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Group Training Programme on Application of CAD/CAM Systems in Mould and Die Tools Design Budapest, 18-30 November 1996

FINAL REPORT

Dr. Tamás MÁRKUS
Programme Director

December 16, 1996

I. INTRODUCTION

A. Background

The Asia Pacific region has witnessed phenomenal economic growth over the past 20 years, resulting widespread industrial diversification and the application of new technologies in all areas of manufacturing, services and agriculture. Future economic advancement, however, will depend on the ability of small and medium firms to continue to improve their productivity through acquisition of more advanced technology, training and technical assistance programs.

The manufacturing industry in the region plays key role in industrial development. It is a basic industry which provides essential technical support services to ensure efficient operation af all the industries. The new technology associated with CADCAM , the performance of the small and medium engineering industries in some developing countries of the region (especially NICs) has been remarkebly enhanced since the early 1990s. The traditional advantage of cheaper labour in the region has greatly lost its significance in face of the greater flexibility of modern production systems using computer aided facilities This new technology directly contributes to significant cost reduction and faster production in all types of engineering industries.

The CAD/CAM technologies have the effect of reducing production time, product development time, labour input, and wastage of materials. In addition, there are other benefits in terms of productivity and quality, and also of flexibility, since automated design and production methods make it easy to alter product design and manufacture to take account of shifts in patterns of demand or of types of input available. In the reconstruction of industy in this region CAD/CAM and automatic handling and assembly systems will of course play an important role, giving an impetus to market of automation equipment as a whole.

Given the new thrust on private sector development in most countries, new industrial enterprises will be encouraged to develop and some of them would invariably need to use automation techniques, especially in engineering industry.

One of the major structural weaknesses of the developing countries' manufacturing industries is the lack of subcontracting and specialization. In other words, there is a lack of backward linkages of large prime manufacturers with domestic supplying firms, the so called 'supporting industries'. The concept of supporting industries has recently received much attention, when the building up of strong supporting industries is among the priority industrial policy issues. They contribute to reducing the import dependency of industrial production, create additional employment, link large- and medium sized companies through subcontracting arrangements, broaden the basis of domestic enterpreneurship and often lead to a higher utilization of domestically available natural resources.

Moulds and dies are essential to downstream industries producing a wide range of plastic, metal, rubber and glass products. The moulds and dies industry, therefore, is a key supporting industry on which many domestic industrial customers can rely. Moreover, with the expected progress of the Asian countries' engineering and chemical industries, demand can be assumed to grow significantly in the future.

The importance of the dies including forging, sheet metal forming and precision stamping dies and moulds for a national industry, is a well known fact. In many sectors of the manufacturing industries dies and moulds are widely used for a variety of operations. For example, at present 40 to 90 percent of the components/parts of automotive products, consumer goods, light-industry goods (e.g. electrical and electronic appliances) and goods produced by machinery and instrument making industries, etc. are all manufactured by using dies and moulds.

The capability of die and mould industry and hence the quality of dies and moulds have a direct impact on the quality of the products as well as the productivity of production operations, cost, consumption of raw materials, etc. Therefore, the development of die and mold design and manufacturing technologies and facilities is, in fact, a necessary condition for the development of other manufacturing industries.

The existing major problems associated with the application of CAD/CAM systems in Asia are as follows:

a) A number of new advanced technologies (CAD, CAM, CAE, CIM) already commercially available in the region are expensive and not very reliable.

b) Despite the technological maturity and increasing reliability of new technologies, the process of diffusion is not as rapid as originally expected, very uneven at country, industry and user level and has been implemented with varied degree of success.

c) These technologies require considerable repair and maintenance skills that are not easily available in the countries of the region. It is very important to have local supply of these technologies to facilitate after-sales service (a supporting infrastructure)

d) The process of integration of new technologies, even integration of CAD and CAM are not without major problems. This fact, again requires specific and deep knowledge of standardisation aspects of computer interfaces, software, data exchange and involvment in research and development.

It has therefore become essential to organize the training programme on the CAD/CAM applications in mould and die tool design for specialists from the Asian countries aimed at getting participants informed on latest trends in application of industrial CAD/CAM systems in engineering industry in developed and developing countries and identification of common elements and approaches in this area as well as possibilities and potentials for the international cooperation. International workshops on CAD/CAM give advice on important key factors with regard to the introduction of automation systems, on the state-of-the-art in the relevant technologies, the degree of diffusion in major application areas and branches, technological and financial barriers and market potentials in the second half of the 1990s.

