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MICROPROCESSOR APPLICATION ENGINEERING PROGRAMME

DP/IND/84/030

INDIA

Technical report: Review of hardware and software projects at various  
Centres. Impart training to Centres and Industries  
on Design Methodology\*

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 Eric J. Wightman, expert in microprocessor  
hardware and software development

Backstopping officer: V. Smirnov, Engineering Industries Branch

United Nations Industrial Development Organization  
Vienna

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\* This document has not been edited.

**MICROPROCESSOR APPLICATION ENGINEERING PROGRAMME**

**DP/IND/84/030/11-05/J13315**

Review of Hardware and Software Projects at various Centres.  
Impart training to Centres and Industries on Design Methodology.

**ABSTRACT**

This report describes a threefold programme of project seminars, specialised aspects of microprocessor applications in industry and follow up actions arising from previous missions.

The itinerary included a visit to the M.A.E.P. centre in Delhi and presentation of technical papers to the MAEP INMAP 83 International Seminar held 6 to 3 December at the Ashok Hotel.

The report includes comments from delegates who attended the seminar, compiled by UNIDO Experts present and this may be considered to be valuable market feedback of the effectiveness of the MAEP activities.

Recommendations are included for changes to the direction of the current programme, based on the above comments and other considerations discussed with the chief project co-ordinator.

## LIST OF CONTENTS

### ABSTRACT

1. Introduction
2. Recommendations
3. Activities of Expert during the mission
4. Conclusions

### LIST OF APPENDICES

- I. Itinerary
- II. INMAP 88 Programme
- III. Abstracts of Lectures - E.J. Wightman
- IV. Summary of Main Points raised by Delegates during INMAP Seminar.
- V. Technical Report DP/IND/84/030/11-05/31.9.E-June 1987-Recommendations

## 1. INTRODUCTION

The objectives of the mission as detailed in Job Description DP/IND/84/030/11-05/J13315 included the following tasks for the Expert:

- 1.1 Appraise himself on the current status of microprocessor applications in the Indian industry.
- 1.2 Appraise himself with the objectives, status and the results of various system engineering development projects going on in various centres.
- 1.3 To help the project personnel in hardware and software development projects going on in various centres.
- 1.4 To impart training to project personnel as well as centres on new methodologies for microprocessor based system engineering system.

The expert was also expected to prepare a final report, setting out the findings of the mission and recommendations to the Government on future actions which might be taken.

The programme of work was to be carried out during the period 22 November to 22 December 1988, as detailed in Appendix I "Itinerary", including one day debriefing in Vienna and associated travel time to New Delhi. In addition one week preparatory work was carried out in U.K. before departure.

This report describes three main activities carried out at the request of the chief project co-ordinator, seminar programme, special assignment and various follow up actions arising from previous missions. The author was based in the Delhi MAEP Centre for the duration of this particular mission.

Conclusions relating to these activities are listed at the end of the report.

## 2. RECOMMENDATIONS

The following recommendations are proposed as constructive measures to enhance the on going programme. They may require substantial injection of funds and UNIDO Experts for implementation:-

2.1 A major re-think on the direction of the M.A.E.P. is indicated, with more emphasis on industry and less emphasis on microcircuit technology. Statistics from developing countries and western countries show that over 80% of industrial growth emanates from small and medium industries and the only channel through which M.A.E.P. outputs to this sector is through the medium of technology transfer.

It is recommended that future M.A.E.P. activities are focussed on this sector with emphasis on consultancy to encourage self sufficiency as distinct from the creation of projects which are then offered to industry by means of technology transfer.

2.2 There is a need to transform the direction of M.A.E.P. from an academic lead programme to a commercial, industrially motivated programme. For example, overseas training facilities should only be extended to engineers with a proven track record of achievement in taking a project from inception to completion, as a means of furthering potential technical project management skills which are essential for diffusing microcircuit technology in small scale industry.

2.3 The importance of mastering the techniques of interfacing with microprocessors cannot be overstressed. All applications, whether aerospace, process industries, manufacturing or medical, require this essential system engineering and ready access to suitable sensors/transducers for converting physical variables such as force, displacement, pressure, temperature and flow for example, into electrical signals which can be input to a microprocessor for subsequent processing and control. With few exceptions, there now appears to be a reduction in this activity, in M.A.E.P., judging by the current types of on-going projects, consequently the use of the operative word "Applications" in M.A.E.P. in industry may have less credibility. This trend should be reversed and the proposed productivity improvements at Integral Coach Factory, Madras, should contribute to this..

