



CAD/CAM

NEWSLETTER

February 1987

Information Compiled by the Canadian CAD/CAM Council
for the Advancement of Computer Integrated Manufacturing *

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1. CAD/CAM Council Defines Projects and Studies Needed

The new report from the CAD/CAM Council, "Management in Crisis: Implementing Computer Integrated Manufacturing in Canada" has recently been issued. Copies of this report, which emphasizes the strategic planning necessary for computer integrated manufacturing, and the essential role of senior corporate management in this, are available from the council secretariat.

Since June 1986, when the council's role in preparation of this report was essentially complete, the attention of the CAD/CAM Council has been focussed on the definition of a new set of projects designed to assist Canadian industry in maintaining and enhancing competitiveness in domestic and international markets through the adoption of advanced manufacturing technologies, and CIM in particular.

At a recent meeting of the CAD/CAM Council, the definition of these proposed activities was completed and documented ready for submission to the Department of Regional Industrial Expansion for consideration and possible implementation by government. The activities recommended for priority have all been chosen from a much larger set of possibilities within the council's mandate. To facilitate possible implementation, each activity has been defined in a form suitable for contracting to, and implementation by, organizations in the private sector.

Essentially, nine projects and activities have been defined in the priority set under the heading of "New Government Initiatives for Ensuring Manufacturing Competitiveness: Projects Recommended by the Canadian CAD/CAM Council, February 1987". Briefly, these include:

1. Technology Inventory
 - 1.a. Gaps in Manufacturing Technology
 - 1.b. Comparison to other Countries
 - 1.c. Establishment of Canadian Goals
2. Human Resources, Education and Training
 - 2.1. Tax Incentives for Training
 - 2.b. Industrial Technology Fellowships
 - 2.c, 2.d Curriculum and Teaching Methods
 - 2.e. Participaction
3. Communications
 - 3.a. Canadian Electronic Mail Network
4. Justification of Investment in CIM

The Gaps in Manufacturing Technology project proposes a series of workshops in regions across Canada attended primarily by representatives from manufacturing companies to define where gaps in manufacturing technology exist. By defining these gaps, and structuring information pertaining to them, it will be possible to organize and focus effort on them from Canada's R&D community. The auxilliary project 1(b) will provide a summary and description of support programs in other countries for advanced manufacturing technologies. Project 1(c) is a continuation of 1(a) and 1(b) for the purpose of establishing Canadian goals for development and application, and communicating these to relevant bodies.

The establishment of adequate human resources for the implementation of computer integrated manufacturing in industry is of vital concern. This involves education and training in educational institutions and in-plant training for managers and technical personnel in industry. Project 2(a) would identify those tax incentives already in existence to facilitate this process, gather information on tax related programs in other countries, and possibly make new proposals for Canada.

Activity 2(b), if implemented, would establish a series of industrial technology fellowships. Holders of the fellowships, over a two year period, would be located on projects in industry and at the CAD/CAM and Robotic centres. By cycling the one hundred to two hundred participants between the various technology centres and to projects in industry, the resulting technology flow would strengthen the Canadian infrastructure, as well as generating a continuing supply of uniquely trained and qualified personnel.

Many Canadian universities are now anxious to define the educational objectives for preparing young people for modern manufacturing and to adopt these requirements into their curriculum. Project 2(c) would provide a consultant study and other elements to assist this process. Project 2(d), to be defined later, would deal with questions related to in-plant training and new teaching methods, such as video tape and distance education, which are particularly needed in this area.

Activity 2(e), participation, expresses the need for a broad public awareness program to explain the essential nature of advanced manufacturing technologies, such as CIM; in job and wealth creation, in maintaining or expanding markets for Canadian products, and in maintaining Canada's standard of living.

Project 3(a), to be more fully defined later, is intended to establish a consensus for, and then the implementation of, an electronic mail network linking the CAD/CAM and Robotics Development and information centres across Canada.

Project number (4) recognizes that the traditional return on investment (ROI) justification, principally based on reduction of direct labour, is no longer serving the interests of Canadian industry concerned with CIM and global markets. We must now recognize and quantify the benefits of reduced lead time, shorter cycle times, improved product quality, and enhanced marketing flexibility.

