COMPUTING RESEARCH NEWS

The News Journal of the Computing Research Association

September 1993 *Vol. 5/No. 4*

Nico Habermann was a "visionary leader in HPCC"

A. Nico Habermann, an internationally renowned computer scientist, died of an apparent heart attack Aug 8 at his Pittsburgh home. He was 62.

Habermann served as assistant director of the National Science Foundation's Computer and Information Science and Engineering Directorate. He commuted regularly from Pittsburgh to Washington, DC.

"We are shocked and saddened by the sudden death of our colleague and friend," said NSF acting director Frederick Bernthal. "He was a visionary leader in high-performance computing, networking and information infrastructure. He will be missed; but his legacy of excellence and leadership at NSF will continue."

Habermann came to NSF from Carnegie Mellon University, where he had served as dean of the School of Computer Science. He had taught at CMU since 1969, became head of its Computer Science Department in 1979 and founded the School of Computer Science in 1988. He had planned to return to CMU after serving at NSF

Habermann is known for his work in programming languages, operating systems and software engineering. He helped implement languages such as Algol 60, Bliss, Pascal and Ada.

At NSF, he led many CISE programs: Computer and Computation Research; Information Robotics and Intelligent Systems; Advanced Scientific Computing; Microelectronic Information Processing Systems; Networking and

Continued on Page 11

Inside CRN

PAGE 2: *Opinions and Letters*

PAGES 3-5: *Expanding the Pipeline*

PAGE 6: *Association News*

PAGE 7: *Conference News*

PAGES 8-10: *Policy News*

PAGES 11-13: *Washington Update*

PAGES 14-15: *Professional Opportunities*

PAGE 16: *People in the News*

House passes NII Act

By Juan Antonio Osuna
CRA Staff

The House passed the National Information Infrastructure Act of 1993 on July 26 with a sweeping 326 to 61 vote.

Introduced by Rep. Rick Boucher (D-VA), bill HR 1757 expands the High-Performance Computing and Communications Act of 1991 to bring libraries, local governments, schools and health care providers onto national computer networks.

Representatives who oppose the bill said telephone, cable and electric companies already are building networks, making government involvement unnecessary. All but one of the 61 members who opposed the bill were Republicans.

Backers of the bill said the federal government plays a crucial role in spurring commercial R&D and in bringing network connectivity to public institutions such as libraries, schools and local governments. The bill also authorizes subsidies for network users, not network providers.

This tension between public and private sectors surfaced most dramatically during markups in June before the Science, Space and Technology Subcommittee on Science. Debate surrounded the bill's provisions to limit the use of the National Research and Education Network—a testbed network expected to reach gigabit speeds in the next few years.

Representatives from the regional telephone companies and the research and education communities, including CRA, deliberated over language limiting use of this testbed, the only portion of the Internet that is federally subsidized. The telephone companies expressed fear that federal support could dilute their pool of potential customers. Research and education groups argued that federal support would do the opposite by encouraging high-tech markets.

In the end, the two groups hammered out and agreed to the following language:

"The federal testbed networks shall not be used to provide network services that are not related to [the mission of the testbed] and that could not otherwise be provided satisfactorily using commercially available network services. Determination of satisfactory availability shall include consideration of geographic access to and affordability of service, and timeliness and technical performance standards in providing services."

Harsher restrictions proposed by the telephone companies were added to the Senate version of the bill (S 4) during a May 25 markup. "Language has been added to this section to clarify

Continued on Page 9

What role will CS research community play in shaping federal science policy?

By Edward D. Lazowska

The Federated Computing Research Conference (FCRC '93) in May featured a lively two-hour "town meeting" devoted to federal science policy and the role of the computing research community in shaping that policy.

Science policy is changing. The implicit contract between the federal government and university researchers, in which most "interesting" research was supported in return for contributions to health care and defense, existed for nearly 50 years but now is null and void. The contract was the victim of the end of the Cold War, the growth of the federal deficit and the widespread perception that research requires oversight to control costs and increase relevance. The new contract is still being written, but it is likely to focus on issues such as economic vitality, improvements in the quality of life and the sustainability of the nation.

This is not so bad for the computing research community. Computing is a key technology for those providing services, governing the nation or practicing science and engineering. The accomplishments of the computing research community and our central role in the future social and economic vitality of the nation are becoming widely recognized in policy circles. After years of being on the outside looking in, the community suddenly finds itself at the center of the national science policy debate, with enormous possibilities and enormous responsibilities.

Hub of activity

CRA is at the hub of this activity. The association has metamorphosed several times over its lifetime, most recently in the late 1980s when the Board of Directors, anticipating these critical policy shifts, created a professionally staffed office in Washington, DC. Following policy issues is a major activity for Fred Weingarten, CRA's executive director, who is assisted by Juan Antonio Osuna and advised by the board, and particularly the Government Affairs Committee. CRA, with a current membership of about 175 industrial computing research laboratories and academic departments of computer science and computer engineering, represents and informs the computing research community.

In the past few years there have been several science policy debates in which the computing research community played a significant role. In 1991 CRA appeared before the House Science, Space and Technology Subcommittee on Science to testify on that year's High-Performance Computing and Communications Act. This year the same subcommittee actively solicited CRA's advice during the drafting of the National Information Infrastructure Act of 1993 (formerly known as the High-Performance Computing and High-Speed Networking Applications Act of 1993), invited the association to testify on the bill (See Page 8) and involved us in some key post-testimony negotiations concerning the fate of the National Research and Education Network (NREN). CRA forged a number of important alliances—with the Computer Systems Policy Project (an influential group of the CEOs of the 13 largest computer manufacturers), the American Library Association (playing a major role in the NREN debate), and others.

Community involvement

At the town meeting, I emphasized the importance of local and national involvement by the computing research community. Contacting your elected

Continued on Page 5

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"Just-in-time" graduate education

By Daniel W. Lewis

Computing has been described as one of the most rapidly evolving fields of our time, with technology cycles as short as 2.5 years. Just consider some of the many technologies that have been introduced or have become popular in the last 10 years: graphical user interfaces, reduced instruction set computing architectures, functional programming, expert systems, neural networks, distributed systems and object-oriented everything.

The introduction of a new computing technology about once every two years has had a pronounced effect on industrial hiring trends. It accelerates a company's need for short-term competitive advantage. It also encourages hiring people experienced in the new technology, rather than spending up to 18 months training someone.

As a result, employers increasingly are asking for people with experience. And in some cases, they hire in a new technology area while simultaneously laying off employees trained in older technologies.

Traditional continuing education programs have not satisfied the need for training. As *Computing the Future* [1] points out: "Many universities and CS&E departments ignore continuing education…partly because of a value system that places such education at the bottom of the list of valued activities."

There is reason to believe that students and companies often share this value judgment, probably because of the variable quality of instruction, casual admission criteria that do not guarantee the necessary background and a typical lack of assessment.

Some employers effectively discourage continuing education with an education policy that provides reimbursement only for course work that leads to a degree. Employees in these companies ultimately enroll in part-time master's programs to get advanced technical training.

Even though a university may have intended its master's to be a traditional scientific degree, many of these students are actually using it as a "professional" degree.

If it takes as long as five years to complete a part-time master's degree, how well does such a program satisfy industrial needs when new technologies are emerging every two years? And how can we improve our part-time master's programs to provide more relevant professional education in the face of such rapid change?

These questions are particularly poignant in high-technology centers such as Silicon Valley where many employees are enrolled in part-time master's programs. The Software Industry Coalition of the Joint Venture Silicon Valley initiative hopes to find an answer by hosting a Symposium on University–Industry Cooperation to "encourage interaction between companies and universities, to understand education needs of the industry, identify potential areas for collaborative research in software engineering, and share information on new areas of technical development."

Linda Pierce put it best in *Computing Professionals* [2] when she said, "We don't know how to do this, but our objective is to have just-in-time skills." I interpret this to mean that part-time students should be able to develop competency in a new specialization within one year.

Although this can be accomplished within the electives of a part-time master's program, students often take electives and core requirements mingled together, thus developing the specialization over a much longer period of time.

Consider instead a professional master of computing degree based on sequential completion of three graduate-level certificates. Each certificate would consist of 10 semester or 15 quarter units of course work that correspond to a structured concentration in a particular subject and include a capstone project as a demonstration of competence.

Certificates could be introduced, revised or discontinued as needed to match technology trends. One can easily imagine certificates relevant today in object-oriented systems and software engineering, distributed systems and parallel processing, artificial intelligence and expert systems, advanced techniques in digital systems and high-performance computer architecture.

Although many continuing education programs already offer certificate programs, programs suggested here would use graduate courses earning academic credit toward a master's degree.

Such a part-time master's program offers several advantages over a more traditional program. By concentrating on a focused sequence of course work, each certificate program provides a faster return on investment for both students and their employers.

Like the "exhibitions" proposed by Peter Denning [3] at significant milestones in his model of education, a certificate-based master's degree would improve student motivation because of a clearer relationship between course work and short-term goals. Because individual faculty members usually will identify closely with one or two specializations, they will be more likely to take an active role in the corresponding certificate curriculum.

Santa Clara University is offering a new certificate program, "Advanced Studies in Software Engineering," that earns graduate academic credit. We have met with several Silicon Valley companies to tell them about this program, and the reaction has been overwhelmingly positive.

We anticipate a similar demand for certificates in other specializations, perhaps ultimately leading to future use of a certificate-based professional master's program as outlined above.

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[1] Juris Hartmanis and Herbert Lin, eds., *Computing the Future: A Broader Agenda for Computer Science and Engineering*, Washington, DC: National Academy Press, 1992.

[2] National Research Council, *Computing Professionals: Changing Needs for the 1990s: A workshop report*, Washington, DC: National Academy Press, 1993.

[3] Peter J. Denning "Educating a New Engineer," *CACM*, vol. 35, no. 12 (December 1992), pp. 83-97.

Daniel W. Lewis is an associate professor and chair of the Computer Engineering Department at Santa Clara University. Tel. 408-554-4449; fax: 408-554-5474; E-mail: dlewis@scu.edu.

Letters to the Editor

It is too soon to make systers an open forum

Editor:

In his article, "How Can Men Help Expand the CS Pipeline?" (May *CRN*, Page 3), Michael Fischer argued that the women-only mailing list, systers, should be an open forum. Such an action would be premature. I was one of a handful of men who registered for the CRA Workshop on Academic Careers for Women held in May. Men were not excluded from this workshop, but many probably felt attending it was worth neither the time nor money, or perhaps they felt uneasy at the prospect of being in such a minority. The workshop was open to those willing to make the effort.

The problem with making systers an open forum is that it is too easy for less-committed men to be involved electronically. It takes very little time or money to send E-mail, and the social constraints of a meeting hall are absent. Such a forum would attract men who simply are looking for a good argument, or worse, men actively opposed to equal opportunity for women. The resulting levels of rhetoric would discourage participation by many of those who currently are active on systers. There are many places on Usenet where the status of women can be discussed in an open forum; none of these can function like systers and related lists.

I, too, look forward to being able to observe on systers and perhaps even participate. But I am willing to wait until I am invited.

Prabhakar Ragde
Associate professor of computer science
University of Waterloo

Expanding the Pipeline

Mentoring project targets female undergrads

By Joseph O'Rourke

The participation of women in computer science and computer engineering (CS&E) declines throughout the length of the academic pipeline. This occurs from high school through graduate school and through the professorial ranks. Although roughly equal numbers of young women and men take computer science courses in high school, women receive about 31% of the bachelor's and 28% of the master's degrees and about 11% of the doctorates in computer science and computer engineering. At the assistant professor level the 1991-92 CRA Taulbee Survey showed a small increase in the number of women, up to 13% from 10% in the previous survey [GM91]. The other numbers were not so encouraging. The decline in the number of women continues in other places in the pipeline. The survey showed that the percentage of female CS&E associate and full professors to be just 8% and 4% in 1992.[1]

The CRA Committee on the Status of Women developed the Distributed Mentor Project[2] to address one of the stages in the pipeline with greatest decline in female participation.

The goal of the project is to increase the number of women entering graduate school in computer science and computer engineering by involving them in research at a university with a female mentor and thereby inspiring them to apply to graduate school. The mechanism matches female undergraduates with female university professors for a summer of research.

Almost no one questions the importance of mentoring for initiating a scientific career. Whether same-gender mentoring is more effective than cross-gender mentoring is more controversial. A recent study concluded that "there appears to be no strong evidence, other than anecdotal accounts of individual cases, that the presence of female role models has a significant influence on career choices" [YS92]. Yet the anecdotal evidence is compelling and accords with intuition.

Certainly a male professor cannot serve as an effective role model on the social aspects of the research life. One female faculty member cautions her female graduate students never to be the first in a group to make cookies or to volunteer to be secretary for a group. More serious advice on balancing professional roles and family and on travel, conferences and so on may be useful and unique to female mentoring.

If women are most effectively mentored by women, then the paucity of women at the high end of the pipeline (the CRA Taulbee Survey located only 53 female full professors in 173 CS&E departments in January 1993 [S93]) could be constricting the pipeline at earlier stages and locking the proportions into a stable mixture. Indeed the CRA Taulbee Survey has recorded roughly the same percentage of female Ph.D. recipients in CS for 14 consecutive years.

With the assistance of an advisory committee of 12 researchers from academia and industry, I prepared and submitted a mentoring proposal to the National Science Foundation to fund this project on behalf of CRA. NSF's Computer and Information Sciences and Engineering (CISE) Directorate has awarded $240,000 to support the project for two years. This funding will be enough to support 20 student/mentor matches in the summers of 1994 and 1995. The support is similar to the ongoing NSF program to supplement existing grants with funds for Research Experiences for Undergraduates, of which 80% went to male students in 1990 [NSF91]. Our program focuses specifically on women and the mentoring relationship and allows people without existing NSF grants to participate. Our program is distributed in nature—most students will leave their home institution for the research.

We seek to attract students from the full spectrum of colleges and universities, because students at smaller schools often have no local female role model. With so few women receiving Ph.D.s in CS&E (126 in 1992 [S93]), even the limited success of our project could have a significant impact.

We will solicit applications from students and from mentors this fall. The deadline for applying is April 1, 1994. Students will be requested to include a transcript, have letters of recommendation sent and discuss their interests and special skills. Letters will be optional, because some talented women will not yet have made connections with professors who would provide such detailed recommendations.

