# COMPUTING RESEARCH NEWS

25 Years of Service to the Computing Research Community

May 1998 Vol. 10/No. 3

# CS&E Budget Review for FY'98-'99

By Fred W. Weingarten

The computing research community should be pleased with the administration's proposals. At the press conference announcing the research budget, computing research was mentioned by several speakers not only as an important field in itself, but as a major enabler of other areas of research. Both the Vice President and Harold Varmus, Director of NIH, noted that the major new opportunities in the health field are due in large part to contributions from federally funded research in areas such as computer science.

However, the community finds both solace and concern in this identification. Certainly, the importance of progress in the computing field to all areas of federal science creates a powerful argument for substantial growth in funding of research. Most in the field (not all) would acknowledge that. Over the last several years, the High Performance Computing and Communications Initiative has had a positive effect on the funding base for computing research. On the other hand, confusion persists between computing research and computer applications–computational and infrastructure service to other areas of science and to agency missions. Only $199 million of CISE's $331 million request, for example, is earmarked for research support. Some computing researchers argue that this confusion tends to make the field appear to be better funded than it actually is. NSF would answer that the request represents a 19 percent increase in research funding over the current year's level and, therefore, research support is certainly not being driven out by infrastructure support at this time.

Another concern is that, although a 19 percent increase in basic research support at NSF is certainly welcome, it potentially could be offset by decreases in defense department support of academic computing research. Some have expressed concern that the very success of information technology and its importance to battlefield and weapons automation, coupled with decreasing funding for Defense research, will pressure DARPA-funded research toward shorter-term payoffs. Certainly, attacks on Defense Department funding of university research, by congress over the last few years do not create confidence in DOD as a reliable source of support.

On the other hand, David Tennenhouse, head of DARPA's Information Technology Office, suggests in an interview published in this issue of *CRN* (see articles, page 1,) that the Office still intends to focus on pushing computing research into the long term. It will be a struggle, and it remains to be seen whether these concerns are real or simply worries on the part of some researchers who insist on looking for dark clouds inside every silver lining of good news.

**National Science Foundation**

The Computer and Information Science and Engineering Directorate, at +16 percent, enjoyed the largest increase (by percentage) of the research directorates. Not all of this will go to basic research support, for CISE has a considerable research infrastructure responsibility in both high performance computing and networking. Nonetheless, the research divisions within CISE all received healthy increases, as Table 1, page 10 indicates; and NSF estimates the growth of research funding from a 1998 level of $168 million at 19 percent to $199 million next year.

One complicating factor in comparing these division numbers with those published last year in *CRN* is the extensive reorganization of CISE that took place earlier this year. This makes it particularly difficult to draw much meaning from trends. This is not a new problem, of course, since programs and funding areas are always being shuffled around among divisions and programs at some level. But, the most recent reorganization was a dramatic one, reducing the number of operating units from six to five and significantly reshuffling responsibilities. The five new divisions and their general research missions are as follows:

**CCR:** Computer-Communications Research – expects to expand its program in biocomputing. It also plans to focus on computer security, in response to growing concerns about the reliability and vulnerability of complex, interlinked information systems.

**IIS:** Information and Intelligent Systems – will focus its attention on

Continued on Page 9

**CRA offers workshops on Effective Teaching and Academic Careers**

**July 23-24, 1998**
**Madison, Wisconsin**
**For details see page 9.**

## Inside CRN

Expanding the Pipeline ..... 2
Community Highlights ..... 3
NGI - One Year Later ..... 4
Federal Funding Agencies ..... 6-7
Professional Opportunities ..... 11
CRA Conference at Snowbird ..... 12

# Interview with David Tennenhouse, DARPA

By Jean E. Smith

*In August 1997, David Tennenhouse became Director of the Information Technology Office at the Defense Advanced Research Projects Agency (DARPA.) He is on leave from MIT's Laboratory for Computer Science and the Sloan School of Management. Dr. Tennenhouse has Bachelor's and Master's degrees in Electrical Engineering from the University of Toronto, and received his Ph.D. from the University of Cambridge in 1989. Dr. Tennenhouse was interviewed for CRN in his office on March 25, 1998.*

**CRN:** Has coming to DARPA from MIT been a difficult adjustment for you? What have you liked most/least about the transition?

**Tennenhouse:** What I'm liking most is my newborn son, who is six months old. That is probably the most difficult adjustment. Compared with that, moving to DARPA has seemed relatively simple.

Not having day-to-day interaction with the technology is a big change. At MIT I had a team of graduate students just down the hall with their noses right in the technology. Whenever things got really frustrating (for whatever reason, usually my own fault) I could walk down the hall and see what they were up to, and that would always cheer me up. Here I'm a step removed from the hands-on technology, and that's a bit of an adjustment.

The positive side is that I get this great field of view. I get to see basically everything that's going on across the entire computer science field, and it's just wonderful. Not a day goes by that I don't learn about some new, really interesting idea and some new interesting piece of work that I wasn't aware of. So the pace of learning is broader but faster.

One of the most difficult adjustments is having a boss. As a faculty member and researcher at MIT, nominally I had bosses in the form of the laboratory directors and department heads, but in practice I really set my own agenda. Here I'm fitting into a reporting structure. There's an interesting difference, though it hasn't been overly onerous.

**CRN:** Did this surprise you?

**Tennenhouse:** Let's put it this way. You don't notice the absence of a boss. This is my first experience with a boss for a very long time. After being an undergraduate I started a consulting firm and I was used to running my own company. On some level, I retired to go back to graduate school.

**CRN:** Would you talk about your research at MIT.

**Tennenhouse:** My primary research agenda has always been technical. I've tended to move between the distributed systems arena and the networking arena and, in some sense, traveled up and down that stack looking for opportunities to have an impact and change things. Two MIT activities that I continue to be involved in (I still try to participate in the supervision of a few graduate students) are the active networks project (DARPA also has a much larger active networks activity involving a number of sites) and the spectrumware activity. They're both a great deal of fun–and that's my number one criterion.

The active networks project is putting a lot more software and computer science thinking into networking. The spectrumware project is doing something similar–putting more software and computer science into what we used to think of

Continued on Page 5

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Expanding the Pipeline

# Institute for Women and Technology Founded

PALO ALTO, California, March 17, 1998 – Companies that believe only men have a special affinity for high technology are missing a significant market opportunity. With the objective of empowering women and understanding their needs in terms of high technology, Xerox Corporation today announced the appointment of Anita Borg to the research staff at the company's internationally renowned Palo Alto Research Center (PARC). The company also announced that it will further its support for women in technology with financial assistance for the newly formed Institute for Women and Technology headed by Borg.

"How communities interact with technology drives much of the work we do at PARC," said John Seely Brown, Xerox chief scientist and director at PARC. "Anita Borg's years of advocacy for women's issues in the computer industry along with her expertise in computer science makes her a valuable addition to PARC's research staff."

At PARC, Borg will focus primarily on building the Institute for Woman and Technology. She will also be consulting on women's issues within Xerox research, and representing PARC externally.

The Institute for Women and Technology is an organization focused on increasing gender diversity in the technology industry and impacting women through the development of high-technology tools and products. Start-up funding will come from Xerox. The Institute for Research on Learning (IRL) in Menlo Park, California, will provide a non-profit home and operational support until the Institute for Women and Technology achieves financial independence. The IRL is a non-profit, tax-exempt national center on learning and innovation in schools and the workplace, and began operations in January 1987 with assistance from Xerox.

"We believe that the Institute for Women and Technology will not only increase the impact of women on all aspects of technology, but that it will result in an evolution of technology that addresses the needs of women and communities around the world," said Seely Brown.

Added Borg: "The time is right. The Institute will work with large women's constituencies including technical professionals, younger women, women in developing communities, and older women. We will offer user and community studies, workshops and meetings, information technology design and deployment projects, Internet-based information resources, and outreach programs."

Prior to joining Xerox, Borg worked at Digital Equipment Corp. She received the Pioneer Award from the Electronic Frontier Foundation and the Augusta Lovelace Award from the Association of Women in Computing. She is a fellow of the Association of Computing Machinery and is a member of the CRA Board of Directors. Borg holds a Ph.D., and master's and bachelor's degrees in computer science from the Courant Institute of Mathematical Sciences at New York University.

**About Xerox PARC**

Founded in 1970, the Xerox Palo Alto Research Center (PARC) is one of four major research centers in Xerox Corporate Research and Technology (CR&T). PARC performs pioneering research that covers broad spectrums of fields, ranging from electronic materials and device research, to systems and work practices in pursuit of innovations that relate to the current and emerging businesses of Xerox Corporation.

# Grace Hopper Celebration Videos Available

Order online through the website of University Video Communications (UVC) at http://www.uvc.com.

The conference, dedicated to the legacy of pioneer Admiral Grace Murray Hopper, exposes the outstanding input of women in computer science and technology from the glorious past to through the innovative future. Will information technology be a key to gender equality?

The videos listed below lend answers to this center stage question, and offer a complete overview of recent advances in computer science and technology. Please help us make sure these "must see" videos get into as many organizations as possible.

1. A Thin-Client Application Framework for Network-centric Computing.
Sandra Johnson Baylor, IBM T. J. Watson Research Center

2. Women and the Future of Technology– Technology and the Future of Women.
Anita Borg, Xerox, PARC

3. Security and Privacy in the Information Economy.
Joan Feigenbaum, AT&T Labs Research

4. Transformations for High Performance Computing.
Jeanne Ferrante, University of California, San Diego

5. A Keynote to Remember.
Anita Jones, University of Virginia

6. New Methods in Soil Ecology Combining Biology and Computation.
Deborah Joseph, University of Wisconsin

7. On Online Computation.
Anna R. Karlin, University of Washington

8. The Digital Library and Future Technologies.
Judith Klavans, Columbia University

9. Panel: Women in the History of Computer Science.
Host: Denise Gurer, SRI International
Pioneers: Jean Bartik, Judy Clapp, Thelma Estrin, Milly Koss, Joyce Currie Little, Ethel Marden

10. Panel: The Future of Computing–Seizing the Future We Want.
Host: Pamela McCorduck, PEN American Center;
Participants: Linda Alepin, Pebblesoft Learning; Katrina Garnett, CrossRoads Software; Ellen Pack, Wire Networks Inc.; Ruthann Quindlen, Institutional Venture Partners; Carol Realini, Chordiant Software Inc.