The objective of this study, therefore, is to develop new methods of calculating the financial justification of CIM by recognizing modern competitive trends in manufacturing. The project would draw from similar work elsewhere, and assemble the resulting information in a form useful to Canadian companies.

With the exception of the Industrial Technology Fellowships project 2(b), most of the projects could be implemented within one fiscal year at project costs in the range of \$100,000-125,000. Project (4) might require \$200,000 over two years. The Industrial Technology Fellowship Program is estimated to require \$3 million for one hundred fellowships in the first year, and \$6 million per year thereafter for a full program of two hundred active fellowship holders.

The CAD/CAM Council is hopeful that this set of recommendations will receive serious and early attention.

2. Justification of Advanced Manufacturing Technologies (AMT)

(Editorial Note: The following has been condensed from notes provided for the CAD/CAM Newsletter by Peter A. Urban, President - Canadian Institute of Metalworking in reference to the Canadian results of a survey done in conjunction with the U.S. National Association of Accountants. It is intended that complete results, comparing the U.S. and Canadian pattern will be published later.)

One of the critical impediments to the introduction of AMT is the uncertainty or vagueness of the economic justification, or simply the ROI or payback calculation.

Conventional accounting does not provide the satisfactory answer, as the AMT introduction is a strategic and complex issue rather than a tactical and simple one.

A multidisciplinary and systems approach is necessary, forcing changes in the organization's approach to marketing, design, manufacturing and distribution.

For example, if the AMT project's main objective is least-cost manufacturing or support of a CIM/FMS strategy then redesign of the product might be desirable: involvement of all pertinent disciplines is required to promote a synergistic result which is not obtainable through the serial approach. All cost reduction projects (and/or ROI calculations) thus force a dialogue between product engineers, manufacturing engineers, marketing and finance.

The complexity of the economic justification of AMT is further heightened by the ambiguity or difficulty to quantify the benefits of AMT in dollars and cents.

For example, how do you translate customer satisfaction into dollars? What does it mean to be more responsive (or flexible) to market demands etc. All these factors could be translated into financial terms, but only with a long term perspective in mind, and even then with some difficulty.

Some of these and other issues were addressed in a survey conducted by the Canadian Institute of Metalworking in Canada in cooperation with the National Association of Accountants in the U.S.A.

A partial set of preliminary results, reflecting the situation in Canada, are listed below. Complete results, comparing the U.S. and the Canadian scene will be published later this year by the NAA in the U.S.A.

The Canadian Institute of Metalworking will be obtaining the complete results of this very extensive survey, hopefully for better understanding of the issues involved in the economic justification of AMT and possible corrective action by those involved.

Respondents to the survey covered a wide variety of large, medium and small sized companies in the aerospace, machinery, automotive and other manufacturing sectors. Forty-one percent characterized themselves as low volume, job shop, build to order operations with lengthy manufacturing cycles measured in months rather than days. Most had invested less than \$1 million for advanced manufacturing technology in the past year. Most (54%), expected future investments of \$1 - 10 million for the next five years.

- Advanced manufacturing technologies used:

• NC machine tools	25%
• Computer driven planning and scheduling	21%
• Computer Aided Design (CAD)	18%
• Computer Aided Engineering (CAE)	12%
• Automated shop floor data collection	6%
• Robotics for welding, painting, pick-and-place	6%
• Computer Aided Inspection/Test	6%
• Electronic link to suppliers and/or customers	6%

- Biggest improvement opportunity considered as extremely important:

• Improved quality	21%
• Reduced manufacturing time	17%
• Inventory reduction	10%
• Minimizing schedule changes	10%
• Improved forecast accuracy	7%
• Shortened product introduction cycle time	7%
• Decreased number of engineering change notices	7%

- What criteria, considered extremely important, are used by your firm in justification of advanced manufacturing technologies:

• Operational performance improvements (e.g. quality, technological capability, delivery)	43%
• Years payback	21%
• Need to compete in marketplace	21%
• Need to implement manufacturing strategy	10%
• Internal rate of return	5%

- If years of payback is used, in how many years does your firm expect to recover its investment in advanced manufacturing technology:

Payback not used	9%
Less than 1 year	9%
1.1 - 2.0 years	16%
2.1 - 3.0 years	50%
3.1 - 40 years	16%

