COMPUTING RESEARCH NEWS

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NSF, DOD R&D slated for small increase

By Fred W. Weingarten
CRA Staff

With this year's budget and appropriations cycle still in shambles, the administration has moved on to next year's funding cycle with its release of the fiscal 1997 budget.

President Clinton is required by law to submit a budget at this time. So the release is not just a White House maneuver to show up a Congress that still has not passed all the 1996 appropriations bills. However, the administration used the opportunity to point out the irony. Of course, it is also an unwritten law that the congressional leadership will declare the budget "dead on arrival."

This ritual takes place no matter which party controls the White House, Senate or House. The president submits the budget; Congress reminds him that they control the purse. This year congressional rejection had a particularly authentic ring to it because of the exceptionally bitter history of the 1996 budget negotiations and the inevitable politics of an upcoming presidential election.

Table 1. NSF Funding by Program (in millions of dollars)

Directorate	1995 Actual	1996 Planned	1997 Request
Research & Related Activities			
Biological Sciences	301	300	26
CISE	258	255	277
Engineering	323	316	354
Geosciences	420	418	454
Mathematical & Physical Science	645	651	708
Social, Behavioral & Econ. Science	110	117	124
Other/misc.	224	217	529
Subtotal: Research & Rel. Activities	**2,281**	**2,274**	**2,472**
Education & Human Resources	612	599	619
Academic Research Infrastructure	117	100	0
Major Research Equipment	126	70	95
Salaries & Expenses	129	133	134
Office of Inspector General	4	4	5
Total NSF Budget	**3,270**	**3,180**	**3,325**

Although the budget as a whole faces a tough battle before it passes, it does contain useful clues to administration priorities for those concerned about research funding. After all, the appropriations bills for the two agencies of particular importance to computing research—the Defense Department and the National Science Foundation—passed last year, and both agencies were treated relatively well. Much to NSF's dismay, the larger appropriations package that contained its funding was vetoed. But the veto was aimed at the Environmental Protection Agency appropriations and had nothing to do with NSF.

The history of last year's congressional action suggests that the administration's R&D budget for these two agencies may not be far off the mark. Both the longer-term trends and the impact of the new Congress can be seen. For several years Defense R&D had been on a downward trend, which is no surprise. But the 1997 request of $38.3 billion is up slightly (.005%, or $172 million) from the 1996 estimated spending total. The push from Republicans to reverse the trend is also apparent, and the president's 1997 budget has reversed course in response.

NSF budget

For the past several years NSF's budget had been increasing—until the 1996 congressional action that, for the first time, resulted in a very small decrease from the previous year's actual spending total. That decrease occurred despite relatively benign treatment in Congress last year.

The realities of balancing the budget on the back of discretionary spending is no doubt what we are seeing. NSF's 1997 budget request is for $3.3 billion, up 4.6% from the 1996 spending estimate of $3.2 billion.

An important message contained in the budget is a sense of administration priorities. In NSF's request, computing research fared no better or worse than most other major scientific areas (see Table 1).

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CRA hires new executive director

By Dave Patterson
CRA Board Chair

I am delighted to announce that William Aspray recently joined the Computing Research Association as our new executive director. Bill comes highly recommended, with colleagues praising his skills at management and fund-raising. He is also a world-class computer historian, with graduate degrees in history and mathematics and an impressive record of research accomplishments. We believe his research interests will blend well with CRA's mission.

Our previous director, Fred "Rick" Weingarten, will continue part time with CRA working on government affairs. We wish to thank Rick for his outstanding service for the last five years in building CRA to its current reputation within the CS&E research community. Today CRA represents four societies (AAAI, ACM, IEEE/CS and SIAM) and more than 160 academic CS&E departments, industrial laboratories and supercomputer centers.

Bill served as director of the IEEE Center for the History of Electrical Engineering from 1989-96. During his tenure the center relocated to Rutgers University, where it was jointly operated by IEEE and Rutgers. A research program was established,

By C.E. Voelker

William Aspray

and existing programs in archives and public outreach were expanded. The staff tripled in size, with appointments of strong historians from major research universities. About $750,000 in research grants was raised, and an endowment of $2.7 million was established. Bill simultaneously held a position on the graduate faculty in history, was adviser to the Rutgers program in the history of technology, medicine and science and served as a member of the advisory board for the Center for the Critical Analysis of Contemporary Culture.

Before joining IEEE, Bill was associate director and acting director of the Charles Babbage Institute for the History of Information Processing at the University of Minnesota. Earlier in his career, he held faculty appointments in mathematical and computer sciences at Williams College and in the history of science at Harvard University.

Bill holds a bachelor's degree in mathematics and philosophy from Wesleyan University and a master's degree in mathematics from the same institution. He wrote a master's thesis in algebra before taking additional graduate work in mathematical logic at Princeton University, the University of Wisconsin and the University of Toronto. He received his Ph.D. in the history of science from Wisconsin in 1980 with a dissertation on Alan Turing and John von Neumann.

