Newsletter of the IEEE Council on

ROBOTICS AND AUTOMATION

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In This Issue

1989 IEEE INTERNATIONAL CONFERENCE ON

ROBOTICS AND AUTOMATION

Sponsored by the IEEE Council on Robotics and Automation

General Chairman: **George A. Bekey,** University of So. California
Program Chairman: **John Hollerbach,** Massachusetts Inst. of Technology
Treasurer and Coordinator: **Harry Hayman**
Local Arrangements: **A.L. Pai,** Arizona State University

May 14-19, 1989
The Registry Resort
Scottsdale, Arizona

ADVANCE ANNOUNCEMENT
and

CALL FOR PAPERS

The theme of this conference is intelligent robot systems, but original basic and applied papers in all areas of robotics and automation are solicited. Special topics related to the theme include, but are not limited to, the following:

- Artificial intelligence as applied to robotics
- Dexterous grasping, haptics, and tactile sensing
- Experimentally verified robot control
- Hand-eye coordination
- Intelligent robotics in manufacturing
- Legged locomotion
- Mechanical design of actuators and manipulators
- Micro-robotics and micro-actuators
- Mobile robots and navigation
- Novel non-visual sensors
- Qualitative physics and reasoning
- Sensors integrated into devices and control
- Task planning
- Telerobotics: man-machine interfaces, advanced devices, artificial environments
- Unstructured environments: space, nuclear, undersea, etc.
- Vision: real-world scenes, recognition, representation

The organizers encourage submission of non-commercial papers from representatives of industry, universities, researcl institutions, and government.

PAPER SUBMISSION: Four copies of papers should be sent by October 21. 1988 to:
John M. Hollerbach, MIT Artificial Intelligence Lab
545 Technology Square, Cambridge, Mass. 02139

Reviews will be conducted by a program committee of established robotics researchers. Invited sessions will be entertained, but their papers will be reviewed in the normal process.

Authors will be notified of acceptance and furnished with an author's kit by January 16, 1989. Final papers in camera-ready form will be due February 15, 1989. Final papers received by the deadline will be included in the proceedings available at the conference.

The conference hosts tutorials on Monday, May 15, 1989 and a workshop and tours on Friday, May 19, 1989. Conference sessions will be held on Tuesday, May 16 to Thursday, May 18, 1989. Prior to September 1, 1988 those with proposals for tutorials or the workshop should contact: **Alan Desrochers**
ECSE Department
Rensselaer Polytechnic Institute
Troy, NY 12180-3590

For further information detach and send this coupon to:

1989 IEEE INTERNATIONAL CONFERENCE ON
ROBOTICS AND AUTOMATION
Conference

Robotics and Automation
P.O. Box 3216
Silver Spring, MD 20901

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Organization ____________________ ____________________

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THE INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS, INC.
IEEE

From the President

Y.C. Ho
Harvard University

As many of you probably know by now, the Robotics and Automation Council received approval from the IEEE Technical Activities Board and the Executive Committee to become a Society as of January 1 1989. You may probably ask "what difference does it make?" The following paradigm might be useful.

Imagine that one year you are living as a single graduate student in a dormitory supported by a fellowship. The next year you are suddenly transformed into a married person with a wife expecting a child and are working full time in your first job. In terms of what you know and what you do, there is probably not that much difference. However, in terms of the psychological outlook and a host of mundane details, such as car payments, mortgage, insurance, health care, etc. that are associated with the setting up of a separate household, there is a world of difference.

The main task for the Council and me this year is to do our best to "get these household details in order", so that come January 1 we can "hit the beach running". You may also ask "what difference does this make to me?" The most important is that you should become a member. By renewing your subscription to the Journal on Robotics and Automation this year you will automatically become the charter member of the Society. Not only will this entitle you to all member discounts, such as registration fees to conferences and workshops, but more importantly it entitles you to vote in elections and to hold office in the Society. Thus, if you are interested in the welfare of the Society and the profession, please **BECOME A MEMBER!** Also, please let your friends who are not current subscribers of the Journal know and ask them to join.

I would also like to take this opportunity to review for you briefly the State of the Society. If you permit me to use the young student paradigm above once more, then I shall say that the Society is young, healthy, and full of promise. Just to mention a couple of exciting examples, those of you who read *Newsweek* may recall a full page account last winter about the workshop on Microrobots which we sponsored in November, 1987. Here, we are producing mechanical gears and levels at the micron level using VLSI etching techniques and raising the possibility of miniature roto-rooters that can snake their way up human veins to clean up clogged arteries. The NSF has already declared micro-mechanical engineering an Emerging Technology and is prepared to support its growth. At the 1988 R & A conference in Philadelphia, you may have seen the videotape of a ping-pong playing robot that was a PhD. Thesis. This was the announced goal of AI two decades ago, which had eluded the profession till now.

However, I would be remiss if I did not list some challenges that face this Society if we are to live up to all these bright promises. Here I would like to inject some parting personal observations. I say, "parting" because given the calendar of the newsletter and my term of office, this probably will be my last message to you as President of the Council. The observations are "personal" since they do not necessarily represent the views of the Council or the profession.

It seems to me that the long term health of any organization or profession must ultimately depend on how well the organization serves the needs of the society at large. By "needs" I do not mean it in the purely utilitarian sense. Society has *intellectual and aesthetic needs.* The artist whose painting sold for 40 million dollars last year is in some sense satisfying the aesthetic needs of society. By the same token, the construction of a robot that can play world class ping-pong and a 10 micron working gear are worthy intellectual achievements independent of their practical implications. We must continue to do work that excites the human imagination.

Secondly, society has *educational needs.* We organize conferences, tutorials and workshops, and publish the Journal. These are fine educational services. But we also have an obligation to keep up and constantly improve the quality and standards of the services we deliver. As we mature into an independent organization, we become automatically the arbiter and the beacon of the profession. It is up to us to set the standards (of scholarship) and Standards (of the profession)!

Finally, of course we ultimately derive our support through serving the practical needs of society. In this respect, I believe there is common agreement that we cannot depend on industrial robots alone to provide the driving force for future growth. In fact, there is a mini-recession going on in the industrial robot sector.

Here I submit that we should pay more attention to the second half of the name of our society. *Automation*, particularly *manufacturing automation*, is a problem not only of national importance but is also on the threshold of an exciting revolution in conceptual and technological development. There are plenty of basic research problems requiring deep intellectual commitment and thought as well as very practical implementational issues that are waiting to be tackled. We should take a broader view of automation.

As Dr. R. White, the President of the National Academy of Engineering said in his address to the NAE last year, "...In manufacturing automation, the process is the product...". The Robotics and Automation Society should work with our sister societies such as CHMT inside IEEE and SME and IIE outside of IEEE to further the growth in this area. For a purely practical reason, an investment in automation research will help us to smooth out "ups-and-downs" of robotic research support which are bound to occur in the future for this profession.

There are plenty of things to be done. And I look forward to serving you to the best of my ability in the remaining months of 1988.