11. Internet/Java.
Amy Pearl, Sun Microsystems

12. Digital Cash.
Birgit Pfitzmann, Universitat des Saarlandes

13. Novel Digital Technologies and Women's Health.
Faina Shtern, US Public Health Services' Office on Women's Health

14. Design for Highly Complex Programmable Logic Architectures.
Telle Whitney, Actel Corporation

Join the celebration! Order the complete set online and get 30% off these already reasonably-priced videos (limited time offer; all CRA members need to order before May 31, 1998).

For more information, please visit UVC's website or e-mail your request to: dls@uvc.com. They can also be reached by phone at 408-379-0100.

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Community Highlights

# In Brief–Committee Activities

**Awards** (*Caroline Wardle, Daniel Reed, Jan Cuny)*

The committees are evaluating the nominations received for the A. Nico Habermann Award and the Distinguished Service Award, and will present a slate of recommended candidates for the CRA board to vote on. Both awards will be presented to those selected at the CRA Conference at Snowbird '98 on July 27. Nominations received for the Undergraduate Awards have been forwarded to the selection committee for their review.

**Coalition to Diversify Computing (***Sandra Johnson Baylor*)

The CRA/ACM Coalition to Diversify Computing (CDC) has a number of projects planned for the remainder of the year. One is to develop a "Minorities in Computer Science" brochure, available in print and on the web, that will feature the successes of 12 to 20 minority students and scientists who have insightful, interesting personal histories. A second project is to continue to develop a CDC website to serve as a repository of information on programs of value to minority researchers. It will also serve as a focal point for CDC activities, and allow the sharing of relevant ideas and resources.

The coalition would like to establish and maintain a CDC database of contacts who have an interest in helping minorities pursue careers in computing. In addition to information on minorities themselves, the database will help build an information infrastructure to be used by CDC to initiate projects, inform people about CDC activities, and build a network of individuals with common goals. The database will be incorporated into the CDC website, and will help to inform those supportive of CDC's goals.

Support will be provided for 10 minority students to participate in the annual professional ADMI meeting in June in Houston, Texas. They will be selected based on their achievements, and will be encouraged to take full advantage of the conference, including making contacts, learning about research and funding opportunities, and possibly presenting the results of their work. CDC also will seek support for seven minority students and/or department heads at minority institutions to attend CRA's Conference at Snowbird.

**Elections** *(David Patterson)*

The committee finalized the slate of nominees, and election ballots were sent to members in mid-April. The deadline for receipt of completed ballots in the CRA office is Monday, May 11. Results will be announced in late May.

**Electronic Services** (*Jack Stankovic*)

The CRA Webpages have been improved. CRA Conference at Snowbird '98 registration is now available via the web (http://www.cra.org/Activities/snowbird/.) An "idea and comments" icon has been added to the website, and we are soliciting feedback from users of the webpages. Future plans include the installation of statistics-gathering tools and search engines.

**Executive Fellowship Program** (*Randy Katz)*

Two applicants were chosen by the selection committee to proceed to the next stage of the selection process. Final decisions will be made based on personal interviews in federal agencies where suitable positions have been identified.

**Government Affairs** *(Peter Freeman)*

On March 9, visits were organized for several Board members to the White House Office of Science and Technology Policy, DARPA, and NSF, and to three congressional offices. On April 21, Peter Freeman testified for CRA at hearings of the House Appropriations Committee on NSF funding (see CRA's statement on the web at www.cra.org.)

"Project LISTEN: A Reading Tutor That Listens," has been selected to represent CRA at the 1998 Exhibition sponsored by the Coalition for National Science Funding (CNSF) on May 20. This is the fourth year that CNSF has put on the exhibition for Members of Congress and their staffs. Project LISTEN, directed by Dr. Jack Mostow, Carnegie Mellon University, is an interdisciplinary research project to develop a novel cure for illiteracy – an automated Reading Tutor that displays stories on a computer screen, and listens to children reading them aloud. Congressional visitors to CRA's exhibit will receive a "hands-on" demonstration of the project.

Continued on Page 9

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# NAE Elects New Members

The National Academy of Engineering (NAE) has again elected members of the Computer Science and Engineering community to the Academy. This honor is reserved for those who make "important contributions to engineering theory and practice, including significant contributions to the literature of engineering theory and practice," and those who have demonstrated "unusual accomplishment in the pioneering of new and developing fields of technology."

This year a total of 84 engineers and 7 foreign associates were elected to membership. The announcement was made by William Wulf, president of NAE (see *CRN* interview with Wulf, September 1997.) U.S. membership now totals 1,941 and foreign associates total 155 members.

This year's newest members:

**James H. Clark**, chairman, Netscape Communications Corp., Mountain View, California. For the development of computer graphics and for technical leadership in the computer industry.

**David J. DeWitt**, professor and Romnes Fellow, University of Wisconsin, Madison. For the theory and construction of database systems.

**Edward J. McCluskey**, professor of electrical engineering and computer science and director, Center for Reliable Computing, Stanford University, Stanford, California. For logic design, computer engineering, and engineering education.

**Jerome H. Saltzer**, emeritus professor of computer science, Massachusetts Institute of Technology, Cambridge, Massachusetts. For computer operating systems.

**Alberto Sangiovanni-Vincentelli**, professor of electrical engineering and computer science, University of California, Berkeley. For computer-aided design of integrated circuits.

**Keith W. Uncapher**, senior vice president, Corporation for National Research Initiatives, Reston, Virginia. For information technology on the national level.

Policy News

# Next Generation Internet One Year Later

By Louise Arnheim

In the year since the computing research community gathered for CRA Next Generation Internet (NGI) workshop, a substantial amount of behind-the-scenes policymaking has been taking place. As a result, there are signs the NGI initiative is gaining needed congressional support and capturing the attention of a wider audience. For example:

- NGI received a widely televised mention by President Clinton in his 1998 State of the Union Address;
- Both the House and Senate Science Committees have introduced NGI authorization bills;
- NGI applications were recently showcased for lawmakers at a Washington, DC, exhibit; and
- ·Internet2, the private, university-led initiative, formalized its activities by establishing UCAID; the University Corporation for Advanced Internet Development.

Much of this more visible activity is attributable to year-long efforts by all parties–the Administration, lead agencies, Congress, academia, and the private sector–to improve the overall NGI policy dialogue.

### Congress and NGI Funding

The most significant development is the introduction of the two NGI bills: S. 1609, and H.R. 3332. As this article goes to press, these two authorization bills are just emerging out of Committee stage. Prior to the Easter recess, S. 1609 was reported out of the Committee on Commerce, Science, and Transportation without amendment and sent to the Senate floor. The House version was scheduled for markup by the full Science Committee after the Easter break.

Both measures amend the High Performance Computing Communications Act of 1991 to authorize NGI funds at the following levels:

**Senate:**
FY '99: $102 million
FY '00: $115 million

**House:**
FY '99: $110 million
FY '00: $115 million

(The House bill actually meets the President's budget request for FY '99).

Rep. James Sensenbrenner (R-Wisconsin), who chairs the House Science Committee, recently called NGI "the logical next step for Internet development." Given the Chairman's cool reception to NGI last year, his co-sponsorship marks a turning point in congressional acceptance of the initiative.

As previously reported by *Computing Research News*, March 1998, Sensenbrenner had pressed the Administration for additional information on NGI. At this time last year, the House Science Committee had decided against including NGI language in its NSF authorization bill. Months later, during hearings on the NGI, Sensenbrenner seemed less than satisfied with the level of detail provided by Administration witnesses.

Ultimately, NGI moved through the congressional appropriations process with key departments and agencies such as DARPA, NIST, NASA, and NSF receiving a collective total of $85 million for FY '98 only (in contrast to President Clinton's original request for $300 million over three years.)

Apparently, Rep. Sensenbrenner was not alone in his quest for more details. Sources tell *CRN* that the Administration's failure to provide sufficient programmatic and planning information was a major reason behind congressional reticence to further fund NGI. It now appears, though, that revised versions of both the Administration's NGI concept paper as well as its implementation plan have satisfied lawmakers' requests.

Another concern of lawmakers was the geographic distribution of federal funds; that is, would NGI resources benefit institutions in rural and low-population-density areas? Here, the oversight Committees were apparently satisfied enough to give the go-ahead for funding, but still wary enough to charge the presidential advisory committee on NGI (the Presidential Advisory Committee on High Performance Computing and Communications, Information Technology and the Next Generation Internet) with keeping watch. Specifically, each bill requires the advisory committee to see whether Internet users in such areas incur a "geographic penalty"; that is, costs that are "disproportionately higher" than those paid by users in urban areas.

When asked what had transpired between last fall and the present to change lawmakers' views, NSF's George Strawn, Division Director, Division of Advanced Networking Infrastructure and Research (who also co-chairs the Large Scale Networking Group) pointed to the revised implementation plan. Another matter which helped, said Strawn, was "the cooperation of NSF's EPSCoR (Experimental Program to Stimulate Competitive Research) with the NSF NGI effort." According to Strawn, this cooperation "helped spur broad geographic participation by the nation's universities."

UCAID's President, Doug Van Houweling, attributed the change to the nature of the policy process. "There's been a lot of communication since last fall," he said. "Part of this is just a matter of people talking to people and getting comfortable." Van Houweling also noted several outreach activities that have taken place in recent months. One such effort was a video jointly produced by UCAID and the National Coordination Office for Computing, Information and Communications. Another effort was a daylong exhibition of federal agency NGI activities called "Netamorphosis." Hosted by the Office of Science and Technology Policy and the National Economic Council, Netamorphosis was expressly designed to familiarize lawmakers with applications made possible by NGI.