Bill has written or edited 10 books and 50 articles on the histories of computing, mathematics, electrical engineering, engineering management and technological competitiveness. These works include *John von Neumann and the Origins of Modern Computing* (MIT Press, 1990) and a popular history of the computer commissioned by the Alfred P. Sloan Foundation, *Computer: A History of the Information Machine* (with Martin Campbell-Kelly, Basic Books, forthcoming 1996).

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Letters may be edited for space and clarity.

Opinions

Web will change the role of journals

BY Jeff Ullman

What does dissemination of research mean in the day of the World Wide Web? There was a time when publishing meant sending a typed copy of a manuscript to a journal editor. Two years later, if you were lucky, you would have published a revised version of your article that satisfied the editor, referees and possibly yourself.

Then we began to notice that in computer science, at least, timeliness was critical. And the value of conference papers was recognized by the research community. Of course, that recognition rarely extended to university administrations, and the "conference versus journal" battle is still being fought at many schools.

In the bad old days, the role of professional societies such as ACM or IEEE was crucial. They appointed the editors, who in turn controlled the limited access to journal space and tried to fill that space with material of the highest feasible quality. Today the amateur has returned to the world of research publication. Anyone can write anything, put it up on the Web and have it read by far more people than would ever see it in a journal.

What are the implications of this new reality for the way we disseminate and evaluate research? There are powerful changes coming in the role of the professional societies, referees and editors. There are also opportunities to rethink the process of tenure and evaluation at research universities.

Ownership of intellectual property: When journals held sway, their economics forced professional societies and commercial publishers to guard closely their copyright to the research articles therein. Today the societies are rethinking their approach to intellectual property, but they need to go much further. Recall, the purpose of the societies is to facilitate dissemination of research, not to inhibit it.

There is simply no excuse for a publisher to ask for more than the right to publish, leaving control in the hands of the author who will undoubtedly get the bulk of exposure from electronic access to the work. If the publication of a journal or conference proceedings is not economically viable without exclusive right to the contents, then it is time to stop publishing paper copies.

Controlling the clutter: That is not to say the function served by journals, their editors and referees is archaic or superfluous.

The more research material there is out there, the harder it is for the researcher to focus on what needs to be examined. Journals, and to a lesser extent conference proceedings, do provide the service of selectivity.

Today, instead of journal editors, the societies need to lend their prestige to a network of area-editors who would be charged with knowing, evaluating for validity (perhaps with the help of referees) and eventually creating a Web page pointing to the most important online documents related to a particular subject. These subjects can be organized in a hierarchy, with different degrees of focus, just as today there are broad journals such as the *Journal of the ACM*, narrower journals and conferences, and highly specialized workshops, each playing an important role in the research dissemination picture. The role of area-editor should be similar in prestige and responsibility to that of journal editors or program-committee chairs today.

The tenure chase: I have for many years exposited, to any university official who would listen, the slogan "Impact, not publications. Conferences, not journals." I believe it fully. Letters from a large number of people in the candidate's field outlining the importance of their research—whether it be through papers, software creation, work on standards committees or whatever—are a better gauge of research achievement than the naive counting of papers.

Whether the majority of institutions will eventually start thinking about impact rather than publica-

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Publishing in journals still important

BY Franco P. Preparata and John E. Savage

The rapidly developing public interest in the World Wide Web is causing many in the research community to propose that the Web become an integral part of the publication process. Although technological breakthroughs often profoundly alter established modes of operation, it is important to choose carefully the options they offer without sacrificing the good features of the old modes.

Disclosure versus publication: In the dissemination of research results, we should distinguish between two major objectives: disclosure and publication.

Disclosure is used to make results immediately available to a research community. Traditionally this function has been served by author-published research reports and, to some extent, by conference proceedings for which the publication delay is within reasonable limits. For this function the World Wide Web is ideally suited. However, for it to be a success, the number of Web sites holding professional materials should be limited, and good Web search engines need to be employed.

Anyone who has spent more than a few minutes using one of the general Web search engines is aware of the enormous amount of highly superfluous material that can be generated. However, experience with area-specific database search programs, such as Glimpse, demonstrates they can be enormously useful. That's both good and bad news because it's easy for papers not indexed in well-known databases to get lost—like the proverbial needle in the haystack.

Unfortunately, the disclosure process described above does not offer the close scrutiny provided by the journal-reviewing process. Journal publication in computer science is typically handicapped by a very long reviewing process. However, the outrageous publication delays we experience today are not intrinsic to journal publication. In other fields, notably physics and biology, journal reviewing is done in a matter of months. In computer science, papers languish for years. Given the long delays in journal publishing it is no wonder some senior members in our field do not encourage it.