R & A Society Administrative Committee Election Procedure

Y.C. Ho, President

The Robotics and Automation Council (to become a Society on 1/1/89) will be electing an Administrative Committee (commonly referred to as the ADCOM) in early 1989. This will be the main governing body of the new IEEE Society. It is the ADCOM who will approve bylaws, elect and/or appoint officers of the Society. During the remaining half of 1988, a nominating committee chaired by our immediate past president will be consulting widely for names of candidates for election to the ADCOM. To be eligible, one must be a member of the Society. All subscribers of the Journal of R & A will automatically become members of the Society on January 1. Your subscription fee for 1989 will simply become the membership fee. Thus, it is important that all of you subscribe to the Journal in 1988.

Furthermore, nominations to the ADCOM will also be accepted if 25 or more of the current members/subscribers petition for a particular candidate. The election for the ADCOM will be held in early Spring of 1989 by mail. Ballots will be sent to all members.

Call for Proposals '89 R&A Conference Tutorials and Workshops

Alan Desrochers
Rensselaer Polytechnic Institute
Education Chairman

The 1989 IEEE International Conference on Robotics and Automation will host tutorials on Sunday, May 14, and Monday morning, May 15. Workshops will be held on Friday, May 19.
Proposals for tutorials and workshops are requested by September 1 and should be sent to

Alan Desrochers
ECSE Department
Rensselaer Polytechnic Inst.
Troy NY 12180-3590

Tutorials are intended to cover established areas of research in a half day session by three or four experts on the topic. Tutorials may also cover basic subjects suitable for someone just entering the robotics and automation field, for example, manipulator kinematics.

Workshops are a day long and provide a forum for discussing new ideals and presenting recent results in emerging areas of research. Panel discussions are especially encouraged. Workshops generally have several presenters who provide diverse points of view on the workshop theme.

Presenters at the tutorials and workshops are required to provide a set of notes. Workshop participants are encouraged to develop their ideas into full papers after the workshop. These papers can then be considered as a special volume to be published by the IEEE Press. In any case, tutorials and workshops are intended to be distinct from invited sessions.

Organizers of either tutorials or workshops are encouraged to submit proposals for the 1989 conference The proposals should contain:

- Title (designate tutorial or workshop)
- Abstract of sufficient detail to allow careful review of its purpose and contents
- Names, addresses, and telephone numbers of all presenters

- Title and short abstract of each presenter's talk.

Papers on topics related to the conference theme **Intelligent robot systems** are especially encouraged. However, tutorials and workshops in all areas of robotics and automation will receive the careful attention of the Robotics and Automation Education Committee. I look forward to your proposals and to seeing you in Arizona in 1989.

Unstructured Environments and Artifical Intelligence

The 1989 Conference on Robotics & Automation

John M. Hollerbach
MIT
1989 Program Chairman

The theme we are announcing for next year's IEEE Robotics and Automation Conference is one of emphasis, and is not meant to exclude other submissions.

Much of today's intellectual excitement in robotics has to do with giving robots *the motoric capabilities, sensing, and reasoning* necessary to handle a complex and uncertain environment. While industrial robotics is apparently undergoing retrenchment, with reduced devices being incorporated into engineered assembly lines, so-called service robotics seems to be taking off. Hazardous environments such as space, nuclear power plants, mining, and underseas require sophisticated robots whose expense and complexity are justified and necessary. Mobile robots can be employed in a variety of man-made environments that fall short of stereotyped assembly situations.

Motoric capabilities

It will be necessary for these robots to move under their own power, to have dextrous end effectors and arms, and to have multiple arms. Much theoretical work on the kinematics, dynamics, and control of robots has been done, but the design of such devices and experimental implementation of control strategies is not as advanced. I would particularly like to see more papers on the design and use of such devices. A key issue in design is actuation, and better if not completely novel actuators will be required to move robotics forward in the future. Microrobots and micro-actuators in particular is an emerging area.

Experimental validation of control strategies

What distinguishes the R&A conference from control conferences such as the ACC and CDC is the emphasis on experimentation and actual use of devices rather than just on mathematics. Robotics as a science requires experimental validation of control strategies. discovery through experimentation is also a key element that is less self-evident. A commitment to create the appropriate instrumentation to test a theory when none exists is also implied. As in the past, submitted papers that involved actual robot demonstrations will be kindly regarded by the program committee. It seems that a videotape of a robot demonstration has become a standard part of presentations at this conference, and this trend will be encouraged by having videotape players in every session.

Vision

Vision is arguably the most important external sense, but vision researchers have their own conferences and tend not to participate significantly in this robotics conference. This may be largely due to the current state of vision research, which does not allow objects to be recognized in even mildly complex scenes, and which is still far from general real-time capabilities. One of the most promising developments has been the use of reduced vision for various forms of hand-eye coordination, and I would like to encourage this trend for the next conference. Other sensing such as range sensing and tactile sensing is also important. It would be particularly nice to see more papers relating to the use of tactile sensors in grippers or multi-fingered hands.

Reasoning

It used to be that robotics was considered part of AI, but a regrettable split occurred in the past decade. Although token attempts have been made to include robotics into the AAAI and IJCAI conferences, some in AI have defined the field to exclude robotics. Personally, I feel robotics is important to AI, and that a meaningful interface can be found in such areas as expert systems, qualitative physics, task planning, and geometrical reasoning. Hence I encourage some of the AI folk who do not ordinarily attend this conference to submit papers.

Teleoperation and telerobotics

Even then, it will be some time before full autonomous control will be achieved with robots in complex environments. Hence there has been a resurgence of interest in teleoperation and telerobotics. For example, teleoperation is likely to be the first near-term application of multi-fingered robot hands. I feel that telerobotics should play an important role in this conference, and I urge the submission of papers in this area.

And speaking of unstructured environments...
The 1989 R&A Conference will be held in Scottsdale, Arizona, from May 14-19, at the beautiful Registry Resort Hotel, which has four outdoor swimming pools. Alex Pai, the local arrangements chairman, suggests that participants not wear coats and ties because of the heat, and George Bekey, the general chairman, has proposed a hairy leg contest.

To contribute to a relaxed conference atmosphere, the actual conference will begin Monday afternoon, but Wednesday afternoon will be off for tours of local industry, the university, or the desert. Participants may wish to bring spouses or to extend their visit to include the Grand Canyon. Tutorials and workshops will again be held before and after the conference. This time wine will be served at the banquet.

Deadlines
Since the conference is later than usual, submission dates are being pushed back as well. Papers are due *October 21*, notification of acceptance will be by *January 16*, and mats will be due *February 15*. Papers for invited sessions are also due on *October 21*, and will be reviewed in the normal process.

News From The Computer Society Robotics TC

Mohan M. Trivedi
University of Tennessee
Robotics TC Chair

1988 marks the year of many new initiatives by the Robotics Technical Committee (TC) of the Computer Society of the IEEE. The membership in the TC has experienced a steady growth, and currently there are about 1000 members in the TC. Highlights of the annual activities organized and planned by the Robotics TC are presented below.