2.4 In order to actively promote a greater awareness of the role of sensors, it is proposed that in the first instance, a strategy for a M.A.E.P. sensor development facility is designed. This should include, as a minimum, a means of systematically logging all potential sources of sensors, transducers and process instrumentation and their developments in India in a data bank which can be used for reference by universities, industry and D.O.E. It can serve as a secondary objective in assessing what is a true measure of indigenous sensor capability in India, for shaping future investment in development programmes.

2.5 It is recommended that a study is carried out to formulate a strategy for any future M.A.E.I. activities with emphasis on small and medium scale industries, in keeping with successful projects supported by UNDP/UNIDO in other developing countries, for example S.M.I.P.C. (Small and Medium Industry Promotion Corporation) in South Korea. The study should include recommendations for:

- Geographical issues - how technology may be diffused throughout India more effectively outside the present major nationalised industries.
- Fiscal measures. Tax allowances, investment incentives, direct grants.
- Awareness programmes.
- Administration issues.
- Technology transfer, licensing, indigenous development including the role of sensors.
- Government/Industry interface.
- Human resources:-
  - a) for managing the programme
  - b) for implementation

### 3. ACTIVITIES OF THE EXPERT DURING HIS MISSION.

Following a briefing from the Chief Project co-ordinator Dr. Krishna Kant a number of activities were planned in order to implement the required objectives of the mission.

Three main fields of activity required inputs from the Expert, as detailed in Appendix I "Itinery":

- INMAP 88 International Seminar on Microprocessor Applications.
- Assignment
- Miscellaneous follow up actions arising from previous missions.

#### 3.1 INMAP 88 International Seminar on Microprocessor Applications for Productivity Improvement.

The author was required to present two papers:

- Artificial Intelligence Using Micros.
- Manufacturing Automation - International Scenario

and to co-chair one of the sessions in accordance with the time table included in Appendix II "INMAP 88 - Programme".

Abstracts of the above papers are included in Appendix III.

The INMAP 88 Seminar, held in the Ashok Hotel, was well attended, 350 persons on the first day, reducing to 100 on the last day.

The quality of the papers presented was generally good, in particular contributions from India from the process industries, but more careful editing of papers in advance would have enabled specialist papers dealing with technology of microprocessors to be separated from system applications, thus making the task of assimilation easier.

The facilities were generally good and a credit to M.A.E.P. staff responsible for the organisation of the seminar, but future programmes would benefit by the use of more reliable visual aids.

During the concluding discussion session held on 3 December between 14.30 and 15.30 hours, a number of delegates expressed their views and these are included in Appendix IV "Summary of Main Points raised by Delegates during Concluding Discussion Session". They were compiled by UNIDO Experts present and may represent important market feedback on the effectiveness of the M.A.E.P. activities. Several of the points made were already the



subject of Recommendations made by the author eighteen months previously in Technical Report DP/IND/84/036/11-05/31.9.E-June 1987 and these are included for reference in Appendix V.

### 3.2 Assignment.

The author was requested to compile a report detailing known state of the art in sensor manufacture in India. Arising from this work a number of issues were raised, as a result of which a proposal was made for the formulation of a strategy for sensor developments in India and it is understood that this may be the subject of a separate project for consideration by UNDP.

### 3.3 Miscellaneous Actions Arising from Previous Missions

Two areas of activity required input from the Expert:

- Low cost cnc system for machine tools, proposed by the author during a previous UNIDO mission.

- Strategy for the Application of Microprocessors for Improving the Productivity of Rail Coach Manufacture, compiled during mission in March 1988.

3.3.1 Low cost cnc system for Machine Tools. This was discussed with Mr. R.N.Basu, Deputy Director General, Directorate General Technical Development, Ministry of Industry and at present serious consideration is being given to this proposed project by the machine tool industry and microchip manufacturers. A joint specification of requirements is to be compiled, following which an approach may be made to UNIDO for assistance.

