYMTRX.DBF have one or more associated index (NDX) file. Each NDX file indexes only one field in its associated DBF file.

DBF database file		NDX index file		DBF field keyed by index file
D01	INSTINFR	N15	TAGINST	TAGNO
D02	SCHPAR	N10	PMLV2SCH	PM_PER_LV2
		N19	TAGSCH	TAGNO
D03	SCHPMLV2	N08	PERSON	PM_PER_LV2
		N16	TAGPMLV2	TAGNO
D04	SCHPMLV3	N09	PERSONLV	PM_PER_LV3
		N17	TAGPMLV3	TAGNO
D05	INSTDEL	N03	DELTAG	TAGNO
D06	JOBVAR	N04	JOBDEX	TEMPVAR
D07	SPARESIN	N06	PART	PART_NO
		N20	TAGSPARE	TAGNO
		N21	TYPSPA	TYPE_NO
D08	SPACONBA	N07	PARTCON	PART_NO
D09	UNLOCATE	N05	LOCATION	INSTLOC
D10	QSTLV2	N18	TAGQST	TAGNO
D11	EXELV2	N13	TAGEXE	TAGNO
D12	HIS_REP	N14	TAGHIS	TAGNO
D13	PMSTWKMX	N11	PMPERLV2	PM_PER_LV2
D14	PLCYMTRX		-	-
D15	ARRAY	N01	ARRNO	PM_PER_LV2

Ref No and kiloBytes (in brackets) for NDX files

N01	ARRNO	(2.7)	N08	PERSON	(1.0)	N15	TAGINST	(1.0)
N02	COPY	(33.3)	N09	PERSONLV	(1.0)	N16	TAGPMLV2	(1.0)
N03	DELTAG	(1.0)	N10	PMLV2SCH	(1.5)	N17	TAGPMLV3	(1.0)
N04	JOBDEX	(1.0)	N11	PMPERLV2	(1.5)	N18	TAGQST	(1.0)
N05	LOCATION	(1.5)	N12	SORT	(16.7)	N19	TAGSCH	(1.5)
N06	PART	(1.5)	N13	TAGEXE	(1.5)	N20	TAGSPARE	(1.0)
N07	PARTCON	(1.5)	N14	TAGHIS	(1.5)	N21	TYPSPA	(1.5)

The large NDX files N02 and N12 are on the CMPM diskette but are not used in running CMPM.

Utility programs and auxiliary files

Auxiliary files

MESG.MEM	A01	Memory file called by ADDINST.PRG (000).
LOADLV2.FRM	A02	Standard format used in GENREP.PRG (900).
LOADLV3.FRM	A03	Standard format used in GENREP.PRG (900).

Utility programs

CMPMPRIN.PRG	U01	Enter "DO CMPMPRIN" from dBase III to print a listing of CMPM's PRG files and then automatically run DOCUMENT.PRG.
DOCUMENT.PRG	U02	Enter "DO DOCUMENT" from dBase III to run DOCUMENT.PRG, which prints all CMPM's PRG files and then lists the fields of all CMPM DBF files. Make sure printer has at least 100 sheets of paper.
FILDIS.PRG	U03	Enter "DO FILDIS" from dBase III to see the status of all DBF files and the settings of the system.

Obsolete files remaining on current diskette

ARRTEST.PRG	M10	Test program.
EDTEMP.PRG	M11	Questionnaire for entering a new instrument.
QTEMP.PRG	M12	Questions for reporting results of maintenance work.
EXELV2.DBF	M13	Early version of D11.
STARTWK.PRG	015	Short routine now incorporated in 014.
COPY.NDX	N06	Large (33kB) index file, not used.
SORT.NDX	N12	Large (17kB) index file, not used.

