CAD/CAM NEWSLETTER

June 1985

Information Compiled by the CAD/CAM Technology Advancement Council*

Summary of this Issue

1. CAD/CAM Council Holds 4th Coordination Meeting

The CAD/CAM Technology Advancement Council recently sponsored the fourth in a series of meetings which have been held over the past few years to provide informal information sharing and coordination between CAD/CAM centres across Canada. The meeting was held in Montreal, June 11 - 12, 1985 with invited representatives attending from centres in Nova Scotia, New Brunswick, Quebec, Ontario, Manitoba, Saskatchewan, Alberta and British Columbia. This included representation from the newly formed CAD/CAM Robotics Centre of the Saskatchewan Research Council in Saskatoon, the Centre for Advanced Resource Technologies (CART) in Prince George, British Columbia and the Centre Québécois pour l'informatisation de la production (CQIP) in Montréal who handled local arrangements for the meeting.

As with the previous three meetings, there was a free and mutual exchange of plans, experiences, and ideas between the representatives who were anxious to help each other in their endeavours to the maximum extent possible. Due primarily to their regional and geographical distribution it was apparent that the centres are functioning in a cooperative mode with very little competition or overlap between them. Centres in some provinces reported that much of their success has been achieved as a result of pulling the resources of various groups together within the province so that they operate under a common plan and avoid duplication which might otherwise have occurred.

Industry studies of problems, attitudes and effectiveness undertaken on behalf of several centres, such as the recently completed Foster report for the Ontario Centre for Advanced Manufacturing, reveal that in spite of the best efforts of the centres, who are achieving reasonable penetration considering their short life to date, there is a tremendous effort still required. Transforming industry through the wide scale adoption of new advanced manufacturing technologies is a large scale problem. Statistics therefore show, that in spite of the best efforts in Canada to date, we are still falling behind with respect to other countries. A number of studies and reports indicate that the barriers are primarily attitudinal, mainly concerning the knowledge and awareness of senior management personnel. The availability of funds is seldom identified as a real problem once a firm decision is made to proceed, but reaching this step may be hindered by traditional, but outdated, managerial or accounting practices. The top priority, at least at the present time, as far as most companies are concerned, is to address the need for information and knowledge. The current problem is therefore seen to be a knowledge diffusion problem rather than money problem. A need for management and engineering education was identified as well as training for plant floor operators, which will eventually follow, and it was then suggested that centres should advise their provincial governments concerning these needs.

As a postscript it can be added from the Foster report, prepared for the Ontario Centre for Advanced Manufacturing, that approximately 80% of Ontario manufacturers have no registered professional engineers on staff. This would tend to indicate that many manufacturers do not have sufficient technical expertise to competently apply new technologies in their operations, without outside assistance.

Early in the Foster report study persons interviewed were asked how they would go about finding information or getting assistance in regards to planning or implementing AMT. Twice as many (35%) mentioned contacting vendors or suppliers as any other method.

Yet, inadequate support and services from vendors is perceived to be a major problem when incorporating AMT. In fact, among large manufacturers, who have presumably had the most experience in implementing new technologies, 48% indicated vendor support (or lack of it) was a problem.

This is no doubt symptomatic of the fact, at least in part, that with the high rate of technological evolution in vendors' products and systems, it is extremely difficult for the vendors to keep field personnel (sales and support) fully trained and familiar with all the latest offerings. Also, with prices steadily dropping in many technologically-intensive markets, there is less absolute profit on each sale, which means the vendor cannot afford to spend as much time assisting or guiding the customer. Compounding the problem is the growing need for integration of disparate products or systems which were previously operated independently. This increases the need for people with interdisciplinary skills and knowledge in many product areas. Attendees at the meeting underscored that the real barrier will come in Computer Integrated Manufacturing (CIM) which we

should be emphasizing more than CAD. In CIM, it was pointed out, responsibility for the development of broadly informed and capable personnel will fall even more heavily on user companies than on vendors.

The perceived shortfall in vendor support (relative to traditional levels) along with the increased need for integration of products from multiple vendors, lends support to the technology centre concept. The ability of the technology centres to provide high quality, unbiased assistance ranging widely in type and duration, and involving working with many vendors' products, is both unique and needed.

As an indication of progress, the New Brunswick Centre pointed out that from 1983 to 1985 the number of CAD/CAM installations in the province had risen from 3 to 13 and is projected to reach 20 in 1986. Similarily, the number of NC machine tool installations in the province have increased from 11 in 1983 to 19 in 1985 and are projected to reach 25 in 1986. It was also pointed out, by an industry representative, that the existence of a centre and the support it can provide is sometimes an important factor in choosing a plant location.