Applications of Artificial Intelligence VI: In April 1988 the Computer Society cooperated with the IEEE Systems, Man, and Cybernetics Society and the International Society for Optical Engineering (SPIE) in organizing the annual Applications of AI VI Conference in Orlando. The conference was highly successful with 21 technical sessions, 3 plenary sessions, and 86 papers. This three day event had about 700 attendees, making it one of the largest Applications of AI Conferences in the country. The plenary sessions included keynote addresses by Prof. B. Chandrasekaran (Ohio State University), who discussed computational aspects of intelligence, Prof. Azriel Rosenfeld (University of Maryland), who presented an overview of Computer Vision, and Dr. Robert Simpson (DARPA), who discussed AI research and progress from the Department of Defense perspective.

Next year's conference will be held in Orlando March 27 - March 31 1989. *See* **Calendar** *and* **Call for Papers** *for more information).*

COMPUSAT-88: An exciting new initiative of 1988 includes a 5 hour satellite symposium, COMPUSAT 88. This video conference is for the professional who is, or expects to be, involved in the use or design of computer-based systems. COMPUSAT-88 should be of interest to student engineers as well as scientists and technologists who seek to broaden their perspectives on interdisciplinary trends and applications. The Robotics TC is one of several technical committees involved in this project. The Satellite Symposium will be aired in October 1988 for viewing at several hundred sites all over North America. Over 10,000 participants from universities, industries, local IEEE Chapters, are expected to view this live two-way technical symposium.

The Robotics TC will present minitutorials, research highlights, demonstration of state-of-the-art applications, panel discussion and a question-answer session. Among participating organizations are Carnegie Mellon University, Universities of Maryland, Tennessee, and Texas, IBM, SRI International, National Science Foundation and DARPA. Please contact the Computer Society to arrange for local viewing of this interdisciplinary technical symposium.

The Robotics TC is cooperating with the IEEE Systems, Man, and Cybernetics Society in developing special issues on **Computer Vision** and **Unmanned Autonomous Vehicles**, to be published in 1989 in the Society's **Transactions**. (*See Call for Papers for more details.*)

The Industrial Renaissance: Technological Trends and Educational Implications

Marvin DeVries

Dr. DeVries is director of the Manufacturing Systems Program at the National Science Foundation. In this paper, he addresses what American Industry should, indeed must, do in order to compete in today's high technology world. This article is excerpted from a longer presentation made at the IBM E/S/I Executive Conference in May 1986

A strong argument can be made that the evolution of manufacturing, when examined from a two-dimensional perspective, has gone full circle; from the craftsman of antiquity to the extreme division of labor of the early part of this century to the reintegration of today.

In reality, we have not gone back to the beginning. A three dimensional perspective of manufacturing evolution would reveal a spiral of technological advance having an ever-increasing pitch. We are truly in an era where manufacturing is moving rapidly from an empirical experience-based activity to a science-based technology. We have recognized that every action in manufacturing can be represented as data– be it textural, graphic, or numeric. The full spectrum of manufacturing– from perception of needs through the marketing of the finished product– generates, transmits, transforms, and uses these data.

Clearly then, the modern computer is the logical tool to magnify the power of the human mind by storing and manipulating the data. The computer provides the opportunity to reintegrate the functions of manufacturing so fragmented for the past century. In this way, opportunities to optimize the entire manufacturing system begin to be apparent, and we no longer need to be concerned with the independent optimization of the bits and pieces of manufacturing. [5]

Technological Characteristics of the Renaissance

The new industrial technology of advances manufacturing will be more automated, more integrated, more flexible, and certainly more precise than manufacturing of the past. Manufacturing will be more automated as machine intelligence increasingly integrates all aspects of manufacturing tasks into a common overall expert system. Manufacturing will be more integrated as computer-integrated technologies are increasingly being used to design, produce, and test products. Manufacturing will be more flexible as it becomes increasingly possible to shift production between products as demand varies. Manufacturing will be more precise as computer-integrated manufacturing builds quality into a product rather than trying to inspect it in after production.

The new industrial renaissance began with the introduction of numerically controlled machine tools. NC replaces the skills of a machinist with a computer-based punched paper tape technology that enabled machine tools to make complex objects in an environment of flexible automation. In the decades that followed there were many evolutionary improvements in machine tool design and control as well as in computer hardware and software. More sophisticated machine tools were developed. The flexible manufacturing systems of today evidence further evolution.

The new technologies of machine intelligence and telecommunications that are needed to control and automate the factories of the future will impact industry in significantly different ways than did earlier technologies. Table 1, which compares the traditional and computer-integrated manufacturing technologies suggests a critical need for new management and organizational styles. [3]

The Real World Renaissance

There are increasing numbers of examples of the current industrial renaissance throughout the world. In every case, the computer forms the basis for this renaissance through integration, not only of the factory itself, but also for the functions of engineering and marketing at levels never achieved before. The benefits of the increasing levels of integration are paramount because increased integration is so closely linked to increased levels of process predictability and quality. CIM offers timely delivery and lower costs without the usual accompanying trade-offs in flexibility and variety. The current industrial renaissance is occuring worldwide; several American examples cited recently [3] are indicative of the renaissance we are considering.

The Ingersoll Milling Machine Company located in Rockford, Illinois is operating a completely automated flexible manufacturing system that has integrated the company's business decisions, manufacturing management, and manufacturing operations. The company is in the specialty machine tool business, thus the flexible

Table 1
Characteristics of Traditional Technology Contrasted to Computer Integrated Flexible Manufacturing

Traditional technology can be described by:	*In contrast the CIM factory is described by:*
• Economy of scale	• Economy of scope
• Learning curve	• Truncated product life cycle
• Task Specialization	• Multimission facilities
• Work as social activity	• Unmanned systems
• Separable variable costs	• Joint costs
• Standardization	• Variety
• Expensive flexibility and variety	• Profitable flexibility and variety
Leading to factories that exhibit characteristics of	
• Centralization	• Decentralization
• Large plants	• Disaggregated capacity
• Balanced lines	• Flexibility
• Smooth flows	• Inexpensive surge and turnaround ability
• Standard product design	• Many custom products
• Low rate of change and high stability	• Innovation and responsiveness
• Inventory used as a buffer	• Production tied to demand
• "Focused factory" as an organizing concept	• Functional range for repeated reorganization
• Job enrichment and enlargement	• Responsibility tied to reward
• Batch systems	• Flow systems

manufacturing system was designed to machine 25,000 different prismatic parts half of which will be made only once. Seventy percent of the machined lots consist of a single part. Production costs are approximately the same as for long runs of standard parts [5].

Modern railway locomotives are being produced in a recently modernized General Electric Company plant located in Erie, Pennsylvania. This facility features an FMS that permits increased design flexibility in large engine frame parts and reduces machining time for 16 days to 16 hours.
The Mazak machine tool facility in Florence, Kentucky features an FMS operated by two persons that produces 180 different parts over a wide range of sized. The company's goal is to be able to reduce the common six-month delivery schedule for machine tools by 80 percent [2].

The USA aircraft industry has traditionally been in the fore-front in the adoption of high technology. The Hughes Aircraft Company in El Segundo, California is one such example. This company employs a computer-controlled FMS consisting of nine machine tools and an inspection system that is linked together by a tow-line conveyor system. The system was designed to do the work of some 25 stand alone machining centers, but was built at 75 percent of the equivalent investment cost and 13 percent of the machining-time costs. Initially, some 5 part designs of 4000 to 7000 pieces per year were scheduled; the incorporation of 10 new designs into the system is forthcoming [1].