### Presidential Advisory Committee on NGI

While Congress is now giving the NGI initiative more serious consideration, it is also eyeing the NGI presidential advisory committee with greater scrutiny. Both the House and Senate bills require the advisory committee to make a report to Congress (and the President) six months after enactment, then yearly until September 30, 2000.

### NGI Agency Activities

While some agencies, such as DARPA, NASA, and NIH are humming with NGI activity, at least two federal agencies may be stuck in second gear. The Department of Energy, for example, has yet to receive NGI funding, and NSF is currently barred from spending the funds allotted by Congress from domain name registration.

**DARPA** – Last fall, the agency issued a BAA (broad agency announcement) for work in three interrelated areas:

1. Network Engineering – DARPA's effort to achieve growth in networks by a factor of 100 (or more).
2. Quorum – The agency's new approach to network-based computing, which features "adaptive quality of service management" as its basic organizing principle.
3. Supernet – A program designed to 1) develop "ultra high-speed multiplexing and transmission technologies with advanced configuration management and control capabilities"; and 2) demonstrate "end-to-end network connectivity involving tens of sites (nodes) and applications."

**DOE** – In contrast, researchers at the Department of Energy can only contemplate NGI-related work. The Appropriations Subcommittee for DOE not only refused to provide funding for NGI activities, it expressly prohibited the Department from using any current funds to conduct NGI projects.

**NSF** – In funding NSF-NGI activities for FY '98, Congress directed the Foundation to use $23 million from the Intellectual Infrastructure Fund (the interest-bearing account derived from domain name registration fees that is run by NSF's subcontractor, Network Solutions Inc). The fund, however, is currently untouchable, pending outcome of a class action suit *(William Thomas et al v. NSI and NSF)* filed last year. In February, the judge overseeing that case issued a preliminary injunction, thereby barring use of the funds in any fashion.

How will this action impact NSF's participation in the NGI? NSF's George Strawn is "hopeful" that both the President's FY '99 request will be approved and that the FY '98 funds will become available. "Our FY '98 challenge," he says "is to be prepared for both possibilities of NGI funding, or no NGI funding. And I believe that we are prepared."

*Other Agency Efforts* – The NGI applications featured at Netamorphosis were representative of ongoing R&D at several federal agencies. These applications include NASA's work on a telemedicine project in echocardiography; NIST's octahedral hexapod (a remote, software-controlled metal-cutting machine); and NLM's drug design collaboratory, a project that enables researchers at different sites to analyze and come up with new drugs.

### Internet2 and UCAID

Closely related, and in some cases paralleling NGI, is Internet2, the university-driven effort to ensure continuing Internet access in the now-commercial and often congested Internet environment.

Until recently, Internet2 was an informal collaboration of mostly university researchers meeting casually to discuss mutual concerns. To provide the group with an ongoing legal framework for future activities, UCAID was incorporated last fall. Among UCAID's 120–primarily university–members are organizations such as NYSERNet and corporations such as 3Com.

Though Internet2's interests are similar to NGI, they involve separate sets of activities. For example, while NGI and Internet2 both focus NGI's promoting advanced applications, explains UCAID President Van Houweling, Internet2 is more concerned with instructional applications, whereas NGI is more concerned with research applications.

Of particular interest to CRA, Van Houweling says, is UCAID's Network Research Liaison Council (CRA's Board Chair, Ed Lazowska, serves on the Council). According to Van Houweling, the Council will ensure collaboration with the computer science community on advanced networking issues.

Van Houweling also places special emphasis on his organization's efforts to promote technology transfer. "We are working closely with industry so that the technology that is developed and proven will in fact find its way into the commercial Internet," he says.

*The CRA report produced from the NGI workshop,* Research Challenges for the Next Generation *Internet, is still available from the CRA office. Contact info@cra.org or call 202-234-2111 for copies.*

Interview from Page 1

as the physical layer of the communication channels.

At the same time, I'm trying to get some of my computer science students to learn a little bit about information theory. One of the most stunning realizations to me was that most of us don't teach information theory to computer scientists. I hope one of the side effects of pushing computer science further down into what we used to think of as the physical layer will force them to deal with it.

**CRN:** What convinced you to come to DARPA?

**Tennenhouse:** I was hearing two views about computer science when I made this decision. One view was that we had basically explored all the space and picked the low-dangling fruit, and now the most important thing was to fill in the gaps. That would be done in a more disciplined way and, in many respects, computer science would become a more traditional discipline–like classical electrical engineering or other aspects of engineering.

An alternative view was that we've actually explored about 5 percent of the space. Filling in the cracks within that 5 percent is an important activity, but it's far from the only activity. There's still 95 percent of the space left. If there's low-dangling fruit we shouldn't hesitate to pluck it, though that doesn't mean we shouldn't go after the hard problems as well. I believe in the latter view, and I wanted to make sure that the field remained very aggressive in thinking about new spaces through which we could explore computer science.

Fundamentally, and I'm not the first one to say this, CS is a science of the artificial. We don't have to use any particular physical mechanism to perform our computations. That means there are no physical limits on how fast we can perform the computations in the future–how big a computation we can perform, or how much memory we can throw at it. Given that lack of limits, it's hard to accept the notion that we've explored most of the space. But the "fill in the gaps" mentality could become a kind of self-fulfilling prophecy.

So computer science is at a fork in the road. The field can decide that it has explored most of the space, or it can decide that there's no reason for computer science to evolve into a classical field. So I came to DARPA to keep us on the dynamic course, and I hope I'll be able to do that. My feeling was that it was very much in my self-interest to come here, because if the field does go down that classical science path I don't really think I want to stay in it.

**CRN:** What do you hope to achieve while at DARPA?

**Tennenhouse:** I'm trying to weave some themes into the various programs and the office. As office director, I can influence the directions that the program managers decide to embark on and I can have some indirect influence on what individual researchers try to do. My number one job is to champion all of this good work and make sure that it's well received by people elsewhere. I've decided that identifying themes is as much as I can try to do.

I currently have three themes: 1) let's get physical, 2) let's get real, and 3) let's get mobile. I hope there'll be six to eight themes by the time I pass the baton. Maybe that's another 5 percent of the space to explore. And there'll be room for another 18 office directors after me before we have to think about turning into a conventional discipline.

With respect to "let's get physical," I believe that the computer science field has become overly focused on the desktop and the laptop as the key platforms. The key metaphor is a human being entering information, a computer processing information, and a human being receiving information back. That falls in the well-explored category, yet there's still much to do.

As I visit labs and researchers, and especially as I talk with graduate students, I'm finding that a large fraction, but not all, of our community is really divorced from the physical world. So let's think of a different world where we're focusing a lot of research on physical phenomena being sampled by sensors and transducers, those are being dropped into the computers, the computers are processing that information, and the computers are directly controlling actuators to get the job done. The human being is not completely out of the loop but, relatively speaking, is acting above the loop in a sort of management capacity.

Trying to get more involved with the physical phenomena isn't really about doing work at the lower layers of the stack or trying to work exclusively on sensors because you could be doing AI-type work, planning work, knowledge-based reasoning work, or visualization-type work–the question is, what is it you're doing your reasoning about, what is it you're doing your visualization about? Is it in the world of the virtual, or is it in the world of the physical? I think we've had a movement toward the virtual for a number of years now. Although I've encouraged that activity in the past, I think it's now time to swing the pendulum back toward the physical or the real world. Related to that is the question: "What are the platforms we think about?" Are they the supercomputers, workstations, and laptops that constitute about two percent of all the computers that are produced? Or are they the other 98 percent, which are all of the embedded processors?

With the "let's get physical" theme goes the notion that we need

Continued on Page 8

# Federal Funding Agencies

## DOD/Air Force Office of Scientific Research
**110 Duncan Ave., Suite B115**
**Bolling Air Force Base**
**Washington, DC 20332-0001**
**http://web.fie.com/fedix/afosr.html**

**Mathematics & Geosciences Directorate**

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| Director | Clifford E. Rhoades, Jr.<br>202-767-5025<br>clifford.rhoades@afosr.af.mil |
| AI Program Manager | Abraham Waksman<br>202-767-7903<br>abraham.waksman@afosr.af.mil |
| Software and Systems Program Manager | James Hendlel<br>202-767-5025<br>james.hendler@afosr.af.mil |

## DOD/Army Research Office
**PO Box 12211**
**Research Triangle Park, NC 27709-2211**
**http://army.mil**

**Mathematical & Computer Sciences Division**

| | |
|---|---|
| Division Director | Robert Launer<br>919-549-4254<br>launer@aro-emh1.army.mil |
| Software & Knowledge-Based Systems | David W. Hislop<br>919-549-4255<br>hislop@aro-emh1.army.mil |
| Computational Mathematics | Stephen Davis<br>919-549-4284<br>davis@aro-emh1.army.mil |

## DOD/Defense Advanced Research Projects Agency
**3701 N. Fairfax Drive**
**Arlington, VA 22203-1714**
**http://www.darpa.mil**

**Technology Offices**

| | |
|---|---|
| Director, Information Systems Office | Marvin Langston<br>703-696-7438<br>mlangston@darpa.mil |
| Director, Information Technology Office | David Tennenhouse<br>703-696-2228<br>dtennenhouse@darpa.mil |

## DOD/Office of Naval Research
**Ballston Center Tower, 800 N. Quincy St.**
**ONR Code 311**
**Arlington, VA 22217-5660**
**http://www.onr.navy.mil**

**Mathematical, Computer & Information Sciences Division**

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| Director | Andre van Tilborg<br>703-696-4312<br>avantil@itd.nrl.navy.mil |
| Applied Analysis | Wen Masters<br>703-696-4314<br>masters@itd.nrl.navy.mil |
| Artificial Intelligence | Michael Shneier<br>703-696-4303<br>shneierm@onrhq.onr.navy.mil |
| Command & Control | Paul Quinn<br>703-696-5753<br>quinnp@onrhq.onr.navy.mil |
| Computer Systems & Technology | Elizabeth Wald<br>703-696-0157<br>ewald@picard.cmf.nrl.navy.mil |
| Discrete Mathematics | Donald Wagner<br>703-696-5313<br>wagnerd@onr.navy.mil |
| Numerical Analysis | Richard Lau<br>703-696-4316<br>laur@onrhq.onr.navy.mil |
| Operations Research | Donald Wagner<br>703-696-4313<br>wagnerd@onrhq.onr.navy.mil |