Mentors will send a curriculum vitae, a description of their proposed research projects and any special skills required of their students. Both

Continued on Page 5

Figure 1: *The percentage of women and men in CS&E at various stages in the pipeline in 1989-92.*

The data up to master's degrees is taken from the National Science Foundation's January 1992 report, *Women and Minorities in Science and Engineering: an Update*. The remaining data is from the 1991-92 CRA Taulbee Survey. The two databases are not entirely compatible. The NSF data is for 1989, whereas the CRA Taulbee data is from 1991-92. NSF includes information sciences departments, and the CRA survey includes Canadian universities. At their point of overlap, the NSF data shows the Ph.D. percentage at 17%, which is shown as dashes in the figure.

[1] The 1989-90 CRA Taulbee survey [GM90] reported 9% CS&E female assistant professors. The latest data for CS without CE is 12%, 14%, 9% and 5%, for Ph.D. and assistant, associate and full professors respectively [S93]. This is about 1% higher than with CE included.

[2] The original idea for the project is from Nancy Leveson and Maria Klawe, in a December 1991 NSF proposal from the CRA Committee on the Status of Women in Computer Science (CDA 9103163).

Attention CRA Members

Mailing labels of our membership and the CRA Taulbee List are available free to CRA members. The labels are available in electronic form or on Cheshire or laser labels. The labels are $25 per set for non-members. Contact Phil Louis at tel. 202-234-2111; fax: 202-667-1066; or E-mail: plouis@cs.umd.edu.

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Why systers excludes men

By Anita Borg

The existence of exclusively female forums is controversial, and legitimately so. Exclusive forums, such as male-only or white-only or Christian-only clubs, have been used to exclude other groups from information and power sharing. As the founder of systers, a large female-only mailing list, I frequently have been called upon to justify the exclusion of men and to explain why systers is not discriminatory in the above sense. I hope this article generates discussion, but more important, that it generates understanding and cooperation.

Increasing the number of women in computer science and making the environments in which women work more conducive to their continued participation in the field requires the active involvement of both women and men. In particular, there must be ongoing and productive communication throughout the field concerning the unique problems that women face when they enter the field and advance. The fact that women are a small minority in the field results in two impediments to this communication.

First, women work almost exclusively with men and have few opportunities to create and participate in a community of women in computer science. Second, men work almost exclusively with men and have limited opportunities to communicate with more than a few professional women.

Open electronic forums can improve communication by introducing women to a larger community but do nothing to reduce the disparity in numbers. On the other hand, exclusively female forums, such as systers, are a particularly effective way to connect women in our field with each other. These forums also ultimately contribute to improved communication between women and men.

Let me first describe what systers is and what it is not. Systers is a private, unmoderated but strongly guided mailing list with a documented set of rules for participation. The membership of the list includes female computer professionals in the commercial, academic and government worlds, as well as female graduate and undergraduate computer science and computer engineering students. Systers has more than 1,500 members in 17 countries. The members form a global community of individuals who otherwise are physically isolated from each other.

Systers is a civilized and cooperative

Continued on Page 5

Expanding the Pipeline

CRA presents Windows of Opportunity Symposium

BY C. Dianne Martin

CRA presented the Windows of Opportunity Symposium for Female Students in Computing in Washington, DC, on May 22-23. The symposium enabled 208 female students in computing from over 100 universities and colleges around the country to come to Washington to learn about career, research and funding opportunities for female students and to network with other female students and leaders in the field.

The purpose of the symposium was to support the National Science Foundation's goal of increasing the number of female graduate students in the computing fields to 45% by the year 2000. The symposium was supported by an NSF grant and hosted by the George Washington University

Several outstanding female researchers were featured speakers. Barbara Liskov of the Massachusetts Institute of Technology, Dianne O'Leary of the University of Maryland, Laurie Hodges of the Georgia Institute of Technology, Elsa Gunter of AT&T Bell Laboratories, Barbara Simons of the IBM Almaden Research Center and Anita Borg of Digital Equipment Corp.'s Network Systems Laboratory The researchers described their academic and career paths and discussed their current research.

Half the attendees were undergraduates, half were graduate students. The undergraduate students attended a session that featured graduate students giving presentations on their research. The graduate students attended a panel session, chaired by Andrea Lawrence of Spelman College, that described the process of choosing research topics and completing a Ph.D. degree. Other sessions covered mentoring, career path management, the systers electronic network, professional societies and posters of student research.

Participants were selected from nominations made by department chairs and deans. Attendees came from computer science, electrical engineering, computer engineering, information science and library science departments. Each attendee is expected to give a presentation at their home institution about the opportunities for females in computing. A videotape of the symposium is being produced and will be distributed to all attendees.

Attendees were overwhelmingly positive about the symposium. Many described it as a life-changing experience, and most said they were encouraged and inspired to continue in studies and careers in computing. All attendees were in favor of holding similar symposia in the future.

C. Dianne Martin was the symposium chair and is a professor of computer science in the Electrical Engineering and Computer Science Department at George Washington University

Women face many pitfalls

The following are excerpts from C. Dianne Martin's introductory remarks "Paradigms, Pitfalls, and Power" made at the CRA Windows of Opportunity Symposium for Female Students in Computing.

This is an especially exciting moment for me to stand before this sea of actual, smiling faces. Up to this point, most of you have existed for me as virtual voices in cyberspace. During this opening session you will hear Rick Weingarten of the Computing Research Association and Nico Habermann of the National Science Foundation give you their views about the importance of this symposium from a national perspective. However, I would like to take the prerogative of the chair to briefly share my vision for this Windows of Opportunity Symposium from a personal perspective. I would like to talk about paradigms, pitfalls and power

We all know a paradigm is a way of looking at things—a world view that frames our perception of reality. If I were to go onto the street right now and ask 20 passers-by to describe a university computer science student, they probably would use these images: male, mid-20s, nerd, obsessively focused on computers, maybe a hacker. If I were to go to any university and ask 20 computer science professors to describe a university computer science student, they would probably use these images: male, mid-20s, nerd, obsessively focused on computers, maybe a hacker. That is a paradigm about computer science that is gender-biased, age-biased and behavior-biased.

Now a word about pitfalls. The first pitfall I want to mention is the pitfall of the "chilly classroom" described by Sheila Tobias. This is the typical university math, science or computer science class that is taught in a lecture style, highly competitive, mostly male environment where women often feel isolated, afraid to ask questions and even dumb. In such an environment, women lack role models and a support group.

The second pitfall is one that I call the pitfall of "the typical student." I have been teaching computer science for 18 years, and I cannot tell you how many women I have advised who have started the conversation with the apologetic phrase, "I'm not your typical student. . . ." With such a self-view it is no wonder women often feel intimidated and lack the confidence to pursue advanced degrees in computer science.

There are many other pitfalls, such as gender harassment, personal safety issues and childrearing responsibilities. But that is not what this symposium is about. This symposium is about *power*—the power that comes from realizing you are part of a critical mass that will enable you to smash paradigms and successfully negotiate around pitfalls.

Continued on Page 5

Tips on how to get funding

BY Joan M. Bass
CRA Staff

At many universities, success in getting research funding is crucial for teachers seeking tenure. But people new to the process can take several steps to give themselves the best chance possible at succeeding

Researchers should submit several proposals to "cover all bets," because not all funding sources finance every thing that is needed for a research project, said Susan Eggers, an assistant professor of computer science and engineering at the University of Washington.

Eggers was one of the speakers at the CRA Workshop on Academic Careers for Women that was held during the Federated Computing Research Conference in San Diego in May The workshop was chaired by Cynthia Brown of Northeastern University

Some agencies have sources of funding earmarked for principal investigators only, but much more money is available for collaborative efforts, Eggers said. The type of funding researchers try for will depend on how far along they are in their research and how broad their interests are.

Researchers should get to know the funding agency's program director before they submit a proposal. "Technical schmoozing," such as introducing yourself at a conference and being persistent about having the program director meet with you, either at the conference or back at the office, is important to being successful, Eggers said.

Researchers should write their proposals early so they can take time to focus their ideas. They also should read successful proposals, be thoroughly familiar with the request for proposal and "follow it to the letter," and submit the proposal on time, Eggers said.

"You are new at this and you'll do it badly the first few times," Eggers said. "But you'll show it to others and get feedback and get better over time."

A proposal should have one objective and state clearly why your problem is important and, briefly, how you plan to solve it. But Eggers cautioned that you should not give the reviewers the nitty-gritty details or information they would not understand.

You have to sell your idea, which often is a hard task for women. You have to argue your idea and say how your work is promising, how it is different or better than other approaches (or complementary to other approaches), what your unique qualifications are and how the results will be valuable to the funder

Despite your best effort, you may have your proposal rejected. "Don't get discouraged," Eggers said. "Make it a learning experience." She said that because more people are trying for fewer dollars, it is getting harder

Eggers stressed that researchers should take the reviews seriously and fix any portions of the proposal that were misunderstood before resubmitting it.

Researchers who get their proposals funded should cite the funder in papers, stay in touch with the funder and do a good job, because this will increase the chances for success in the future.

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Expanding the Pipeline

Mentoring project from Page 3

students and mentors can ask to work with specific individuals to accommodate established relationships.

A selection committee will examine the applications in the spring, seeking an optimal match between students and mentors. An award of $5,000 per student/mentor match will support about ten weeks of research during the summer of 1994. The application and selection process for the summer 1995 projects will start in the fall of 1994.

We expect the research experience to be stimulating. We also intend to foster true mentoring, going beyond the all-too-common exploitation of programming labor. Researchers might mentor more than one student, but we will avoid over extending professors and diluting the mentoring relationships. Ideally, students will come away with an appreciation for research, an understanding of the university environment, contacts among both graduate students and professors who can advise them on applying to graduate school and a special relationship with a successful female computer scientist or engineer who can be a model, an inspiration and a resource for years to come.

Summer 1994 applications are available from the Distributed Mentor Project, Computing Research Association, Suite 718, 1875 Connecticut Avenue NW, Washington, DC 20009. For more information, contact Joseph O'Rourke, Department of Computer Science, Smith College, Northampton, MA 01063. Email: orourke@sophia.smith.edu.

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Joseph O'Rourke is chair of the Computer Science Department at Smith College.

Pitfalls for women from Page 4

Let me ask a few questions:
How many of you are male? *(all but one)*
How many of you are in your mid-20s? *(about half)*
How many of you would characterize yourselves as nerds? *(one)*
How many of you would characterize yourselves as totally focused on computers? *(maybe)*
How many of you would characterize yourselves as athletic? *(a few)*
How many of you have experienced a "chilly classroom"? *(over half)*
How many of you have started a conversation with the words, "I am not your typical student…"? *(about one-third)*
How many of you consider yourselves computer scientists? *(most of the audience)*

Let me tell you something about this group of 208 emerging computer scientists that I know because I read all of your applications. You all come with the highest recommendations of your department chair or dean. You are all gifted students, but you are also musicians, artists, athletes, campus leaders, teachers, librarians, mothers, grandmothers, community leaders and so on. The truth is that you do not need computer science as much as computer science needs you. You bring a balanced, holistic world view that is critical to successfully integrating computer technology into society in ways that are appropriate and positive.

I want all of you to burn a picture in your minds of this critical mass of more than 200 computer science students who do not fit the common description of a computer science student. You are the computer scientists of the coming decade who will provide new role models, eliminate the pitfalls and expand the paradigm of computer science for those who follow.

FCRC town meeting from Page 1

state and federal representatives ensures that these representatives, and also your university's provost and president, are aware of the major science policy issues and the critical role computing research plays in the vitality of the nation and of your region. When making contact, emphasize the positive—the contributions our discipline has made and can make. For advice, talk to your colleagues and CRA executive director or any board members.

Joseph Traub of Columbia University described the activities of the Computer Science and Telecommunications Board. CSTB is chartered by the National Research Council, which is the operating arm of the National Academies of Sciences and Engineering. William A. Wulf, a recently retired CRA board member, is chair of CSTB. Juris Hartmanis, another CRA board member, headed the CSTB panel that wrote the widely discussed report *Computing the Future: A Broader Agenda for Computer Science and Engineering*.

Mary Vernon of the University of Wisconsin at Madison discussed her participation on the NSF Blue Ribbon Panel on High-Performance Computing. Beside Vernon, only one other core computing researcher—Burton Smith—was appointed to this 14-member panel headed by Lewis Branscomb and charged to advise the National Science Board on how the National Science Foundation should participate in high-performance computing over the next five years.

Continued on Page 7

Systers from Page 3

tive forum in which flaming is rare and personal attacks are actively discouraged. Members are asked not to forward a message or use its contents outside the list without the permission of contributors to the message. This rule empowers our members and protects our privacy by giving each of us control over the breadth of distribution of our comments. It is based on a common courtesy that, if applied more generally, would make the net a more hospitable place for substantive group problem-solving. It is not a rule of secrecy.

Systers is not analogous to a private all-male club. It is different because women in computer science are a small minority of the community. It is different because systers is not interested in secrecy or in keeping useful information from the rest of the community. Useful messages regularly are made public after checking with the contributors. *It is unlikely that an undisempowered minority will keep inaccessible information from the large empowered majority that has every means of communication available to it.* I have not addressed whether a forum such as systers would be necessary in an ideal and egalitarian world or even in a world similar to our own but with many more women in computing. When we get there, we can make that decision.

The following paragraphs enumerate the reasons for keeping systers a female-only forum. None of these benefits accrue to women in other existing open forums.

Women need a place to find each other. Within computer science, women often are a geographically dispersed and individually isolated minority. Women rarely have the opportunity to interact in person with other women in computer science on any subject. Women (and men) have many opportunities to interact with men. Until systers was created, the notion of a global community of women in computer science did not exist.

Women need female role models and mentors. A primary function of women-only interaction is mentoring. Exposing women to the full range of significant interactions among women, without the perception of help or advice from men, serves to bolster self-esteem and independence. This includes exposure to women discussing purely technical issues among themselves. Our experience shows that this makes women more—rather than less—able to interact professionally with men.

Women need a place to discuss our issues. Many open forums that focus on women's issues suffer from a common problem. Discussions frequently are dominated by disagreements between men and women about what the issues are rather than how to deal with them. This is not a problem with all men, but is a problem with almost all such open forums. Women more often share common ground that allows them to get beyond defining issues and on to constructing solutions.