A final example is the Vought Corporation, which expects to save $25 million in machining 600 different designs one at a time in random sequence on a flexible machining center that cost $10 million. The anticipated savings comes about from a reduction in the number of hours required to produce the parts. With conventional technology, 200,000 hours were needed compared to 70,000 hours on the new system[7].

Goldhar and Jelinek [3] quote from an article in the *Wall Street Journal* that summarizes the impact of this technological renaissance in manufacturing:

> A revolution in manufacturing is completely transforming the economies of production. It is doing so by reducing the cost penalty of product diversity. Within companies, the traditional conflict between marketing, which wants to offer customers more modes, and the factory, which has wanted to limit product line variety for the sake of production efficiency, is becoming a thing of the past...
>
> Setups that used to take hours now take minutes as a result of new, sophisticated machine tool and microprocessor control and sensor technologies. The faster setups are the key to collapsing the structure of downtime, inventories, and overhead cost that plagues the conventional factory... [4]

That *Journal* also pointed out several other characteristics of modern, high-technology manufacturing – a smaller market share no longer implies cost penalties; competitive advantages can be gained through improved marketing techniques, including more responsive distribution channels as well as capturing higher-priced, lower-volume niches[4].

Managerial Perspectives

In general, the development of technological change is relatively easy, what is difficult are the impediments to their implementation: institutions, bureaucracies, and people. In 1982, the Manufacturing Management Council of the Society of Manufacturing Engineers (SME) undertook a study of the critical issues facing manufacturing management. Emerging from this study, which involved large and small manufacturers from across the USA, was a surprising emphasis on the issue of integrating manufacturing's capabilities into the corporate strategic planning process.

Lack of manufacturing involvement in the planning process relates to historical emphasis placed upon development of market and commercial strategies. This situation was based upon the assumption that commercial and market strategies would drive manufacturing to do whatever was necessary to support them. Manufacturing was required to plan and react year-to-year based upon sales projections. Ample capacity (frequently excess) and sufficient inventory (probably excess again) was provided to cover the needs. But manufacturing represents the largest area of cost and investment. The lack of a master plan results in a diminished competitive edge, to say nothing of the failure to use the developing manufacturing capabilities as a competitive weapon.

The basic charter of manufacturing has always been to produce a quality product on time at a competitive cost. There has been a continuing change in the emphasis, however, on the relative priority of quality, service, and cost. Our preoccupation with marketing hype as the key to product sales and the ever-increasing search for profits has been at the expense of quality and service. In so doing, we have nearly sacrificed our world leadership positions in manufacturing. The importation of quality products – from electronics to steel – has shocked us into a painful reevaluation of our management priorities.

An understanding of the following Six Critical Issues can lead management to a clearer understanding of what it must do to regain and retain a robust position in a world marketplace.

1. **QUALITY: Getting it Right the First Time**
   The top priority for manufacturing management must be quality across the board - in engineering, training, maintenance, in planning, and in product. The consequencies of late engineering, incomplete planning, inadequate scheduling, constantly reworked tooling, poor computer programming, and frequent product changes, are enormous and have incalculable costs to manufacturing. The by-products are frustration, scrap parts, excessive overtime, and quality compromise. Quality must be managed and measured from the top at every step. Industry can't continue to measure quality at the finished-part level. By then, it's too late.

2. **RESOURCE UTILIZATION: Using Existing Facilities more Efficiently**
   The second-highest priority for manufacturing management must be to see that existing facilities are utilized more effectively. Increasing the use of present facilities must take precedence over involvement in the latest technologies. Underutilization of existing equipment and resources is a more serious problem than the lack of capital asset funds for new equipment. For example, poor schedule disciplines and inadequate maintenance programs, spare parts storage, and the inability to schedule and load machines properly contribute to low utilization of NC equipment. The shortage of training organizations and the inability to control engineering changes are cites as other important problems.

3. **HUMAN RESOURCE MANAGEMENT: Highlighting Dignity and Responsibility at the Lowest Possible Level**
   More personal attention is needed in selecting and managing human resources. Across the board, manufacturing firms bemoan the difficulty in attracting top-notch college graduates. They cite low pay, a lack of awareness about careers in manufacturing, and the seeming absence of a professional climate in technical and managerial areas. Changing the name of the industrial relations department to "Human Resources" will not solve the problem. What's needed is understanding and adopting the concept that people represent a human capital resource. The traditional USA labor/management and customer contact relationships are adversarial. Only in crisis does the "you-or-me" stance shift to "you-and-me". This transition from adversarial to cooperative holds the potential for real productivity breakthroughs.

4. **ENGINEERING/MANUFACTURING INTERFACE: Dealing with Manufacturing Engineers as Professionals**
   Given the heavy publicity for productivity, the factory of the future, and CAD/CAM, clearly the time is right for manufacturing to assume its appropriate role as a management partner of engineering, finance and marketing. It is imperative that talented and professional manufacturing engineers and managers must take leadership roles in the many supporting functions throughout our manufacturing organizations. If the true manufacturing engineering charter is to be realized, professionals of the field must move into such areas as quality, material and facilities. Too often, subcontactors and subtier vendors are selected without the involvement of manufacturing engineering.

5. **MANAGERIAL LEADERSHIP: Upgrading at All Levels**
   Leadership must be upgraded at all levels of manufacturing management. Key to the development of more effective manufacturing managerial leadership is general management's view of its mission. Both manufacturing and general management have long viewed the manufacturing function as having a sole mission: that of low-cost producer. This myopic view has been dangerous to the health of companies; today it is catastrophic. Sophisticated companies will seize the opportunity provided by flexible technologies to produce customized products with highly trained, flexible employees at costs nearly equal to those of competitors who focus on such low-cost technologies as transfer lines or on low-cost labor. Manufacturing management must translate the overall business strategy into a manufacturing strategy for the firm. Furthermore, it must also contribute to the development of business strategies

and new productive planning, thereby gaining top management support and a competitive edge.

6. **OPERATIONS STRATEGIC PLANNING: The Need for Longer Term Strategies**
The manufacturing manager's job is to help manage change, taking the necessary risks to keep the manufacturing operation competitive. It isn't good enough just to do things right. We must find the right things to do and concentrate our efforts and resources on them. Too many corporate and manufacturing managers view manufacturing as a functional cost center, which justifies all expenditures using a short-term payoff rationale. Manufacturing must become more farsighted in establishing the parameters by which actions are judged. Manufacturing must be recognized as an integral part of the total business and, as such, governed by long-term strategies. Toward this end, the use of functionally integrated, long-range business planning must be demonstrated by manufacturing management and demanded from others who impact the future.

After the critical issue study was completed in 1983, the SME Critical Issues Committee reviewed it and agreed there was one dominant issue of overriding significance. They called it the Pogo Statement (from the comic strip, "Pogo" by Walt Kelly). Pogo is known to millions of readers for his satirical summary, *We have met the enemy... and he is us.* The critical issue in manufacturing management is – *us.* Even at high levels in our organizations, we still ask, "Why don't they do something about this issue or that policy?" We still ask why engineering doesn't meet its commitments; why materials are late; why the best engineers choose not to work in manufacturing; and why strategic planners don't ask for inputs from manufacturing operations.