- What factors have been used to justify investments in advanced manufacturing technologies, if justification is quantified in dollars:

1. Lower direct labour	17%
2. Reduced manufacturing cycle time	13%
3. Lower scrap & rework	11%
4. Lower hourly support labour	9%
5. Lower material cost	9%
6. Increased manufacturing capacity	9%
7. Lower inventory	9%
8. Improved competitive position	5%

9. Lower salaried support labour	4%
10. Improved product quality	4%
11. Improved delivery & services	4%
12. Reduced production development time	2%
13. Consistency with business strategy	2%
14. Additional manufacturing capacity/ flexibility	2%

(Interestingly enough, if only qualitative factors are considered, item #10, improved product quality, became #1, followed by above items #11 and #13, which would become items #2 and #3 respectively.)

- In response to a question as to what changes would improve the firm's investment decisions, no one suggested that changes in methodology are not needed; rather they suggested that:

• Emphasize justification of strategy rather than each project	13%
• Multi-year commitment to investment plan	13%
• Strengthen long term orientation	13%
• Quantify the impact of <u>not</u> making the investment	13%
• Monitor actual costs and benefits after expenditures are completed	11%
• Reduce emphasis on financial return	9%
• Increase expenditure approval limits at lower management level	9%
• Prepare more accurate forecasts	7%

- When asked, what obstacles stand in the way of improvements in investment decisions, they have indicated:

• Capital budget limitations	22%
• Orientation towards short-term returns	19%
• Absence of strategy or manufacturing plan	15%
• Inaccuracy or unreliability of cost/benefit forecasts	15%
• Management policies & practices	10%
• Inappropriate capital investment theories	7%
• External standards	6%
• Lack of understanding by decision makers	3%
• Habit	3%

- In setting goals for their firms, the following financial indicators were always or often used (in decreasing frequency):

- Sales
- Sales growth
- Cash flow
- Gross margin
- Net income as percentage of sales
- Return on total assets
- Cost of capital

- Inventory levels
 - Operating income as percentage of sales
 - Return on total capital
 - Return on equity
 - Contribution margin
 - Other
- In setting goals for their firms, the most frequently mentioned non-financial indicators were (in decreasing frequency):
- Product quality
 - Delivery performance/customer service
 - Market growth
 - Labour productivity
 - Throughput rate (e.g. output per day)
 - Product development performance
 - Market share
 - Material yield
 - Equipment productivity
 - Manufacturing flexibility
 - Technological capability
- When asked, what changes to their firm's performance measurement systems are desirable, they mentioned the following (in decreasing frequency):
- Measure cost of quality variance
 - Measure cost of carrying inventory
 - Measure productivity
 - Measure manufacturing cycle time
 - Measure cost of engineering change orders
 - Emphasize longer term financial returns
 - Emphasize daily schedule attainment
 - Emphasize exception reporting
 - Emphasize variance analysis
 - Measure manufacturing capacity utilization
 - Emphasize market share
 - Measure cost of delivery variances
 - Measure cost of product development
 - Reduce return of investment objectives
 - Emphasize responsibility accounting
 - Emphasize current (net replacement value) costing
 - De-emphasize labour efficiency measurements
 - Introduce non-financial operating measures
 - Replace straight-line with unit-of-production depreciation
 - Decrease book lives of machinery and equipment
 - Simplify measurement system and focus on key results
- In answering the question as to what obstacles they see in the way of the changes, which were highlighted above as desirable, the following was most frequently mentioned (in decreasing frequency).

- Emphasis of management on short term financial results
- Inappropriate performance measurement concepts
- Conservative accounting and financial practices
- Management policies
- Management compensation based on short-term results
- Habit
- Lack of understanding of options by decision-makers
- Other priorities

3. CAD/CAM Information Available

- "A Survey of Advanced Robotics Technology in Japan"

Mark Paul Turchan, University of Tokyo, May 1986 (Revised January 1987), 99 pp.

This report, of interest and considerable depth, results from knowledge gained by M. Turchan, a Waterloo University graduate, while later at the University of Tokyo until the Spring of 1986 and prior to his return to Canada where he is now employed by Bell-Northern Research in Ottawa.