Women need to discover their own voice. Discussion among women is different from that of women together with men. Men, even when in a minority and even when well-meaning, have a different style of interaction. They often dominate discussions. Even when they do not, the style of a mixed conversation tends to be in the style of male-dominated discussions. As women understand more clearly what those differences are and what professional discourse is like on our own, we will be better able to bring our voice to open forums.

I recently received two messages that illustrate how systers helps women participate more effectively and more professionally with men.

A researcher from an industrial lab said, "When I first joined the list a few years ago, I was skeptical about the need for a list specifically devoted to issues facing women working in computer science. But since then, I have become much more aware of the differences in the ways men and women interact, and many of the experiences and views shared by others on this list have helped me to better understand how to function effectively in a male-dominated research environment."

A university professor described a change in her students. "The availability of the list to our women graduate students here at [the university] has had a remarkable affect on our students. The women are becoming more self-confident and more aggressive in their dealings with our male-dominated faculty, many of whom still regard women as out of place in the program."

Systers is not the only forum in which concerned women participate. It is only a starting place and place of respite in our journey to equality. It is essential that we continue to actively communicate and participate with men, that we not become isolated from professional men and that we bring our issues to the fore at every appropriate opportunity. Because most of us work exclusively or nearly exclusively with men, it is impossible for us to become isolated from men even if we wish to be. Because men make up the vast majority of the field, it would be foolish to believe that real change could take place without them.

To include men in systers would take away a vital source of mutual support from women. On the other hand, the need for serious discussion in an open forum exists. It behooves whoever runs such a forum to realize that women who have experienced civilized, productive communication on systers will be for the most part uninterested in participating in a wide open free-for-all. The commonly applied list management principle "if you can't take the heat, get off of the list" will not work. It has been tried and has failed.

The forum will need a strong leader/moderator, committed to the encouragement of productive discussion and willing to stop unproductive argument. I do this for systers. While I have neither the desire nor the energy to run another forum, I surely am not the only person capable of doing it. I offer my help and experience to anyone who is willing to take on the task.

It is not the reluctance of women or our participation in forums like systers that limits communication and joint problem-solving with men. It is the

Continued on Page 13

Association News

New board members elected

Ruzena Bajcsy

Computer science professor and director of the GRASP Laboratory, University of Pennsylvania

Bajcsy has a doctorate in electrical engineering from Slovak Technical University in Czechoslovakia and a doctorate in computer science from Stanford University

Bajcsy's research interests are in the general area of machine perception—including segmentation, 3-D shape recognition and multiresolution problems—and how it relates to the field of computer vision and extends to other modalities, particularly touch. She is a Fellow of the American Association for Artificial Intelligence and of the Institute of Electrical and Electronics Engineers.

Bajcsy is program chair of IJCAI-93; a member of the National Research Council Committee on Computer Science and Telecommunications; a member of the board that wrote *Computing the Future*; and a member of National Science Foundation advisory boards on engineering and on the Computer and Information Science and Engineering Directorate.

Barry W. Boehm

Computer science professor and director of the Center for Software Engineering, University of Southern California

Boehm earned a doctorate in mathematics from the University of California at Los Angeles.

Boehm's research interests are software process modeling, software requirements engineering, software architectures, software metrics and cost models, software engineering environments and knowledge-based software engineering

He has served as director of the Defense Advanced Research Projects Agency's Information Science and Technology Office and the Defense Department's Software and Intelligent Systems Technology Office; was TRW's chief scientist of the Defense Systems Group; and was head of Rand Corp.'s Information Sciences Department.

Boehm has served on several editorial boards and has served on the governing board of the Institute of Electrical and Electronics Engineers Computer Society and an American Institute of Aeronautics and Astronautics and IEEE Fellow

Duncan H. Lawrie

Professor and chair of the Computer Science Department at the University of Illinois, Urbana-Champaign

Lawrie has a doctorate in computer science from the University of Illinois. His research interests are computer architecture and information systems. He is an Institute of Electrical and Electronics Engineers Fellow and has held several positions in the IEEE Computer Society

Lawrie said he would like to use his experience as a researcher and as a past president of the IEEE Computer Society to help CRA meet the challenge of bringing together our discipline's other professional societies to create a powerful voice of reason to inform the public and our policymakers.

CRA board meets in Washington

By David A. Patterson

The July 1993 Computing Research Association Board of Directors' meeting was held for the first time in Washington, DC. Given the importance of representation in Washington for CRA's goals, we intend to have one CRA board meeting per year in this fine city.

Guests on the first day of the meeting included Duane Adams of the Advanced Research Projects Agency, Nico Habermann of the National Science Foundation's Computer and Information Science and Engineering Directorate and William A. Wulf, chair of the National Research Council's Computer Science and Technology Board. As a result of the discussion that evening, we made the following plans:

• The CRA Government Affairs Committee, under the able direction of Edward Lazowska, was given the task of helping the Senate Appropriations Committee understand high-performance computing and communications.

• CRA will continue its congressional policy seminars. In July Leonard Kleinrock gave a presentation on high-speed data networks. Nancy Leveson tentatively is scheduled to speak on software reliability and integrity in the fall. Our goal is to sponsor two or three seminars per year to maintain CRA visibility with Congress.

• CRA will reconvene the "S&E Summit," and invite the presidents and executive directors of CRA, the Association for Computing Machinery (ACM), the Institute of Electrical and Electronics Engineers Computer Society (IEEE CS), the Society for Industrial and Applied Mathematics (SIAM), the American Association for Artificial Intelligence (AAAI), the Computer Systems Policy Project, Computing Professionals for Social Responsibility and the Computer Science and Telecommunications Board to meet in Washington to discuss items of interest to computer science research with science policy leaders such as the

Continued on Page 13

Dave Patterson begins term as CRA board chair

David A. Patterson, chair of the Computer Science Division at the University of California at Berkeley, became the new chair of the Computing Research Association on July 1.

The other officers, who will serve until June 30, 1995, are Vice Chair Maria Klawe, head of the Computer Science Department at the University of British Columbia; Secretary Gregory R. Andrews, professor and head of the Computer Science Department at the University of Arizona; and Treasurer Michael R. Garey, director of the Mathematical Sciences Research Center at AT&T Bell Laboratories. The CRA Board of Directors elects the four officers.

CRA would like to thank its past board officers. Past chair, John R. Rice, professor of computer science at Purdue University, remains on the Board of Directors, as does the past vice chair, Peter Freeman, dean of the College of Engineering at the Georgia Institute of Technology

CRA's new board members, who were elected by the association's member organizations to three-year terms that began July 1, are Ruzena Bajcsy, professor of computer science at the University of Pennsylvania; Barry Boehm, professor of computer science at the University of Southern California; and Duncan Lawrie, professor and head of the Computer Science Department at the University of Illinois, Urbana-Champaign.

Four board members were re-elected: Maria Klawe; W. Richards Adrion, professor of computer and information sciences at the University of Massachusetts, Amherst; John E. Savage, professor of computer science at Brown University; and Robert W. Ritchie, director of university affairs at Hewlett-Packard Co.

At press time, H.T. Kung resigned from the board and Patterson designated Mary K. Vernon of the University of Wisconsin at Madison as his replacement. Vernon is an associate professor of computer science. She also is a member of the NSF Blue Ribbon Panel on High-Performance Computing

CRA appreciates the time and effort contributed by its retiring board members: Victor Basili, professor of computer science at the University of Maryland; and William A. Wulf, professor of computer science at the University of Virginia.

CRA's bylaws state that elections will be held each spring to fill seats left open by expiring terms of office or by resignations. Seven seats were open this year. Each CRA member organization is allowed one vote for each open seat on the board.

The CRA Election Committee puts together a slate of candidates from nominations made by members of the computing research community. In preparing the slate, the committee seeks reputable computer researchers and research administrators who are willing to devote time and energy to CRA. The committee looks for a varied slate in terms of research field, organization type, gender, ethnic background and geography

CRA chair: A call to action issued to CS&E researchers

By David A. Patterson

In the waning days of my chairmanship of the Computer Science Division at the University of California at Berkeley I attended the Federated Computing Research Conference in San Diego. At the time I was planning my sabbatical, with travel as reward for my three years as Berkeley Chair. Almost as soon as I arrived, I was approached by members of the Computing Research Association about running for chair

My reply was "Why in the world would I want to do *that*?"

Their answer: "The United States is forming a new social contract for research, the first since World War II with Vannevar Bush's 'Endless Frontier.' Physics started at the front of that line, and little changed in 45 years. Here is a chance to help set a new contract that may last for decades, to reorder the priorities. And it is computer science and engineering's chance to move up in that line, as it deserves."

Alas, this argument had a terrible flaw—it made tremendous sense. So I agreed to run and was elected. But if the argument applies to me, it applies to you as a member of the computer science and engineering research community. Thus this article is a call to action, letting you know that CRA will be asking for your help at an important time in the history of CS&E. If CRA calls asking for help, we are counting on you to volunteer

The good news is that CRA has been on a roll. In just three months, from May through July, we accomplished a great deal:

• CRA has become a serious representative of computing in Washington. The association influenced the important Boucher bill (the National Information Infrastructure Act of 1993) and is being asked for the CS&E research perspective on other upcoming legislation. By the end of 1993, CRA will have sponsored three congressional seminars.

• The CRA Workshop on Academic Careers for Women was a smashing success, with some thinking it is the most significant event that they have attended.

• The Federated Computer Research Conference (FCRC '93) was another great success and is likely to become a regular national event, offering both quality and breadth.

• The CRA Industrial Research Workshop at Snowbird in July marked the beginning of a new S&E community: directors of S&E research organizations who, before the workshop,

Continued on Page 9

Conference News

FCRC from Page 5

The computational scientists on the panel were open-minded but were not well-informed about the contributions to high-performance computing made by academic and industrial members of the computing research community

These panel members tended to view capabilities in this area as the product of vendor development efforts. Vernon and Smith presented fellow panel members with a list of research contributions, which included reduced instruction set computing technology; computer-aided design tools; multicomputers and the message passing programming model; shared-memory architectures and programming models; hypercube, mesh, and fat tree interconnects and routing algorithms; SIMD architectures; the data parallel and SPMD programming models; vector compiler technology; parallel compiler technology; Unix and Mach; lightweight and wait-free synchronization primitives; performance debugging tools; parallel database architectures and algorithms; parallel optimization algorithms; and algorithms and machine learning technology for computational biology

The panelists became convinced that most high-performance computing technology is the result of computing research and that support for computing research was relevant to the panel's charter

Vernon and Smith emphasized to panel members that broad-based advances are still required (it is not just a software problem) and that computing researchers are users as well as developers of high-performance computing technology (advances require access to prototypes, early commercial systems and current-generation MPPs).

Vernon also discussed the activities of the NSF Computer and Information Science and Engineering (CISE) Advisory Committee. The members of this committee are a key communication mechanism between the research community and the CISE Directorate.

CRA's Weingarten identified four major areas of policy activity. The first is high-performance computing and communications—both retrospectively (How well are the goals of the HPCC Act of 1991 being achieved?) and prospectively (What midcourse legislative changes could be made to improve the effectiveness of this effort?).

The second policy area is authorization, particularly the definition of NSF's role in future science and technology efforts as it will relate to other agencies such as the National Institute of Standards and Technology

The third area is appropriation. Once the right agencies are authorized to conduct the right activities, it is necessary to fund the initiatives. This can be difficult because of budget cutbacks.

The fourth area is NREN. The telecommunications industry has developed an enormous interest in digital communications. The politics of continued federal involvement in this area—an area in which technology and the market are created by innovations from the research community—have become complex.

Audience participation

More than an hour of the town meeting was devoted to audience participation. Many issues were addressed:

• *What constructive roles can individuals and departments play in the science policy arena?* One must recognize the importance of this activity, be willing to serve and support those who do serve. (Volunteering as a rotator at NSF is frequently recommended by those who have done so.)

• *How can the computing research community achieve consensus on policy issues?* This is a critical topic. Vernon and others emphasized the value to the discipline of combining vigorous internal debate with a unified and mutually supportive external presence. There is no magic formula. We must think about policy issues, discuss them with our colleagues and communicate with people already active in the policy arena: department chairs and industrial research lab directors, members of the CRA Board of Directors and the CISE Advisory Committee.

• *How will basic research fare in the new climate?* The panelists felt that this question was ill-posed. Although researchers increasingly will be expected to argue the relevance of their research, this is not equivalent to a polarization between theory and systems or basic and applied research. Strong ties with industry are emphasized in the new climate. Technology transfer in computer science and engineering already is quite effective; our field should be in a strong position to make the case for enhanced research funding.

• *What effect will changes in the computing industry have on computing research?* Audience members expressed concern about the downsizing and refocusing of the great research laboratories established by companies such as AT&T and IBM. Will the new generation of leadership companies in computing (Microsoft, for example) invest as much in research and human resources?

• *What should be done about the tight job market for recent Ph.D. recipients in computer science and computer engineering?* This question generated a spirited discussion. Many are concerned that the computing research community is ignoring the lessons learned in mathematics and physics. Audience members were enthusiastic about asking that faculty and departments publicize how their recent Ph.D. recipients have fared in the job market. It is likely that CRA will charter a group to make short-term and long-term policy recommendations.

Edward D. Lazowska is chair of the Department of Computer Science and Engineering at the University of Washington and chair of the CRA Government Affairs Committee. E-mail: lazowska@cs.washington.edu.

IFIP Congress '94 is in Germany next August

By Wilfried Brauer and Ronald P. Uhlig

Computer science is in a period of great change. Many questions must be answered on an international scale. The best forum to discuss these and other related issues is the 13th World Computer Congress, IFIP Congress 1994, which will be held next Aug. 28–Sept. 2 in Hamburg, Germany.

People from around the world will discuss the latest developments in information and communication technologies and their applications, impact and foundations. Of even greater interest, interactions and feedback among these areas will be discussed in some depth, and action agendas for progress will be presented to the computer and communications community in a message summarizing the findings of the congress.

The congress will offer technical discussions in five tracks. On the first day, Experts Day, keynote speakers will present their views on the impact of investment strategies on computer and communications use. They will speak from the perspective of national strategies in the United States, Japan and Europe. The addresses will be delivered by high-ranking government and industry speakers. Influential politicians from the European Community and the German government will attend the opening, as will the president of the union of German industrial companies.