PRG program		Makes use of PRG		DBF & NDX	Other	
Group M	General purpose files.					
CMPM	M01	MAINMENU	M02			
MAINMENU	M02	ADDINST	000			
		SCHRESIN	100			
		EDDEL	200			
		EDSCHPAR	300			
		ENEDQUFO	400			
		ENTEXLV2	500			
		INREPAIR	600			
		INVENTOR	700			
		INFSEARC	800			
		GENREP	900			
		GRAPHIC	G00			
		PMSUMMAR	S00			
		INITIALI	I00			
		CNF	M03			
CNF	M03					
PD	M04					
Group 0	Add data for a new instrument.					
ADDINST	000	NSMENU	001		MESG.MEM	A01
		PRMENU	002			
		STMENU	003			
		NIMENU	004			
		REMENU	005			
		AIMENU	006			
		RIMENU	007			
		AEMENU	008			
		NDMENU	009			
		SSMENU	010			
		POSENTRY	011			
		RECTANGL	012			
		CNF	M03			
NSMENU	001					
PRMENU	002					
STMENU	003					
NIMENU	004					
REMENU	005					
AIMENU	006					
RIMENU	007					
AEMENU	008					
NDMENU	009					
SSMENU	010					
POSENTRY	011	CNF	M03			
		CALTAG	013			

PRG program		Makes use of PRG		DBF & NDX		Other
RECTANGL	012					
CALTAG	013	CNF	M03	PLCYMTRX	D14	
				INSTDEL	D05	
				DELTAG	N03	
				INSTINFR	D01	
				TAGINST	N15	
				PLCYMTRX	D14	
				SCHPAR	D02	
				TAGSCH	N19	
				PMLV2SCH	N10	
UPDATE	014	CNF	M03	UNLOCAT	D09	
				LOCATION	N05	
				PMSTWKMX	D13	
				PMPERLV2	N11	
STARTWK	(now part of 014)					

Group 1 Schedule or reschedule maintenance for an instrument.

SCHRESIN	100	LISSCHIN	101			
		RESCHEDU	102			
		SCHEDULE	103			
		CNF	M03			
LISSCHIN	101	CNF	M03	SCHPAR	D02	
				TAGSCH	N19	
RESCHEDU	102	DICHSCHE	104	SCHPAR	D02	
				TAGSCH	N19	
				SCHPMLV3	D04	
				TAGPMLV3	N17	
				PERSONLV3	N09	
				SCHPMLV2	D03	
				TAGPMLV2	N16	
				PERSON	N08	
				PMSTWKMX	D13	
				PMPERLV2	N11	
				ARRAY	D15	
				ARRNO	N01	
SCHEDULE	103	DICHSCHE	104	SCHPAR	D02	
				TAGSCH	N19	
				PLCYMTRX	D14	
				PMSTWKMX	D13	
				PMPERLV2	N11	
				SCHPMLV2	D03	
				PERSON	N08	
				TAGPMLV2	N16	
				ARRAY	D15	
				ARRNO	N01	

PRG program		Makes use of PRG		DBF & NDX		Other
				SCHPMLV3	D04	
				PERSONLV	N09	
				TAGPMLV3	N17	
DICHSCHE	104	DIPMPESC	107			
		DIGRSCHE	105			
		DILOSCHE	106			
		CNF	M03			
DIGRSCHE	105	CNF	M03	PLCYMTRX	D14	
DILOSCHE	106			UNLOCAT	D09	
				LOCATION	N05	
DIPMPESC	107	SHOWPME	108			
		CNF	M03			
SHOWPMPE	108	CNF	M03	PMSTWKMX	D13	
				PMPERLV2	N11	

Group 2 Edit/delete/display information about an instrument.

EDDEL	200	EDINSTIN	202			
		DELINST	203			
		LOOKINFR	204			
		CNF	M03			
SEARCH	201	CNF	M03	SCHPAR	D02	
				TAGSCH	N19	
				INSTINFR	D01	
				TAGINST	N15	
EDINSTIN	202	SEARCH	201			
		CNF	M03			
DELINST	203	SEARCH	201	UNLOCATE	D09	
		CNF	M03	LOCATION	N05	
				PMSTWKMX	D13	
				PMPERLV2	N11	
				ARRAY	D15	
				ARRNO	N01	
				SCHPMLV3	D04	
				TAGPMLV3	N17	
				PERSONLV	N09	
				INSTDEL	D05	
				DELTAG	N03	
				PLCYMTRX	D14	
				QSTLV2	D03	
				TAGQST	N18	
				EXELV2	D11	
				TAGEXE	N13	

PRG program		Makes use of PRG		DBF & NDX	Other
LOOKINFR	204	SEARCH	201		
		CNF	M03		

Group 3 Edit parameters (location, mtce person) for scheduling.