Manufacturing management needs to take more powerful initiative within companies – to show greater commitment, to be more innovative and quality conscious, to show more bias to action. Studies show a reciprocal deterioration in confidence between middle management ant top management. Members of both these management levels need to ask themselves some hard questions:

- When is the last time I did something really creative and innovative in my organization?
- How do I display my quality consciousness to my employees?
- Am I perceived as a manager that takes action?
- Am I willing to take risks?
- Am I a leader in implementing new technologies for long-term improvements and operational effectiveness in my company?
- How do I encourage my subordinates to get involved?

The reaction to these results is, in itself, a critical issue. What is the Manufacturing Manager to do? How is he to remedy the situation?

Many responses are possible. We can get out the banners and print the posters as we did twenty years ago for the Zero Defects Program; we can talk interminably of the problems introduced by government regulations, write our politicians about the inequities of the tax structure and the unfairness of foreign competition, and generally search out the myriad of excuses always at hand. Or, we can become pro-active and re-establish manufacturing as the key element to the success of our companies. Manufacturing today is on the threshold of the most dramatic changes since the Industrial Revolution. Trite as this may sound, it is true. The advent of the computer as a practical means of guiding the machines that produce, inspect, handle, and package our products will have a profound effect on how we produce the products of the future. This will not be limited to intelligent machines for cutting chips, but will extend to our ability to design new products that will more closely reach optimum functional performance while taking advantage of the most effective means of manufacture. All of this is an environment free of the generation of tons of paper.

The "bottom line" is manufacturing management; management must be trained in the process of strategic planning and must "earn" the right to participate in the company's strategic planning process. Corporate management must also be educated in how the changes in manufacturing can impact the strategy of of the company. Manufacturing management must be the advocate of this changing environment.

Rosenthal [6] surveyed a broad range of managers to obtain a coherent picture of factory automation in the USA. Groups included "leading-edge" users who provided a sense of best direction, a group of "suppliers" who could give a broad view of the approaches and activities of current and potential users, and lastly, a group of "experts" who identified integrating themes that went beyond particular manufacturers or suppliers. Rosenthal found that:

• **Leading-edge users of computer-aided manufacturing processed believe in learning by doing.** Most have proceeded in an incremental fashion to develop an internal base of experience with factory automation technologies. They tend to have supportive management and a sense of where they are heading. Their current measurement capabilities, however, restrict the basis for making adoption decisions as well as the subsequent evaluation of impacts from recent technological innovations. These users usually rely heavily on outside suppliers for critical technical assistance and consider reliability factors to be more important than price in selecting a vendor. They generally feel they cannot afford to postpone decisions until improved technologies become available. Current leading-edge users will strongly affect the future direction of these technologies.

• **Suppliers claim that most manufacturers are not sophisticated customers.**
They would like potential users to be more aware of their needs for improved manufacturing processes and to be more interested in the long-term strategic benefits of computer-aided manufacturing technologies already on the market. A classic dilemma seems to have arisen: decisions to adopt expensive factory automation technologies are often made by managers who lack the background to asses technological options, while staff familiar with the new technologies are less able to appreciate associated strategic dimensions. A likely outcome is a decision that is either short-sighted or misguided. Suppliers with limited direct experience in new applications of their technologies and little in-depth knowledge of the business situations of their customers, on the other hand, cannot be expected to help users avoid such errors.

• **The most difficult problems in achieving computer integrated manufacturing are managerial rather than technical.**
Manufacturers contemplating factory automation face different issues depending on whether they adopt a retrofit strategy using existing production systems or whether they design and implement automated processes for new manufacturing facilities. In either case, they often have inadequate internal technical resources, strong barriers to communication across traditional functional lines, and a reward structure that does not encourage risk-taking in the interest of long-term strategic gains. Manufacturing organizations that do not deal directly with these kinds of managerial problems are not likely to succeed in factory automation, even if appropriate technological options exist.

If Rosenthal's impressions are valid, it is essential that in formulating a strategy for factory automation, manufacturing managers should evaluate the adequacy of their current knowledge base, human resources, and formal measurement systems. Also, they should establish explicit operational meanings for general goals applied to integrated factory automation applications.
[6]

In the next issue of the Newsletter, Dr. DeVries will conclude this evaluation of the Industrial Renaissance by discussing its Educational implications.

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Feature Article

Inside Japan, Inc.

Steve Perrin

Mr. Perrin received his M.S.E.E. from Georgia Tech in May, 1988. He is currently working for IBM, Research Triangle Park NC. In 1986-87 he spent a year working in Japan at the Fujitsu Laboratories, Ltd. as a participant in the Japan Research Fellowship Program. During his year in Japan, he lived the corporate life, residing in a company dorm with other young single employees, taking part in company socials, and working as a team member of a research group. The following is an excerpt from his final report.

Along with government ministries, labs like Fujitsu are home to many of the country's best and brightest, who are given much of the credit for Japan's economic flowering.

Associated with any honor, however, is a corresponding degree of hardship. Fujitsu employees, managers in particular, have a reputation for living very difficult lives, with great pressure to succeed and little time for either their families or social life. My own group, known as the "sensing technology laboratory", is no exception. This group of about forty people shows a tremendous commitment to their work, even by Japanese standards. They are also recognized as being one of the most productive organizations within the company.

Product development and patents

Most people in the lab agreed that they do not conduct a great deal of fundamental research, the kind that might be considered for a Nobel Prize. To paraphrase Dr. Kaneyuki Kurokawa, the laboratory director, that type of work is a luxury that Fujitsu cannot afford at present. The work that I did see was instead very much product oriented. On Open House day everybody showed off his work to the rest of the lab, and the variety of products being developed, from semiconductors to fiber optics, was truly amazing. The real strengths of this lab lie in their variety, flexibility and determination to bring their products to market.

Fujitsu, like most Japanese companies, is very patent conscious. Even simple patents can prove to be powerful bargaining tools. Our group was encouraged to fill a quota of patent applications each year, and the number of applications filed was reviewed and announced weekly. Last year, new ideas for superconductor applications were specifically solicited by the company. Each employee was encouraged to contribute to the company's stock of proprietary innovations in this area.

Working together

The office organization at Fujitsu exemplifies the Japanese tendency to identify closely with groups. Everyone in my lab works at one end of a large room containing roughly 200 employees. Desks are arranged in tight rows, each row corresponding to departments within our group. A person's eight nearest neighbors are no more than an arm's length away, ensuring that design teams are indeed working "closely together" on the project at hand.

The flurry of activity around the office, phone calls, conferences, and coffee breaks, was too much for me to block out. I studied in the library. But as new employees began to enter the group, I came to appreciate the merits of our arrangement. People learn through osmosis in the office, not only about the work going on, but also about social customs and mores of the company. By watching our bosses, only a few feet away, we learn how to conduct a business meeting or to give motivation and direction to a worker. From others we learn skills like conducting business over the phone or arranging for the next group banquet. This kind of exposure is invaluable for a young employee.