The tracks will begin with presentations by experts in their fields. In about 25 meet-the-experts sessions, participants will break into small groups of no more than 50 attendees and one expert. During two Specialist Days, the tracks will continue with invited and submitted contributions. The five tracks are as follows:

- Hardware, Software and Communication Technology;
- Computer and Communications Applications;
- Impact (the role of computers and communications in solving major world problems);
- Foundations; and
- The Role of Information and Communication Technologies for Developing Countries.

The second part of Congress '94 is designed to stimulate feedback among the tracks. On Linkage Day, joint sessions between pairs of tracks will address serious issues related to both areas. To generate interest for this unprecedented approach and focus the feedback discussions, the International Program Committee has formulated several key questions. Every congress participant will have the opportunity to participate in working groups that will develop preliminary action agendas for the issues.

On Message Day, the preliminary action agendas developed by the working groups will be presented to participants during a plenary session. This message to the computer and communications community will discuss preferred directions that individuals from industry, government and academia can take. Action items will be published as the Congress '94 Message.

More information is available from the following sources:

- Gopher (see IFIP under International Organizations)
- LISTSERV: LISTSERV@CEARN; PostScript files: IFIP94-1 PS through IFIP94-6 PS; ASCII file: CFPWCC94 TXT
- Anonymous FTP: SOFTWARE.WATSON.IBM.COM / PUB / IFIP; PostScript files: mget IFIP94-* PS; ASCII file: get CFPWCC94 TXT
- Conference Secretariat IFIP '94, Congress Centrum, Hamburg; Fax: 49-40-3569-2343.

The deadline for submitting papers is Jan. 14. The deadline for submitting informal presentations (posters, videos and commercial demonstrations) is April 22.

Wilfried Brauer is a professor of computer science at the University of Technology in Munich, Germany, and a council member of the IFIP.

Ronald Uhlig is director of Intelligent Network Solutions at Northern Telecom and chair of the International Program Committee. Fax: 214-684-3787; E-mail: 0002591777@mcimail.com.

1994 CRA Conference at Snowbird
July 10–12 ◆ Snowbird, Utah

The 1994 CRA Conference at Snowbird will include the Department Chairs Workshop and the Research Managers Workshop. The CRA Conference at Snowbird is the flagship conference for academic and research laboratory administrators interested in computing research issues. If you would like to receive information about the conference when it becomes available, fill out this form and return it to CRA.

Name _____

Title/Position _____

Organization _____

Department _____

Address _____

City _____ State _____

ZIP+4 _____ E-mail Address _____

CRA Conference at Snowbird, Computing Research Association,
1875 Connecticut Ave. NW, Suite 718, Washington, DC 20009.
Tel. 202-234-2111; Fax: 202-667-1066; E-mail: plouis@cs.umd.edu.

Policy News

CRA submits testimony on infrastructure bill

In May the House Science, Space and Technology Subcommittee on Science held a hearing on the National Information Infrastructure Act of 1993, HR 1757. The following is an edited version of the written statement submitted to the subcommittee by Edward Lazowska on behalf of the Computing Research Association. Lazowska is chair of the Department of Computer Science and Engineering at the University of Washington and a member of the CRA Board of Directors.

Your subcommittee's outstanding work, both on HR 1757 (formerly known as the High-Performance Computing and High-Speed Networking Applications Act of 1993) and on HR 656 (the High-Performance Computing Act of 1991), is of keen interest to CRA and of critical importance to America's future.

There are five points I would like to emphasize:

1. Advances in high-performance computing and communications (HPCC) have been phenomenal.

Astounding advances in computing have become so routine that I sometimes worry we are in danger of taking this progress for granted.

My Macintosh laptop has about 25 times the memory and 10 times the processing speed as the building-sized mainframe that served the entire academic and administrative needs of Brown University just two decades ago.

It is difficult to accurately predict the incredible progress technology is making. I recently ran across a chart from 1972 that synthesized a number of expert predictions concerning progress in large-scale computing. The experts' predictions for 1990, which undoubtedly seemed wild in 1972, turned out to be low by a factor of about 25 for both memory capacity and processing speed. And the experts' predictions for the year 2000 are a factor of 1,000 below current estimates.

But as difficult as it is to predict this kind of progress, it is even more difficult to forecast the changes that will be brought about by such progress. Electronic data processing, yes, but who would have guessed compact disc players, cellular telephones, CAT scanners, faxes or electronic prototyping environments? Who would have predicted that computation would join physical experimentation and mathematical analysis as a third basic paradigm for how to do science and engineering? Who could have known that major areas of biology and computer science would converge due to the digital nature of the human genome?

Were it not for the contributions of computer science and computer engineering research, we would not even be dreaming of attacking the grand-challenge problems of science and engineering or of creating a national information infrastructure.

2. These advances have been the result of a highly effective partnership between government, industry and academia.

Intel Corp. has done an enormous amount to advance the state of the art in scalable multicomputers and to make these systems practical. But the cube architecture itself, the message-passing programming paradigm, the operating system software and many key high-performance algorithms are recent products of federally funded CS and CE research at universities. Much of the early use of Intel's systems occurred in government laboratories. Many SIMD single-instruction, multiple-data architectures and the data-parallel programming model evolved from university laboratories.

> *HPCC applications and digital technology and digital information will strengthen America's economy and unite its people.*

The record of technology development and transfer between government, industry and academia is unprecedented. I cannot think of another field that enjoys comparable relationships. We must not lose this momentum.

3. As phenomenal as these advances have been, the next decade or two will be the time in which digital technology can truly transform America.

Advances in computing are making it possible to attack the grand-challenge problems of science and engineering

With even greater pervasiveness, though, advances in computing are enabling what Richard Rashid, Microsoft Corp.'s research director, has referred to as the "digital information revolution." He said, "New technologies make it easier to transform analog messages, including the spoken word, text or pictures, into the digital language of computers, which then can be transmitted, processed and stored electronically. In digital electronic form, textual, audio and video information can be combined, [and] used by a variety of different machines in new and exciting applications."

HPCC applications and digital technology and digital information will strengthen America's economy and unite its people.

4. Stronger investment in basic research and human resources in computer science and computer engineering is essential.

Today's amazing digital technology is the direct result of yesterday's investments in basic research and human resources in computer science and computer engineering

Tomorrow's even greater advances, and the changes they will bring, will be possible only if we invest today

Digital technology has progressed so far already and computing devices are so fast that many people are tempted to believe the technology needed to make the vision embodied in HR 1757 a reality is on the shelf and ready to be deployed. I commend this subcommittee for recognizing that this is not the case and for making explicit in HR 1757 that further investments are essential in basic research and human resources in computer science and computer engineering, both in general and in the specific application areas covered by the act.

I would like to provide some specific examples of the role of computing research in areas related to the High-Performance Computing Act of 1991 and the National Information Infrastructure Act of 1993. I will steer clear of the obvious, such as designing and prototyping high-performance computer architectures and network architectures. The high-performance computing and networking technologies upon which these acts are based largely are products of federally funded university CS and CE research. Here are a few examples:

• Digital libraries: Twenty years from now, with sufficient attention paid to the issue, people will be amazed at the way we use libraries today. As the subcommittee knows, a key benefit of digital information in general and digital libraries in particular is that they benefit all of America, and have the potential to benefit remote areas even more than major metropolitan areas.

Because of the last generation of advances in computing, much of the basic hardware to support digital libraries exists today. The University of California at Berkeley's current $47 million library construction project will house 2 million books, which could be stored on $500,000 worth of electronic media.

We are a long way from being able to build a digital library of the scale and sophistication envisioned by HR 1757. CS and CE research issues that need to be addressed, many of which are identified in the act, include storing the incredible volume of information; managing the memory hierarchy to achieve reasonable access times; locating information; dealing with the demands of multimedia documents (text, images, music, voice, video); accommodating variations in communication and display capabilities; achieving reliability; designing compression algorithms to improve cost and performance; designing advanced user interfaces; and devising new cryptographic protocols to help deal with copyright and use issues.

There also are many policy issues:

• SILK interfaces: Advanced user interfaces are just one aspect of digital libraries and of government information systems, health care systems and many education applications. This commonality emphasizes the importance of supporting core research in computer science and computer engineering, so that these common problems get solved once, solved generally and solved right.

In the past several years, advances in hardware technology and in algorithms have placed nearly within reach interfaces that employ speech, images, language and knowledge—so-called "SILK interfaces."

Interfaces that understand speech in a limited domain of discourse already are used commercially. Systems that work usably well in a general setting have been demonstrated in the laboratory. Storage technology has advanced remarkably

High-resolution color images require a significant amount of storage, and color video requires significant network bandwidth. But these now are within reach. The day of digital movies sent to the home via a fiber-optic network is not far off, and aggressive use of images and video in user interfaces is becoming common.

Technology to understand language also is making rapid advances through progress in the hardware and software domains. Uses of this technology include a broad range of reading and writing aids: tools for highlighting and summarizing articles; greatly improved spelling, grammar and style checkers; and filing assistants. Technology to generate language, coupled with speech synthesis hardware, is common. Programs that read stored text aloud are a boon to the sightless; programs that read columns of numbers in a spreadsheet make verification easier

Over the coming years, progressively more sophisticated SILK interfaces will have the potential to revolutionize the ease of use of digital systems. CS and CE research such as this is essential to the success of the national information infrastructure.

These few examples barely begin to illustrate the fundamental role computing research must play in achieving the goals of the acts. The human resource requirements are equally significant. At all degree levels, the demand for computer scientists and computer engineers remains strong. The enormous opportunities for new business that will be created by the digital information revolution are but one factor working to ensure that this demand will continue.

A key concern of CRA is that the implementation of the High-Performance Computing Act of 1991 fell far short in placing sufficient resources into basic research and human resources in computer science and computer engineering, particularly within the National Science Foundation. CRA would emphasize that:

• Basic research and human resources in computer science and computer engineering are essential to achieving the short- and long-term goals of the acts. Advances in computer science and computer engineering fuel these initiatives.

• To ensure a well-balanced program, a significant amount of this support must be provided through non-mission-oriented agencies—particularly NSF—that sustain the broad fundamental technology base.

• By any measure, existing support for computing research is low. Comput-

Continued on Page 9

Policy News

Table 1. NII Act of 1993 Authorizations by Program (in millions of dollars)

	1994	1995	1996	1997	1998	Total
Connections:						
NSF	15	30	50	–	–	**95**
Research for Applications	6	15	20	20	20	**81**
Education (NSF)	16	45	60	75	75	**271**
Health (HHS)	22	54	72	90	90	**328**
Libraries:						
NSF	8	16	22	32	32	**110**
NASA	4	8	10	12	12	**46**
Government Information	4	12	16	21	21	**74**
Total Per Fiscal Year	**75**	**180**	**250**	**250**	**250**	**1,005**

NII from Page 1

that the federal program will not subsidize government networks that might compete with private commercial networks," a Senate press release said.

However, the educational community and the telephone companies have reached agreement and both recommend that the language in HR 1757 be substituted in S 4.

The Senate version, the National Competitiveness Act, includes NII legislation among other sections dealing with advanced manufacturing and wind engineering.

Although the Senate Commerce Committee approved S 4 in May, the bill has not been scheduled for a floor vote.

The House NII bill underwent several other significant changes during its subcommittee markup. Upon insistence from Republican members, all funding authorized by the bill must be drawn from funding already authorized and allocated to existing programs. Hence, the bill does not add money to the HPCC program, but rather shifts the program's focus.

Also added to the bill since its introduction is a provision whereby recipients of grants and awards must procure products from American companies "when available and cost effective."

Finally, a "sunset" amendment was added to the bill, which would end any new NII funding by fiscal 1998.

The NII bill calls for the Federal Coordinating Council for Science, Engineering and Technology to direct an interagency program, involving the departments of Commerce, Energy, Defense, Health and Human Services, and NASA and the National Science Foundation.

NII funding is broken down into the following components (see Table 1):

Connections: NSF would help pay the cost of Internet access for educational institutions, libraries, museums and state and local governments.

Applications research: This includes funding for research on security, privacy and copyright problems, as well as in the areas of user interfaces and social science.

Education: NSF would fund projects to demonstrate educational uses of the Internet; development of hardware systems, software and networks for teacher training and informal education; and the development of education software. Funding is directed at all levels of education.

Health: HHS would fund testbed networks to exchange medical images and records, basic research on virtual reality, development of interactive technology to help patients and on-line services to provide statistical information revealing patterns of disease among specific populations.

Libraries: NSF and NASA would fund projects to digitize libraries and organize and store large quantities of information, with a focus on finding friendly user interfaces and a way to protect copyright. This component also would fund prototype projects to make digital libraries available on the Internet.

Government information: This section seeks to encourage dissemination of electronic information by federal, state and local governments and focuses on getting depository libraries to offer information through the Internet.

Testimony from Page 8

ing is a foundation technology, so advances in computing have a pervasive effect.

It is estimated that the computing industry accounts for 10% to 20% of the gross domestic product. The software industry alone contributed $37 billion of value added to the US economy in 1992.[2]

It is estimated that the federal government spends $150 billion per year on computing. Yet the support in NSF for CS and CE research is only about $110 million per year.[3]

• Because the basic level of support for computing research is so low, particularly within NSF, it is critical that new initiatives be supported with new money, rather than repainting existing projects or diverting funds from those projects. Authorization without appropriation may have a negative effect.

5. The National Information Infrastructure Act of 1993 seems to be precisely on target, although we do have several suggestions concerning its implementation.

CRA strongly supports HR 1757. This is the right time for an applications act, and this is the right act. The application areas are well selected; they are of great importance and of broad societal impact, and they are natural extensions of HPCC advances that have been achieved.

The act shows a clear commitment to basic research in support of these advanced applications—a recognition that the ambitious goals of the act require further advances in computing and CE research areas. Advances in computing technology are so great—performance doubles about every 18 months—that it is necessary to rethink basic approaches continually.

The demonstration projects are essential, not just because they will allow the technology to be developed and prototyped, but because they will provide a forum for the government and the private sector to consider critical regulatory issues based on experience rather than speculation.

CRA appreciates the concerns of the telecommunications industry as expressed in their policy statement[4] and in testimony before this subcommittee. We would point out, however, that federally funded research and education networking is a customer for private sector services, not a competitor, and that this Internet community has been responsible for creating the high-performance communication technology and applications. CRA feels that attempts to legislate a strict separation between production networks and experimental networks, and attempts to place detailed restrictions on the use of the latter are incompatible with the nature of the Internet and would paralyze future advances.