EDSCHPAR	300	CNF	M03	SCHPAR	D02
				TAGSCH	N19
				PMLV2SCH	N10
				INSTINFR	D01
				TAGINST	N15
				UNLOCAT	D09
				LOCATION	N05
				SCHPMLV3	D04
				TAGPMLV3	N17
				PERSONLV	N09
				SCHPMLV2	D02
				TAGPMLV2	N16
				PERSON	N08
				PMSTWKMX	D13
				PMPERLV2	N11
				ARRAY	D15
				ARRNO	N01

Group 4 Edit or enter data into a question form for maintenance results

ENEDQUFO	400	CNF	M03	SCHPAR	D02
				TAGSCH	N19
				QSTLV2	D10
				TAGQST	N18

Group 5 Enter results of preventive maintenance work.

ENTEXLV2	500	CNF	M03	INSTINFR	D01
				TAGINST	N15
				EXELV2	D11
				TAGEXE	N13
				QSTLV2	D10
				TAGQST	N18

Group 6 Enter details of repair work.

INREPAIR	600	CALLOST	601	JOBVAR	D06
		CNF	M03	JOBDEX	N04
				INSTINFR	D01
				TAGINST	N15
				PLCYMTRX	D14
				HIS_REP	D12
				TAGHIS	N14

PRG program		Makes use of PRG		DBF & NDX		Other	
CALLOST	601	PD	M04				

Group 7 Enter/update/search for information about spare parts.

INVENTOR	700	SPAUP	702				
		SPAREP	703				
		ENTSPA	701				
		CNF	M03				
ENTSPA	701	CNF	M03	INSTINFR	D01		
				TAGINST	N15		
				SPARESIN	D07		
				TAGSPARE	N20		
				PART	N06		
				TYPSPA	N21		
SPAUP	702	SPASEA	704	SPACONBA	D08		
		CNF	M03	PARTCON	N07		
SPAREP	703	SPASEA	704				
SPASEA	704	CNF	M03	INSTINFR	D01		
				TAGINST	N15		
				SPARESIN	D07		
				PART	N06		
				TYPSPA	N21		

Group 8 Search for information about an instrument.

INFSEARC	800	KEYSEARC	801	INSTINFR	D.1		
		CNF	M03	TAGINST			
KEYSEARC	801	CNF	M03				

Group 9 Generate and print out reports.

GENREP	900	QFORM	902	SCHPMLV2	D03	LOADLV2.FRM	A02
		JOBREP	903	PERSON	N08	LOADLV3.FRM	A03
		HISPMLV2	907	SCHPMLV3	D04		
		REPAIRHI	906	PERSONLV3	N09		
		WEEKSEL	904	INSTINFR	D01		
		CNF	M03	TAGINST	N15		
		PD	M04	SPARESIN	D07		
				TAGSPARE	N20		
				ARRAY	D15		
				ARRNO	N01		
				PMSTWKMX	D13		
				PMPERLV2	N11		

PRG program		Makes use of PRG		DBF & NDX		Other
QFORM	901	CNF	M03	QSTLV2	D10	
		PD	M04	TAGQST	N18	
JOBREP	902	WEEKSEL	904	SCHPAR	D02	
		JOBPRINT	905	TAGSCH	N19	
		CNF	M03	SCHPMLV2	D03	
				PERSON	N08	
WEEKSEL	903	CNF	M03			
JOBPRINT	904	QFORM	902	JOBVAR	D06	
				INSTINFR	D01	
				TAGINST	N15	
REPAIRHI	905	CNF	M03	HIS_REP	D12	
				TAGHIS	N14	
				INSTINFR	D01	
				TAGINST	N15	
HISPMLV2	906	CNF	M03	QSTLV2	D10	
				TAGQST	N18	
				INSTINFR	D01	
				TAGINST	N15	
				EXELV2	D11	
				TAGEXE	N13	

Group G Generate graphic displays.