Information and ideas are prized within Fujitsu. New information is regularly solicited from nearly every person in the organization. For thirty minutes to an hour each week, my department has a section meeting to spread news and develop plans. At these meetings every person present is personally invited to contribute, and his or her thoughts are given thorough consideration.

Minimizing the perils of technology transfer

In Dr. Kurokawa's organization only a few such transfers actually have to occur during the development of a project. The researchers who create a technology are also responsible for the development of products which use this capability. Specialists are brought in as needed. For example, manufacturing engineers will come in well before a project is completed so they can contribute to the final design while learning about the technology involved. However, most of the work is done by the same core of individuals. This approach eliminates the need to pass information between successive design teams, while centralizing responsibility for any problems that occur. The people in my group do not have the time to pursue multiple research interests, but they do get the satisfaction of seeing an idea through to its fruition.

Reports from Research Institutes

VASC LAB at CMU

Takao Kanade
Carnegie-Mellon University

The VASC, the Vision and Autonomous Systems Center of the Robotics Institute at Carnegie-Mellon University, consists of laboratories and projects in computer vision, manipulation, mobile robots, and other intelligent robot systems. Researchers in the VASC are working to develop new robotics technology and to demonstrate it in integrated robot systems, using the VASC's unique combination of research laboratories and engineering facilities.

Research Projects and Laboratories

Calibrated Imaging Laboratory: In this laboratory, basic research in computer vision is conducted in the areas of camera calibration, color and highlights, shape recovery, camera motion, and active control of cameras. The facilities include very high-precision cameras and measurement instruments for geometry and for light.
Faculty: Shafer.
Manipulator Laboratory: The Direct-Drive Robot Arm was first developed in this laboratory, and research on direct drive arms is continuing with the study of feedforward control using force sensors and predictive models of the arm dynamics. In addition, the Reconfigurable Robot Manipulator System is being developed, to allow diverse robot arms to be constructed from interchangeable components.
Faculty: Khosla, Kanade.
Hand-Eye Laboratory: The Hand-Eye Lab is developing a complete robot manipulation system to study how CAD solid models can be used to guide vision and manipulation. This system includes photometric stereo for vision, solid models of objects, and a robot arm.
Faculty: Ikeuchi, Kanade.
NAVLAB Robot Vehicle: The NAVLAB is a computer-controlled van that uses color TV cameras, a scanning laser rangefinder, and inertial navigation to drive along roads. The CODGER blackboard system, developed for the NAVLAB, is a general-purpose distributed blackboard for robot system integration and control.
Faculty: Hebert, Thorpe, Shafer, Kanade.
Parallel Computers for Robotics: The WARP supercomputer is now a fully functional component of the computing facilities in the VASC, and a WARP is installed on the NAVLAB to provide high-speed computer vision. Ongoing work in this area includes a vision library for the WARP and development of the HET high-speed communications network for control of the NAVLAB and other robotics applications.
Faculty: Webb, Chien.
Mars Rover: At the turn of the century, NASA is expected to launch a Mars Sample Return Mission that will send a robot vehicle to the surface of Mars, collect sample on and below the planet's surface, and return the samples to Earth. The Mars Rover project, performed in cooperation with Field Robotics and Manipulation Centers, will develop the basic technologies including locomotion, perception, planning, and system integration for an autonomous Mars Rover.
Faculty: Kanade, Thorpe

Research Personnel

The VASC currently includes 8 faculty members, 20 Ph.D. students, 10 staff members, and 7 visitors from industrial and research laboratories. The research faculty are:

Takeo Kanade : Vision, manipulation, robot systems.

C.H. Chien : Vision, parallel architectures.

Martial Hebert : Mobile robots, range scanners, vision.

Pradeep Khosla : Manipulators, sensor-based control.

Katsushi Ikeuchi : Vision, solid modeling.

Steve Shafer : Vision, mobile robots, robot architectures.

Chuck Thorpe : Mobile robots, vision, path planning.

Jon Webb : Vision, parallel architectures.

Research Facilities

The VASC has comprehensive, state-of-the-art research facilities that are dedicated to the Center, including many unique items of equipment. The VASC facilities include:

- VAX 8800, 8650, and 11/780 computers
- 30 SUN workstations with 9 full-color frame digitizers/displays
- 2 IRIS 2400 3D graphics workstations
- A Hitachi 80-gigabyte optical disk file system
- 3 color and 2 black-and-white printers, including a Panasonic EMCP 500 (4000x5600 dots, 400 dot/inch) color printer
- 3 robot arms, including PUMA, the CMU direct-drive arm, and the reconfigurable manipulator system
- 2 range scanners: an ERIM laser scanner and a White light-stripe scanner
- 14 video cameras, including a high-precision (10 bits/pixel) Princeton Scientific 602 CCD camera
- 2 outdoor robot vehicles: the Terregator and the NAVLAB
- Complete facilities for geometric and spectral camera calibration
- Satellite video link to Denver and Washington, D.C.

Newsbrief

University of Kentucky Building Robotics Center

Construction is under way for a $10 million facility for the University of Kentucky's **Center for Robotics and Manufacturing**. Completion is scheduled for mid-1989. The center has been funded by the state of Kentucky as a center of excellence in manufacturing systems. When completed, the center will be one of the largest university facilities in the world devoted to research and development, industrial extension, and education involving robotics, industrial automation, and manufacturing systems.

Prof. William A. Gruver, Director of the Center since December 1987, announced that $1.2 million in sponsored research is being conducted by the Applied Research Division of the Center in the following areas:

- Industrial computers, communication, and controls
- Computer-aided design and engineering
- Inspection and sensor design for process control
- Knowledge-based systems for automation and manufacturing
- Information systems for computer-integrated manufacturing

Newsbrief

RPI Awarded NASA Robotics Center

Rensslaer Polytechnic Institute, has received funding from NASA to establish the **Center for Intelligent Robotic Systems for Space Exploration**. According to **Prof. George Saridis** of the RPI Robotics and Automation Laboratory, this is the only center in robotics to be established under the NASA program.

Newsbrief

Michigan Technical Report List Announced

The Robot Systems Division of the University of Michigan has published a list of 56 technical papers produced by the division over the past three years. The list is available from The Center for Research on Integrated Manufacturing, Univ. of Michigan, 1101 Beal Ave., 134 ATL Bldg., Ann Arbor, Mich. 48109-2110.

CALLS FOR PAPERS

IEEE Workshop on Visual Motion

Irvine, California
March 20-22, 1989

This workshop will bring together researchers from Computer Vision, Visual Perception, and Artificial Intelligence to discuss current work on the representation and analysis of motion in image sequences. Papers are invited on all aspects of the analysis of human and machine vision, including:

- Motion detection mechanisms
- Optical flow and motion correspondence
- Structure from motion
- Temporal planning and inferences
- Event recognition and representation
- Control structures for dynamic scene analysis
- Uncertainty in dynamic scene analysis
- Applications in navigation, object manipulation and recognition

Submit 3 copies of the paper, not over 25 double-spaced pages, before **July 15, 1988** to either:

Ellen Hildreth
Artificial Intelligence Lab.
545 Technology Square
Cambridge, MA 02139
or
Ramesh Jain
Elect. Eng. & Comp. Sci.
Univ. of Michigan
Ann Arbor MI 48109-2122

Applications of Artificial Intelligence VII

Orlando, Florida
March 27-31, 1989

This conference will be sponsored by the by the IEEE Systems, Man, and Cybernetics Society and the Int. Society for Optical Engineering (SPIE) in cooperation with the IEEE Computer Society. Sessions at the 1987 Conference of particular interest to robotics area professionals included: Robotic Systems, Path Planning, Architectures for AI, Knowledge-Based Systems, Computer Vision, and Knowledge Representation.