CRA has been working with other education and research organizations to develop a clear policy agenda regarding the National Research and Education Network, and we would welcome the opportunity to work with the telecommunications industry to devise a mutually agreeable framework.

We would like to bring to the subcommittee's attention one key application area that is closely related to the act but not included in it: engineering design. Improving the engineering design process—our ability to design products and bring them to market—is critical to restoring America's competitiveness. This area is poised for significant advances because it relies on the HPCC technologies in which so much progress has been made. Additional progress required to achieve these advances is common to the other HPCC application areas covered by the act, including progress or improvements in visualization, network security and privacy, collaborative technology, database technology and user interfaces.

References

[1] Robert E Lynch and John R Rice, *Computers: Their Impact and Use; BASIC Language*, New York: Holt, Rinehart and Winston, 1975.

[2] "The US Software Industry: Economic Contribution in the US and World Markets," *Economists Inc.* (March 1993).

[3] An additional $96 million per year is spent on the supercomputer centers and NSFnet. Although the supercomputer centers are a valuable national resource and have been instrumental in effecting a paradigm shift in many areas of science and engineering, they generally have not been relevant to the advancement of CS and CE research that supports high-performance computing.

[4] CEO policy statement of 14 major telecommunications companies, March 23, 1993.

Call to action from Page 6

had not gotten together to talk about problems and issues common to all of them. These 20 research directors—each of whom supervises 25 to 100 CS&E Ph.Ds—made friends, started E mail exchanges and promised to meet again in 12 months.

The job of the CRA is to continue or accelerate this momentum.

Everything we do takes some portion of bandwidth of the five CRA staff and some portion of bandwidth of the CRA board. While we get few foolish suggestions, we have to balance our resources with our priorities for the field. CRA is interested in your suggestions on its future directions. To start the discussion, here are my views on the priorities for CRA for the next three to five years.

Our successors will curse our memories if we miss this opportunity to set the new research agenda that may last decades. Hence, highest priority is representation in Washington. This means we cannot shortchange this task for the next three to five years. Because the Washington research agenda inevitably has some influence on the Canadian research agenda, these activities also are important for our Canadian members.

Our next priority is to continue to do the things we have been doing well. These activities and projects include:

• Activities of the CRA Committee on the Status of Women, such as the Workshop on Academic Careers for Women.

• FCRC '96: Planning is under way and CRA must help ensure the conference is as successful as the first FCRC.

• The CRA Conference at Snowbird ("Big Snowbird"), which is our oldest contribution to the CS&E community.

• The Industrial Research Workshop at Snowbird ("Little Snowbird") is our effort to help the community of industrial research labs to grow.

• *Computing Research News*, which is the voice of CRA. A recent readership survey said 85% of subscribers read three or more of the last four issues, spending an average of 45 minutes reading this short news journal.

• The award-winning annual CRA Survey on the Production and Employ

Continued on Page 16

Policy News

Congress increases NSF budget, debates its mission

Table 1. NSF Appropriations (in millions of dollars)

	1993 Estimate	1994 Request	Increase over 1993	1994 Appropriation	Increase over 1993
Research	1859.0	2204.8	18%	2045.0	10%
Education	487.5	556.1	14%	569.6	17%
Polar Programs	158.0	163.1	3%	158.1	0%
Antarctic Logistical Support	63.4	65.1	3%	65.1	3%
Academic Research Facilities and Instrumentation	50.0	55.0	10%	55.0	10%
Critical Technology Institute	1.0	1.0	0%	1.0	0%
Salaries and Expenses	111.0	125.8	13%	121.0	9%
Relocation	N/A	5.2	N/A	5.2	N/A
Inspector General	3.7	4.1	11%	3.9	5%
Total NSF Budget	**2,733.6**	**3,180.2**	**16%**	**3,023.9**	**11%**

BY Juan Antonio Osuna
CRA Staff

The House passed an appropriations bill June 29, giving the National Science Foundation an 11% increase for fiscal 1994 (see Table 1).

The House Appropriations Subcommittee on Veterans Affairs, Housing and Urban Development and Independent Agencies decided on the increase during a markup on May 27. The appropriations package is now before a Senate appropriations subcommittee.

The 11% increase falls short of the 18% increase NSF had originally requested for 1994. The 11% increase would bring NSF's total budget to $3.02 billion, with $2.05 billion for research and related activities. The research portion would increase by 10%.

Meanwhile, the House Science, Space and Technology Subcommittee on Science held the second of two hearings June 15 on NSF's mission.

Subcommittee chair Rep. Rick Boucher (D-VA) asked NSF officials for guidance in drafting legislation to reauthorize NSF. The agency's five-year authorization expires this year. A bill is expected to be introduced during a markup in mid-September.

During the hearing, NSF's acting director Frederick Bernthal and National Science Board (NSB) chair James Duderstadt reaffirmed that NSF should continue to focus on basic research and not substantially alter its mission.

The administration wants NSF to broaden its mission to include more applied research. NSF officials claim basic research is an essential component for achieving these goals and one that NSF has a special role in nurturing.

In a white paper titled *In Support of Basic Research* submitted for the record, the NSB said:

"Basic research is not intended—nor should it be expected—to advance short-term goals. Rather, it is an investment that, like education, takes time to mature but has tremendous practical payoffs in the long run. Assuring the knowledge base appropriate for economic growth, long-term job creation and social well-being requires a conscious commitment to strong and consistent long-term support for basic research and education. Providing requisite support for this process is a matter of strategic national importance."

In another discussion on NSF mission, Rep. Ann Eshoo (D-CA) raised the issue of the disproportionate ratio of males to females on the NSB. "Why is there only one woman on the National Science Board?" she bluntly asked Duderstadt.

Eshoo said she planned to send President Clinton a letter on the underrepresentation of women on the board. Later this year, Clinton is expected to appoint nine new members to the 22-member board.

"We are acutely sensitive of the underrepresentation of women and minorities," Duderstadt remarked.

On a more general level, NSF submitted draft legislation to the subcommittee that would authorize the agency to promote women and other underrepresented groups in the sciences.

Clinton, Congress offering more electronic information

BY Juan Antonio Osuna
CRA Staff

President Clinton and Congress are taking steps to make more federal information available to the public electronically. On June 8, the president approved and signed into law the Government Printing Office Electronic Information Access Enhancement Act of 1993.

The new law (L103-40) ensures the public electronic access to:

- the *Federal Register*,
- the *Congressional Record*,
- other publications distributed by the superintendent of documents,
- a directory of government electronic information and
- information that other federal agencies specifically request to be made electronically available.

Although GPO would grant federal depository libraries free access to these resources, it would charge the public enough to recover costs. The bill mandates that an on-line system be operational within a year of the law's enactment.

The new law is based on two identical bills introduced by Rep. Charlie Rose (D-NC) and Sen. Wendell Ford (D-KY) on March 11.

In addition to the GPO law, the Office of Management and Budget issued a revised Circular A-130 on July 2, directing agencies to make more information available through electronic networks, including Internet.

"The development of public electronic networks, such as the Internet, provides an additional way for agencies to increase diversity of information sources available to the public," the 18-page circular said.

The government's new effort to offer electronic access has already materialized in at least one agency—the Library of Congress.

The Library of Congress has made more than 28 million records in over 30 files available through the Internet for free. These files include all machine-readable cataloging files; copyright files, 1978 to the present; public policy citations, 1976 to the present; and federal bill status files. Both the technical processing/cataloging system (MUMS) and the reference/retrieval system (SCORPIO) will be searchable.

To ensure that service to Congress and to on-site users is not degraded, the system will be limited to 60 users at a time. However, the library may later increase this limit.

To connect to the Library of Congress, telnet to locis.loc.gov

The Library of Congress also started a gopher server called LC MARVEL, offering menu-based access to the cataloging files and federal databases at other agencies. A MARVEL gopher client can be reached by telneting to marvel.loc.gov. However, the library recommends that users provide their own clients, so as not to overload the system.

GAO: NCIC easily abused

BY Juan Antonio Osuna
CRA Staff

The General Accounting Office made a statement before a House subcommittee in late July about the abuse of National Crime Information Center (NCIC) databases.

NCIC is the nation's largest computerized criminal justice information system, consisting of 24 million records accessible by 500,000 people. It is accessed daily by police at federal, state and local levels.

On a request from Rep. Gary Condit (D-CA), GAO testified on NCIC abuse before a joint meeting of the House Judiciary Subcommittee on Civil and Constitutional Rights and the House Government Operations Subcommittee on Information, Justice, Transportation and Agriculture.

NCIC is not easily penetrated from the outside. However, because there is no password authentication, NCIC is easily abused by insiders, GAO said. Most users of the system simply identify themselves and their agencies using codes that are not kept secret.

The testimony documented one incident where a woman repeatedly queried databases on behalf of her boyfriend, a drug dealer seeking thorough background checks on his potential clients.

Another typical scenario involved a corporation paying a private investigator to illicitly obtain NCIC records on job applicants.

In many cases, GAO said, law enforcement personnel misunderstood agency policy. Dozens of cases have been reported in which background checks are done on security guards and people seeking firearm, liquor or taxi permits. NCIC is supposed to be used only for checking backgrounds on criminal justice applicants.

"Penalties for such misuse have been limited to administrative sanctions, such as written or oral reprimands, suspensions or termination of employment," GAO officials testified.

Witnesses at the hearing suggested that Congress should pass a law that targets NCIC abuse and provides stiff penalties. Beyond that, GAO said, law enforcement agencies may need to be forced into adopting higher security mechanisms.

NCIC 2000, a proposed major upgrade, would provide security features such as encryption, access control and a knowledge-based intrusion detection system. However, GAO warned that NCIC 2000 would still incorporate more primitive systems maintained at the state level, which would preserve old vulnerabilities.

To protect the information, state and federal agencies would have to make a coordinated effort to change their systems and policy, GAO said.

Washington Update

Bill Roundup

Telecommunications and Information Infrastructure and Public Broadcasting Facilities Assistance Act of 1993 (HR 2639):

Rep. Edward Markey (D-MA), chair of the Energy and Commerce Subcommittee on Telecommunications and Finance, introduced a bill July 14 to promote the development of the national telecommunications and information infrastructure and the construction and planning of public broadcasting facilities.

The bill specifically offers matching grants to health care providers, educational institutions, research facilities, libraries, museums, state and local governments, and other social service providers for expanding network and information infrastructure.

Under the Telecommunications and Information Infrastructure program, the Commerce Department would issue $51 million in grants for fiscal 1994 and such sums as may be necessary for the next three years.

Telecommunications Drug Enforcement Act of 1993 (HR 1615):

Rep. Cardis Collins (D-IL), chair of the House Energy and Commerce Subcommittee on Commerce, Consumer Protection and Competitiveness, introduced a bill April 1 allowing the government to bar a suspected drug dealer from using mobile radio services.

Electromagnetic Labeling Act of 1993 (HR 1982):

Rep. Leslie Byrne (D-VA) introduced a bill May 5 to establish labeling requirements for products that create low-frequency electromagnetic fields.

Emerging Telecommunications Technologies Act of 1993 (S 335, HR 707):

The House passed a bill March 2 to make at least 200 megahertz of the frequency spectrum available for commercial use in order to foster the development of new communications technologies. On the Senate side, a similar bill was approved by the Energy and Commerce Committee on May 25.

Rep. John Dingell (D-MI) and Rep. Edward Markey (D-MA) introduced the House bill on Feb. 2; Sen. Daniel Inouye (D-HI) and Sen. Ted Stevens (R-AK) introduced the Senate bill on Feb. 4.

Both bills direct the Commerce Department to identify underused frequencies allocated for federal use, then turn the frequencies over to the Federal Communications Commission so that they can be assigned for commercial use.

The key difference between the two versions is that the Senate bill directs the FCC to assign frequencies to companies using competitive bidding. The House bill does not alter the current assignment process, which uses a lottery system.

Telecommunications Policy Coordination Act of 1993 (HR 1613):

Rep. Cardis Collins (D-IL) introduced a bill April 1 to establish an Office of Telecommunications Policy within the Executive Office. The director of this office would establish an advisory committee.

Department of Science, Space, Energy and Technology Organization Act of 1993 (HR 1300):

Rep. Robert Walker (R-PA), ranking minority member of the Science, Space and Technology Committee, introduced a bill March 10 to establish a cabinet-level Department of Science, Space, Energy and Technology.

In order to streamline government and reduce duplication of research, Walker proposed consolidating many agencies into a single department that would include the National Aeronautics and Space Administration, the Environmental Protection Agency, the Energy Department, the National Institute of Standards and Technology, the National Oceanic and Atmospheric Administration and the National Science Foundation.

Commission on the Advancement of Women in the Science and Engineering Work Forces Act (HR 467):

Rep. Constance Morella (R-MD) introduced a bill Jan. 6 to establish a commission to help overcome low representation of women in the sciences.

The 17-member commission would track representation of women in the science work forces, study policies and practices of government and industry and recommend changes.

Privacy for Consumers and Workers Act (HR 1900):

Rep. Pat Williams (D-MT) introduced a bill April 28 to prevent abuses of electronic monitoring in the workplace.

The legislation requires employers to notify employees and new hirees when and where electronic monitoring will occur, as well as what kind of information will be collected and how it will be used.

Under the legislation, employees have the right to review data collected on them after the employer completes the investigation. The bill prohibits monitoring in bathrooms, locker rooms and dressing rooms.

Individual Privacy Protection Act of 1993 (HR 135):

Rep. Cardis Collins (D-IL), chair of the House Energy and Commerce Subcommittee on Commerce, Consumer Protection and Competitiveness, introduced a bill Jan. 5 to establish an Individual Privacy Protection Board.