GRAPHIC	G00	GRAPH	G01			
		GRAPH1	G02			
		NOINGR	G07			
		WKLDLV2	G03			
		WKLDLV3	G04			
		TOWKLDV2	G05			
		TOWKLDV3	G06			
		INVKPMP2	G08			
		NOINSLOC	G09			
		CNF	M03			
GRAPH	G01			SCHPMLV2	D03	
GRAPH1	G02			SCHPMLV3	D04	
WKLDLV2	G03			SCHPMLV2	D03	
				PERSON	N08	
WKLDLV3	G04			SCHPMLV3	D04	
				PERSONLV	N09	
TOWKLDV2	G05			SCHPMLV2	D03	
				PERSON	N08	

PRG program		Makes use of PRG	DBF & NDX	Other
TOWKLDV3	G06		SCHPMLV3	D04
			PERSONLV	N09
NOINGR	G07		PLCYMTRX	D14
			JOBVAR	D06
			JOBDEX	N04
INWKPMP2	G08		PMSTWKMX	D13
			PMPERLV2	N11
			ARRAY	D15
			ARRNO	N01
NOINSLOC	G09		UNLOCAT	D09
			LOCATION	N05

Group S Prepare summary of preventive maintenance work.

PMSUMMAR	S00	PD	M04	UNLOCAT	D09
				LOCATION	N05
				PMSTWKMX	D13
				PMPERLV2	N11
				SCHPMLV2	D03
				PERSON	N08
				SCHPMLV3	D04
				PERSONLV	N09
				INSTINFR	D01
				TAGINST	N15

Group I Initialise databases (cancel all recorded data).

INITIALI	I00	CNF	M03	INSTINFR	D01
				TAGINST	N15
				SCHPAR	D02
				TAGSCH	N19
				PMLV2SCH	N10
				PLCYMTRX	D14
				SCHPMLV2	D03
				PERSON	N08
				TAGPMLV2	N16
				SCHPMLV3	D04
				PERSONLV	N09
				TAGPMLV3	N17
				INSTDEL	D05
				DELTAG	N03
				QSTLV2	D10
				TAGQST	N18
				EXELV2	D11
				TAGEXE	N13

PRG program	Makes use of PRG	DBF & NDX	Other
		PMSTWKMX	D13
		PMPERLV2	N11
		UNLOCAT	D09
		LOCATION	N05
		HIS_REP	D12
		TAGHIS	N14
		SPARESIN	D07
		TAGSPARE	N20
		PART	N06
		TYPSPA	N21
		SPACONBAL	D08
		PARTCON	N07

I A E A

COMPUTERISED MANAGEMENT FOR PREVENTIVE MAINTENANCE

(C M P M)

U S E R'S G U I D E

INT/4/054-08

A.M. PATANKAR

IAEA EXPERT

VIENNA

COMPUTERISED MANAGEMENT FOR PREVENTIVE MAINTENANCE

(C M P M)

This program has been developed with multiple objectives. Besides management of preventive maintenance it provides inventory of laboratory instruments, spare parts inventory for these instruments and also repair record keeping for the instruments. The management provides scheduling/rescheduling of the jobs for preventive maintenance and recording of observations during the execution of preventive maintenance. The provision for questionnaire preparation regarding measurement and execution of preventive maintenance for each instrument is also given. All these facilities provided by the program can be categorised in four groups.

I. Information/Data Collection
II. Information/Data Search, edit, delete or look
III. Preventive maintenance task scheduling/rescheduling
iV. Activity analysis and reporting.

I. INFORMATION/DATA COLLECTION:

All the information regarding instruments is collected with reference to tag number for each instrument. The tag number is an unique number for each instrument assigned by the program on entry of the instrument. This number is not alterable once the instrument is entered.

Instrument grouping and tag number generation:

The instruments handled by this program have been devided in ten different groups. Each group have nine types in it. This grouping of instruments is shown in appendix 1. The tag number consists of four digits. (GTNN).

The first digit (G) is assigned as per the group to which the instruments belongs (0 G 9).

The second digit (T) is assigned as per the type to which it belongs in that group (1 T 9).

The last two digits (NN) represent how many instruments of the same type have been entered in the system (01 NN 99).

Now for example Multichannel Analyzers (MCAs) from two different companies eg. Canberra Series 40 MCA and ND 76 MCA if entered will be assigned 3501 and 3502 respectively as tag number. The first two digits in both the cases are same because they are fifth type in the third group, but last two digits are 01 and 02 respectively because Canberra series 40 MCA is the first MCA entered where as ND 76 is the second in the system. Obviously the third MCA if entered will have tag number 3503.