3.3.2 Strategy for the Application of Microprocessors for Improving the Productivity of Rail Coach Manufacture. Following discussions with Mr. S.Krishnan, Deputy Chief Mechanical Engineer, ICF Madras during the INMAP Seminar, it seems that lateness of delivery of major items of capital equipment, coupled with organisational changes, have contributed to lack of progress on this project. The organisation changes comprise:

- Mr. A. Balasubramanian formerly Chief Mechanical Engineer Madras, is now CME Southern Railway.

- Mr. B. Rangarajan is now CME Madras Integral Coach Factory.

A meeting was convened by Mr. K.N.Jain, Director (Mechanical Engineering) of Indian Railways and attended by the chief project co-ordinator, Dr. Krishna Kant, Mr. R. Chandra, Director Mechanical Engineering (Facilities), Mr. V.S.Bhatnager, Engineering Director (Workshops) and the author on Friday December 15 at 3.00p.m. in Delhi to review the productivity proposals compiled in March. (Reference Technical Report-April 1988.)

They included:

- Machine tool status and condition monitoring development system
- Automation of manual machines
- Automation of tool management and storage system
- Digital readout for manual machines
- Automatic check out equipment for bogie testing
- Component gauging
- Service centre for cnc electronic equipment

Mr. V. S. Bhatnager, for Indian Railways requested that the proposals should proceed to the point of pilot studies on each of the proposed seven projects but with broadened scope to include the Patiala factory (engine manufacture) and with emphasis on tool management and component gauging. Joint project teams were to be formed by representatives of M.A.E.P. Delhi, RDSO Lucknow and ICF Madras. The author was requested to return to India for two months the week beginning January 1989 to provide UNIDO Expert input, make a formal presentation to the Rail Board on proposals to date and compile a strategy for implementation with emphasis on indigenous Indian resources.

#### 4. CONCLUSIONS

These conclusions are largely based on observations made during the INMAP 88 Seminar since they complement recommendations previously made by the author on an earlier mission:-

4.1 Capability now exists in Indian industry, particularly the larger nationalised industries, for handling the majority of applications currently encompassed by M.A.E.P.

4.2 There are gaps in the execution of the M.A.E.P. on a detailed level, notably weakness in project direction and the ability to "make things happen" on multi-discipline projects. Co-operative projects, directed by D.O.E., but implemented jointly by Universities and industry, along the lines of similar joint projects managed in European countries, would serve to focus the need for greater objectivity and the implementation of the productivity proposals for I.C.F. Madras are seen as a welcome contribution in this direction.

4.3 There appears to be some aversion to tackling system projects which require much interfacing with physical measurements by way of sensors, in favour of "desk top" projects based on standard PC packages and elementary software, if Pune Centre is taken as a representative sample of the latest trend.

4.4 The future role of M.A.E.P. requires clarification, to project a clear identity to industry. At present the services of M.A.E.P. embrace a mixture of training, consultancy and project developments which were not clear to delegates attending the INMAP Seminar. More promotion of M.A.E.P. activities, possibly by publication of applications successfully completed which were the subject of some of the papers presented at INMAP 88, should be considered but the priority issue appears to be a review of which market sectors should be served by M.A.E.P. and how this should be accomplished.

APPENDIX I

ITINERY - E. J. WIGHTMAN - 22 November to 22 December 1988

<u>Date</u>	<u>Time</u>	<u>Activity</u>
Tue 22 Nov	8.30a.m.	Depart U.K.
Wed 23 Nov	3.30a.m.	Arrive hotel N.Delhi
	10.00a.m.	UNDP briefing
	11.00a.m.	MAEP Centre. Dr.Krishna Kant, Chief project Co-ordinator.
Thu 24 Nov	9.00a.m.	Prepare Lectures
Fri 25 Nov		
Mon 28 Nov	3.00p.m.	Ministry of Industry-Mr.R.N.Basu -Deputy Director General,General Technical Development.
Tue 29 Nov to Mon 5 Dec inclusive		Prepare Lectures.
Tue 6 Dec to Thu 8 Dec inclusive		INMAP 88 International Seminar Ashok Hotel N. Delhi
Fri 9 Dec	10.00a.m.	UNDP MR. ISLAM-SIDFA
	2.00p.m.	MAEP Centre.
Mon 12 Dec to Fri 16 Dec inclusive	9.00a.m.	MAEP Centre Assignments and draft report
Mon 19 Dec	9.00a.m.	MAEP Centre. Review report with chief project co-ordinator.
Tue 20 Dec	10.00p.m.	Depart to airport for Vienna.
Wed 21 Dec	11.30a.m.	Arrive UNIDO for de-briefing.
Thu 22 Dec	10.30a.m.	Depart for U.K.