In discussing the need for further coordination and information exchange between centres, representatives endorsed the need for a National Manufacturing Technology Information Centre which they stated to be needed and overdue.

As indicated in the April issue of the CAD/CAM Newsletter, a report has been prepared and is available from the National Research Council as "A Reference Guide to CAD/CAM and Robotics Development and Information Centres in Canada and the U.S.A.". The report, NRCC # 24511, is expected to be of use to industry managers and technical personnel to advise them of the capabilities of the centres which are available to them as well as being useful to the centres themselves. Approximately 70 centres across Canada, and close to 40 centres in the U.S.A., on a selected basis, are described in the 382 page report. For further information concerning this report which is available in either French or English at a price of $10.00.

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2. CASA/SME President Reviews NASA Study for Toronto Audience

Speaking to attendees of "The First Annual CASA/SME Chapter 286 Dinner", Mr. James M. Hardy, International President of the Computer and Automated Systems Association of the Society of Manufacturing Engineers (CASA/SME), reviewed recent developments of the association and in computer integrated manufacturing in the U.S.A.

CASA was launched as a separate division within SME in 1975 to provide a needed focus on CAD/CAM, Computer Integrated Manufacturing (CIM) and automated systems. Mr. Hardy reported that CASA has grown dramatically, with forty chapters now operating in thirty countries, and is approaching ten thousand members. The CARIC library, maintained at the SME headquarters in Dearborn, Michigan, now contains approximately 22,000 volumes.

Reference was made to the CASA wheel, designating the many facets of CIM, and to the CASA program for industry LEAD awards which are presented each year. This award, the highest CIM recognition, is conferred on a company technical management team that has successfully implemented CIM into its operation. Recipients, since the inception of the award, have been:

- John Deere Tractor Works, Waterloo, Iowa
- Ingersoll Milling Machine Co., Rockford, Illinois
- Western Electric Co., Richmond, VA
- General Electric Co., Steam Turbine Generator Business, Schenectady, N.Y.

Mr. Hardy also described the study undertaken for NASA on the state of advanced manufacturing technology in the U.S.A. The study was undertaken in view of the dual objective of NASA to be a leader in the development and application of technology in addition to the objective of launching a manned space station by 1992 with a budget of $8 billion. The study team interviewed chief executive officers of five companies who are leaders in the application of CIM, two of which were LEAD award winners.

A few of the findings reviewed are as follows:

- The computer integrated manufacturing projects were undertaken by the companies in response to world wide competition, even as a matter of survival.

- Critical factors involved selecting the best people for the project team, and providing them with clear authority and accountability.

- Successful projects used the total management and technical strength available, not that of just a few people.

- The study interviewers were astounded at the detailed systems knowledge of the chief executive officers interviewed. Obviously they had really been involved, not just briefed for the occasion.

- There is a concern that most companies in the U.S.A., do not appear to have a significant effort and many might not have the management skills to undertake such projects.

Resulting from a recommendation of the study, Mr. Hardy advised that NASA have requested the SME to be the repository of knowledge in CIM technology. A review of the obligations and resources this would involve is therefore being undertaken by the SME.

3. National Science Foundation Announces Six Major Engineering Research Centres

A recent April 1985 release by the National Science Foundation (NSF) concerning the announcement of six major engineering research centres included information related to computer aided design and manufacturing. The six universities and two affiliates chosen to operate the six centres will receive up to $94.5 million over the next five years.

Included in the list, Purdue University, West Lafayette, Indiana, will establish a Center for Intelligent Manufacturing Systems, with initial funding of approximately $1.6 million and up to $17 million over the five-year period. The center will focus on automation for batch manufacturing of discrete products. The central concept will be to develop an "intelligent" manufacturing system which is capable of at least semi-autonomous reasoning to reduce the cost, time and errors involved in batch manufacturing.

The University of Maryland, in collaboration with Harvard University, will establish a Center on Systems Research at the College Park Campus. Additional research, including that in robotics, will be carried out in Cambridge, Massachusetts. Maryland will receive up to $16 million over five years with approximately $1.5 million to be received the first year. The research theme at this center will be basic research in the implications and applications of Very Large Scale Integrated circuits, computer-aided engineering and artificial intelligence in the design of interactive automatic control and communication systems. The participation of Harvard will add to the theoretical and applied systems engineering aspects of the center and bring a wider range of industrial firms into the effort. John S. Baras, professor of electrical engineering, will head Maryland's center.