Now all subsequent information as regards to these instruments will always be stored with reference to these tag numbers. The assignment of the tag nuimber is automatically done by the program as you select and enter the instrument in the system and is shown on the screen.

Two types of information can be entered in for the instrument as:

1. Instrument inventory information including spares.
2. Instrument behavioural information.

The detailed procedure of entry for both the types is shown in the attached user's interaction with the program.

II. INFORMATION/DATA SEARCH, EDIT, DELETE OR LOOK

These four functions, SEARCH, EDIT, DELETE and LOOK instrument ifnromation are very useful to change the instrument information as and when required. All four functions are complementary to each other. The detailed procedure for these functions is shown in the attached document.

III. PREVENTIVE MAINTENANCE TASK SCHEDULING AND RESCHEDULING

Distribution of tasks for preventive maintenance is performed by the programme under scheduling or rescheduling. This is done with the help of tag-number and policy matrix.

Organisation or Policy Matrix:

Policy matrix has an information on different types of schedules for the jobs for different types of equipment. There are total ten types of schedules which give different intervals in terms of weeks for level-1, level-2 and level-3 jobs. The information for each type of equipment on how much time is required for executing these jobs in terms of 6 minutes time units is kept in the form of records and also includes which schedule each type of instrument will follow. All this information is kept in the database file called PLCYMTRX.DBF. The different fields of the policy matrix representing this information for each type of the instrument are as follows.

Field 1. EXP_SER_YR = No of years the instrument is expected to give good service.

Field 2. PM_SCH_NO = Which schedule number the instrument will follow.

Field 3. TU_LV1 = Time units units required to do level-1 job.

Field 4. TU_LV2 = Time units required to do level-2 job.

Field 5. TU_LV3 = Time units required to do level-3 job.

Field 6. NO_of_INST = No. of instruments entered in this type

Field 7. NOINSTDEL = No. of instruments deleted from the system of this type

(1 Time Unit = 1 TU = 6 minutes)

Since the schedules also are incorporated in the same data base, the first three fields have been multiplexed. All the ten schedules are kept at an interval of ten records starting from the first record, i.e. record no. 1, 11, 21, 31, 41, 51, 61, 71, 81 and 91 give ten different type of schedules. All other records give the information for a particular type of an instrument. When the information for schedules is accessed, the first three fields of PLCYMTRX are interpreted as

Field 1	INT-LV1 :	interval for level-1 jobs in weeks
Field 2	INT-LV2 :	interval for level-2 jobs in weeks
Field 3	INT-LV3 :	Interval for level-3 jobs in weeks

The policy matrix forms the core of CMPM on which scheduling of jobs is performed.

Further during scheduling, the care is taken that the jobs are uniformly distributed over a year so that overloading of jobs is avoided for a particular week.

Instruments at one location are scheduled for the same time provided the person handling the instruments does not have more than specified number of instruments per week to look after. This factor i.e. maximum number of instruments a particular person can look after in one week is also alterable before scheduling.

IV. ACTIVITY ANALYSIS AND REPORTING:

The program provides analysis of activity through various kinds of reports and graphs. The attached document shows all kinds of reports and graphs it provides for management.

The complete program is menu driven and self explanatory. The menu goves information on the kind of entry required. The program assumes no knowledge of dBASE III or any programming language on the part of the user.

A copy of the working program disc is available with each counterpart of the participating country viz Bangladesh, India, Indonesia, Republic of Korea, Malaysia, Pakistan, Philippines, Sri-Lanka, Thailand and Vietnam.