Copyright Reform Act of 1993 (HR 897):

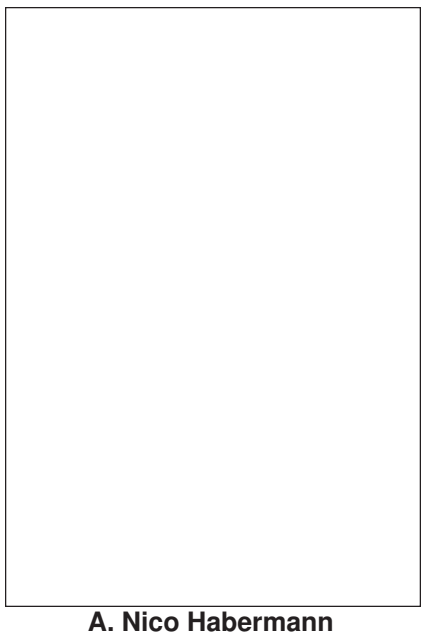
Rep. William Hughes (D-NJ), chair of the House Judiciary Subcommittee on Intellectual Property and Judicial Administration, introduced a bill Feb. 16 to overhaul copyright law.

Current law requires plaintiffs to have registered works with the US Copyright Office before they can sue for statutory damages and attorneys' fees. The bill seeks to repeal this law so owners who have failed to register works can still sue for damages.

Technology Transfer Improvements Act of 1993 (HR 523):

Rep. Constance Morella (R-MD) introduced a bill Jan. 21 that would allow the federal

Continued on Page 12



A. Nico Habermann

Nico from Page 1

Communications Research and Infrastructure; and Cross-Disciplinary Activities.

Habermann also founded the Software Engineering Institute.

A native of Amsterdam, Habermann received his doctorate in applied mathematics from the Technological University at Eindhoven, Netherlands. He earned his master's and bachelor's degrees in mathematics from the University in Amsterdam.

Habermann was a member of the Computer Science and Telecommunications Board of the National Academy of Sciences, adviser to the Max Planck Institute in Germany and a member of the New York Academy of Sciences. He also was editor of the Institute of Electrical and Electronics Engineers *Transactions on Software Engineering*.

Below, several of Habermann's colleagues pay tribute to him.

David Notkin and Larry Snyder

Department of Computer Science and Engineering, University of Washington

Nico came to CMU in 1968 after completing his dissertation under the direction of Edsgar Dijkstra on the "THE Operating System." His research interests continued to include operating systems issues, especially concurrency control mechanisms such as P&V, but soon expanded to include efforts in both programming languages and software engineering.

In his approach to programming languages, Nico was concerned with technical, as well as aesthetic, aspects of languages and compilers. This led to his work as an assistant professor in co-inventing the systems implementation language BLISS and in directing the implementation of the Algol-60 compiler for the PDP-10. Nico was capable of intensive and sustained periods of concentration. His solutions to complex compiler problems were clean, simple and elegant. His taste and judgment in language design were evident in his critique of Ada.

His work in the mid- to late 1970s on the TAMOS (Family of Operating Systems) and on the IPS operating system projects led to his interest in software engineering. He realized that many of the problems faced in constructing large systems arose from the difficulties of getting multiple people to effectively coordinate their activities over time. This led to Nico's creation of the Gandalf project, which focused on the generation of interactive, task-oriented software development environments. The project, which spanned well over a decade, included results in areas as diverse as software configuration management, syntax-directed editing, management of multiple views at the programming language level and heuristic user interfaces.

In 1989 his 20 doctoral students honored Nico as part of the CMU Computer Science Department's 25th anniversary. Collectively, we recalled an adviser who took great interest in our ideas, who spent the time necessary to guide us in our explorations and who had the highest expectations for our intellectual goals and writing. There was wide consensus that we sought to emulate his advisory style with our own students. At the time we had directly or indirectly graduated more than 50 Ph.D.s. This list will, of course, continue to grow over the years, representing just one part of Nico's legacy.

Continued on Page 13

Recently released reports

Promoting High-Performance Computing and Communications: A Congressional Budget Office report that examines the federal government's role in spurring commercial development of HPCC technologies. Copies may be requested at tel. 202-226-2809.

Advanced Network Technology: a background paper (OTA-BP-TCT-101), released by the congressional Office of Technology Assessment, that provides an overview of network technology trends and federal programs that support research in high-speed networks. Copies may be requested at tel. 202-783-3238.

Science, Technology and the Federal Government: This National Academy of Sciences report gives a broad overview of the federal government's role in science. Copies may be requested at tel. 202-334-2424.

High-Performance Computing: Advanced Research Projects Agency Should Do More to Foster Program Goals: A General Accounting Office report (GAO/IMTEC-93-24) criticizing ARPA for its procurement practices, its narrow focus on hardware and other problems. Copies may be requested at tel. 202-512-6000.

Technology Policy Initiatives in the Clinton–Gore Administration: A Congressional Research Service report on the administration's technology policies. Requests for copies should be directed to a local representative or senator.

Washington Update

HPCC budget details released

The Clinton administration released in June the budget details for the federal High Performance Computing and Communications (HPCC) program.

The proposed fiscal 1994 budget of $1.1 billion for HPCC would make it the most significant federal program for computer science and computer engineering researchers. Among the 10 federal agencies that participate in HPCC, the National Science Foundation and the Advanced Research Projects Agency are the major players.

Table 1 shows 1994 funding levels for agencies participating in the program. Tables 2 through 5 show agency funding levels for each of the five HPCC components. A new proposed component of HPCC is Information Infrastructure and Technology and Applications. In 1994, $36 million has been requested for, $12 million for NASA, $24 million for the National Institutes of Health and $24 million for the National Institute of Standards and Technology, for a total of $96 million.

Table 1. HPCC Budgets by Agency (in millions of dollars)

Agency	Fiscal 92 Actual	Fiscal 93 Estimated	Fiscal 94 Requested
ARPA	232.2	275.0	343.0
NSF	200.2	225.2	341.0
DOE	93.0	101.0	123.8
NASA	70.3	82.1	123.0
NSA	47.7	43.6	41.7
NIH	41.3	46.5	71.1
NOAA	9.8	9.8	12.4
EPA	5.0	7.9	11.9
Education	1.0	2.0	2.0
NIST	2.1	2.1	26.1
Total	**702.6**	**795.2**	**1,096.0**

Table 2. HPCS Budget (in millions of dollars)

Agency	Fiscal 92 Actual	Fiscal 93 Estimated	Fiscal 94 Requested
ARPA	103.3	119.5	151.8
NSF	23.7	25.9	34.2
DOE	15.0	10.9	10.9
NASA	14.1	11.1	20.1
NSA	34.8	34.8	22.7
NIH	3.0	3.0	6.5
NOAA	–	–	–
EPA	–	–	–
Education	–	–	–
NIST	0.3	0.3	0.3
Total	**194.2**	**205.5**	**246.5**

Table 3. ASTA Budget (in millions of dollars)

Agency	Fiscal 92 Actual	Fiscal 93 Estimated	Fiscal 94 Requested
ARPA	38.5	49.7	58.7
NSF	98.2	108.0	140.0
DOE	58.0	65.3	75.1
NASA	48.1	59.1	74.2
NSA	9.0	5.4	7.6
NIH	28.0	31.4	26.2
NOAA	9.4	9.4	10.5
EPA	4.3	6.0	9.6
Education	–	–	–
NIST	0.6	0.6	0.6
Total	**294.1**	**334.9**	**402.5**

Table 4. NREN Budget (in millions of dollars)

Agency	Fiscal 92 Actual	Fiscal 93 Estimated	Fiscal 94 Requested
ARPA	32.9	43.6	60.8
NSF	32.0	40.5	57.6
DOE	12.0	10.0	16.8
NASA	7.2	9.0	13.2
NSA	3.8	3.2	11.2
NIH	3.5	4.1	6.1
NOAA	0.4	0.4	1.6
EPA	0.0	0.4	0.7
Education	1.0	2.0	2.0
NIST	1.2	1.2	1.2
Total	**94.0**	**114.4**	**171.2**

Table 5. BRHR Budget (in millions of dollars)

Agency	Fiscal 92 Actual	Fiscal 93 Estimated	Fiscal 94 Requested
ARPA	57.5	62.2	71.7
NSF	46.3	50.8	73.2
DOE	8.0	14.8	21.0
NASA	0.9	2.9	3.5
NSA	0.1	0.2	0.2
NIH	6.8	8.0	8.3
NOAA	0.0	0.0	0.3
EPA	0.7	1.5	1.6
Education	–	–	–
NIST	–	–	–
Total	**120.3**	**140.4**	**179.8**

Bill roundup from Page 11

government to copyright software in certain cases where it developed software, at least in part, under a cooperative R&D agreement specified by the Stevenson-Wydler Technology Innovation Act of 1980.

The bill also allows the government to grant copyrights to private businesses that "publicly perform or display computer software throughout the world by or on behalf of the government."

Technology Education Assistance Act of 1993 (HR 2728):

Rep. Thomas C. Sawyer (D-OH) introduced a bill July 23, authorizing a grant program to improve the use of technology in schools at all levels. The bill provides grants for state and local educational agencies, establishes an Education Technology Council within the Education Department and supports regional R&D

Buddy System Computer Education Act (HR 1902):

Rep. Jill Long (D-IN) introduced a bill April 28 to award grants for computer-based education projects. The Education Department would select three states and award grants on a competitive basis for children in grades six through eight. The money would be used to provide hardware, software and training for teachers.

Technology Education Assistance Act of 1993 (HR 89):

Rep. Dale E. Kildee (D-MI), chair of the House Education and Labor Subcommittee on Elementary, Secondary and Vocational Education, introduced a bill Jan. 5 to improve the use of technology in schools.

The bill authorizes $500 million in fiscal 1993 for elementary and secondary schools to improve the use of computer, video and telecommunications technologies.

Elementary and Secondary School Library Media Act (HR 1151, S 266):

Sen. Paul Simon (D-IL) and Rep. Jack Reed (D-RI) introduced identical bills on Jan. 28 and Feb. 25 respectively to establish a Division of Library Media Services within the Education Department, and establish three programs for infusing school libraries with better technology

Telecommunications Infrastructure Act of 1993 (S 1086):

Sen. John Danforth (R-MO) introduced a bill June 9 to enhance the development of the national telecommunications infrastructure by fostering competition.

The bill preempts any state or local laws governing the telecommunications industry; forces telecommunications providers to sell services on a nondiscriminatory basis without any restrictions on the customer reselling those services; allows the FCC to set telecommunications standards; allows cable companies to offer telecommunications services only if provided through a subsidiary; and allows telephone companies to offer video or other information services only if provided through a subsidiary

National Network Security Board Act of 1993 (S 237):

Sen. Larry Pressler (R-SD) introduced a bill Jan. 27 to create a National Network Security Board within the Federal Communications Commission, for monitoring and investigating disruptions in long-distance and local telephone systems.

Telecommunications Network Security and Reliability Reporting Act of 1993 (S 238):

Sen. Larry Pressler (R-SD) introduced another bill Jan. 27 that would require the Federal Communications Commission to report annually on the security of the nation's telecommunications networks.

DOE National Competitiveness Technology Partnership Act of 1993 (S 473):

The Senate Committee on Energy and Natural Resources approved a bill May 26 to link Energy Department laboratories with private sector laboratories.

Introduced by committee chair Sen. Bennett Johnston (D-LA) on March 2, the bill implements a National Information Infrastructure program by amending the High-Performance Computing Act of 1991. It creates a coordinated interagency program that would develop partnerships, deploy information technologies and educate people on how to use them.

Electronic Library Act of 1993 (S 626):

Sen. Bob Kerrey (D-NE) introduced a bill March 22 to establish state-based electronic libraries. The National Science Foundation, in consultation with the Education Department, the Commerce Department, the Advanced Research Projects Agency and the Library of Congress would issue grants to states for developing electronic libraries.

The bill authorizes $10 million for fiscal 1994, $25 million for 1995 and such sums as may be necessary for 1996 and each fiscal year thereafter

Library of Congress Fund Act of 1993 (S 345):

The Senate Committee on Rules approved a bill May 26 to allow the Library of Congress to sell information products and services.

Introduced by Sen. Claiborne Pell (D-RI) on Feb. 4, the bill authorizes the Library of Congress to charge users for the "search of databases" and "electronic access to the contents of the collections," among other products and services.

Technology for Education Act of 1993 (S 1040):

Sen. Jeff Bingaman (D-NM) introduced a bill May 27 to enhance the use of new technologies in education and to sustain a technologically literate work force.

The bill creates an Office of Educational Technology within the Education Department that would offer grants and loans to state, local and private organizations for advancing

Continued on Page 16

Washington Update

Nico from Page 11

William A. Wulf

Chair of the Computer Science and Telecommunications Board

Nico Habermann was, quite simply, one of the finest human beings that I have ever known. Others will remember Nico for his scientific achievements. But he and I arrived at CMU within a few months of each other and worked together for 25 years. My strongest memories are of his integrity, loyalty and his deep sense of service.

Whether the issue was treatment of an individual student at CMU or national science policy at NSF, one of Nico's first concerns was doing things morally and ethically. His loyalty to his many students, as well as his family and friends, was legend; he always had the time, the energy and the wisdom to do what was needed. His service at NSF was just the latest of the personal sacrifices he made on behalf of the computing community.

All of us whose lives were touched by him are richer for it, and we will miss him deeply.

Fred W. Weingarten

Executive Director of the Computing Research Association

Nico Habermann came to NSF in 1991. It must have been a difficult choice. Asking a highly respected researcher and educator to leave the satisfactions of campus life to spend a few years working in the labyrinth of Washington science policy may seem like asking a fish to volunteer a few years in the desert. But Nico was strongly committed to advancing the computing research field.

The years he has spent here were fruitful and challenging ones. Computing research has been receiving greater political attention and support, and CISE programs prospered comparatively well under his guidance. But political attention is demanding. As the NSF assistant director for CISE, Nico found himself playing an important leadership role in making and justifying computing research programs. In networking, he had to manage the extraordinary growth of the NSFnet and the transition of the program to one with much broader public concern over the national information infrastructure. He had to ensure that broad support of basic computing research was maintained in the face of political demands for short-term economic impacts.

Nancy Leveson, chair of CRA's Committee on the Status of Women, said, "Nico was a great friend of women in computing research. At NSF, he strongly supported programs to identify and break down barriers and to encourage greater participation by women in the field. In his keynote address at a recent NSF-funded symposium for female students in computing, he reiterated his commitment to a goal of 45% female enrollment in graduate computing programs within ten years.

On all of these topics and more, Nico became an increasingly persuasive and articulate spokesperson for the field. He never stopped nudging us as a community to do more, to show more interest in policy and to speak more effectively. The Washington science policy community and the entire computing research community have lost an important leader and good friend.