In view of its long standing achievements and experience in the field of CAD/CAM, Hungary is well placed for organizing a special workshop for developing countries in the field of CAD/CAM applications in engineering industry. Hungary has a number of industrial support and service institutions in the basic area of analysis, design, quality control, maintenance and repair, production technology, etc. There is a whole structure to demonstrate participants all aspects of CAD/CAM systems including their practical applications.

In order to address a) - d) issues discussed above UNIDO, together with the Hungarian Government, organized a Group Training Programme on 'Application of CAD/CAM Systems in Mould and Die Tools Design' for specialists from seven Asian countries (India, Malaysia, Pakistan, Philippines, Sri Lanka,Thailand, Vietnam). The training program gives information on the latest trends in application of industrial CAD/CAM systems in engineering industry in developed and developing countries. The program also gives a sound basis in industrial application of CAD/CAM in mould and die design and manufacturing.

This programme is designed for specialists from engineering industry with university (or equivalent) degree and who are responsible for the application of computer aided design and manufacturing systems in production with at least 3 years of practical experience (engineers, senior engineers, chiefs/heads of sections and departments and managers). Participants should have an advanced knowledge of CAD/CAM systems and their applications for product design and fabrication.

B. Programme objective

To enable 14 engineers and managers from the seven Asian countries to introduce and to adapt computer-aided software engineering techniques for the design of mould and die tools in manufacturing industries.

C. Organization

The Training Programme was organized by UNIDO in cooperation with the Government of Hungary and with SAGE Ltd (Host institute) in Budapest from 18 to 30 November 1996. Additional 5 companies and about 30 experts and trainers from many companies worked on the realisation of the training program.

Besides the planned 14 participants from the seven Asian countries, the request of India to nominate a third experts was positively evaluated and accepted and finally 15 experts could participate in the Training Programme. One UNIDO representative also visited the Programme.

Annex I. contains the list of participants

II. EXECUTION OF THE TRAINING PROGRAM

The Program methodology and implementation was based on a four-step approach with the following characteristics:

a) The first part had presentations on various aspects of the latest design practice and production methods of mould and die tools, to give equal basis for the participants with different background.

b) The second part introduced CAE simulation and analysys methods used to design optimal solutions for mould and die tools, the CAD/CAM specific mould and die design practice also was demonstrated. To give the maximum output for the participants real, existing tool designs were discussed and processed with the CAD/CAM/CAE systems. In this phase 4 CAE and 2 CAD/CAM systems were demonstrated some of them giving hands-on practice possibilities for the participants.

c) The third section had a number of industrial visits. The visits were organized on identical approach:

- at first an overall view on the company's product profile and market characteristics was given,
- then CAD/CAM specific design and technology planning experiences were introduced (with system software and hardware specifications),
- manufacturing and workshop practice was introduced then, discussing experiences and the recommended solutions of quality issues,
- finally questions and remarks of the participants were discussed, answered by the experts.

The participants' interest was especially attracted by those technologies and professional experiences which are also utilized in their industries. The experts' interest was also extremely high when industrial CAD/CAM sytems and workshop level experiences were demonstrated because some of the systems are just under implementation or just have been working for a period in their home countries.

The participants gaine experiences altogether with 6 CAD/CAM systems in industrial environment and utilization. The field of application was broad: forging die tools, sheet-metal press tools, aluminum pessure cast and die cast tools, plastic injection mould tools and rubber industry tools were all covered.

d) In the 4th logical part of the Programme the issues of CAD/CAM standards in planning, selection and implementation of CAD/CAM technologies were discussed and the key role of product data exchange standards in building up supporting industries was also outlined.
Some of the participants have been working on the implementation of various projects addressing manufacturing technologies (including CAD/CAM applications) consequently the topics attracted deep interests, new needs for additional guidance and generated useful discussions.

On basic questions of project issues and on ongoing projects a very well prepared and helpful presentation was given by the visiting UNIDO representative.

Annex II. contains the Time-table and topics of the Training Program.