2564M/86-10-02/A. Patankar

APPENDIX 1

0. NUCLEAR SAFETY
1. ALARM/NUCL. FIRE
2. POCKET DOSEMETER
3. GAMMA SURVEY M.
4. ALPHA/BETA CONT.
5. NEUTRON DOSE M.
6. TLD
7. AIR/LIQ. MONITOR
8. BODY/HAND/FOOT M.
9. DECONTAM. KIT

10. PRESERVATION
11. SAFETY CIRC./SW.
12. LAB. ENVIRONMENT
13. DEHUM./AIR-CON.
14. D.O. REL. VARIST.
15. CVT
16. NETWORK/GROUND
17. COVER/DOOR/WIND.
18. EMERGENCY POWER
19. FIRST AID KIT

20. STANDARDS
21. RADIATION SOURCE
22. DOSEMETER
23. DOSE CALIBRATOR
24. D.C. SOURCE
25. D.C. METER, AVO
26. A.C. SOURCE
27. A.C. METER, AVO
28. PREC. PULSE GEN.
29. OTHER

30. NUCLEAR INSTRUMENTS
31. BIN, D.C. SUPPLY
32. PRE/LIN/LOG AMP.
33. SCALER/TIMER
34. SCA/DD
35. MCA
36. MCA. + COMPUTER
37. SAMPLE CHANGER
38. NIM/CAMAC MODUL
39. OTHER

40. RECORDERS
41. CHART, PEN/THERMO
42. XY PLOTTER
43. PRINTER/TELETYPE
44. PAPER TAPE PUNCH
45. MAGNETIC TAPE
46. VIDEO
47. PHOTOGRAPHIC
48. RH/T AND V
49. OTHER

50. ANALYTICAL INST.
51. PH METER
52. GAS CHROMATOGR.
53. LIQ. CHROMATOGR.
54. OXYGEN ANALYSER
55. HYDROGEN ANAL.
56. DIFF. THERMAL A.
57. SPECTROMETER
58. COLORIMETER
59. OTHER

60. REPAIR INSTR.
61. AVO METER
62. DIG. MULTI METER
63. OSCILLOSCOPE
64. FUNCTION GEN.
65. NUC. PULSE GEN.
66. ELECTRIC TOOLS
67. DIGITAL PROBES
68. H.V. TEST UNIT
69. OTHER

70. AUXILIARY EQUIP.
71. OVEN/HOT PLATE
72. DEWAR
73. CENTRIFUGE
74. REFRIGERATOR
75. VACUUM PUMP
76. COMPRESSOR
77. HOT WATER BATH
78. BALANCE
79. OTHER

80. NUCLEAR DETECTORS
81. ION CHAMBER
82. PROP. COUNTER
83. G.M. COUNTER
84. LIQ. SCINT. DET.
85. SOLID SCINT. DET.
86. GELI/SILI DET.
87. INTR. GE DET.
88. SURFACE BARRIER
89. OTHER

90. SPECIAL SYSTEM
91. REACTOR CONTROL
92. ACCELERATOR
93. COMPUTER
94. TELECOMM.
95. NUCL. IMAGING
96. NUC. MED.INSTR.
97. GEOPHYSICAL
98. PROCESS CONTROL
99. OTHER

INTERNATIONAL ATOMIC ENERGY AGENCY

RCA PROJECT ON THE MAINTENANCE OF NUCLEAR INSTRUMENTS

SOME ELEMENTS OF LABORATORY MAINTENANCE PLANNING:

1.) Make an inventory of the instruments available in the laboratory.
2.) Make a library of instruction manuals, maintenance manuals, spare part lists, trouble shooting charts, circuit diagrammes, etc.
3.) Nominate a person responsible for all maintenance activities in the laboratory.
4.) Nominate a chief operator responsible for the daily care, the quality control and the logbook for each particular instrument.
5.) Formulate clear written task descriptions of persons given in 3 and 4 (See flowcharts 10-12).
6.) Formulate and execute check and quality control procedures for each instrument to be executed under the responsibility of chief operator: what has to be done, when and by whom.
7.) Formulate and execute test and quality control procedures for each instrument to be executed by maintenance personnel: what has to be done, when and by whom.
8.) Formulate and execute a preventive maintenance procedure for each particular instrument or instrument set: What has to be done, when and by whom.
9.) Make and use a logbook for each instrument in which 6, 7 and 8 are given and space to note down what was done, when and by whom and what the findings were. The report of the first test or commissioning, of possible repairs and of the actual use of the instrument should also be given.
10.) Make clearly readable flow charts for users, operators and maintenance technicians indicating what to do when an instrument seems not to function correctly or breaks down.
11.) Make clear flowcharts for maintenance technicians what to do in case replacement parts are needed.
12.) Make clearly readable flowcharts what a technician has to do when he is not able to do an instrument repair himself.
13.) Formulate and execute clear instructions about the cleaning and cleanliness of the laboratory.
14.) The points 5 to 13 will result in a clear maintenance and quality control schedule, which is a main part of a laboratory maintenance plan.
15.) Formulate and execute a power conditioning policy (especially for new instruments).
16.) Formulate clear written instructions what to do in case of a power failure.
17.) Formulate and execute an airconditioning policy.
18.) Formulate and execute clear instructions about use of airconditioners dehumidifiers and ventilators.
19.) Procure a minimum set of tools needed for preventive maintenance and small repairs.
20.) Formulate and execute a spare part policy.
21.) Formulate and establish instrument procuring procedures which take into account the technical performance of the instruments and the necessity that technicians, engineers or future users check the offers.
22.) Formulate at least the minimum budget requirements to enable the maintenance task.

