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MICROPROCESSOR APPLICATION ENGINEERING PROGRAMME

DP/IND/84/030

INDIA

Technical report: Training programme on DBMS (data base management systems) and guidance of projects*

Prepared for the Government of India
by the United Nations Industrial Development Organization,
acting as executing agency for the United Nations Development Programme

Based on the work of Andrew Yeiser, expert in data base development

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United Nations Industrial Development Organization
Vienna

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* This document has not been edited.

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EXPLANATORY NOTES

Currency

The *Rupee* had an official trading value of approximately Rs 15 to the U.S. dollar.

Technical Terms and Acronyms

CAD: Computer Aided Design - computer drafting.

CD: A plastic *compact disk* similar to those used for recorded music, but containing information in computer readable form. A single 12 cm. diameter CD can contain as much information as 300,000 typewritten pages (double spaced A4).

CD/ROM: Compact Disk - Read Only Memory, see also CD and ROM.

CD/WORM: Compact Disk - Write Once Read Many memory, see also CD and ROM.

DBMS: Data Base Management System - Programming to manage the storage, retrieval and reporting of information stored in data bases.

GERT: Graph Evaluation and Review Technique - an advancement from PERT showing contingency planning.

PERT: Project Evaluation and Review Technique - An activity network type project management tool.

MAEP: Microprocessor Application Engineering Program.

ROM: Computer ***Read Only Memory*** containing per recorded information that can be read, but cannot be changed or re-recorded.

SAIL: **Steel Authority of India Limited.**

WORM: Computer ***Write Once Read Many*** memory that can be recorded on once and then read repeatedly, but cannot be changed or re-recorded.

ABSTRACT

This report describes a one month mission to participate in a training program on DBMS (data base management systems), and also to guide projects regarding development of data bases at the MAEP (Microprocessor Application Engineering Program) at the Department of Electronics in New Delhi. The venue was changed to the MAEP center at SAIL (Steel Authority of India Limited) in Ranchi. Additional activities were included: to review the project management techniques and systems engineering practices in use at SAIL.

Data base projects were reviewed and recommendations made. Several seminars and a lecture were presented. Investigation of the project management practices in use resulted in a number of suggestions and recommendations for improvement. A preliminary project management training program was conducted.

INTRODUCTION

This report describes a one month mission of UNIDO project DP/IND/84/030 supporting the MAEP (Microprocessor Applications Engineering Program) at the SAIL (Steel Authority of India Limited) Research and Development Center at Ranchi, Bihar State. The beginning date was 1 February 1989.

This mission had as its specific objectives to:

- Appraise the expert of the current status of microprocessor applications in Indian Industry.
- Participate in training programs organized by New Delhi and other MAEP centers.
- Guide projects on data base development in various centers.
- Suggest the methodology for software standardization in the Indian environment.

The objectives were revised by adding a review of the project management and system engineering techniques in use in the SAIL center in Ranchi.

All objectives were achieved.

RECOMMENDATIONS

1. Strengthen formalized project management and system engineering practices. Use a good commercial microcomputer program management software package. The theory and mechanics of project management are well understood by the engineers at Ranchi. Successful management of large projects requires something additional, however. The ways in which the tools of project management are used determine success or failure. Experience based counseling and advice on the techniques of application of project management principals are not readily available to the project engineers in India. Since application techniques are not described in texts nor taught in classes, periodic assistance from international experts with wide industrial experience in the successful application of (large scale) project management techniques would be beneficial.

2. Require formal procedures for the control of changes to documents (drawings). Significant time and cost overruns result from inadequate change control of drawings and specifications.

3. Expand the microprocessor hardware training for industry being offered at the Ranchi MAEP (Microprocessor Application Engineering Program) center to include repair and maintenance training for microcomputer based systems. Unavailability of adequate, rapid repair of automation systems (or its high cost from commercial sources) may be a limiting factor in the successful automation of industries in developing countries. Most of the institutional infrastructure necessary for such training is already in place in the MAEP center at Ranchi: classrooms, digital work stations, microcomputers, tools, instruments, etc. The center is currently training

Indian steel plant personnel on digital electronics and microprocessors. If established, the digital repair training facility might provide training to other developing countries wishing to acquire their own computer repair and maintenance capability.