APPENDIX II  
INMAP '88 PROGRAMME

INTERNATIONAL SEMINAR ON MICROPROCESSOR APPLICATIONS  
FOR PRODUCTIVITY IMPROVEMENT

INMAP '88

(6th - 8th December, 1983)  
Hotel Ashok, New Delhi

Organised by:  
Microprocessor Application Engineering Programme (MAEP)  
Department of Electronics (DoE)  
(A joint DoE - UNDP Project)  
4th Floor, A-Block, CGO Complex,  
Lodi Road, New Delhi - 110 024.  
INDIA

6th December, 1988

09.00 - 10.00 - Registration/Inauguration

Welcome - Dr. V.P. Bhatkar  
Senior Director, DoE  
Presidential Address - Sh. K.P.P. Nambiar  
Secretary, DoE  
Inaugural Address - Sh. S. G. Pitroda  
Advisor to Prime Minister  
on Technology Mission  
Key Note Address - Prof. D. Popovic  
University of Bremen, FRG.  
Vote of Thanks - Dr. Krishna Kant  
Chief Coordinator(MAEP)

10.00 - 10.30 - Tea

10.30 - 12.30 - Session I - Microprocessor Architectural  
Advancements

Chair Persons - Dr. V.P. Bhatkar  
Sr. Director(DOE)  
Dr. C.A. Hobson  
UNDP Expert, UK

Paper I : Microprocessors : Present and Future  
Dr. C.A. Hobson, UNDP Expert, UK  
Paper II : Artificial Intelligence Using Micros  
Dr. D. Popovic, UNDP Expert, FRG  
Dr. V.P. Bhatkar, Sr. Director(DoE)  
Paper III: The Age of the Microprocessors  
Dr. A. Paul Raj, C-DAC, Pune  
Paper IV : Artificial Intelligence Using Micros  
Dr. E.J. Wightman, UNDP Expert, UK

12.30 - 13.30 - Lunch

13.30 - 15.30 - Session II - Microprocessor Applications in Medicine

Chair Persons - Dr. R.D. Lele, Chief Physician,  
Jaslok Hospital, Bombay  
Prof. S.Guha  
IIT, Delhi

Paper I : Computers in Cardiology  
Prof. S.N. Tandon, IIT, Delhi.  
Paper II : Microprocessor Applications in Medicines  
-State of the art  
Dr. R.D. Lele,  
Chief Physician, Jaslok Hospital, Bombay.  
Paper III: Medical Electronics-Status in India  
Shri H. Vijay Kumar, SCTIMST, Trivendrum  
Paper IV : Image Processing and its Medical Applications  
Dr. C.A. Hobson, UNDP Expert, UK.

15.30 - 16.00 - Tea

16.00 - 17.30 - Session III- Microprocessor Applications in Railways

Chair Persons : Shri Raghunathan  
RDSO, Lucknow.  
Shri Desh Deepak  
Project Coordinator,  
MAEP, Lucknow.

- Paper I : Microprocessor Applications in the sector of  
Railway Transportation for Productivity Improvement  
Dr. Ananthnarayanan, ADG, RDSO, Lucknow
- Paper II: Z80 Based Central Processor Unit for field  
stations in Metro Railway Systems  
Shri P.V. Prasada Rao, Manager  
Shri B.V. Bajaj, ECIL, Hyderabad.
- Paper III: Indigenous Microprocessor based systems for  
Indian Railways - Survey Report  
Shri Desh Deepak, Project Coordinator, MAEC, Lucknow  
Shri V.V. Singh, MAEC, RDSO, Lucknow

7th December, 1988

9.30 - 11.30 - Session IV A: Microprocessor Applications in  
Service Sector

Chair Persons: Dr. M.P. Dhir, Director, CRRI  
Dr. W.R. Slater, UNDP Expert, USA

- Paper I : Automation of Water Treatment Plants-The  
systems approach  
Dr. J.L. Peters, UNDP Expert, Netherland
- Paper II : A distributed Control system implementation  
for a waste water Treatment plant  
Dr. W.R. Slater, UNDP Expert, USA  
Mr. James M. Black, CH2M Hill Inc, USA  
Mr. Virginia B. Erickson, CH2M Hill Inc, USA
- Paper III : Microprocessor applications in Road Technology  
Sh. Y.R. Phull, CRRI  
Sh. S.R. Vijayaraghvan, CRRI, New Delhi
- Paper IV : Use of Microprocessor based equipments in  
testing and evaluation of motor vehicle drivers  
Dr. D.M. Sarin, CRRI  
Sh. Alind Saxena, CRRI  
Sh. B.L. Suri, CRRI, New Delhi.