Submit papers and proposals for tutorials and special sessions by **Sept. 12, 1988** to the general chairman:
Prof. Mohan Trivedi
Elec. & Computer Eng. Dept.
Univ. of Tennessee
Knoxville TN 37996-2100
Phone: (615) 974-5450
E-Mail: trivedi@vms.engr.utk.edu.

NASA Conference on Space Telerobotics

Jet Propulsion Laboratory, Calif. Inst. of Technology, Pasadena, CA
Jan. 31 - Feb. 2, 1989

Objectives of this conference are:

- Provide a view of current NASA telerobotic research and development
- Stimulate technical exchange on man-machine systems, manipulator control, machine sensing, artificial intelligence and system architecture
- Identify important unsolved problems of current interest which can be dealt with by future research

Topics of interest include Sensing and Perception, Robotic Mechanisms, Control Execution, Operator Interface, Planning and Reasoning, System Architecture, and Robot Computing.

Primary **target applications** for the space telerobotics technology to be discussed at the conference include:

- Dexterous and mobile manipulators to assist astronauts and ground-based operators in performing mechanical assembly/disassembly and satellite servicing and retrieval tasks
- Execution of complex servicing and repair operations on earth-orbiting space platforms and systems
- Remotely autonomous roving vehicles for survey of lunar and planetary surfaces

Submit abstracts of about 500 words by **August 1** to:

G. Rodriguez
MS 198-330
Jet Propulsion Laboratory
4800 Oak Grove Drive
Pasadena CA 91109
Tel.(818)354-4057.

Acceptance notices and instructions for preparation of final manuscripts will be sent by October 1, 1988.

Fleximation 89

Bern Switzerland
May 1989

The Foreign Commercial Service of the U.S. Department of Commerce is seeking U.S. companies interested in presenting papers and demonstrating their equipment and services at a conference and exhibit on flexible automation. Themes to be treated cover robotics, CAD/CAM, vision and sensing, AI and expert systems, controls, related educational and training aids and cell design, integration and services. Fleximation '89 will be supported by major Swiss and German trade magazines and associations.

For more information contact:

Daniel Taher
U.S. Embassy
PO Box 1065
CH-3001 Bern, Switzerland
Tel 031/43 70 11,
Telex 912 603,
FAX: 031/437 336.

IEEE Transactions on Systems, Man, and Cybernetics

The Robotics TC of the Computer Society is cooperating with the Systems, Man, and Cybernetics Society to publish two special issues in 1989.

Special Issue on Computer Vision

Computer vision has been an area of significant research interest and activity for the past several years. These efforts are directed towards providing better understanding of the very complex and challenging tasks of developing computational theories and techniques for image understanding. On the practical side, computers are increasingly utilized in processing and analyzing images acquired in a variety of application domains. Vision systems with applications in manufacturing, robotics, remote sensing and biomedical fields are being developed.

We are soliciting high quality, original technical contributions dealing with both theoretical and practical aspects of computer vision. Comprehensive state-of-the-art review papers are also considered. Some of the specific areas of interest are:

3-D Vision
Color and Multispectral Vision
Motion Analysis
Algorithms for Vision
Vision Systems
Modeling, Representation, and Control Strategies
Robot Vision
Aerial Scene Analysis
Biomedical Image Analysis
Architectures for Vision

Submit five copies of the complete manuscript by Sept. 15 1988 to either:

Prof. Mohan Trivedi
Electrical & Computer Eng. Dept.
Univ. of Tennesee,
Knoxville TN 37996-2100
or
Prof. Azriel Rosenfeld
Center for Automation Res.
Univ. of Maryland
College Park MD 20742

Special Issue on Unmanned Systems and Vehicles

Publication is scheduled for December 1989. Abstracts are due September 15, 1988 and full papers November 1, 1988. Submit contributions to

Arun K. Sood
Dept. of Computer Science
George Mason Univ.
4400 University Drive
Fairfax VA 22030-4400
Tel (703)323-2713.

Calendar

Date	Event	Place	Sponsors/Info
July 24-27, '88	**IEEE ICEE 88**, Inter. Conf. on Neural Nets	Sheraton Harbor Island East, San Diego CA	San Diego IEEE Section & IEEE TAB Neural Network Committee. *Contact:* Naomi Feldman, 3770 Tansy St., San Diego CA 92121
Aug. 8-11 '88	3rd Int. Conf. on Applications of Artifical Intelligence in Engineering	Hyatt-Rickeys Hotel, Palo Alto CA	Computational Mechanics Institute, 25 Bridge St. Billerica MA 01821. *Contact:* Sandra Elliot (617)667-5481
Aug. 14-17, '88	3rd Int. Conf. on CAD/CAM: Robotics & Factories of the Future	Southfield Hilton, Southfield, MI	International Society for Productivity Enhancement. Contact Kelyan Ghosh, Industrial Engineering Department, Ecole Polytechnique, PO Box 6079, Postal Station A, Montreal, Quebec H3C 3A7
Aug 24-26, '88	3rd IEEE Int. Symposium on Intelligent Control	Key Bridge Marriot Hotel, Arlington VA	IEEE Control Systems Soc. in coop. with IEEE Robotics & Automation Council, IEEE Systems, Man & Cybernetics Soc., and IEEE Indust. Electronics Soc. *Contact:* Prof. Harry E. Stephanou, School of Information Technology, George Mason Univ., Fairfax VA 22030
Aug 29-31, 88	"Symbiotic & Intelligent Robotics":IEEE Workshop on Languages for Automation	Univ. Maryland, College Park. Md.	IEEE Computer Soc.in coop. w/ IEEE SMC Soc., Robotics TC, PR,IP&CV TC, Univ. of Maryland, Univ. of Pittsburgh, G. Mason Univ., Univ. Polit. de Madrid, E-SYSTEMS Corp. *Contact:* P.A. Ligomenides, EE Dept, Univ. of Maryland, College Park, 20742
Sept 5-8, 88	1st Int. Conf. on Visual Search	University of Durham. UK	*Contact:* D. Brogan, FIC VS, Deptk. of Psychology, Univ. of Durham, Science Laboratories, South Road, Durham DH1 3LE, UK
Sept 19-21, '88	1st UK informal seminar on COMADEM: Condition Monitoring & Diagnostic Engineering Management	City of Birmingham (UK) Polytechnic	City of Birmingham Polytechnic (UK) in assoc. with the Inst. of Diagnostic Engineers. *Contact:* Dr. Raj B.K.N. Rao, Dept. Mechanical & Production Eng., City of Birmingham Polytechnic, Perry Barr, Birmingham, B42 2SAU, United Kingdom
Oct. 4-5 '88	SGAICO Annual Conf. on Artificial Intelligence in Manufacturing, Assembly, & Robotics	Univ. of Bern, Switzerland	Prof. H. Bunke, Universitat Bern, Institut fur Informatik und Angewandte Mathematik, Laenggass-Strasse 51, CH-3012, Bern, SWITZERLAND
Oct 12-14, '88	IAPR Workshop on Computer Vision - Special Hardware & Industrial Applications	Tokyo Japan	Int. Assoc For Pattern Recognition *Contact:* Mikio Takagi, Inst. of Industrial Science, Univ. of Tokyo, 7-22-1, Roppongi, Minato-ku, Tokyo 106, JAPAN
Oct 17-20, '88	IAPR 9th International Conference on Pattern Recognition	Beijing, China	*Contact:* 9ICPR Secretariat, Chinese Association of Automation, P.O. Box 2728, Beijing, China
Oct. 31-Nov 2 '88	IEEE Int. Workshop on Intelligent Robots and Systems	Tokyo, Japan	IEEE Industrial Electronics Soc., IEEE System Man & Cybernetics Soc., Robotic Society of Japan, New Technology Society. *Contact* Prof. Toshio Fukuda, Science Univ. of Tokyo, Dept. Mech. Engineering, 1-3 Kagura-zaka, Shinjuku, Tokyo 162 JAPAN. Tel: 03 (260-4271, ext. 352. FAX (03) 266-3490
Nov. 2-4 '88	CAA88: Information Technology & Factory Automation	Turin Italy	AICA (Italian Assoc. for Information Technology & Automatic Computation), and ANIPLA (Italian Nat. Assoc. for Automation, in cooperation with the IEEE Robotics & Automation Council. *Contact:* Mrs. Claudia Roveglia, Dipartimento di Automatica e Informatica, Politecnico di Torino, C.so Duca degli Abruzzi, 24 I-10129 Torino, ITALY (Tel: + 39 11 556 7000; Telex: 220646 POLITO I, FAX: + 39 11 556 6329)