## DOD/Office of Naval Research, cont.

| | |
|---|---|
| Probabilities & Statistics | Wendy Poston<br>703-696-4320<br>postonw@onr.navy.mil |
| Robotics | Teresa McMullen<br>703-696-3163<br>mcmullt@onrhq.onr.navy.mil |
| Software | Ralph Wachter<br>703-696-4304<br>wachter@itd.nrl.navy.mil |
| Scientific Visualization | Lawrence Rosenblum<br>202-767-5333<br>rosenblum@ait.nrl.navy.mil |

## Department of Energy
**ER-31**
**19901 Germantown Road**
**Germantown, MD 20874-1290**
**http://www.doe.gov**

| | |
|---|---|
| Director, Office of Energy Research | Martha A. Krebs<br>202-586-5430<br>martha.krebs@mailgw.er.doe.gov |
| Director, Office of Computational & Tecnology Research | David B. Nelson<br>301-903-7486<br>nelson@er.doe.gov |

**Mathematical, Information & Computational Sciences Division**

| | |
|---|---|
| Acting Director | Daniel Hitchcock<br>301-903-6767<br>DANIEL.HITCHCOCK@oer.doe.gov |

## NASA
**300 E St. SW**
**Room 2R82, Code JOC**
**Washington, DC 20546**
**http://www.nasa.gov**

**Information Systems Division**

| | |
|---|---|
| Director | Sandra Daniels-Gibson<br>202-358-2155<br>sgibson@hqops.hq.nasa.gov |
| Deputy Director | Vacant |

**Center of Excellence in Space Data & Information Sciences**

| | |
|---|---|
| Director | Yelena Yesha<br>301-286-4403<br>yeyesha@cesdis.usra.edu |

## National Institute of Standards & Technology
**Building 225, Room A231**
**Gaithersburg, MD 20899**
**http://www.nist.gov**

**Computer Systems Laboratory**

| | |
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| Director | Shukri Wakid<br>301-975-2822<br>swakid@nist.gov |

## Office of Science & Technology Policy
**17th Street & Pennsylvania Avenue NW, Room 424**
**Washington, DC 20502**
**http://www2.whitehouse.gov/WH/EOP/OSTP/html/OSTP_Home.html**

| | |
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| Director; Assistant to the President for Science & Technology | Neal Lane (Pending Approval)<br>202-456-7116 |
| Associate Director for Science | Arthur Bienstock<br>202-456-6130 |
| Associate Director for Technology | Duncan Moore<br>202-456-6046 |
| Associate Director for Environment | Rosina Bierbaum (Acting)<br>202-456-6077 |
| Associate Director for National Security & International Affairs | Kerri Ann Jones<br>202-456-2894 |

# Federal Funding Agencies

## National Science Foundation
**4201 Wilson Blvd.**
**Arlington, VA 22230**
**http://www.nsf.gov**

### Advanced Computational Infrastructure & Research (ACIR)

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| Division Director | Robert R. Borchers<br>703-306-1970<br>borchers@nsf.gov |
| Deputy Division Director | Richard Hirsch<br>703-306-1970<br>rhirsch@nsf.gov |
| Partnership for Advanced Computational Infrastructure (PACI) | Richard Hirsch - Acting<br>703-306-1970<br>rhirsch@nsf.gov |
| Advanced Computational Research | John Van Rosendale<br>703-306-1970<br>jvanrose@nsf.gov |

### Advanced Network Infrastructure & Research (ANIR)

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|---|---|
| Division Director | George Strawn<br>703-306-1950<br>gstrawn@nsf.gov |
| Deputy Division Director | Aubrey Bush<br>703-306-1949<br>abush@nsf.gov |
| International-Interagency Program | Steven N. Goldstein<br>703-306-1949<br>sgoldste@nsf.gov |
| Networking Research | Tatsuya Suda<br>703-306-1949<br>suda@nsf.gov |
| NSFNET | William Decker<br>703-306-1949<br>wdecker@nsf.gov |
| Special Projects | Darleen L. Fisher<br>703-306-1949<br>dlfisher@nsf.gov |

### Computer & Communication Research (CCR)

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| Acting Division Director | John Lehman<br>703-306-1940<br>jlehmann@nsf.gov |
| Acting Deputy Division Director | S. Kamal Abdali<br>703-306-1912<br>kabdali@nsf.gov |
| Theory of Computing | Zechezkel Zalcstein<br>703-306-1911<br>zzalcste@nsf.gov |
| Numeric Symbolic & Geometric Computation | S. Kamal Abdali<br>703-306-1912<br>kabdali@nsf.gov |
| Operating Systems & Compilers | Peter Scheuermann<br>703-306-1912<br>pscheur@nsf.gov |
| Software Engineering & Languages | Frank Anger<br>703-306-1911<br>fanger@nsf.gov |
| Design Automation | Robert Grafton<br>703-306-1936<br>rgrafton@nsf.gov |
| Computer Systems Architecture | Robert Grafton (Acting)<br>703-306-1936<br>rgrafton@nsf.gov |
| Communications | Thomas Fuja<br>703-306-1910<br>tfuja@nsf.gov |

### Experimental and Integrative Activities (EIA) Division

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|---|---|
| Division Director | John Cherniavsky<br>703-306-1980<br>jchernia@nsf.gov |
| Acting Deputy Division Director | Micheal Foster<br>mfoster@nsf.gov<br>703-306-1981 |

### Experimental and Integrative Activities (EIA) Division, cont.

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| Experimental Software Systems | William Agresti<br>wagresti@nsf.gov<br>Micheal Foster<br>mfoster@nsf.gov<br>703-306-1981 |
| Interactive Graduate Education & Research Training | William Agresti<br>703-306-1981<br>wagresti@nsf.gov |
| Digital Government Program | Lawrence E. Brandt<br>703-306-1981<br>lbrandt@nsf.gov |
| POWRE (Professional Opportunities for Women in Research & Education) | Dragana Brzakovic<br>703-306-1981<br>dbrzakovi@nsf.gov |
| Science & Technology Centers | Dragana Brzakovic<br>703-306-1981<br>dbrzakovi@nsf.gov |
| Educational Innovation | Harry Hedges<br>703-306-1981<br>hhedges@nsf.gov |
| REU (Research Experiences for Undergrads) Sites Programs | Harry Hedges<br>703-306-1981<br>hhedges@nsf.gov |
| Research Infrastructure | Stephen R. Mahaney<br>703-306-1981<br>smahaney@nsf.gov |
| CISE Minority Infrastructure | Rita Virginia Rodriguez<br>703-306-1981<br>rrodrigu@nsf.gov |
| CONACyT (National Council of Science & Technology Research of Mexico) | Rita Virginia Rodriguez<br>703-306-1981<br>rrodrigu@nsf.gov |
| Postdoctoral | Rita Virginia Rodriguez<br>703-306-1981<br>rrodrigu@nsf.gov |
| Advanced Resources for Experiments Program (CARE) | Micheal Foster<br>703-306-1981<br>mfoster@nsf.gov |
| High Performance Computing & Communication | Robert G. Voight<br>301-306-1981<br>rvoight@nsf.gov |
| CISE Challenges | Vacant |
| Special Projects | Henry Hedges<br>hhedges@nsf.gov<br>Rita Virginia Rodriquez<br>rrodrigu@nsf.gov<br>301-306-1981 |

### Information & Intelligent Systems (IIS) Division

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| Division Director | Y.T. Chien<br>703-306-1930<br>ytchien@nsf.gov |
| Acting Deputy Division Director | Gary W. Strong<br>703-306-1928<br>gstrong@nsf.gov |
| Computational & Social Systems | Les Gasser<br>703-306-1927<br>lgasser@nsf.gov |
| Information & Data Management | Maria Zemankova<br>703-306-1926<br>mzemanko@nsf.gov |
| Human Computer Interaction (HCI) | Gary W. Strong<br>703-306-1928<br>gstrong@nsf.gov |
| Knowledge & Cognitive Sciences | Larry Reeker<br>703-306-1926<br>lreeker@nsf.gov |
| Robotics & Human Augmentation | Howard Moraff<br>703-306-1928<br>hmoraff@nsf.gov |
| Special Projects | Steven Griffin<br>703-306-1930<br>sgriffin@nsf.gov |
| Staff Associate, Centers | Irene D. Lombardo<br>703-306-1963<br>ilombard@nsf.gov |

Interview from Page 5

to be thinking about very large numbers of network enabled processors. That presents an interesting inflection point because, although the vast majority of all computers are embedded processors, they haven't really been networked or networked in any real deep fashion.

The "let's get real" theme is about doing the "let's get physical" in real time. There are a number of applications for which we have used supercomputing in the recent past to produce results on an almost overnight, eight-hour, or one-hour basis. The interesting question is: As we get more and more computational capabilities, do we use these to take on larger problems–expand the scale of the problems–or do we try to get the problems done essentially in an interactive, almost instantaneous way? I think we should continue to explore bigger and bigger problems, but it's probably a good time for us to figure out how to drive most computations down into real time. That's one of the things we have to do if we're going to get the human out of the loop, which I think will be an important criterion.

The third theme, "let's get mobile," is not about mobile computing, which I am also a great fan of; it's about mobile code. It's seizing on another inflection point, and I think that's something DARPA does well. It's my belief that technologies like Java are 5 percent of a much bigger story. As proud as I am of our active networks research, I think that's 0.1 percent of the story.