9.30 - 11.30 - Session IVB : Microprocessor Applications  
in Communications

Chair Persons: Dr. A.M. Norton  
UNDP Expert.

- Paper I : Microprocessor in C-DOT - DSS  
Sh. S. Shankararayan, C-DOT, New Delhi

- Paper II : Microprocessor Interfacing techniques  
- using programmable logic devices  
Dr. A.M. Norton, UNDP Expert, Mexico
- Paper III : High Performance Token bus local area network  
Sh. S. Rajaram  
Sh. Chidambara  
Sh. K.J. Somashekhara  
Sh. Roopchandar, ITI, Bangalore
- Paper IV : Microprocessor for ISDN applications  
Sh. S.Shankarnarayan,C-DOT, New Delhi

11.30 - 12.00 - Tea

12.00 - 14.00 - Session VA : Microprocessor Applications  
in Process Industries

Chair Persons : Prof. D.Popovic  
UNDP Expert, FRG  
Dr. G.N. Acharya  
Director,CEERI,Pilani

- Paper I : Microprocessor based electronic systems for  
modernising of the sugar industries  
Dr. G.N. Acharya,CEERI,Pilani
- Paper II : Advanced control and supervision of utility  
systems in petroleum industries  
Dr. J.K. Pal,EIL, New Delhi
- Paper III : Microprocessor based instrumentation for the  
paper and pulp industry  
Dr. P.E. Shankarnarayanan,CEERI, Madras
- Paper IV: Microprocessor applications in process  
industries for simulation and control  
Sh. Ajay B. Pathak, SattControl(India)Ltd., Pune

12.00 - 14.00 - Session VB : Microprocessor Applications  
in Agriculture & Education

Chair Persons: Prof. V.V. Athani,  
IIT, Bombay  
Dr. J.H. Agarwal  
Project Coordinator(MAEP), Jabalpur.

- Paper I : Microprocessor and computer based electronics  
applications in agriculture - World wide scenario  
Dr. J.H. Agarwal, Project Coordinator, MAEP, Jabalpur.
- Paper II : Microprocessor based agricultural instrumentation  
in agricultural research and production  
Prof. Jag Mohan Singh  
Punjab Agriculture University, Ludhiana.
- Paper III : Microprocessor Applications in Agriculture  
Sh. G. D. Pathe, RCF Ltd., Bombay
- Paper IV : Some developments in Microprocessor applications  
in Agriculture  
Dr. J.L. Peters, UNDP Expert, Netherland
- Paper V : Teaching microprocessor based process control



- experience at IIT , Kanpur  
Dr. D.N. Saraf, IIT Kanpur  
Dr. Sanjay Gupta, IIT, Kanpur.

14.00 - 14.30 - Lunch

15.00 - 17.00 - Session VIA: Microprocessor Applications in Steel

Chair Persons : Dr.P.E. Shankarnarayanan  
Project Coordinator, AAPP, Madras

- Paper I : Microprocessor in steel plant modernisation  
Dr. J. Bhattacharya, Project Coordinator  
Sh. M. Satyaranjan, MAEP, Ranchi.
- Paper II : Microprocessor based distributed control  
system using optical link  
Dr. A.K. Ray, IIT, Kharagpur  
Sh. Tathagata Biswas, IIT, Kharagpur  
Sh. Sumantha K. Ghosh, IIT, Kharagpur
- Paper III : Real Time system for Gas management for steel plants  
Shri S.K. Roy, NIC, New Delhi.  
Sh. R. Pitchiah, AAPP, New Delhi.  
Sh. Pradeep Chopra, AAPP, New Delhi.
- Paper IV : Fine gauge control of strip using microcomputer  
based systems in five in stand in cold rolling mill  
Sh. P.V.S. Lakshman, MAEP  
Sh. S.B. Chowdhury, MAEP  
Dr. B. Puthal, MAEP  
Dr. J. Bhattacharya, MAEP, RDCIS, SAIL, Ranchi.
- Paper V : Microprocessor based SCADA systems for an  
electric arc furnace  
Prof. V.V. Athani, IIT, Bombay