Date	Event	Place	Sponsors/Info
Nov 6-11 '88	SPIE Symp. on Advances in Intelligent Robotics Systems	Cambridge MA	SPIE. Sessions include "Technology Dev. for Space Telerobotics" and "Intelligent Control of Robot Systems" *Contact:*Paul S. Schenker, Cal. Inst. of Tech, Jet Propulsion Lab., 4800 Oak Grove Dr., MS 193-330, Pasadena CA 91109 (818)354-2681
Nov. 6-10, '88	"Robots:Coming of Age": Int. Symposium & Exposition on Robots	Hilton Int. Hotel, Sydney, Australia	Australian Robot Association, G.P.O. Box 1527 Sydney NSW 2001, Australia, and the Institution of Engineers, Australia. Tel (02)959 3239, FAX (02)959 4632, e-mail KEYLINK(DIALCOM'))&:)MKAOO!, Telex 10715600 (MKAT AA). An Australian Bicentennial activity
Nov 7-10, '88	IEEE Int. Conf. on Computer Aided Design (ICCAD)	Santa Clara CA Convention Center	IEEE Computer Soc. *Contact:* Al Jimenez, PROCASE 3130 DelaCruz Blve, Suite 100, Santa Clara CA 95054 (408)727-0714
Dec 5-8, '88	2nd Int. Conf. on Computer Vision (ICCV)	Tarpon Springs FLA	IEEE Computer Society. *Contact* Ruzena Bajcsy, Univ. of Pennsylvania, Dept. Computer & Information Science, 200 S. 33rd St., Philadelphia PA 19104-6389
Jan.31-Feb.2, '89	NASA Conf. on Space Telerobotics	Jet Propulsion Lab., Calif. Inst. of Technology, Pasadena, CA	See **Call for Papers**
Feb, '89	SME Conf. on Robotics in Aerospace	Anaheim CA	*Robotics International of SME Contact:* Lori Navalta, Society of Manufacturing Engineers One SME Drive, PO Box 930, Dearborn, MI 48121.
Mar 13-16 '89	3rd Topical Meeting on Robotics & Remote Systems	The Omni Hotel, Charleston SC	Amer. Nuclear Soc., U.S. Dept. Energy, Robotics International of SME *Contact:*Joseph S. Byrd, Gen. Chair, E.I. Du Pont de Nemours & Co., Savannah River Laboratory, Aiken SC 29808 Tel:(803)725-3527 (FTS)239-3527
March 20-22,1989	IEEE Workshop on Visual Motion	Irvine California	See **Call for Papers**
March 27-April 1, 1989	Applications of AI VII	Orlando, Fla.	IEEE Computer Soc. and Systems, Man, & Cybernetics Soc., and Int. Soc. for Optical Engineering (SPIE) in coop. with IEEE Computer Soc.. See **Call for Papers**
May 14-19 '89	IEEE Int. Conf. on Robotics & Automation	The Registry Resort, Scottsdale, Arizona	IEEE Council on Robotics & Automation.See announcement and related articles.
May '89	Fleximation '89: 2nd Int. Conf. and Exhibit/Workshops of Advanced American Flexible Automation Equipment and Services	Bern, Switzerland	U.S. Dept. of Commerce. See **Call for Papers**
May 27-31 '89	Int. Conf. on Pattern Recognition	Atlantic City, NJ	IEEE Computer Soc., PAMI TC *Contact:* Herbert Freeman, Rutgers University, Hill Center, New Brunswick, NJ 08903, (201) 932-4208

Newsletter of the IEEE Council on

ROBOTICS AND AUTOMATION

Editor: **Dr. Wesley Snyder**
Dept. Electrical & Computer Eng.
North Carolina State Univ.
Raleigh NC 27695-7914

From the Editor

Wesley E. Snyder
North Carolina State University

This issue of the Newsletter is nearly overflowing! We have news about the changes which will come with the formation of the Robotics and Automation Society in January 89, a crammed Calendar, plans for the '89 R&A Conference in Phoenix, reports from research institutes, a thoughtful article by Marvin DeVries of the National Science Foundation on the need for changes in the structure of American industry and a first-hand report on Japanese industry from the perspective of an American graduate student working as a junior engineer in a major electronics firm.

In the Fall issue of the newsletter we plan to present a special feature on robotics research in the Federal Republic of Germany with an overview based on an interview with Gerhard Hirzinger, chairman of the West German Robotics Council. This was planned for the Summer issue, but we received so many responses from research institutes that we decided to defer it. Also in the plans for future issues are reports from research institutes in Australia and Japan.

Robotics R&D is truly worldwide. The Australian Robot Association is planning a major conference and exhibition in conjunction with the country's bicentenniel celebration. More information is in the Calendar.

Our **deadline** for receipt of material for the Fall issue is **September 1**. Please note this, especially for calendar announcements and other timely material. E-mail contributions are great, especially since we don't have to have them keyed in, but please follow them with a hard copy, since e-mail is not always as reliable as the U.S. mails. We appreciate the contributions we have received for the newsletter and welcome your suggestions.

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