The survey was funded by the Department of External Affairs under the Technology Inflow Program and executed under the overall direction of the Ministry of State for Science and Technology in order to obtain a better appreciation of the progress being made in Japan in this strategic technology field, particularly in factory automation applications. In this regard, it is clear from the findings that the rapid implementation of this technology in Japan will pose challenges to the competitiveness of Canadian manufacturing. As well, the report is designed to help define Canadian research priorities and potential opportunities for collaboration with Japan in research and development and for technology transfer.

The survey covered approximately 75 government, university and industrial laboratories, coordinating and promotional centres, etc., of which more than 50 were visited. The most important finding is the breadth in Japan of apparently well coordinated research. Many exciting developments are in progress.

Seventy universities in Japan are currently engaged in robotics research. More than sixty Japanese companies have an R&D staff for robotics exceeding ten researchers. In addition, seven national laboratories are involved for a total of at least 130 establishments.

Concern is also expressed in the report that Japan has an active and effective program of visiting researchers etc. for gathering information on robotics from other countries, resulting in an essentially one-way exchange since Canada and other countries have very little in this regard.

For copies of the report, or information on its availability, contact:

O. Silverman
Director, Strategic Planning
Strategic Technologies Branch
Ministry of State, Science & Technology Canada
Ottawa, Ontario
K1A 1A1

- "Japan's Research and Development of New Technologies for the Clothing Industry"

This report, from the Department of Regional Industrial Expansion, is complimentary to a previous report published in 1985 under the title "The Application of New Technologies to the Clothing Industry - Report on R&D in Five European Countries".

Given the importance of the clothing industry in the Canadian economy, these reports have been prepared to fill an important gap in the information needed by both industry and governments in their strategic planning. This new report on developments in Japan will therefore be of interest to companies, research organizations, universities, federal and provincial departments and agencies.

The report focuses its attention on the research and development of new automated manufacturing technologies for clothing in Japan under a national project known as the Automated Sewing System. The project is organized and fully funded by the Ministry of International Trade and Industry (MITI). Projects selected for inclusion in the National R&D Program, commonly referred to as the Large-Scale Project, must satisfy the criteria of being urgent R&D projects requiring large budgets, long range programming, involving large risks and being in the public as well as the private interest.

The basic research for the automated sewing project is carried out by three national laboratories and institutes affiliated with MITI, while product and system development is performed by 28 private sector companies whose work is co-ordinated by the Technology Research Association of the Automated Sewing System (TRAASS). Some 500-600 researchers are involved in the project which is funded in the range of \$8-13 million annually.

The purpose of the project is to develop technologies for an efficient, flexible automated system to produce a wide variety of clothing in small quantities.

Some of the technologies involved include, stabilization of fabric dimensions through temporary hardening, three dimensional sewing using multiple sewing heads and jigs, soft fabric conveying and the use of flexible dummies for three dimensional pressing.

This project has aroused great interest worldwide, and has had a strong bearing on the decisions by the United States and the European Economic Community to launch important research and development projects in this field in order to develop indigenous technology.

Copies of the report are available in French/English bilingual format.

Contact: Textile, Clothing and Footwear Branch
Department of Regional Industrial Expansion
235 Queen Street
Ottawa, Ontario
K1A 0H5

- "Report of the National Technology Policy Roundtable"

This report does not concern CAD/CAM or CIM specifically, but rather it is concerned with national policy in Canada relative to all technologies on a broad scale. The report is stated to come as close as we are ever likely in achieving a definitive consensus on the essential elements of a national science and technology strategy.

Prepared under the organizational leadership of the Canadian Advanced Technology Association (CATA), the report has been derived from a year of information gathering and consolidation obtained via invitations for participation to 250 leading members of Canada's advanced technology community, with 50 in each of the reports' five theme areas.

The report urges that Canada is involved in a technological war for national economic survival, that it is a war we are losing and that we must move quickly to re-orient our priorities.

CATA is a national industry association representing the views and interests of the advanced technology community in Canada.

Copies of the twenty-five page summary report and the more detailed 131 page annex are available.

Contact: Canadian Advanced Technology Association (CATA)
Suite 803, 275 Slater Street
Ottawa, Ontario
K1P 5H9
Telephone: (613) 236-6550

- Directory of CAD/CAM Products and Services in Canada

The third edition of "A Directory of Companies and Organizations Providing CAD/CAM Products and Services in Canada" is now available from the Department of Regional Industrial Expansion. Earlier editions were prepared and distributed in 1976 and 1981 by the former Department of Industry, Trade and Commerce.