The widespread availability of mobile code offers the opportunity to completely rethink how we implement systems today. It's not that mobile code is something that we haven't thought about in the past. It's not even that it hasn't existed in the past–it's just that we haven't really done it in anger. Now that we have it on a widespread basis, I think there's going to be huge opportunities.

At the detailed level, if your research field is transaction systems, you can revisit them. Should you do them differently in the presence of mobile code? If your specialty is fault tolerance, how should you revisit that problem? So almost every space within computer science in which we have a known toolkit of solutions can be reexamined to see if those solutions are still appropriate and to adjust them as we need to.

More broadly, I think this is going to give us the key edge that we need to figure out how to build very large, robust distributed systems. So this is a space where the interests of the computer science community and those of DOD can really come together. DOD has a continuing need to build very large distributed systems. Unfortunately for DOD, much of the commercial world is no longer doing so. Banks, insurance companies, etc., buy essentially packaged software from Oracle, Microsoft, etc. They knit a few things together, and they write some relatively clunky visual basic code. It all looks very ugly, but it has this wonderful attribute that it works. People may say that it doesn't work well, that it isn't really reliable, etc., but the commercial world has made a cost-benefit tradeoff and decided that it works well enough.

That leaves DOD in the position of being the only ones continuing to build large, complex systems the old-fashioned way. So I think it is urgent that DOD invent completely new ways of assembling large-scale distributed systems. That is not necessarily synonymous with complex systems. We have to work out ways to simplify the design of systems that today are too complicated to build and to operate. And, as a matter of pure intuition (that scares the hell out of my boss,) I believe that mobile code is going to give us the edge we need. If we start with Java-like functionality and push very hard, we're going to get there.

**CRN:** How long do you expect your tenure to be at DARPA?

**Tennenhouse:** DARPA positions are typically for two to four years. For a university person like myself, the usual arrangement is to come on a two-year IPA–there is eligibility, subject to mutual agreement, for two one-year extensions. Most find that 3 years is about the right amount of time. Having been office director for about 6 months, that feels right. In the past 6 months, I've had time to figure out a few of those things that happen every year and convince myself that I can reasonably manage the paperwork. That gives me another 2 years to be effective, and 6 months to train the next person.

I think it's a great system. There's no benefit to me in building an empire here. There is every benefit to working to get things done as quickly as possible. Although I am involved in long-term research, that doesn't mean we should do it slowly. One of the things about being here for three years is that I feel the need to get on with it.

**CRN:** Do you think more should be done to increase the number of computer scientists who are willing to spend time in Washington?

**Tennenhouse:** I sense that it is becoming more difficult to attract computer scientists to DARPA. And I think this is an unfortunate side-effect of a large fraction of the computer science community becoming more conservative. It used to be that computer science departments were known to be full of a bunch of crazies who couldn't really be expected to live by the normal tenure process anyway. Somehow the faculty of engineering would just put up with them.

Increasingly, as the departments strive for respectability, they're conforming to the process. For example, one hears from people that it wouldn't really be good for someone to do a tour at DARPA until they're a full professor. From my perspective, by the time someone's a full professor one of two things has happened. They've either built up such a wonderfully successful operation that it would be difficult for them to leave, and not only that, it may not even be in the DOD's interest for them to leave because there's a good chance that DOD is benefiting from that operation. Alternatively, they haven't built up a successful operation, and therefore may not be the kind of leader that we want to have coming here.

Within the computer science community there has to be more room for researchers, and particularly young researchers, to take chances. The promotion process is part of the problem and DARPA is another part of the problem. Unfortunately, there is a tight coupling between the activities and the way we operate here at DARPA and the way in which the research community operates, especially in the academic departments. That's created some undesirable feedback loops.

For example, if DARPA funding is less reliable, as it has been in the recent past, then researchers are naturally going to feel like they have to hedge their bets. There's been a trend toward individual researchers trying to have as many DARPA contracts as they can. But who wants researchers to hedge their bets? We want researchers to identify the most important thing to do, and throw their hearts and souls into it. So here we have a situation where DARPA has been a key creator and driver of that feedback loop.

Overall, I think a situation exists within the computer science research community that is reducing not only the willingness of researchers to take chances, but also their ability to do so. We don't need everyone to take great big risks. However, we do need a subset of leadership-oriented people who are going to strive for new directions.

**CRN:** Do you think that enough is being invested in academic research?

**Tennenhouse:** In the absolute sense, DARPA's total investment in what could be considered computing research is certainly larger than most people think. That's because a lot of people view my office, and perhaps the information systems office (to the extent that they still have some AI-funded work), as the principal funders of CS research in DARPA.

In practice, if you look across the whole agency, you'll find that almost every office in DARPA is a substantial source of investment in CS research. The credit for that lies with Bob Kahn. When Bob was director of the predecessor to this office, he launched a program called "strategic computing," which has been immensely successful. In DOD, the term has become "information superiority." This is the cornerstone of the DOD strategy. Computer science has now been woven into almost all of the DARPA offices. Realistically, however, most of those are points of application of computer science, which makes it more difficult for someone to develop a real critical mass in a new topic within computer science.

While the total research investment may be large enough, I think where we're having difficulty is in remaining nimble. Maintaining a broad investment in everything isn't what DARPA does best–the truth is that the National Science Foundation does that much better than we do. NSF has a very good peer review process, and will provide broad-based funding for a lot of good ideas that would clearly slip through our system.

When DARPA spots a good idea, it can put substantial resources behind it to amplify it, which is what DARPA does well. Since there's a limited number of ideas that either we can amplify or that the computer science community can actually put people behind, we just have to fund a number of good ideas and try not to fund too many bad ones.

So I think that there are two problems. One is that as DARPA moves out of a topic, people who are already working in that area and have been funded in the past experience a considerable period of anxiety. However, these are always good people, and so they will continue to attract substantial funding. An example is that DARPA has substantially reduced its investment in massively parallel processors over the past few years. However, the DOD modernization office has a substantial investment and the Department of Energy is ramping up its investment. So DARPA created a space (through the good efforts of Steve Squires, another of my predecessors,) and we're seeing the leadership for that space move out. In fact, although the source of the money is changing, the total amount of money on the table is actually going up. However, I'm sure it creates a lot of anxiety for people during that transition and anxiety is never a good thing, particularly for researchers. It's a waste of energy and time.

I think DARPA's biggest problem isn't so much the budget size as the thirst for innovative ideas. So I throw that challenge back to the CS community and say that it's the challenge of submitting to us really good, national-scale ideas–ideas that are going to have long-term impact–that is the gating function. I think that really good ideas are funded, and that we're primarily idea-limited, even on a national scale.

**CRN:** Is there a feeling that DARPA doesn't need more computing research?

**Tennenhouse:** In the Pentagon's Joint Vision 2010 project, which is driving a lot of the current investment thinking, information superiority is the cornerstone. That demands large-scale continued investment in information technologies. From that perspective, there is a very solid cornerstone for folks to build on.

Having said that, there certainly have been mutterings within DARPA of a different sort, including, "If the computer science

Continued on Page 10

Budget from Page 1

data-centered research infrastructures, knowledge networking, phase 2 of its Digital Libraries Initiative, and research to improve the accessibility of information systems.

**EIA:** Experimental and Integrative Activities – this division has the broadest charter and is responsible for CISE participation in many cross-agency initiatives. For instance, it will be part of an initiative on learning technologies.

**ACIR:** Advanced Computational Infrastructure and Research – the bulk of ACIR funding ($74 million out of $81.6 million) will go to support of the two "Partnerships for Advanced Computational Infrastructure," which evolved last year out of its decade-old Super-computer Centers program. The remaining $7.6 million will go to research projects in high-end computation.

**ANIR:** Advanced Networking Infrastructure and Research – the bulk of ANIR's budget, $48.7 million, will go to support the very high speed Backbone Network Service (vBNS) and connections to vBNS as part of the administration's Next Generation Internet (NGI) Initiative. The remaining $14.4 million will represent a major increase in funding for networking research related to NGI.

One additional point regarding the ANIR budget. The appropriations committee directed NSF to spend $23 million on networking connections and research this year from fees collected by a private firm under contract to NSF for managing domain name registrations. Those funds have now been held up in court and their status is uncertain. They are not reflected in the "Current" budget item for ANIR– probably one reason the proportional increase looks unusually high.

Two cross-agency initiatives will involve heavy CISE participation, the Knowledge and Distributed Intelligence Initiative and the Educational Technologies Initiative.

CISE will be increasing its investment in Knowledge and Distributed Intelligence (KDI) by $14.1 million. This program ran into some resistance last year in the Senate Appropriations Committee. Although funds were ultimately put in the budget, NSF was asked not to proceed until a more detailed program plan was sent to Congress. NSF feels that those problems have been put behind them and is moving full speed ahead on the initiative, both in terms of spending this year's money and asking for an increase next year. A request for proposals is now on the street (see *CRN*, January 1998.)

The KDI program is predicated on the observation that computers and high-speed data networks are transforming the entire process of scientific research. It follows that research in areas such as digital libraries, high-speed networking, and representation of complex data sets will advance all of scientific research. CISE, with both its computing research and its infrastructure responsibilities, will play a major role in coordinating the cross-directorate effort, although the other disciplines are expected to fund computational research specifically focused on their disciplinary needs. CISE has asked for a $14.2 million increase over this year's funding for KDI.

The Educational Technologies Institute combines research programs in CISE with those in the Education Directorate to fund research in the applications of information technology to research. CISE has asked for an increment of $1 million in this area.

**High Performance Computing and Communications**

On the multiagency program front, the senior citizen is the High Performance Computing and Communication Initiative. The HPC Act expired last year as the principal authorizing legislation, but the program continues in updated form as an administration initiative. It has been renamed "Large Scale Networking and High-End Computing and Computation." Overall program funding is set at $850 million. Last year's HPC request was $1.128 billion, so funding might seem substantially down. But given the renaming and redefinition of the program, it is impossible to draw a meaningful line between the FY 1998 and FY 1999 numbers.