P.H.Vuister/Vienna

Responsibilities for different levels of preventive maintenance

Professional user

The "user" is the professional scientist or clinician who is responsible for work done with the instrument. He is concerned with results but may not know much about how the instrument works.

Responsibilities:
- Supervise the technician who operates the instrument.
- Ensure the technician does regular quality control checks and basic Preventive Maintenance (PM).
- Review instrument lab log books regularly.

Operator

The "operator" is a technician who regularly uses the instrument. He has no special tools or instruments for maintenance but must have proper check sources, phantoms, etc.

Responsibilities:
- Daily care of instrument.
- Daily care of laboratory conditions (cleanliness, air conditioning, windows closed, etc).
- Routine quality control (QC).
- Upkeep of instrument lab log book.

In terms of CMPM, this work is PM LEVEL 1.

Maintenance technician

The "maintenance technician" is a person with some technical skill in instrumentation and having basic knowledge of the tools and equipment used for maintenance work. He may be an operator who also has these extra skills or an instrument technician who has been allocated to general maintenance duties.

Responsibilities:
- Routine PM.
- Routine QC with special tools or equipment.
- Simple repairs.
- Upkeep of instrument maintenance log book.

In terms of CMPM, this work is PM LEVEL 2.

(cont)

Instrument expert

The "instrument expert" is an engineer, physicist, or senior technician to whom senior management delegates responsiblity for the maintenance and QC of instruments. He has thorough electronics experience and some general knowledge of the use of each instrument. He must have an adequate work place and all necessary test equipment.

Responsibilities:
- Thorough QC.
- Instrument overhaul.
- Complicated repairs.
- Spare parts management.
- Review of instrument maintenance log books.
- Supervision of maintenance technicians.

In terms of CMPM, this work is PM LEVEL 3.

For some more complicated instruments PM Level 3 may be done on a contractual basis by the supplier´s engineers.

CMPM's Policy Matrix

D14

Structure for database: C:plcymtrx.dbf
Number of data records: 100
Date of last update : 08/29/88

Field	Field Name	Type	Width	Dec
1	EXP_SER_YR	Numeric	2	
2	PM_SCH_NO	Numeric	2	
3	TU_LV1	Numeric	2	
4	TU_LV2	Numeric	2	
5	TU_LV3	Numeric	2	
6	NO_OF_INST	Numeric	2	
7	ROW_NO	Numeric	2	
8	NOINSTDEL	Numeric	2	
** Total **			17	