III. FINDINGS AND RECOMMENDATIONS

The experience gained during Programme execution and the many discussions with the participants concluded the following findings and recommendations

1. The 2-week Programme is suitable to meet the objectives and to train experts, when they are professionals in one or more fields of the topics.

2. There is an explicite need to repeat the Programme and to train other experts from the participating countries.

3. Strong needs were also expressed for a second phase of this Training Programme with 2-3 major (specialised) topics and with possible returns to the visited companies.

4. Although the background of the participants varies in technology, capacity and systems they need guidance in industrial introduction of the new CAD/CAM technology.

5. Explicit needs came for helping ongoing projects (e.g. from India) with expertise on manufacturing technologies, implementation of CAD/CAM applications.

6. Expertise and possibility of cooperation was asked in the field of the new international standards on data exchage (e.g. India, Malaysia, Pakistan).

7. Having finished the establishment projects the regional CAD/CAM Centeres need additional expertise (e.g. in university level training of CAD/CAM applications in Sri Lanka).

8. The participants stated, that the Training Programme fulfilled its objectives and with the demonstrated many application areas a strategic view also was given on the implementation and utilization methods of CAD/CAM technologies in mould and die tools design.

9. Because of the export oriented marketing policy of many of the visited companies, the participants realised the rapid technology evolution powered by CAD/CAM applications and the resulting strong market position of a sub-contrator or supplyer type enterprises.

10. The development of an action plan for the follow up of the Programme is recommended at the end of January or the first half of February 1997 when all the incoming needs of the participating countries will arive and will be processed and discussed.

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TRAINING PROGRAMME

1st Week

Monday, November 18.

1000-1145 Opening Session
- Welcome (By Dr. Tamás Márkus Director of SAGE Ltd, UNIDO Expert on CAD/CAM Applications, Programme Director)
- Roll call of participants
- Program discussion
- Administrative matters
- Any other business

SAGE Ltd 1148 Budapest, Fogarasi u. 10-14. 4th floor, Meeting Room

1200-1300 Lunch, SAGE Ltd

1330-1615 Design of closed forging die tools and sheet metal pressing dies (Prof. Dr. György Ziaja, Technical University of Budapest)
Technical University of Budapest (TUB) Bldg D.#122

Tuesday, November 19.

0845-1145 Overview of mould design (Dr. József Ujj Associate Professor, UNIDO Expert on Mould Design)
TUB Bldg MM. 1st Floor, Reading Room

1145-1300 Lunch, TUB

1300-1600 Methods, technologies, tools in mould and die production
(Dr. Sándor Markos Associate Professor TUB, CAD/CAM Manager of GRAVITAS 2000 Ltd)
TUB Bldg G. 1st Floor #115

Wednesday November 20

0845-1145 Computer Aided Engineering (CAE) methods in die and mould technology
- Computer aided simulation of sheet-metal forming. Application of PLANE-CAE System (Dr. Ferenc Boór Research Fellow TUB, Director of MAZE 2000 Co.)
- Standard elements of moulds and tools. Application of HASCO CAD- standards element software (György Somkuti Eng., TRADEST Ltd and Miklós Nagy MSc., HASCO Budapest)
- Computer aided moulding analysis. Application of C-Mold system (Gábor Karacs MSc,TAROK Engineering Ltd)

TUB Professor Guest House, Conference Room

1145-1300 Lunch, TUB

1300-1600 CAE Systems demonstrations
- PLANE CAE (Dr. Ferenc Boór TUB, MAZE 2000 Co.)
- HASCO Standards Module (György Somkuti Eng., TRADEST Ltd)
- C-Mold (Gábor Karacs MSc., TAROK Ltd and Zoltán Dézsy Grad. TUB)

TUB Bldg G. Computer Rooms

Thursday November 21.

0845-1145 FEM based simulation of metal forming processes. FORM-2D system
(Dr. György Krállics Associate Professor TUB)
TUB Bldg D. #506

Design and manufacturing of forging dies, moulds with surface modelling.
Application of CAMAX system (Péter Turi MSc, TRADEX Ltd)
TUB Professor Guest House, Conference Room

1145-1300 Lunch, TUB

1300-1600 Processing with CAD/CAM systems:
- Design of form tools with solid modelling - I-DEAS
(Sándor Zsámboki MSc., Knorr Bremse Co.)
- Design of a forging die with surface modelling - CAMAX
(Túri Péter MSc., TRADEX Ltd)
- Methods of measurement (Dr. Tibor Szalay Associate Professor and
Dr. Erika Zatykó Associate Professor TUB)

TUB Bldg G. 1st floor Computer Rooms and Laboratory

Friday November 22.