**Next Generation Internet**

This initiative, first announced by the President in October of 1996, had a rocky first year, with appropriations below the administration's request of $105 million last year, and complaints from both the Senate and House oversight committees about program objectives. This year, the waters seem a bit calmer. Authorizing bills have been introduced in both the House and Senate, and it is hoped that they will pass with little opposition.

This year, the administration is asking for $105 million for the NGI and they expect a much more

Continued on Page 10

In Brief from Page 3

**Membership Committee**
(*Larry Snyder*)

In February, the committee contacted the handful of academic departments that had not paid 1997-1998 membership dues encouraging them to join the other association members. Virtually all of the late departments have rejoined, making CRA the representative of nearly all research computing departments in the United States and Canada.

**Publications** (*Jeff Ullman*)

We are happy to announce that, in addition to the page images of *CRN* available from www.cra.org, many recent articles have been converted to HTML and are available in brief and full text. A search by topic is also available from the CRA webpages. Try it!

**Snowbird Conference**
*(James Foley and Mary Jane Irwin)*

Registration materials for Snowbird '98, July 26-28 in Snowbird, Utah have been mailed out. The cutoff date for reduced registration is June 10, 1998. Additional information and Snowbird program updates are available on the web at www.cra.org/snowbird/. For program updates for the conference see the backpage of *CRN*.

**Surveys** *(Gregory Andrews)*

A new "departmental profiles" survey, seeking information in areas not covered by CRA's Taulbee Survey, was circulated to Ph.D.-granting departments of computer science and computer engineering in mid-April. The survey is available online at www.cra.org/Profiles/FillOut, and electronic completion is preferred. The deadline for submission is May 29, 1998. It is hoped that preliminary results will be available by end of July for the CRA Confernece at Snowbird '98. Final results will appear in the September edition of *CRN*.

**Workshops** *(David Patterson, Chair, Academic Careers)*

The Effective Teaching Workshop will take place Thursday, July 23 and the Academic Careers Workshop Friday, July 24, 1998, both in Madison, Wisconsin. They will be collocated with a major meeting of the AAAI and several other meetings of groups interested in artificial intelligence, cognitive science, and related topics (see announcement, this page.)

## Effective Teaching in Computer Science and Engineering and Academic Careers Workshops

**EFFECTIVE TEACHING WORKSHOP**
http://www.cra.org/main/cra.events.html#workshops

**Thursday, July 23, 1998 – Madison, WI**

The purpose of the CRA Effective Teaching in Computer Science and Engineering Workshop is to help new faculty members teach computer science and engineering more effectively. This highly interactive workshop includes some theoretical material on learning styles and instructional objectives, as well as a very substantial amount of practical information on such topics as preparing and delivering lectures, writing and grading examinations and course assignments, dealing with problem and gifted students, selecting and negotiating teaching assignments, and balancing teaching with research.

The organizer is Professor Tim Finin (University of Maryland, Baltimore County).

**Lecturers:**
Tim Finin, University of Maryland, Baltimore County
Richard Korf, University of California, Los Angeles
Tom Mitchell, Carnegie Mellon University
Charles Nicholas, University of Maryland, Baltimore County
Gene Spafford, Purdue University

For registration and agenda, visit the CRA website at the URL listed above.

**ACADEMIC CAREERS WORKSHOP**
http://www.cra.org/main/cra.events.html#workshops

**Friday, July 24, 1998 – Madison, WI**

The CRA Academic Careers Workshop covers a number of topics that will help the young faculty member to have a successful career. This workshop is inspired by the very successful Workshops on Academic Careers for Women in Computer Science staged by the CRA Committee on the Status of Women in Computing Research (CRA-W), but it is oriented to both men and women who are beginning their academic careers in computer science and engineering, or who are advanced graduate students contemplating an academic career.

The organizer is David Patterson (University of California, Berkeley).

**Lecturers and Tentative Topics:**
Janice Cuny (CRA-W co-chair, University of Oregon)
Bobby Schnabel (Associate Dean of Academic Affairs for Engineering, University of Colorado, Boulder)
"Time Management/Family Issues"
Mary Jane Irwin (Vice Chair of ACM, Pennsylvania State University)
"The Tenure Process"
David Patterson (past CRA Board chair and past Computer Science Department Chair, University of California, Berkeley)
"Getting Funding"
Stuart Russell (NSF Presidential Young Investigator, University of California, Berkeley)
"Selecting and Managing a Research Project"
"Networking with Other Researchers" (TBD)

For registration and agenda, visit the CRA website at the URL listed above.

Interview from Page 8

community isn't going to do anything new, then we really ought to figure out how to transition the things that they're doing to other stakeholders and to the people who really own that now-developed space." In other words, when a space hasn't been developed and it's just a glint in the eye, clearly there's no customer and that's a place for DARPA to go in and make it happen. Once we've made it happen, we should find a customer who is going to sustain it, which is what has been done in supercomputing.

The question for computer science, then, is: "Does the CS community want to continue to move from space to space to space exploring sequences of new ideas in a very dynamic environment, or do we feel that a better direction for CS is to evolve into a discipline with known subcategories that remain fixed and stagnant?" If it's the latter, then we should try to get ourselves stable, regular funding sources for each of those activities. And that's what the Computing Research Association should be trying to do.

I actually think there's a very important place in computer science to keep seeking new territory. I haven't heard any mumblings within DARPA that suggest that people aren't interested in exciting new places where we could use computers, or exciting new techniques for building computers or for building their software systems and appliances

**CRN:** How do you view the relationship between DARPA and the National Science Foundation?

**Tennenhouse:** I think there have been some excellent DARPA/NSF collaborations. The gigabit testbeds is one that I participated in. Various people, in particular those who weren't funded, had negative things to say about the testbeds but, in practice, they basically created an industry. The fact that DARPA and NSF were willing to build the testbeds, above and beyond the science that was conducted over the testbeds, created a sense of confidence in industry that triggered a tremendous amount of investment. It's an industry that now continues to invest extensively in its own research and development.

DARPA has really successful joint activities with NSF on a number of fronts, involving digital libraries, speech recognition, and an upcoming activity on data-intensive computing. These are, first and foremost, relationships that are built between program managers. They work well when program managers work hand in hand because they have a dream and they realize that the way to achieve it is to work together. I see that continuing.

We have multiagency arrangements with a number of other agencies. We've worked a lot with the Department of Energy, and with NASA, NIST, and others. I'm not sure whether the future is going to involve the broad projects involving 12 agencies, or smaller groups of 3 or 4 agencies, getting together to do projects. But I'm very convinced there'll be multiagency projects continuing in the computer science domain.

A distinguishing feature of information technology within DARPA compared with the other DOD offices is that we reach far beyond DOD. We are striving to influence the broader scientific and commercial sectors. We believe that's the best way for us to get the technology into DOD hands. That doesn't always sit comfortably with folks higher up in the organization because it's very hard to prove cause and effect. However, we've had a continuous string of cases where we've funded researchers or we've worked with the other agencies; the work has then rebounded off the scientists, the commercial companies, or the start-ups back into the hands of the DOD–and done so at a speed that puts the normal procurement channels to shame. Laptop computers got to Desert Storm because of that commercial industry and because of the rebound effect, and not because of classical DOD procurement.

**CRN:** What is your view of the Next Generation Internet?

**Tennenhouse:** I'm incredibly pleased with NGI, and the program managers are really excited about the prospects. We're going to have some great connectivity at multigigabit speeds for the researchers to use in large geographic portions of the country. We're going to have some really interesting new hardware technologies for networks and we're going to have some tremendous software technologies, particularly in the networking engineering concept part of the program.

I think some really exciting new concepts are going to emerge, particularly on how to run Internet over wavelength division multiplexing technologies, and we'll get a tremendous amount of simplification within the current protocol stack. While we're doing NGI, the backbone network is going to undergo this usership transformation where packet data is going to become the dominant user of the network; and so, as it becomes the dominant user, all of a sudden you can justify rethinking a lot of what today goes on between the IP layer and the underlying physical infrastructure.

**CRN:** In closing, is there a message you'd like to convey to *CRN*'s readers?

**Tennenhouse:** I think this is a tremendously interesting time for the computer science community and for DARPA. At one time, this office was known as the Information Processing Techniques Office (IPTO). It was founded by J.C.R. Licklider, and Lick had a really clear vision that he referred to as "interactive computing." And he didn't mean timesharing–he meant humans really interacting and working synergistically with computers. It has been a great vision that has dominated a lot of what computer science has done. Folks like Bob Taylor carried on with that vision, and not just here at DARPA. He went on to do tremendous work at Xerox PARC and at the DEC Systems Research Center. We haven't finished with that vision.

Having said that, I feel that it's time for us to step away from interactive computing and to start thinking beyond it. That's really what's behind the "let's get physical" , "let's get real," and "let's get mobile" themes. It's time to get the human out of the loop. So interactive computing has been an important part of our research agenda for about 30 years now, and I think it's going to be part of the agenda for another 30 years. But it's time to start another agenda, and I need help formulating it. That's the message.

rom Page 9

Budget from Page 9

positive response from the appropriations committees. NSF will focus much of its $25 million on connectivity for research universities. DARPA has the responsibility to explore "blue sky" technologies for transmission and switching rates ranging to thousands of times faster than current Internet capabilities. Other agencies contributions will be focused more closely on specialized research linked to their individual missions.

There still seems to be some confusion about whether the NGI Initiative is an R&D program or a program to deploy an advanced computational infrastructure for research. Both the legislation and the administration plans seem to suggest that the program actually has aspects of both. To the extent it is a deployment program, that Congress can be expected to continue to ask about geographic distribution, as it did last year. The issue is not just between traditional "haves" versus "have-nots" states with respect to research support. There are major research universities that find the cost of connectivity to the high performance backbone to be prohibitively high.