Multiplexed field names for Records 01, 11, 21, 31, 41, etc

	INTV1	INTV2	INTV3					
Record#	EXP_SER_YR	PM_SCH_NO	TU_LV1	TU_LV2	TU_LV3	NO_OF_INST	ROW_NO	NOINSTDEL
1	12	24	48	4	1	0	0	0
2	16	8	5	25	80	1	1	0
3	8	7	1	5	10	0	2	0
4	10	9	5	5	10	5	3	0
5	8	6	1	10	10	2	4	0
6	8	9	5	10	10	1	5	0
7	10	7	10	20	40	3	6	0
8	6	4	5	20	40	1	7	0
9	12	8	5	10	40	1	8	0
10	16	3	1	5	5	0	9	0
11	8	24	48	1	0	0	10	0
12	16	7	1	5	10	0	11	0
13	18	7	1	5	20	1	12	0
14	10	7	1	5	15	0	13	0
15	10	7	1	5	10	0	14	0
16	12	3	3	5	20	0	15	0
17	18	3	5	20	30	0	16	0
18	18	7	1	5	10	0	17	0
19	12	7	10	20	80	0	18	0
20	14	3	1	5	5	0	19	0
21	4	24	48	2	0	0	20	0
22	6	3	1	2	3	0	21	0
23	8	7	1	5	40	0	22	0
24	10	7	3	20	20	1	23	1
25	14	4	5	5	80	0	24	0
26	14	4	1	5	20	0	25	0
27	14	4	5	5	80	0	26	0
28	14	4	1	5	40	0	27	0
29	10	2	2	10	10	0	28	0
30	10	2	2	10	10	1	29	0
31	4	12	48	2	0	0	30	0
32	12	3	1	10	20	1	31	0
33	12	3	1	10	20	2	32	0
34	12	3	1	10	10	1	33	0
35	12	2	5	10	10	0	34	0
36	10	5	5	10	20	3	35	1
37	10	5	5	20	40	0	36	0
38	8	5	10	20	60	0	37	0
39	14	5	1	5	20	1	38	0
40	14	5	1	5	20	1	39	0
41	4	8	48	2	0	0	40	0
42	10	3	1	5	10	0	41	0
43	10	3	5	10	20	0	42	0
44	16	1	5	20	30	2	43	0
45	16	1	2	5	10	0	44	0
46	10	1	1	5	10	0	45	0

(cont)

	INTV1	INTV2	INTV3					
Record	EXP_SER_YR	PM_SCH_NO	TU_LV1	TU_LV2	TU_LV3	NO_OF_INST	ROW_NO	NOINSTDEL
47	10	2	5	10	20	0	46	0
48	16	2	5	10	10	0	47	0
49	12	2	10	10	10	0	48	0
50	12	2	10	10	10	0	49	0
51	1	12	48	3	0	0	50	0
52	12	3	5	30	20	2	51	0
53	12	7	10	30	60	1	52	0
54	12	7	5	20	40	1	53	0
55	12	5	5	10	40	0	54	0
56	12	5	5	10	40	0	55	0
57	12	7	10	20	60	0	56	0
58	12	7	10	20	60	1	57	0
59	12	5	10	20	60	0	58	0
60	12	5	10	20	60	4	59	0
61	1	8	48	1	0	0	60	0
62	18	4	1	5	10	2	61	0
63	14	1	5	10	30	1	62	0
64	12	1	2	10	30	2	63	0
65	14	1	2	20	30	0	64	0
66	18	1	5	10	30	1	65	0
67	14	1	5	15	5	0	66	0
68	14	4	5	10	5	1	67	0
69	14	2	5	20	5	0	68	0
70	14	2	5	20	5	1	69	0
71	1	8	48	1	0	0	70	0
72	16	1	5	10	10	0	71	0
73	16	3	1	5	5	0	72	0
74	16	4	1	10	20	1	73	0
75	10	3	5	5	20	1	74	0
76	14	2	5	10	30	1	75	0
77	16	10	10	20	40	0	76	0
78	18	2	5	10	20	0	77	0
79	18	2	5	10	20	2	78	0
80	18	1	5	10	20	6	79	0
81	1	8	24	1	0	0	80	0
82	16	1	1	20	10	1	81	0
83	8	1	5	20	20	0	82	0
84	6	1	5	15	5	0	83	0
85	12	2	10	10	40	1	84	0
86	10	4	5	20	10	0	85	0
87	10	4	5	20	10	0	86	0
88	10	4	5	20	10	2	87	0
89	10	4	5	20	10	0	88	0
90	10	4	5	20	10	0	89	0
91	1	8	24	6	0	0	90	0
92	16	10	50	40	99	0	91	0
93	10	10	50	60	80	0	92	0
94	12	10	25	20	60	2	93	0
95	10	9	5	10	20	0	94	0
96	10	7	5	20	80	0	95	0
97	10	9	25	20	60	0	96	0
98	8	9	59	30	80	0	97	0
99	12	10	25	20	60	0	98	0
100	12	10	7	20	60	0	99	0