Board meeting from Page 6

president's science advisor, the NSF director, the head of ARPA and the Defense Department's Defense Research and Engineering director.

• CRA sent a letter to the National Science Board saying that the time is ripe for someone to show leadership in setting the new science policy and that NSB members, as presidential appointees, are in an ideal position to do this. We said CRA would be happy to help NSB with this important task.

The second day started with a few mundane items such as approving the minutes and the budget. Following are highlights of the rest of the meeting:

• SIAM was added as an affiliated professional society of CRA, joining ACM and AAAI. If the IEEE Computer Society decides to join, as we fervently hope, then CRA will have official relationships with all the major S&E associations involved in S&E research.

• Changes to CRA bylaws were adopted to clean up some existing language and to codify changes made to the election procedures.

• The start-up plan for *Computing Research News* was to distribute it to members of all S&E departments, with the assumption that once CRA was established, *CRN* would only be distributed to faculty in dues-paying departments. The board feels that CRA has become established with Ph.D granting S&E departments, but we are still in a start-up mode with industrial laboratories and non-Ph.D departments. Hence, if you are at a Ph.D.-granting institution, you will only receive *CRN* in 1994 if your department is a 1993-94 dues-paying member of CRA. If you suspect your department is not a dues-paying member, you might contact your chair to see why. A paid subscription to *CRN* is available to people in departments that are not dues-paying members.

• An ad hoc committee was created to come up with recommendations concerning the supply and demand of S&E Ph.D. recipients. We hope to have an initial report at the next board meeting in December.

• The board unanimously passed a motion commending Ed (Rick) Weingarten for doing an outstanding job as executive director of CRA. Not only do board members who are also members of other societies say we are lucky to have Rick, but members of Congress are telling us as well.

The meeting closed by setting dates for the next two board meetings: December 9–10 in San Francisco and July 9–10 at Snowbird, UT. (The CRA Conference at Snowbird is July 10–12.)

Systers from Page 5

sexism in our society, our field and our consciousness that limits us all. If men work together with women in an open forum and are seriously interested in hearing what women have to say rather than in telling us what we need, then such a forum could be a fruitful and productive sibling for systers.

Anita Borg is a consultant engineer at Digital Equipment Corp.'s Network Systems Laboratory in Palo Alto, CA.

Morgan Kaufmann ad

Professional Opportunities

CRN Advertising Policy

Send copy and payment for Professional Opportunities advertisements to Advertising Coordinator, *Computing Research News*, 1875 Connecticut Ave. NW, Suite 718, Washington, DC 20009. Tel. 202-234-2111; fax: 202-667-1066; E-mail: jbass@cs.umd.edu. E-mail submissions are preferred.

The format of an ad must conform to the following: 1) the first line must contain the name of the university or organization and will be printed in bold, 2) the second line must contain the name of the department or unit and will be printed in italics and 3) the body of the ad should be in paragraph form. The words in the first two lines are included in the total word count for the ad. Headings or text requested in all uppercase or bold will be set in bold and will count as two words.

The rate is $2 per word (US currency). A check or money order (*please do not send cash*) must accompany the ad copy. Purchase orders are acceptable. All CRA members receive at least 200 free words per dues year

Professional Opportunity display ads cost $30 per column inch. The ad must be submitted in camera ready, offset (positives or negatives) or mechanical form. Please call for information on placing display ads for products or services.

Computing Research News is published five times per year: in January, March, May, September and November. Professional Opportunities ads with application deadlines falling within the month of publication will not be accepted. (An ad published in the November issue must show an application deadline of Dec. 1 or later.) Advertising copy must be received at least one month before publication. (The deadline for the November issue is Oct. 1.)

Oregon State University

Department of Computer Science

The Department of Computer Science, Oregon State University, anticipates one or more openings for tenure-track assistant, associate or full professors, to start in September 1993 or thereafter. Specialization in software engineering or computer graphics is desirable, but all qualified applicants will be considered.

Applicants should have completed or expect to complete all requirements for a doctorate in computer science or a closely related field and should have demonstrated research and teaching potential. Candidates for senior positions should have established research reputations.

To apply for these positions, send a complete resume, statement of research interests and at least three sealed letters of reference to Faculty Search Committee, Department of Computer Science, Oregon State University, Corvallis, OR 97331-3202. Application by electronic mail is acceptable and may be sent to rudd@cs.orst.edu.

Review of applications began July 1, but positions will remain open until selections have been made. Women and minorities are particularly encouraged to apply

Oregon State University is an equal opportunity, affirmative action employer and complies with Section 504 of the Rehabilitation Act of 1973. OSU has a policy of being responsive to the needs of dual-career couples.

University of North Florida

Department of Computer and Information Sciences

The University of North Florida (UNF) invites applications and nominations for chair of the Department of Computer and Information Sciences. The chair is responsible for providing leadership, direction and articulation, where appropriate, in the development of academic programs and priorities; assignment of teaching and academic counseling responsibilities; application of grievance processes; development and management of budgets; allocation of departmental resources; and recruitment and recommendation of faculty salaries. The chair is expected to participate in instructional responsibilities. The chair serves as the official representative of the department to internal and external entities.

Minimum qualifications for this 12-month position include an earned doctorate in computer science, information systems or a closely related field; credentials commensurate with a tenured faculty appointment at the full professor level; outstanding interpersonal skills; demonstrated teaching excellence; and a strong commitment to equal opportunity and diversity. Successful administrative, grantsmanship and industrial experiences and a history of involvement in both computer science and information systems are desirable. The successful candidate should have a history of promotion and tenure based on evaluation of performance as a regular teaching faculty member

The department is located in the College of Computing Sciences and Engineering and offers degree programs through the master's level. The undergraduate computer science program is CSAB accredited. There are about 500 CIS majors.

UNF is nationally known for excellent undergraduate and graduate programs. The undergraduate and graduate student body of UNF numbers just under 10,000. An urban university, UNF is among the most selective public universities in the nation. UNF is a member of the State University System of Florida and is located on a 1,000-acre campus in Jacksonville, a metropolitan area with a population of almost 1 million.

Send nominations and applications, including a resume and references, to Dr Layne Wallace, Committee Chair, Chair's Search Committee, Department of CIS, University of North Florida, 4567 St. Johns Bluff Road S, Jacksonville, FL 32224. Tel. 904-646-2985; fax: 904-646-2988; Bitnet: lwallace@unf1vm.bitnet or; Internet: lwallace@sinkhole.cis.unf.edu. The application deadline is Oct. 15.

Provisions of Florida's Government in the Sunshine and Public Records Law are applicable. UNF is an affirmative action, equal access, equal opportunity employer

University of Cincinnati

Department of Electrical and Computer Engineering

Applications are solicited for tenure-track positions at all ranks in the Electrical and Computer Engineering Department starting in September 1994. The following areas are of special interest: 1) computer system design; parallel and distributed computing; operating systems; databases; architecture; computation theory; VLSI systems design, test and verification; and VLSI/CAD tool development; 2) intelligent systems and informatics, including computer vision, artificial neural network-based systems, manufacturing and discrete-event systems; automatic factory control; and intelligent control systems.

The department offers MS and Ph.D programs in electrical engineering, computer engineering and computing sciences and an ABET-accredited undergraduate program in electrical and computer engineering. The department has 30 full-time faculty, 1,200 graduate students and 400 undergraduates; it graduates 35 master's and 15 Ph.D recipients per year

Candidates should have an earned doctorate in electrical engineering, computer engineering or computer science. Send curriculum vitae and the names of five references to Professor V.J. Kapoor, Department Head, Electrical and Computer Engineering Department, University of Cincinnati, Cincinnati, OH 45221-0030. E-mail: vkapoor@ucengr.uc.edu.

The university is an affirmative action, equal opportunity employer and encourages applications from women and minorities.

Purdue University

Department of Computer Sciences

We have more than 38 faculty members in operating systems, networks, programming languages, database systems, robotics, software engineering, solid modeling, supercomputing, theory and numerical analysis. We invite applications at all professorial levels in any area of computer science, with some preference for people in systems and software.

The department affords great opportunities for people who want to get involved in exciting research. Each faculty member has access to the departmental computing facilities (many Sun file and compute servers, a 64-processor Ncube 2 and many workstations), to the computing center's Cyber 205, ETA-10 and Intel iPSC/860 supercomputers, and to national computer networks.

You must have, or be about to receive, a doctorate (or equivalent experience) in computer science or a related discipline. Salary is competitive and depends on background and experience. Submit resume and names of references by March 1 to Chair, Personnel Committee, Department of Computer Sciences, Purdue University, West Lafayette, IN 47907.

Purdue University is an equal opportunity, affirmative action employer

University of Southern California

Electrical Engineering-Systems Department

The Electrical Engineering-Systems Department invites applications for several tenure-track positions. Preference will be given to senior-level applicants who have demonstrated leadership ability in building a strong research program and who also have a distinguished teaching and research record. Areas of interest include communication networks for multimedia applications with an emphasis on the lower layers of the OSI network model (physical, link protocol and routing/signaling aspects); statistical communication and/or signal processing algorithms and their VLSI implementation; and computer-aided design for digital systems.

We also invite applications for tenure-track assistant professors in the area of intelligent control with emphasis on intelligent vehicles and highways.

Applications must include a comprehensive resume, a list of three to five professional references and a letter of interest clearly indicating the position designated above for which you are applying. Please send material to Chair, EE-Systems Search Committee, EE-Systems Department, USC, Los Angeles, CA 90089-2560.

USC is an affirmative action, equal opportunity employer and encourages and welcomes applications from women and minorities.

University of Massachusetts, Amherst

Department of Computer Science

The Department of Computer Science invites applications for tenure-track faculty positions at the assistant and associate levels and research-track faculty and postdoctoral positions at all levels and in all areas of computer science. Applicants should have a doctorate in computer science or related area and should show evidence of exceptional research promise. Senior level candidates should have a record of distinguished research. Salary is commensurate with education and experience.

Our department has grown substantially over the past five years and currently has 32 tenure-track faculty, eight research faculty, about 10 postdoctoral research scientists and 180 graduate students. Continued growth is expected over the next five years. We have ongoing research projects in robotics, vision, natural language processing, machine learning, connectionism, expert systems, distributed problem solving, human–computer interfaces, distributed processing, database systems, information retrieval, operating systems, object-oriented systems, software engineering, real-time systems, real-time software development and analysis, programming languages, computer networks, theory of computation, parallel computation, computer architecture and medical informatics (with the University of Massachusetts Medical School).

The department recently established a national center (CRICYS) for research on real-time, intelligent complex computing systems that includes a major project (Project Pilgrim) with Digital Equipment Corp. on distributed, heterogeneous networks; an NSF/CII award in the area of computer vision, distributed artificial intelligence and real-time systems; a four-year state/industry/university center working on intelligent information retrieval and an ARPA/NSF/industry-sponsored activity in autonomous real-time systems in flexible manufacturing.

To support our research, we have an extensive research computer facility including more than 200 Sun, AXStation, DECStation and TI Explorer workstations, numerous servers; two Sequent Balance multiprocessors; a Kendall Square Research KSR 1-64 parallel processor; a 4,096-node Connection Machine; a variety of graphics devices; both Salisbury and Utah/MIT robotic hands; several Denning mobile robots; and a real-time testbed.

Send a letter with your curriculum vitae to Chair of Faculty Recruiting, Department of Computer Science, University of Massachusetts, Lederle Graduate Research Center, Amherst, MA 01003. Please specify whether you are applying for a tenure-track or non-tenure-track (research or postdoctoral) position. Review of vitae begins Oct. 1, 1994, and continues until available positions are filled. Positions available subject to funding

The university is an affirmative action, equal opportunity employer

Lehigh University

Department of Electrical Engineering and Computer Science

The Department of Electrical Engineering and Computer Science at Lehigh University seeks applicants in networking and software systems for a tenure-track computer science faculty position. Candidates must have a doctorate in computer science or electrical engineering with appropriate networking background. We require a strong commitment to teaching and evidence of innova-

Professional Opportunities

tive research through journal publications. Preference will be given to junior faculty but we would consider senior faculty with an impressive record of publication and funding in the fields of interest.

The department has an expanding Computer Science Division with excellent facilities. It offers B.A., B.S., M.S. and Ph.D degrees in computer science. Lehigh University has a 127-year history of excellence in engineering and technology indicated by high national rankings. The university is located on an attractive 1,600-acre mountainside campus in Bethlehem, PA, close to the Pocono Mountains and within easy reach of Philadelphia and New York City

Candidates should send a curriculum vitae and at least three references to Dr Alastair McAulay Chair and Chandler Weaver Professor, Faculty Search Committee, Department of Electrical Engineering and Computer Science, Lehigh University, 19 Memorial Drive W, Bethlehem, PA 18015. Send E-mail to eecs@eecs.lehigh.edu for further information about the department.

Lehigh University is an affirmative action, equal opportunity employer. Women and minorities are encouraged to apply

Northeastern University

Department of Electrical and Computer Engineering

The Department of Electrical and Computer Engineering at Northeastern University in Boston seeks tenure-track faculty in computer engineering with specializations in software engineering, computer architecture, parallel computing and VLSI systems design.

The ECE department currently has 45 full-time faculty, two nationally and internationally recognized research centers and a large and expanding graduate program. Expansive opportunities for research exist due to one of the highest concentrations of high technology in the nation.

A doctorate in electrical engineering, computer engineering, computer science or related field is required. Previous academic or industrial experience is preferred. Salary and rank are commensurate with experience.

Send resumes to John G. Proakis, Chair, Electrical and Computer Engineering, 309 Dana Research Building, Northeastern University, 360 Huntington Ave., Boston, MA 02115.

Polytechnic University

Department of Computer Science

Applications are invited for three positions in computer science: associate coordinator at the Farmingdale campus, a senior faculty member and an industry assistant professor.

The coordinator will be expected to guide and develop the academic, research and administrative activities in computer science at Polytechnic's suburban Farmingdale campus on Long Island, NY The coordinator will be a member of the faculty with opportunity for teaching as well as research. Leadership and interpersonal skills are essential for this position.

The senior faculty member will be expected to help develop, in concert with current faculty, an active and strong group in one of the following areas: compilers, computer architecture, databases, operating systems, parallel and distributed systems, programming languages or software engineering. Candidates must have a strong research record including significant publications and the demonstrated ability to secure external funds through grants or contracts.