15.00 - 17.00 - Session VIB : Microprocessor Applications  
in Test & Measuring Instruments

Chair Persons : Prof. B.G. Taylor  
UNDP Expert, Switzerland

- Paper I : Microprocessor applications in yarn testing  
Sh. S.B. Dholakia,  
Sh. H.S. Mazumdar  
Sh. O.N. Soni  
Sh. R.S. Chhajed  
Sh. Kirti J. Thakkar, AAPP, Ahmedabad
- Paper II : Microprocessor based field operated  
instruments for geophysical applications  
Sh. M.A. Shamsi, Astt. Director  
Sh. B.K. Sharma,  
Sh. S.K. Mittal,  
Sh. V.P. Sharma, CSIO, Chandigarh
- Paper III : Microprocessor based ATE for  
productivity improvement  
Sh. H.M. Pathak,

- Paper IV : Sh. A.M. Dhake, MAEC, Pune  
Microprocessor based cross correlation  
type flow meter  
Sh. D.P. Goel, Head, PID  
Ms. Sushma Aggarwal, CSIO, Chandigarh

8th December, 1988

09.30 - 11.30 - Session VII - Microprocessor Applications  
in Industrial Control

Chair Persons : Prof. S.S. Lamba,  
IIT, Delhi  
Dr. E.J. Wightman  
UNDP Expert, UK

- Paper I : Real Time Control and monitoring by Microcomputer  
Dr. B.G. Taylor, UNDP Expert, Switzerland  
Paper II : Distributed control systems  
- Implementation strategies  
Dr. Purkayastha, DESIN, New Delhi  
Paper III : Microprocessor based state feed back  
controlled Rotor Fed Induction Motor Drive  
Prof. S.S. Lamba,  
Sh. J.K. Chatterjee,  
Sh. J.K. Mendiratta, IIT, Delhi  
Paper IV : Experiences of DCS utilisation at MRL  
Shri P. Jayabal, MRL, Madras

11.30 - 12.00 - Tea

12.00 - 13.30 - Session VIII: Microprocessor Applications  
in Manufacturing Automation and Standardization

Chair Persons: Dr. J. L. Peters  
UNDP Expert, Netherland  
Sh. H.S. Mazumdar,  
Project Coordinator,  
AAPP, Ahmedabad

- Paper I : Standardization in Microprocessor field - Review  
Prof. D. Popovic, UNDP Expert, FRG  
Paper II : Microprocessor Bus standards make  
life easy/difficult for designer  
Shri H.S. Mazumdar,  
Sh. R.S. Chhajed, AAPP Ahmedabad  
Paper III : BHEL experience in manufacturing automation  
Shri G.P. Dodeja  
Dr. Vasantha B.J. BHEL, New Delhi  
Paper IV : Manufacturing automation - International scenario  
Mr. E.J. Wightman, UNDP Expert, UK

13.30 - 14.30 - Lunch

14.30 - 15.30 - Discussion Session - Microprocessor & Productivity :  
Technology

Chair Person - Sh. Sangameshwaran,  
Ex-Executive Director,  
Bhilai Steel Plant.

- Panel Members :
1. Dr. P.E. Shankarnarayanan,  
Project Coordinator, AAPP, Madras
  2. Prof. D. Popovic,  
UNDP Expert, FRG
  3. Prof. C.A. Hobson,  
UNDP Expert, UK
  4. Prof. B.G. Taylor,  
UNDP Expert, Switzerland
  5. Dr. J.H. Agarwal,  
Project Coordinator, MAEP, Jabalpur
  6. Mr. Gokhale,  
Director(Research), RDSO. Lucknow
  7. Dr. Krishna Kant,  
Chief Coordinator, MAEP
  8. Sh. H. S. Mazumdar,  
Project Coordinator, AAPP, Ahmedabad

APPENDIX III

ABSTRACTS OF LECTURES - E. J. WIGHTMAN

6 December - ARTIFICIAL INTELLIGENCE USING MICROS

3 December - MANUFACTURING AUTOMATION - WORLD SCENARIO

## ARTIFICIAL INTELLIGENCE USING MICROS

by

E. J. Wightman - UNIDO Expert

### ABSTRACT

This paper sets out to review the application of micros to principles of Artificial Intelligence, together with a review of what have become more widely known as "Expert Systems". Examples of applications in the fields of Process Engineering, Robotics and Manufacturing are described to illustrate how the micro has become indispensable in the implementation of A. I. technology.