Some observers blame that inequity on the uneven architecture of NSF's vBNS system (the initial backbone of the NGI,) some blame the phone companies for charging unnecessarily high tariffs for high-speed telecommunication connectivity. Regardless, to the extent that the NGI is seen as the next incarnation of what has become a critical research and educational infrastructure, Congress is unlikely to ignore geographical access issues.

| Division | 1997 | Actual 1998 | Plan 1999 | Request Percent Change |
|---|---|---|---|---|
| | (In Millions of Dollars) | | | |
| Computer-Communications Research (CCR) | $55.7 | $60.7 | $67.5 | 11.3 |
| Information and Intelligent Systems (IIS) | 34.6 | 39.9 | 46.7 | 17.3 |
| Experimental and Integrative Activities (EIA) | 56.0 | 60.7 | 72.2 | 18.9 |
| Advanced Computational Infrastructure and Research (ACIR) | 76.9 | 76.9 | 81.6 | 6.2 |
| Advanced Networking Infrastructure and Research (ANIR) | 49.9 | 46.1 | 63.1 | 36.9 |
| **Total CISE Directorate** | **$273.0** | **$284.2** | **$331.1** | **16.5** |

Table 1: Funding for the National Science Foundation's Computer and Information Science and Engineering (CISE) Directorate.

| Agency | NGI Request | Total 1999 LSN/HECC Request |
|---|---|---|
| | (In Millions of Dollars) | |
| Commerce (NIST and NOAA) | $5 | $22 |
| Defense (DARPA and NSA) | 40 | 187 |
| Energy | 25 | 128 |
| EPA | 0 | 5 |
| HHS (NIH/NLM) | 5 | 107 |
| NASA | 10 | 91 |
| NSF | 25 | 310 |
| **Total LSN/HECC** | **$110** | **$850** |

Table 2: Funding for the Large Scale Networking and High End Computing and Computation Initiative.

# Professional Opportunities

## CRN Advertising Policy

Send copy and payment for Professional Opportunities advertisements to Advertising Coordinator, Computing Research News, 1100 Seventeenth Street, NW, Suite 507, Washington, DC 20036-4632. tel. 202-234-2111; fax: 202-667-1066; e-mail: crn@cra.org. **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, 2) the second line must contain the name of the department or unit, 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. You may request in writing that some text be set in bold; a bold word in the body of the ad counts as two words.

The rate is $2.25 (US) per word. Purchase orders, money orders, and checks are acceptable (please do not send cash). All CRA members receive 200 free words per dues year. CRA's standard advertising package consists of running an ad in CRN, and distributing it electronically to CRA's jobs listserv and Web page (where it remains for two months). As an alternative to this package, advertisers may request that their Professional Opportunities ads just be published in CRN or just distributed electronically. The cost of the ad is the same whether the standard or the alternative package is selected.

Professional Opportunities display ads cost $60 (US) per column inch, with a two-inch minimum. Ads must be submitted in camera-ready, offset (positives or negatives) or mechanical form. If your ad is larger than three inches, please request our Advertising Rate Card.

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 of CRN will not be accepted for publication in CRN unless the ad says applications will be accepted until the position is filled. If the closing date of a Professional Opportunities ad does not correspond with the publication of an issue of CRN, advertisers can choose the alternative advertising package and only have the ad distributed electronically. Advertising copy that is to appear in CRN must be received at least one month before publication. The deadline for the September issue is August 1. Ads for electronic distribution only may be submitted at any time.

### Bowdoin College
Department of Computer Science

The Department of Computer Science at Bowdoin College invites applications for a full-time one-year visiting position at the rank of visiting assistant professor or instructor for the 1998-99 academic year. Ph.D. preferred, ABD considered. The successful candidate will be expected to teach four courses during the year including one introductory course each semester, algorithms, and one additional course (possibly in the candidate's area of expertise.) Teaching experience is preferred.

Applicants should send a letter of application, a curriculum vitae, a statement of teaching philosophy and interests, and arrange for three reference letters to be sent to:

David Garnick, Chair
Department of Computer Science
8650 College Station
Brunswick, ME 04011-8486

Questions can be directed by email to garnick@bowdoin.edu. Consideration of applications will begin April 15 and continue until the position is filled.

Bowdoin is a highly selective, coeducational, liberal arts college of 1,550 students located two hours north of Boston, close to Portland, along the Maine coast in a community of 24,000. Departmental lab facilities include Macintoshes for the introductory courses, and a network of Linux machines for use by students in intermediate and advanced courses. Further information about Bowdoin and the department is available at www.bowdoin.edu. Bowdoin is committed to equal opportunity through affirmative action. Women and members of minority groups are encouraged to apply.

### Carnegie Mellon University
Department of Engineering, Department of Public Policy, and Department of Computer Science

Carnegie Mellon seeks faculty candidates in information technology and public policy for a joint appointment between the Department of Engineering and Public Policy and the Department of Computer Science. Requires Ph.D. in CS, IS or computer engineering and demonstrated policy research skills. Topics of interest include: security; privacy, and vulnerability; interoperability and other standards; human interfaces; R&D policy; management of technical innovation; aids for decision making and policy analysis; resource equity; social impacts. Resume, references, and sample papers should be sent to: Granger Morgan, EPP, Carnegie Mellon, Pittsburgh, PA 15213

### Clemson University
Department of Computer Science
Lecturer Position

Applications are invited for a non-tenure-track lecturer position beginning August 15, 1998. Qualifications include a Ph.D. in Computer Science or an MS in Computer Science with substantial teaching experience. A strong commitment to high-quality undergraduate instruction is essential. The successful candidate must be able to work independently with highly motivated students. Salary is commensurate with experience.

The department has more than 350 undergraduate majors and more than 100 graduate students, and offers BA, BS, MS and Ph.D. degrees. Clemson University is the land-grant University of South Carolina and has an enrollment of more than 17,000 students. Clemson, SC is a small college town located on Lake Hartwell at the edge of the Blue Ridge Mountains.

Applicants should forward a curriculum vitae, along with three references that can attest to the candidate's teaching ability to:

Chair, Lecturer Search Committee
Computer Science Department
401 Edwards Hall
Clemson University
Clemson, SC 29634-1906

Screening will begin May 1, 1998 and will continue until the position is filled.

Clemson University is an equal opportunity, affirmative action employer.

### Computists International
Computists' Communique

For careers beyond programming: research jobs, competitions, AI/industry news, announcements. <www.computists.com>, laws@computists.com.

### IntelliGenesis Corp.

Start-up company located on Wall Street seeks creative minds for immediate employment. Requirements: a passion for making computers think, a familiarity with object-oriented programming (Java ideal; C++ OK), and decent English. Experience with GA's, NN's, Alife, NLP a plus. Informal working environment. E-mail resume to ben@intelligenesis.net.

### Mälardalen University
Department of Computer Science and Engineering (IDt)

The Department of Computer Science and Engineering (IDt) at Malardalen University, Vasteras, Sweden has openings for the following positions:

* Real-time Systems
  Lecturer/Researcher
  2 Ph.D. students
* Hardware
  Design Lecturer/Researcher
  2 Ph.D. students
* Computer Science
  Ph.D. student
  2 Lecturer/Researcher

More information about the positions can be found at http://www.idt.mdh.se/positions.html.

Mälardalen University (MdH) was established in 1977. Supported and encouraged by regional industry (e.g. ABB), MdH has become one of the fastest growing universities in Sweden. At this time, MdH ranks as the third largest Engineering educator; currently 8,000 students are studying at MdH.

Real-time Systems research was established at MdH around 1990 by three persons as a glue between academia and industry and has meanwhile grown to approximately 30 persons, 17 involved in research with 120 students starting each year. It has been identified (by the university board) as the research area of highest priority at MdH. In addition to strong industrial cooperation, the group became a member of CABERNET in 1997. IDt was host to the Euromicro Workshop on Real-time systems in 1994 and will be organizing the Euromicro Conference,1998.

Vasteras, a city of about 125,000 inhabitants, is located close to Lake Mälaren, about 100km west of Stockholm. It is the capital of the region of Mälardalen, which is the historic industrial center of Sweden. It hosts the headquarters of ABB Sweden.

### University of California, Santa Barbara
Department of Computer Science

The University of California, Santa Barbara invites applications for a faculty position in experimental computer science. For candidates with outstanding qualifications, a tenured appointment is possible. Applicants in all areas of computer science are welcome. However, the department emphasizes building strengths in software systems.

The Department of Computer Science is part of an expanding College of Engineering which encompasses over 100 faculty in various engineering disciplines. Excellent instruction and research computing facilities are available. UCSB is a major research institution, elected member of the Association of American Universities, as well as an integral part of the nine-campus University of California system (widely regarded as the most distinguished system of public higher education in the United States.) Graduate degrees in Computer Science are offered at the MS and Ph.D. levels.

Applicants should hold a doctoral degree in Computer Science or a related field; the appointment is scheduled to begin in 1998-1999. The position will be open until filled. Send resume and names of at least four referees to:

Recruitment Committee
Department of Computer Science
University of California
Santa Barbara, CA 93106-5110.

To apply by electronic mail, send the application in an ASCII or postscript file to: recruitment@cs.ucsb.edu. Additional information about the Computer Science Department may be found at www.cs.ucsb.edu.

### University of Houston
Texas Center for Computational and Information Sciences (TCCIS)

The Texas Center for Computational and Information Sciences (TCCIS) at the University of Houston seeks computer or computational scientists for projects with the DoD Modernization Program in the areas of computational electromagnetics, computational chemistry and fast parallel algorithms, and for NSF PACI funded projects with NPACI and the Alliance in the areas of distributed computation, wide area data caching, hierarchical storage management and parallel scientific software libraries. The TCCIS has excellent computational, visualization and networking resources. For details see http://www/tccis.uh.edu.

Required: Ph.D. in Computer or Computational Science; experience with parallel supercomputers or distributed computing (either systems or applications experience is acceptable); fluency in high-level and parallel computer languages.

Hiring Range: Salary commensurate with experience.

Send applications to:

Dr. Lennart Johnsson, Director
Texas Center for Computational and Information Sciences
PGH 592
University of Houston
Houston, TX 77204-3475
johnsson@cs.uh.edu, Fax: 713-743-3335,
Phone: 713-743-3374.