4. Create separate data base administration functions for both the microcomputer and mainframe data bases. Eliminate or reduce the problems stemming from partially redundant stand alone data bases. Combine them into non redundant data bases if feasible. Otherwise arrange for periodic updating among them, preferably automatic.

5. Include disaster recovery planning in industry application studies and for the MAEP centers. Make mutual back up arrangements with sister organizations using similar hardware and software. Without advance planning, dependency on automation can increase the losses to industry (increased cost and time required for recovery) due to disasters such as fire, earthquake, lightening, explosion, etc.

6. Adopt CD/WORM (Compact Disk - Write Once, Read Many times memory) technology for the storage of computer generated drawings and for the distribution of data bases containing automation information to industry. The CD/WORM is an inexpensive way to provide microcomputers with the capacity to produce and store very large data bases. Adopt CD/ROM (Compact Disk - Read Only Memory) technology for the acquisition of international data base information. It is less expensive than on-line services or magnetic tapes currently being used in the center. It is adaptable to microcomputers as well as to mainframes and minis.

7. Adopt the 'C' programming language for software standardization. Develop program module interface standards for the passing of variables and parameters between program modules and program documentation specifications. Establish a microprocessor application program module library.

I. ACTIVITIES AND OUTPUT

The principal activities described below were intended to increase the effectiveness of micro-processor based automation of Indian industry at the project level. Very large scale steel plant modernization projects are scheduled in the near future. The effective application of computer automation to project management tasks and to the production of drawings will be vital to this effort.

A. Appraisal of status

An assessment of the work going on at the MAEP center at Ranchi indicated that it was quite advanced technically.

Data base status

Data bases are being designed that show a good concept of the principals. Different groups are, however, designing separate data bases that are partially redundant, that is they contain some of the same data elements. This can lead to inconsistency of the data from them, since it is very difficult to make sure that every change and update is performed in each of them simultaneously. The sub optimization of the separate data bases does not necessarily result in overall optimization. This can result in slow response times.

The solution is to combine related data bases into a single non redundant data base. In practice this makes coordination between the groups working on the presently separate data bases difficult. This problem can be solved by separating the functions of designing the logical structure of the data base with its

attendant administrative functions from the function of programming inputs and outputs i.e. application programming.

The recommendation is to create a technical group with responsibility for data base administration. Different classes of machines such as main frames and micros should have separate data base administrators. The data base administrator's duties should include the logical design of the data base, coordination of various requirements, assignment of passwords and access authority, tuning to optimize overall response time, etc. and for backups.

The administrator normally has no responsibility for creating application programs to input or edit data or produce outputs. He does, however have the responsibility for assuring that new applications are safe to run before allowing them access to the data base. He should maintain a test data base with the same structure as the functional data base that can be used to develop new applications.

Project management practices

Meetings with the project management personnel indicated that they have a good theoretical understanding of the principals. Project management controls are being applied manually. Experience in America as well as in developing countries on large scale projects indicates, however, that the mere use of network planning is not sufficient. Projects nominally producing network progress reports have resulted in disastrous failure. The techniques used in the application of these tools determines success or failure. Unfortunately these techniques are not described in texts of which the expert is aware, and advice from Indians with extensive experience in the successful management of large projects is not readily available to the project management staff.

Further assistance in the application of project management techniques from international experts would be of value to the planned steel plant modernization projects being planned.

CAD (computer aided design)

The sheer bulk of drawings necessary for the planned steel plant modernization projects necessitates the immediate use of CAD (computer aided design). Manual drafting simply will not be able to produce drawings at the rate required. Additionally there is a significant learning period necessary for a draftsman to become proficient in the use of CAD.