The University of California at Santa Barbara will receive up to $14 million over the five-year period. The first award of approximately $1.17 million will be used to establish a Center for Robotics Systems in Microelectronics. The center's principal objective will be to create new technology in flexible automation for semi-conductor device fabrication and to educate engineers for skills in the implementation of robotic systems. The center will be headed by Susan Hackwood, professor of electrical and computer engineering.

The centers are being established to develop fundamental knowledge in engineering that will enhance international competitiveness. This will be done by focusing cross-disciplinary research on subjects of emerging technologies and fundamental underpinnings of the engineering sciences. The centers also will promote interaction between industry and the universities and prepare top quality engineering graduates needed by U.S. industry. The centers are expected to gain significant industrial support.

Other centres included in the announcement include:

- Telecommunications at Columbia University;
- Composites Manufacturing at the University of Delaware at Newark, in collaboration with Rutgers University;
- Biotechnology Process Engineering at the Massachusetts Institute of Technology.

The six centers included in this announcement of April 1985 are the first of a series. Additional awards are expected to be made in future years.

4. Robot Population in Canada

The survey undertaken by Canadian Machinery and Metalworking, and reported in their May 1985 issue, contains some useful data concerning the robot population in Canada. Interpreting the data reported in the March 1984 and May 1985 tabulations, the following comparison is obtained for the number of installations at the end of the preceding year in each case.

	March 1984		May 1985	
	No.	%	No.	%
Major automotive firms	266	77	318	63
Other industry	52	15	108	22
Education, Research & Demonstration	29	8	76	15
Total	347	100	502	100

Caution should be noted concerning interpretation of the increase from 347 to 502. It is apparent that much of this is due to the increasing breadth and depth of the survey as witnessed by the number of organizations now reporting installations earlier than 1984, the most recent year of the survey.

Additional data were reported in the February 1985 issue of CAD/CAM and Robotics Magazine, based on a telephone survey conducted by M. Nelson of the Ontario Ministry of Industy and Trade. A total of 870 robots were identified, with estimates of the true number in the 900 - 1000 range. The reported distribution by user compares favourably with the above data, being estimated at 69.1% automotive and automotive parts sectors, 20.7% other manufacturing and 10.2% in government, education and crown corporation environments.

The Canadian Machinery & Metalworking report of May 1985 contains an additional section to report on installations of other new "frontier" manufacturing equipment. It is interesting to note that coordinate

measuring machines, or other forms of inspection equipment, account for nearly all of the reported installations in this category. A further section of their May publication contains data on the number of CAD/CAM installations in Canada while the March issue contained their annual NC census report.

5. Flexible Manufacturing Systems in the United Kingdom

Previous issues of the CAD/CAM Newsletter have drawn attention to descriptions of flexible manufacturing systems in the U.K., such as the first major unmanned flexible manufacturing system, called SCAMP, installed in Colchester, Essex, North-East of London. As reported in the June 1983 Newsletter, this pioneering installation, which contains nine machining processes and eight robots, was completed after four years of research with government support for more than half of the $5.6 million cost. The system shows that it is possible to machine 25 to 100 units, untouched by hand within three days, whereas conventional manufacture would require 50 handlings over a period of eight weeks.

A second, well publicized installation in the U.K., is at the Normalair Garrett Corporation factory at Crewkerne in Somerset where a small factory using a flexible manufacturing system controlled by a PDP11-70 produces precision components such as cabin pressure controllers for aircraft (see CAD/CAM, Vol. 5 & 6, 1984).

The following articles describe several advanced manufacturing and flexible manufacturing systems employed at the Rolls-Royce, Derby plant in England for the manufacture of jet engines, including the RB-211 engine used in the Boeing 747 and with some modification in the Boeing 757.

- "Rolls-Royce Target: Batches of One" The FMS Magazine, January 1983, pp. 90 - 94.

  Describes three of sixteen FMS projects which collectively constitute a plan to reduce inventory at Rolls-Royce by £ 600 million over a four to five year time span. The target, for which it is believed the technology is now available, is to manufacture jet engine components in batches of one. It is expected that each FMS module established will pay for its capital cost within the first twelve months of operation by savings in inventory. The first of such systems employs seven Elb creep feed grinding cells, each containing two machines and one MHU ASEA robot, for the production of turbine blades. However, this seven cell grinding system is due to be superseded technologically by a single new twin head (Hauni-Blohm) grinding machine with a computer controlled five axis positioner. A third system, called the AIMS system (Automated Integrated Manufacturing System), employs robo cars over a wide factory floor area to handle forgings for turbine discs and compressor wheels in their movements from a work in progress storage area to the turning and machining centres.

- "Automation of Aero-engine Manufacture" The Rolls-Royce Magazine, No. 16, March 1983.