### University of Illinois at Chicago
Electrical Engineering and Computer Science Department

The EECS Department invites applications for tenure-track faculty at all levels, as well as instructors. A Ph.D. degree in computer engineering or computer science or its equivalent is required for tenure-track positions. Outstanding candidates in all areas will be considered, but we are especially interested in the following areas: computer networks; communication systems; multimedia systems; operating systems; computer systems security; hardware/software co-design; computer architecture; object-oriented design and systems; computer graphics; HCI; collaborative design; intelligent agents; interactive learning environments; fault tolerance and high-assurance information systems. All the candidates should have outstanding research and teaching potential. For information about our department, visit our webpage at http://www.eecs.uic.edu.

For full consideration, send a curriculum vitae and the names and addresses of at least three references by May 31st to (all applications will remain on file for one calendar year):

Professor Clement Yu
Search Committee Chair
Department of EECS (M/C 154)
851 S. Morgan Street, Room 1120 SEO
Chicago, IL 60607-7053.

The University of Illinois at Chicago is an Affirmative Action/Equal Opportunity Employer.

### University of Illinois
Beckman Institute,
Artificial Intelligence Group
Research Scientist

The Artificial Intelligence Group of the Beckman Institute for Advanced Science and Technology is seeking two full-time research scientists, with expertise in knowledge-based expert systems, uncertain reasoning, and machine learning. Of particular interest are applicants with expertise in Bayesian networks, artificial neural networks, and blackboard systems. The Beckman Artificial Intelligence Group is the primary center of artificial intelligence research at the University of Illinois, with twelve faculty members from departments across campus and over fifty graduate students. We seek someone who will be an active researcher and can assist with leading a research group.

Candidate must have a Ph.D. in computer science or a related field. This is a full-time, 12-month, academic professional position. The University of Illinois has a comprehensive benefits package. Salary is competitive and commensurate with experience. These positions are grant-funded; reappointments are contingent on continued funding. The current funding in place is for three and a half years.

The positions are open until filled. Starting date is as soon as possible. If interested, please send a description of background and interests, curriculum vitae, and the names of three references to:

Professor David Wilkins
Search Committee Chair
Beckman Institute, University of Illinois
405 North Mathews
Urbana, IL 61801
Phone: 217-333-2822

Applications by e-mail in Word, ASCII, or PostScript are preferred. Please e-mail: ai-search@odysseus.ai.uiuc.edu.

The University of Illinois at Urbana-Champaign is an Affirmative Action / Equal Opportunity Employer.

### University of Western Ontario
Law and the Department of Computer Science

The Faculty of Law and the Department of Computer Science invite applications for a full-time probationary tenure-track appointment at the rank of Assistant or Associate Professor to begin November 1, 1998. This position is a joint appointment between the two faculties. In addition to demonstrated ability in research and teaching, the successful candidate for this position must have expertise related to the ownership, control, licensing, and regulatory environments surrounding the international treatment of software technology and data. The successful candidate will bring enthusiasm, academic strength, and collaborative abilities to the Faculty of Law and Department of Computer Science.

The position requires demonstrably relevant research. The preferred qualifications are an LL.M. (or equivalent in Law) and a Ph.D. in Computer Science (or equivalent).

For further information please contact either Dean Eileen Gillese at the Faculty of Law at 519-679-2111 ext. 8404 or Professor Stephen Watt, Chair, Department of Computer Science at 519-661-4244. The deadline for receipt of applications is June 20, 1998. Interested candidates should forward a curriculum vitae and the names and addresses of three academic referees to:

The Joint Law/CS Appointments Committee
Josephine Spencer Niblett Building
The University of Western Ontario
London, Ontario, N6A 3K7.

Positions are subject to budget approval. In accordance with Canadian Immigration requirements, this advertisement is directed to Canadian Citizens and Permanent Residents of Canada. The University of Western Ontario is committed to employment equity, welcomes diversity in the workplace, and encourages applications from all qualified individuals including women, members of visible minorities, aboriginal persons, and persons with disabilities.

# CRA Conference at Snowbird '98

**The flagship conference for academic and research laboratory administrators interested in computing research issues.**

## Sunday, July 26

◆CRA Board of Directors Meeting 8:00AM-4:00PM
❖Registration 2:00PM-7:30PM
❖New Chairs Workshop 4:00PM-6:00PM
*Chairs:*
John Stankovic, University of Virginia
Peter Freeman, Georgia Institute of Technology

❖Welcome Reception 6:00PM-7:30PM
◆Dinner 7:30PM-9:30PM
**Speaker:**
Graham B. Spanier, President, Pennsylvania State University
Higher Education's Information Technology Agenda: A Presidential Perspective

## Monday, July 27

❖Breakfast Buffet 7:00AM-8:30AM
❖Registration 7:00AM-6:00PM
◆Welcome 8:30AM-8:40AM
**Speakers:**
Mary Jane Irwin, Academic Snowbird Chair, Pennsylvania State University
James Foley, Industrial Snowbird Chair, Mitsubishi Electric Research
◆Joint Academic/Industrial Plenary Session I 8:40AM-10:10AM
Human Resources: Where Are We Now? Where Do We Need to Be?
*Chairs:*
Mary Jane Irwin, Pennsylvania State University
James Foley, Mitsubishi Electric Research
**Speakers:**
Frances Allen, IBM TJ Watson Laboratory
L. Scott Perry, Advanced Platform Services
Andrew Bernat, University of Texas, El Paso
**Panelists**:
Peter Freeman, Georgia Institute of Technology
Richard Wirt, Intel
❖Break 10:10AM-10:30AM
◆Workshop I (parallel sessions) 10:30AM-NOON
❖Best Practices: Recruiting and Retaining Faculty and Students from Underrepresented Groups
*Chairs:*
Andrew Bernat, University of Texas, El Paso
Leah Jamieson, Purdue University
❖Taulbee Survey Report: What We Know, What We'd Like to Know
*Chairs:*
Dexter Kozen, Cornell University
Stuart Zweben, Ohio State University
❖Opportunities in Distance and Continuing Education in CSE
*Chairs:*
Christopher Lacher, Florida State University
Stephen Seidman, Colorado State University
❖Innovative Curricular Developments and Surviving Accreditation
*Chairs:*
Richard LeBlanc, Georgia Institute of Technology
Joseph Turner, Clemson University
❖Joint Academic/Industrial Workshop–Spinoffs and Spin-outs: Moving Ideas from the Research Lab into the World of Venture Capital
*Chairs:*
Peter Hart, Ricoh Silicon Valley
Mark Weiser, Xerox Palo Alto Research Center
**Speaker:**
Steve Weyl, Ricoh Silicon Valley, Inc.

❖Luncheon NOON-1:30PM
CRA Board Interaction with Conference Participants

◆Plenary Session II 1:30PM-2:30PM
❖Preparing for the 21st Century: The IT Revolution in Education
*Chair:*
Jeffrey Ullman, Stanford University
**Speakers:**
Murray Goldberg, University of British Columbia
Ellis Horowitz, University of Southern California
James Kurose, University of Massachusetts

◆Workshop II (parallel sessions) 2:30PM-4:00PM
❖What Everyone Should Know About Information Technology
*Chairs:*
Lawrence Snyder, University of Washington
Jeffrey Ullman, Stanford University
❖Department Management: Mentoring Junior Faculty
*Chair:*
Mary Lou Soffa, University of Pittsburgh
❖Software Engineering Programs, Curriculum and Control
*Chair:*
Kenneth Sevcik, University of Toronto
❖What's Happening at the Computer Science and Telecommunications Board (CSTB)
*Chair:*
David Clark, Massachusetts Institute of Technology, Chair CSTB
**Speakers:**
Marjory Blumenthal, CSTB
Jane Griffith, CSTB
❖Industrial Workshop–Managing Industrial Labs
*Chair:*
Mark Weiser, Xerox Palo Alto Research Center

❖Birds of a Feather/Open Networking 4:00PM-6:00PM
◆Dinner and State of the CRA Address 7:00PM-9:00PM
**Speakers:**
Edward Lazowska, CRA Board Chair, University of Washington
William Aspray, CRA Executive Director
The CRA Distinguished Service Award and the CRA A. Nico Habermann Award will also be presented.

## Tuesday, July 28

❖Breakfast Buffet 7:00AM-8:30AM

◆Plenary Session III 8:30AM-10:00AM
❖Current Trends in Science Policy As It Affects CSE
*Chair and Commentator:*
Fred Weingarten, CRA Director of Public Policy
**Speaker:**
Albert Teich, AAAS
❖Break 10:00AM-10:30AM
◆Workshop III (parallel sessions) 10:30AM-NOON
❖What's New at NSF/DARPA
*Chair:*
Edward Lazowska, CRA Board Chair, University of Washington
**Speakers:**
Juris Hartmanis, National Science Foundation
David Tennenhouse, DARPA
❖Department Management: Computing Labs–Equipment, Maintenance, Staffing
*Chair:*
James Morris, Carnegie Mellon University
❖Issues Faced by Primarily Undergraduate Departments
*Chair:*
Henry Walker, Grinnell College
❖Joint Academic/Industrial Workshop–Dealing With Intellectual Property Issues
*Chair:*
Randy Katz, University of California, Berkeley

❖Luncheon NOON-1:30PM
CRA Board Interaction with Conference Participants

◆Workshop IV (parallel sessions) 1:30PM-3:00PM
❖Communicating with Congress/Parliament
*Chairs:*
Peter Freeman, Georgia Institute of Technology
Fred Weingarten, CRA Director of Public Policy
❖Department Management: Budgeting, Buyouts and the Final Frontier (i.e., Space)
*Chairs:*
Miroslaw Truszczynski, University of Kentucky
Stephen Seidman, Colorado State University
❖Joint Academic/Industrial Workshop–Technology Transfer and Industrial Relations
*Chairs:*
Michael Pazzani, University of California, Irvine
Robert Ritchie, Retired (Hewlett-Packard)

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