A meeting was held with D. Bhatnagar and N. K. Kakkar of the Project Engineering Group to complete the specifications of a microcomputer based CAD system for the center. A willingness to approve the procurement was expressed by management.

Drawing change control

The lack of some critical elements of system engineering practices was noted. Important among them was the practice of a specification review meeting at the end of the specification phase of a project with an accompanying specification freeze. Likewise, a design phase ending in a design review and a design freeze. After the freeze, any change to the specifications or design drawings should be subject to formal change control.

Very briefly, formal change control traditionally requires that any change required be submitted in writing (as a Change Proposal) to a change control committee that meets weekly. All organizational elements that might be impacted by changes are represented on the change control committee. Each

committee member assesses the effect of the proposed changes on his organization and reports to the committee.

If the change is accepted by the committee, changes to the delivery schedule, cost, and any other impacts are incorporated along with the effectivity date and the required documents and drawings are revised, giving them new revision numbers.

Making changes without first assessing the interactions that might occur is very dangerous, but undue delay in accepting necessary changes is costly. Formal change control is strongly recommended.

B. Training program

The training program that was organized was centered on project management and system engineering techniques that were judged to be the most critical need by the counterpart personnel.

A seminar on computer aids to industrial productivity was presented to SAIL top management.[1] A seminar on project management and system engineering was presented to the project engineering group.[2] A lecture on project management and system engineering was presented to the SAIL engineering staff.[3]

C. Project guidance

Informal discussions were held with the computer staff and the microprocessor laboratory on data base design.

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1. See ANNEX 2, *Seminar for Top Management*, page 16.

2. See ANNEX 3, *Seminar for Project Engineers*, page17.

3. See ANNEX 4, *Project Management Lecture*, page 18.

A problem with the mainframe computer information storage and retrieval program was mentioned. It was not accepting current update information. Investigation indicated that some files had not been adequately sized at the time of the data base creation. The file modification feature of the program was not functional, so that it will be necessary to create the data base again and re-enter the data. Time did not permit verification of this approach.

D. Software standardization

For reasons of transportability, that is, the ability to use the same program on a variety of different types of computer, the 'C' programming language is recommended as the standard for MAEP. Compilers exist for virtually every computer in common use. The 'C' language is the language of choice for the creation of system software as well as application programs in most of the advanced software centers.

Specifications should be developed for the documentation of program modules and for the passing of parameters and data between modules so that modules written for one program may be easily used in others.

A library of these modules should be established and made available to all programmers.

II. UTILIZATION OF THE RESULTS OF THE ACTIVITY AND CONCLUSIONS

The length of the mission (one month) did not allow a realistic evaluation of the results, but verbal assurances from management indicate that a number of the recommendations and suggestions will be acted on.

The value of short missions could be improved by scheduling subsequent return missions to assess progress and provide guidance in the implementation of the recommendations.

ANNEX 1

Senior Counterpart Staff

Dr. J. Bhattacharya, Project Coordinator

Dr. B. Puthal, MAEP Center

Kumar Ray, Computer Center

ANNEX 2

Seminar for Top Management

Computer Aids to Industrial Productivity

16 February 1989

Those in attendance

Dr. S. K. Gupta, Director
C. R. Srinivasan, Executive Director
S. N. Das, Executive Director, Management Training Institute
Dr. V. Ramaswamy, General Manager
N. C. Ramasubbu, General Manager
Dr. S. M. Aeron, Deputy General Manager
A. V. L. N. Rao, Faculty Member, Management Training Institute

ANNEX 3

Seminar for Project Engineers

Project Management and System Engineering

20 February 1989

Those in attendance

Dr. C. B. Choudhary, Computer Center
A. K. Satsangi, Project Engineering
S. Lal, Planning and Coordination
S. S. Das, Planning and Coordination
Deepak Bhatnagar, Planning and Techno-Economics
Y. Singh, Project Management and Engineering Division
K. P. Verma, Project Engineering and Management Division

ANNEX 4

Lecture Announcement

NO.RD/PCTE/TC/SEM/89 Date:20/2/89

TECHNICAL TALK

Topic : System Engineering/Project Management.