The industry assistant professor will be expected to teach both undergraduate and graduate classes in such areas as computer architecture, operating systems and programming. The candidate should have an outstanding teaching record.

Applicants for all positions must have a Ph.D degree.

The Department of Computer Science, which offers B.S., M.S. and Ph.D degrees, is located in the School of Electrical Engineering and Computer Science. The department currently has 15 tenure-track faculty members. Its undergraduate program is accredited by CAB, and in 1992 it awarded 95 MS degrees and nine Ph.D degrees. Areas of active research include computational biology; computational geometry; image analysis and understanding; large distributed databases; network management; parallel, distributed and randomized algorithms; parallel and distributed systems and architecture; pattern recognition; and software reliability and testing

The department's active research program is supported in part by faculty grants from NSF and other agencies, industry, and the Center for Applied Large Scale Computing, which participates in the Consortium for International Earth Sciences Information Network. The department recently moved into a new university building in Brooklyn that is part of the 16-acre MetroTech development of buildings for academic, research and commercial activities. As a result of the university's favorable location, faculty and students enjoy close interaction with major companies in the financial, telecommunications and computer industries.

Polytechnic University (formerly known as Brooklyn Poly) is a private technological urban university established in 1854. It is located on three campuses in the New York City metropolitan area. The main campus is in downtown Brooklyn adjacent to Brooklyn Heights, one of New York's desirable residential communities. Two suburban campuses are located in Farmingdale, on Long Island, and in Hawthorne, in Westchester County. The university has an enrollment of about 3,500 students.

Qualified applicants should send their curriculum vitae to Chair of the Search Committee, Professor Richard V Slyke, Department of Computer Science Polytechnic University, Six MetroTech Center, Brooklyn, NY 11201. Tel. 718-260-3186; E-mail: rvslyke@prism.poly.edu. Evaluation of candidates will begin immediately and continue until the search is complete.

Polytechnic is an equal opportunity employer

University of Pennsylvania

Department of Computer and Information Science

The University of Pennsylvania invites outstanding applicants for junior tenure track faculty positions, with senior positions possibly being available as well. Appointments are to start July 1, 1994.

Because the appointment process tends to take a minimum of two to three months, interviews will be conducted in early 1994. Applications must be received on or prior to Jan. 10 in order to be assured full consideration.

Faculty duties include both undergraduate and graduate teaching, as well as research. We are looking to complement existing research strengths in computer graphics and animation, natural language processing, computer vision, robotics, computational biology, programming languages, databases, logic and computation, high-performance computer networks, artificial intelligence, real-time computing and distributed systems.

Applications, including the names of at least three references, should be sent to Chair, Faculty Search Committee, Department of Computer and Information Science, University of Pennsylvania, 200 South 33rd St., Philadelphia, PA 19104-6389.

The University of Pennsylvania is an affirmative action, equal opportunity employer

University of Maryland, Baltimore County

Department of Computer Science

The Department of Computer Science of the University of Maryland, Baltimore County (UMBC) invites applications for several tenure-track openings at the level of assistant professor. We are particularly interested in candidates in architecture, computer networks, software engineering, operating systems, databases, parallel and distributed processing, and scientific computation. Senior applicants with an exceptional record of research and teaching also may be considered.

The department consists of 16 full-time faculty and 24 adjunct faculty. We offer BS., M.S. and Ph.D degrees in computer science and have about 130 graduate and 700 undergraduate students. The department has just moved into a new building and has completely renewed its computational facilities.

The UMBC Campus has 10,000 students and is joined at the graduate level with the University of Maryland at Baltimore (UMAB), located a few miles away in downtown Baltimore. The resulting University of Maryland Baltimore Graduate School has a strong research program with over $100 million per year in external research funding and includes Maryland's medical, law and dental schools. UMBC is located in the Baltimore–Washington corridor, providing easy access to both metropolitan areas and to numerous federal agencies, industrial research centers and consulting firms.

Your application, including a curriculum vitae and three letters of reference, should be sent to Faculty Search, Computer Science, University of Maryland, Baltimore MD 21228-5398. Tel. 410-455-3000; fax: 410-455-3969. Send E-mail to search-info@cs.umbc.edu for additional information and to search@cs.umbc.edu for general inquiries.

UMBC is an affirmative action, equal opportunity employer

Oregon Graduate Institute of Science and Technology

Department of Computer Science and Engineering

The Oregon Graduate Institute of Science and Technology (OGI) seeks a head for its rapidly growing Department of Computer Science and Engineering (CSE). Applications are invited from individuals who have research interests consonant with those of the department, a distinguished record of scholarly productivity, a strongly funded research program and solid evidence of leadership ability

Current department research includes programs in functional programming languages, formal methods for software design and development, high-performance computing, database and operating systems, neural networks and spoken language understanding systems.

OGI is a private, graduate-only institution offering MS and Ph.D degrees. It is located in the greater Portland metropolitan area, about 12 miles west of downtown. The CSE department currently has 17 faculty, 110 matriculated students and sponsored research in excess of $4 million per year

We intend to fill this position by July 1, 1994. To apply, send curriculum vitae with names and addresses of five references to Dr. James J Huntzicker, Provost, Oregon Graduate Institute, P.O. Box 91000, Portland, OR 97291-1000. E-mail: search@cse.ogi.edu.

OGI is an equal opportunity, affirmative action employer. Qualified women, minorities and people with disabilities are encouraged to apply

University of South Carolina

College of Science and Mathematics

The University of South Carolina, Columbia, invites applications and nominations for the position of dean of the College of Science and Mathematics. The dean of the College of Science and Mathematics is responsible for administering the college's budget of about $17.5 million in state funding and $21 million in outside support. **The college** consists of seven departments and several institutes.

Applicants should send a letter of application and a complete resume to Dr Ralph E White, Chair of the Science and Mathematics Dean Search Committee, Department of Chemical Engineering, Swearingen Engineering Center 2C13, University of South Carolina, Columbia, SC 29208. Tel. 803-777-6060; fax: 803-777-8265.

The University of South Carolina is an equal opportunity employer and specifically invites and encourages applications from women and minorities.

People in the News

Traub receives CRA award

The Computing Research Association is pleased to name Joseph F. Traub as the recipient of the 1992 Award for Service to Computing Research. Traub received his award at the Federated Computing Research Conference in May. This award was made in recognition of his dedicated leadership, extensive service to the field, and particularly acknowledged his invaluable contribution as first chair of the Computer Science and Telecommunications Board of the National Research Council. Traub served as the board's chair from 1986 to 1992.

Under Traub's leadership, CSTB established itself as a leading policy voice for the computing research community. The board's studies and reports have covered a range of issues including systems security, information infrastructure, human resources, competitiveness and management of the High-Performance Computing and Communications program. Traub also managed two expansions of the board, which broadened its scope to include computational science and telecommunications, as well as computer science and computer engineering.

The final report prepared under his stewardship, *Computing The Future*, provided an overview of the state of computing research and the key issues facing the field. That report stimulated an important debate in the research community, and it presaged much of the current public discussion of government science and technology policy.

Lane named as NSF director

President Clinton nominated Neal F. Lane on July 13 to head the National Science Foundation. Provost and physics professor from Rice University, Lane is expected to be a defender of basic research.

Playing a key role in the decision to nominate Lane was presidential science adviser John Gibbons, who said the administration avoided industrial candidates, instead opting for someone with basic research experience.

The Senate will hold hearings on Lane's nomination this fall. NSF officials hope he will be confirmed by Oct. 1.

A specialist in theoretical atomic physics, Lane has been involved with both "big" and "small" science; he has worked with teams of students and on the Superconducting Super Collider, a $10 billion project.

Lane serves on the Blue Ribbon Panel on High-Performance Computing, formed by NSF to evaluate technological trends and priorities.

In 1984, Lane led an advisory committee that designed a network of NSF supercomputing centers. He later served on an advisory committee for the congressional Office of Technology Assessment and wrote the report *From Grade School to Grad School*.

He served as provost for Rice University since 1986, after having been the Chancellor of the University of Colorado for two years. In 1979 and 1980, he served as the director of NSF's Physics Division. Prior to that, he taught physics for 20 years.

Lane earned his bachelor's, master's and Ph.D. degrees from the University of Oklahoma.

Directors named to NIST, DR&E

Arati Prabhakar has been confirmed as the director of the National Institute of Standards and Technology. The first woman to hold the post, Prabhakar previously served at the Advanced Research Projects Agency and spent a year at the congressional Office of Technology Assessment under an AAAS Fellowship.

Meanwhile, Anita Jones, chair of the University of Virginia Computer Science Department, has been confirmed as DOD Defense Research and Engineering director. Jones was a founder and vice president of AT&T Laboratories and currently serves on the Defense Science Board.

Call to action from Page 9

ment of Ph.D.s and Faculty in Computer Science and Computer Engineering (formerly known as the CRA Taulbee Survey) is widely read and anticipated by our members.

The third level of priorities is all other CRA activities, including helping new teachers, developing strategies to match the supply and demand of Ph.D.s, and cosponsoring curriculum workshops.

These priorities need people to make them happen, and we are the ones who must do this work. At this critical juncture in our shared future, our field needs enlightened volunteers who will push it into the next century. I look forward to your help and commitment.

Bill roundup from Page 12

educational uses of technology. Additionally, a National Commission on Technology Education would assist in guiding federal policy and setting technical standards.

The legislation specifically mentions granting funds to educational institutions "to acquire connectivity with wide area networks such as the Internet."

Technology for the Classroom Act of 1993 (S 264):

Sen. Jeff Bingaman (D-NM) introduced a bill Jan. 28 that would authorize $90 million for fiscal 1994 for implementing new communications technologies in schools.

Half of the money would provide grants directly to schools of all levels so they could implement technologies such as computers, software, databases, films, transparencies and video, audio and telecommunications equipment. The other half would be funneled through state agencies so they could implement programs.

1993 ITAC winners named

By Douglas Powell

Two pioneers in microelectronics have received the 1993 ITAC/NSERC awards for their original contributions to the field of information technology. Savvas G. Chamberlain, of the Department of Electrical and Computer Engineering at the University of Waterloo, and Adel Sedra, former chair of the Department of Electrical and Computer Engineering and now vice president and provost at the University of Toronto, were each presented with a $50,000 award in Ottawa earlier this year on behalf of the Information Technology Association of Canada (ITAC) and the Natural Sciences and Engineering Research Council (NSERC).

Chamberlain has gained international recognition for his fundamental work on semiconductor devices and large-scale integrated circuits. Educated at London's Northern Polytechnic and at Southampton University where he completed his graduate studies in electronics, the 52-year-old Chamberlain is a pioneer in the development of charge transfer theory applied in charge-coupled devices (CCDs), image sensors, solid-state photodetectors, and MOSFET (self-scanned optical image sensor) devices. He has published more than 100 papers and holds more than 15 patents and patents pending on CCDs, integrated circuits, optical imaging devices and solid-state scanners.

In 1990, Chamberlain was elected Fellow of the Institute of Electrical and Electronics Engineers (IEEE) for his contributions in CCD imagers and MOSFETs. The following year, he was awarded the first Microelectronics Fellowship from NCR Canada Ltd.'s engineering and manufacturing operation in Waterloo in recognition of his outstanding contributions to new silicon technology applied to contact image sensor devices. He is an active participant in two Centers of Excellence: he is a principal investigator in the federal network MicroNet and a researcher at the Information Technology Research Center (ITRC) of Ontario.

"What is extremely beneficial is that this kind of award encourages role models for younger faculty. That cannot be emphasized too much," Chamberlain said. "We need these individuals to generate new technology and to transfer it to industry. In doing so, we are creating valuable opportunities for our economy and training graduate students at the same time."

Chamberlain has developed versatile tools for computer simulations, such as the three-dimensional VAT-MOS and the new-generation CHORD, as well as a new hydrodynamics simulator for submicron semiconductor devices. These have been adopted by researchers at universities and in companies such as IBM Corp., Intel Corp., Northern Telecom Inc. and Westinghouse. The ability to combine a thorough understanding of the physics of semiconductors with an appreciation of the physical properties and parameters required in high-performance devices has enabled Chamberlain to design, fabricate and characterize new types of sensors.

He also has successfully applied his research to commercial ventures. His pioneering work on CCD image sensors formed the basis for the launch of Dalsa Inc., a Waterloo, Ontario-based manufacturer of sensors for applications in photography, astronomy and computer vision. Beginning in 1980 as a two-person consultancy, Dalsa now has more than 60 employees engaged in manufacturing and marketing.

Sedra is a renowned researcher and teacher who has made significant contributions in the field of communications systems. His work on the theory and design of electronic filters has significantly advanced the field of signal processing.

His software package for filter design is used in more than 30 companies and universities. Author of more than 130 papers, his book *Microelectronic Circuits* is the standard teaching text in 150 universities worldwide. Sedra's contributions to engineering education have been recognized by a number of awards, and he was instrumental in the creation and continuing operations of the Information Technology Research Center.

"I'm an electronics circuit designer who has worked on a variety of circuits, both theory and design techniques," Sedra said. "All of them share the attribute that they are used in telecommunications applications. That's my special contribution to information technology."

One of his most notable innovations is his work on electronic filters, an important component in telecommunications and other electronics systems. He began in the early days of passive filters and then moved on to active filters. Later, his research focused on switched-capacitor filters, which are fully integrated networks on one integrated-circuit chip. "These circuits have tremendous advantages in terms of costs, reliability and reduced size," Sedra said. "As the technology changed, my research team moved on to adopt new ones and to introduce circuit innovations. We are currently working in this area on high-speed, high-frequency filter circuits that are self-adjusting without the need for individual tuning in manufacture."

Born 50 years ago in Egypt, Sedra studied at Cairo University, then came to Canada to complete his graduate work at the University of Toronto. In only 18 months, he finished his doctoral studies in electrical engineering and subsequently joined the faculty of that department. Nine years later, he was appointed a full professor. In 1984, he was made a Fellow of the IEEE for his contributions to the theory and design of active-RC and switched-capacitor filters.

"This award certainly makes a difference to me," Sedra said. "It has become very prestigious nationally. The winners represent the cream of information technology researchers in Canada. So to join the ranks of such deserving people gives me a wonderful moral boost."

Douglas Powell is a graduate student at the University of Guelph and a free-lance science writer