Based on information gathered circa 1984, the third edition provides company profiles and product listings with separate sections on associations and societies, research organizations and educational institutions. Approximately 140 companies are listed in the new expanded edition, up from 91 in the first edition, and 106 in the second.

Approximately 79 pages. Available on request in English or French.

Contact: Office of Industrial Innovation (5C)
Department of Regional Industrial Expansion
235 Queen Street
Ottawa, Ontario
K1A 0H5
Telephone: (613) 954-3472

4. Canada Awards for Business Excellence - 1987

Companies who are leaders in business performance, and who wish to be considered for the 1987 Canada Awards for Business Excellence are invited to obtain the one page entry questionnaire in order to submit their application. Entry procedures for the program are straightforward. For each category entered the one page questionnaire must be answered in less than four pages. The program is open to all business enterprises, or their divisions, located in Canada and can bring both honour and national recognition to their achievements.

The 1987 awards will honour up to five organizations in each category of endeavour. Categories for awards in 1987 are: Productivity, Invention, Innovation, Marketing, Entrepreneurship, Labour/Management Cooperation, Industrial Design and a Small Business Category. For example, previous award winners in the past two years have included:

<u>Company</u>	<u>Category</u>
Allen Bradley Canada Ltd.	Productivity
Garrett Canada	Productivity
Inco Limited, Ontario Div.	Productivity
Pratt & Whitney Canada	Innovation
NCR Canada Ltd.	Industrial Design

Entries for this year close May 15, 1987. Program entry forms are available in English or French from the DRIE regional offices or by contacting the following:

Canada Awards for Business Excellence (ACAE)
Dept. of Regional Industrial Expansion
235 Queen Street
Ottawa, Ontario
K1A 0H5
Telephone: (613) 954-4079

5. CAD/CAM Quotes

- "A recent study shows that in the last five years, Japan has outspent the US two to one in automation. During that time, 55% of the machine tools introduced in Japan have been CNC machines. --- Of all the CNC machines installed worldwide since 1975, more than 40% are in Japan."

R.B. Bergstrom, Editorial, Manufacturing Engineering, p. 7, Jan. 1987.

- "The payback from most robot installations is high, but the real results can be lost in the accounting system."

"Justification of Robot Systems", R.N. Stauffer, Manufacturing Engineering, November 1986, pp. 49-52.

- "There is a unanimous consensus within the advanced technology community in Canada that we have to now accord the same kind of national priority to building science and technology-based industrial strength that we accorded the war effort in the 40's and the creation of our social welfare system over the last three decades.

All Canadians have a stake in the future economic survival of Canada. The Roundtable report provides a blueprint for building long term, national economic strength."

R. Woodbridge, President, Canadian Advanced Technology Association.

- "As a result of 15-20 years of policy neglect, Canada's science and technological capability is approximately half the comparable level achieved by major competitor countries: we are not investing sufficiently in science and technological education: we employ roughly half the scientists and engineers; we do roughly half the R&D: our advanced technology industry base accounts for roughly half the share of national GNP: our established industrial sectors are adjusting more slowly to the use of advanced technologies, and we have no national strategy to stay with the front runners."

Canadian Advanced Technology Association, January 1987.

- "As a rule of thumb, we are doing everything by halves."

The Report of the National Policy Technology Roundtable, January 1987, p. 10.

- "Co-operation at the international level is still too much in spirit and not enough in practice. This is undesirable for both Japan and other countries such as Canada, which is not as well-structured in its robotics research compared to Japan.

The obvious recommendations call for: 1) Increased coordination of robotics research at a national level in Canada and 2) More co-operation, formal and equal exchange of robotics researchers between Japan and Canada."

M. Turchan "A Survey of Advanced Robotics in Japan".

6. Twenty Selected Abstracts Provide a World View on CAD

For a review of CAD/CAM developments around the world, please refer to the selection of twenty abstracts in the section attached.

By obtaining and using some of the references cited it is possible for industrial companies to save valuable management and engineering time in project planning and responding to the challenges of computer integrated manufacturing.

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

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