Speaker : Mr. Andrew Yeiser, UNDP Expert in Computer Systems Analysis & Programming.

Date : 21.2.89

Time : 3.30 PM

Venue : RDCIS, Auditorium

All executives from R&DC/CET/CRMM/MTI are invited to attend.

for PRM & I/c(PC&TE)

Distribution :

All Divisional Heads

All Group Incharge/TA to director /TA to ED/TA to GM(R)/ EPS to GM (EM)/PS to GM (T)

TA to ED (CET)/TA to ED, MTI/PS to Addl. Director(CRMM)

All executives of R&DC/CET/CRMM/MTI

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MICROPROCESSOR APPLICATION ENGINEERING CENTRE
R&D CENTRE-SAIL, RANCHI-834 002.

STATUS NOTE (AS ON FEBRUARY, 1989)

During the past 3 - 4 years' of existence, the Microprocessor Application Engineering Centre at Ranchi has ful-filled the objective to a great extent. Some of the high-lights are as under :

[1] The centre has established microprocessor laboratory with the availability of basic hardware from UNDP for the development of microprocessor based controls in steel plants.

[2] It has set-up a training laboratory to organise training for steel plant and mining engineers to propagate the use of microprocessors. The participants were provided hands-on-training with microprocessor kits.

The participants on their return to the works tried to appreciate the importance of the use of microprocessor particularly in energy saving and drive control area. Some of them initiated a few projects for implementation in the respective plants.

[3] The centre receives frequent request from different steel plants and the allied industries to organise training programme there. The centre has complied with most of such requests.

[4] The centre has successfully completed and implemented the following projects in the plants :

i] Data acquisition system for Blooming Mill at Bhilai Steel Plant,

ii] Intelligent coke weighing controller in the Blast Furnace of Durgapur Steel Plant,

iii] Software development for Anode Quenching Effect at BALCO-KORBA,

[5] The centre has trained 263 engineers till Dec.,1988.

[6] The centre is presently engaged in implementation of the following projects :

i] Process Monitoring System in five stand Tandem Mill at Rourkela Steel Plant.
(Target : March, 1989)

ii] Pin Hole detection system in CRM-RSP, Rourkela.
(Target : March, 1990)

[7] During this period, the engineers of the centre have gained considerable experience and confidence to contribute in a better way for the promotion of this technology in different industries. Simultaneously, a few small scale industries have been developed to fabricate and assemble the hardware prototype units for field trial.

The centre would work in energy saving activities in industries and encourage local vendors to develop expertise in implementing such schemes in industries.

FUTURE PLAN FOR TRAINING :

The centre has competance to provide training to engineers of other developing countries engaged in steel plants or similar industries. The centre can accommodate ten engineers from other countries for training in the following area :

i] Process Instrumentation

- Sensors,
- Controllers,
- Actuators.

ii] Digital Electronics,

iii] Microprocessor hardware and software,

iv] Process control system design,

v] Hardware/Software integration

vi] Main frame computer system,

vii] Programming languages namely; FORTRAN,COBOL,PASCAL & C,

viii]Data base management system,

ix] Personal computers,

[8] HARDWARE MAINTENANCE TRAINING FOR OTHER DEVELOPING COUNTRIES.

There is a great demand for training of engineers in REPAIR and MAINTENANCE of microprocessor and computer hardware. This can be executed by the Centre/RDCIS with the addition of some balancing facilities like board tester, oscilloscope, programming units etc.

The expenditure per participant per day is estimated to be around US $ 60. This figure is tentative.

If this proposal be accepted in principle the Centre would need UNIDO Expert for initial guidance and two/three fellowships and study tour of short duration to acquaint the Centre staff in such activities abroad.

It might be appropriate if UNIDO staff could visit the Centre to assess its strength and give necessary guidance.