0720 Meeting in the Lobby of the Hotel and travel with hired bus to RÁBA Works, Győr (about 130kms west of Budapest)

0930-1500 Visiting **RÁBA WORKS**
Host: István Pintér BSc., Director of Informatics,

CAD/CAM of forging die tools. ANVIL-5000 system on DEC platform. 3D CNC milling of tools, EDM wire and die sinking technologies, inspection techniques.

1515-1630 Lunch, Győr

1815 Arrival to Hotel

2nd Week

Monday November 25.

0800 Meeting in the Lobby of the Hotel, travel (public transportation) to IWAG-IKARUS.

0900-1200 Visiting **IWAG-IKARUS.**
Host: Bálint Lacsny MSc., Director

CAD/CAM of sheet-metal pressing die tools. EUCLID sytem on Silicon Graphics platform, CNC manufacturing of dies, metrology

1230-1345 Lunch, IWAG-IKARUS

1315-1500 Visiting the IKARUS Autobus Museum and the workshops of Préstechnika (Metalpressing) Ltd.

Tuesday November 26.

0720 Meeting in the Lobby of the Hotel and travel with hired bus to Le Belier Hungary Co,
Ajka (about 150kms SW of Budapest)

1000-1515 Visiting **Le Belier Hungary**
Host: István Horváth MSc., Head of Die Making Workshop

CAD/CAM of molds and tools. DUCT 5 system on SUN SPARC platform. CNC milling of dies and electrodes, EDM die sinking technologies, coordinate measuring methods.
Visit of the aluminum high pressure casting and die casting workshops.
(Lunchbreak: 1230-1330)

1900 Arrival to Hotel

Wednesday November 27.

0845-1130 Introducing the profile, products and technologies of **GRAVITAS 2000 Ltd.**
Host: Dr. Sándor Markos CAD/CAM Manager
TUB Bldg G. #115

1140-1240 Lunch, TUB
1240-1315 Travel (public transportation) to GRAVITAS 2000 Ltd.

1345-1645 Visiting the company
Host: Zoltán Fülöp, Director

CAD/CAM of plastic injection moulds. CAMAX, VARIMETRIX systems on Silicon Graphics and INTERGRAPH platforms. CNC milling and EDM machining of tools, measuring.
GRAVITAS 200 Ltd . 1139 Budapest, Lomb u. 31/c

Thursday November 28.

0845-1500 Visiting **SAGE Ltd.**
Host and presentations by Dr. Tamás Márkus Director, UNIDO Expert on CAD/CAM Applications, Programme Director)

Company profile, basic activities
Application based modules of CAD/CAM systems. Interfacing and upgrading
The use and benefits of international standards in CAD/CAM applicatioans

1200-1315 Lunch, SAGE Ltd

1330-1500 The STEP international production data standard: goals, solutions. The Express language, Application Protocols (APs), conformance testing methods.
Recent application status at major CAD/CAM vendors.
Application oriented selection of CAD/CAM systems, project implemetation issues
Discussion

SAGE Ltd. 1148 Budapest, Fogarasi u. 10-14. 4th floor, Meeting Room

Friday November 29.

0800 Meeting in the Lobby of the Hotel, travel (public transportation) to Z-Form

0900-1215 Visiting **Z-Form**
Host: István Zakariás MSc., Director

CAD/CAM of manufacturing tools of rubber industry. Pro/Engineer and PEPS systems on HP platforms. CNC manufacturing of moulds, metrology.

Z-Form Ltd. 1087 Budapest, Asztalos Sándor u. 4.

1215-1245 Travel (public transportation) to SAGE Ltd.

1245-1345 Lunch, SAGE Ltd

1400-1500 Closing Session (Closing words by Dr. Barnabás Fáy, Vice President of UNIDO Hungarian National Committee)

SAGE Ltd. 1148 Budapest, Fogarasi u. 10-14. 4th floor, Meeting Room

Saturday, November 30 and Sunday, December 1

Departures from Budapest.