Article describes the flexible manufacturing systems in the Derby plant for the manufacture of turbine blades and the AIMS system for compressor and turbine discs. The need to re-examine the entire manufacturing concept, with emphasis on opportunities to improve previous high set up costs, long lead times and high inventory levels is stressed, plus the opportunity to improve quality levels. Previous advances in creep feed grinding have reduced the cycle time for a blade machining time from typically, six minutes to 45 seconds. In the "batch of one" flexible manufacturing concept extensive use is made of devices such as slave rings, expanding mandrels, standard pallets and encapsulation to provide easy gripping, transportation and parts registration. (Editorial note: In the turbine blade FMS, the blades are encapsulated in a zinc matrix using a process and equipment developed and supplied by Fisher Gauge of Peterborough, Ontario).

- "Rolls-Royce Installs Multi-robot Grinding" Industrial Robot, March 1983, pp. 16-17, 19

Describes project activity starting in 1981 which lead to the development and installation of a large multi-robot machining line for producing turbine blades at the Rolls-Royce, Derby U.K. facility. Delivery of the complete system including seven Electrolux (now ASEA) robots and 95 m of pallet conveyor, including pre-delivery trials in Sweden and air freight delivery to the U.K. was accomplished in approximately 17 weeks with line start-up in October 1982. Most cells of the seven cell system contain one robot, two continuously dressed creep feed grinding machines, plus blade cleaning and inspection equipment. Between cells the conveyor system provides transport of the encapsulated and palletized blades.

- "Fully-automatic Flexible Manufacturing all for Turbine Blades" P.L. Taylor, Aircraft Engineering, December 1984, pp. 8-9

Describes operation of the electrical discharge machines (EDM) employed in the final cell of a seven cell flexible manufacturing system for producing turbine blades. An indexing cassette containing five electrodes is employed for five machining operations followed by an ultrasonic cleaning unit where any dielectric and swarf is removed prior to automatic inspection. On completion the previously encapsulated blades are returned to the FMS conveyor by the cell robot.

6. CAD/CAM Information Available

- "Computers in Industry" Spring 1985.

In addition to being included as a special insert in the May issue of seven of their publications such as Design Engineering and Canadian Machinery and Metalworking, this special 94 page report is available in

reprint form. A wide range of contributed articles discuss steps in the justification for CAD/CAM, a tutorial on local area networks (LANS), recent developments in voice recognition, speech synthesis and machine vision, computer integrated manufacturing, flexible manufacturing, manufacturing resource planning and other associated topics. Copies are available $10 each, five for $25 and $3 for each additional copy.

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7. CAD/CAM Conferences, Exhibitions, Workshops and Seminars

- "CIPS Congress 86"
April 28 - May 2, 1986, Vancouver, British Columbia.

Call for papers has been issued by the Canadian Information Processing Society (CIPS) for the 1986 National Conference to be held in Vancouver, B.C. just prior to the opening of EXPO '86. Papers are invited on a wide range of topics including communications, transportation, artificial intelligence, man/machine interface (including CAD/CAM), decision support tools, data management, application development productivity, hardware and software. Indication of author interest is due September 1, with draft or extended abstract October 14 and final manuscript of accepted papers March 3, 1986.

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- "The Eighth Symposium on Engineering Applications of Mechanics"
June 8-10, 1986, Université de Sherbrooke, Sherbrooke, Québec.

The 8th EAM Symposium, to be held at the Université de Sherbrooke on June 8-10, 1986, will have as its theme "Advanced Techniques for Improved Productivity". As in the past, the Symposium objective is the advancement of Canada's industrial capability by promoting the transfer of technology in Mechanics between industry, research and development laboratories and Canadian universities.

Session topics planned for the 8th EAM Symposium include: technology transfer, advanced industrial materials, computer graphics and design automation, and integrated manufacturing technology. The technical programme will consist of invited papers on these subjects as well as contributed papers selected from those to be submitted in response to the call for papers.

Persons interested in receiving further notices or other information are asked to contact the Symposium Chairman:

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8 CAD/CAM Abstracts

(See section attached.)

9. Recent CAD/CAM Quotes

- "CADD is to engineering what the combine is to wheat farming"
  T. Routledge, H.A. Simons (International) Ltd., Canadian Consulting Engineer, May 1984 and May 1985, p. 34.

- "The price of economic success is constant retraining, nothing less"
  Manufacturing Engineering, May 1985, p. 31.

10. This newsletter may be reproduced in whole or in part. Reprinting in other Canadian publications is encouraged. Acknowledgement to the CAD/CAM Technology Advancement Council would be appreciated.

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