The subject has been approached from a practical standpoint with reference to the specialised areas of activity which constitute the key elements of input comprising a working system.

The role of the micro is seen to be an important ingredient towards the wider application of Artificial Intelligence because of low cost and ease of application for systems requiring the necessary parallel processing capability demanded for implementation and future expansion as technology advances.

Current development activities in various countries are briefly summarised. It is concluded that there is much scope for development of special purpose systems for physical processes using micros, in particular the integration of tactile and vision sensors, in parallel with research into simplified language based A. I. systems and knowledge based software shells.

**MANUFACTURING AUTOMATION - INTERNATIONAL SCENARIO**

by

**E. J. Wightman - UNIDO Expert**

**ABSTRACT**

This paper centres on three main topics, firstly the use of computers in the manufacturing process to improve accuracy, quality and response to market needs, secondly the criteria necessary to progress from the manufacture and use of machine tools to computer controlled machine tools including flexible manufacturing systems, thirdly to examine requirements for implementation of a modernisation programme, based on experiences in Third World and OECD countries.

## APPENDIX IV

### INMAP 88 CONFERENCE

#### Summary of Main Points raised by Delegates during Concluding Discussion Session 8 December at 14.30 to 15.30 in Ashok Hotel.

1. Sensors. There is a need to define what is available in India, possibly in the form of a data bank. Sourcing is a major problem affecting the whole of M.A.E.P. Consideration should be given to forming an indigenous sensor development programme.
2. Co-operative projects are recommended between:
  - Industry
  - M.A.E.P.
  - Universities and Research Establishments (CERI etc.)
3. During the M.A.E.P. activities to date, results show that industry has a better track record of achievement than M.A.E.P. centres which are part of D.O.E. or are university based. Examples - Bangalore and Ranchi have performed better than Pune and Jabalpur.
4. The end products of the M.A.E.P. were queried. Who utilised the outputs of the programme?
5. M.A.E.P. should promote software with system engineering and applications of microprocessor based systems.
6. There is a need for pilot projects for future systems development to develop project management expertise.
7. There is a need for awareness and education programmes at all organisational levels, from chief executive, directors, managers, development engineers and shop floor, with emphasis on senior management levels.

The above notes were compiled by the following UNIDO Experts who attended the Discussion Session:-

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## APPENDIX V

Technical Report DP/IND/84/030/11-05/31.9.E - June 1987- Extract

### 2. RECOMMENDATIONS

The M.A.E.P. activities to date are succeeding in promoting awareness of the benefits of microprocessor applications in various industries at component level. Several developments arising from this programme now warrant special attention at system/management level:-

2.1 There is a need for projects combining multi-disciplined activities such as sensors, interfacing, microprocessors and actuators, to provide a background against which system engineering and project management disciplines may be developed.

2.2 Since a microprocessor accounts for only 30% of a typical system, more attention should now be directed towards intelligent sensor developments. The lack of an indigenous sensor industry in India is seen to be a serious constraint to the rapid application of control systems in the near future, because of dependence on foreign supplies.

2.3 Experts are required in Ranchi and Pune centres to assist in system engineering and project management disciplines. UNIDO assistance is required.

2.4 Major projects in the field of computer aided manufacture have been defined which could be a logical extension of UNIDO/UNDP projects in the fields of computer aided design/manufacture and computer aided management. A national project incorporating an FMS facility for "hands on" industrial training is now proposed as a means of integrating facilities where the infrastructure already exists for training technical and managerial specialists.

2.5 Further projects in advanced manufacturing technology for precision mechanical components and automatic assembly of thick film circuits are currently being planned which may require UNIDO/UNDP assistance.

2.6 The CAD, LSI facility developed in Bangalore centre should be extended to other M.A.E.P. centres. Consideration to the development of custom designed displays for system monitoring should be included for a future work programme extension requiring UNIDO/UNDP assistance.