Reviewing practices: Conferences, by the very nature of their reviewing process, cannot provide the rigorous standards enforced by the best journals. Even the most prestigious and highly competitive conferences have popularized a style that at best falls short of standards and at worst hampers future research. Limited space has licensed withdrawal of details (proofs omitted). Unfortunately, this has become the practice even when the length of the paper is well below the allowed maximum. When a conference paper in this format is not expanded for journal publication, a potentially fruitful area of research is stifled.

Disclosure is necessarily generating clutter, and timeliness may fully justify this. It is the function of publication to redress this shortcoming by letting a vast peer community pass judgment on disclosed research. The World Wide Web could supplement traditional media in facilitating access. However, it could be dangerous to replace the traditional editor/referee pool with individuals fully in charge of selectivity. This would remove the feature of anonymity that is crucial to the maintenance of high standards.

Ownership of copyrights: The cost of journals continues to grow at an alarming rate. As a result, research libraries are dropping less popular journals to make room in their budgets for more popular ones. Journals are increasing their charges because their costs are growing. In the process, authors are losing opportunities to have their work read. This may be nothing more than a natural competitive process—one

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People in the News

Sloan Fellows announced

The Alfred P. Sloan Foundation recently selected 100 outstanding young scientists and economists to receive Sloan Research Fellowships. The 10 Computer Science Fellows and their research interests are:

Pankaj K. Agarwal: Duke University. Algorithms and combinatorial problems in geometry with applications in robotics, graphics and geometric optimization.

James H. Anderson: University of North Carolina. Focused mainly on mechanisms for concurrent object sharing in multiprocessor, real-time and distributed systems.

Sanjeev Arora: Princeton University. The approximation properties of NP-hard optimization problems. Interest in identifying problems that have (or do not have) good approximation algorithms.

Mary Baker: Stanford University. Distributed systems at many levels. Current focus on mobile and wireless computing issues, such as ubiquitous connectivity and performance bench-marking.

Martin Farach: Rutgers University. Computational molecular biology with emphasis on the construction of evolutionary trees and on string algorithm for nucleic acid comparison and database retrieval. Design and analysis of sequential and parallel algorithms.

Daphne Koller: Stanford University. Artificial intelligence and theoretical computer science with emphasis on dealing with uncertainty using principled mathematical tools from probability theory, decision theory and economics.

Ronitt Rubinfeld: Cornell University. In computational learning theory, investigating efficient algorithms for learning probabilistic finite automata. Also studying the correctness of computer systems.

Peter Schroder: California Institute of Technology. Developing mathematical and computational tools for making fast, efficient and robust computational systems for solving integral equations, PDEs and other large-scale simulation problems with high degrees of geometric complexity.

Shang-Hua Teng: University of Minnesota. Scientific computing, parallel computation, computational geometry, VLSI and circuit simulation, algorithms, combinatorial optimization and probabilistic analysis, distributed computing and cryptography.

David Zuckerman: University of Texas at Austin. The role of randomness in computation, complexity theory, expanders and their applications, random walks on graphs and cryptography.

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Brooks receives Bower Award

Frederick P. Brooks Jr. has won the 1995 Bower Award and Prize for Achievement in Science, the richest US prize in science. Brooks is the Kenan Professor of Computer Science at the University of North Carolina at Chapel Hill.

This international award is given by the Franklin Institute in Philadelphia and includes a gold medal and a cash prize of at least $250,000.

Brooks, who coined the term "computer architecture," was honored for "separat[ing] computer software from hardware, thereby allowing these two fundamental realms of the computer age to develop dynamically and independently; for originating the eight-bit byte to facilitate text processing; and for pioneering the application of computer graphics to a broad array of biomedical and engineering problems," the prize's citation said.

"This squarely places computer science as a discipline on a par with all the other hard sciences, where it should be but not always is," said Ruzena Bajcsy, professor of computer science at the University of Pennsylvania. "It has recognized a man who combines experimental and theoretical work in the best tradition, to which the Computer and Information Science Department at the University of Pennsylvania has adhered ever since the ENIAC."

ACM names award winners

The Association for Computing Machinery recently announced the winners of its awards for this year. (Other winners were announced in the March *CRN*.)

Software System Award. Awarded to an institution or individual(s) recognized for developing a software system that has had a lasting influence, reflected in contributions to concepts, in commercial acceptance or both. The prize includes $10,000; financial support for the award is provided by IBM Corp.
Winners: For the World Wide Web: Tim Berners-Lee, World Wide Web Consortium, and Robert Cailliau, CERN. For NCSA Mosiac: Marc Andreessen and Eric Bina, Netscape Communications Corp.

Allen Newell Award. Presented to an individual selected for career contributions that have breadth within computer science or that bridge computer science and other disciplines. The endowed award is supported by the American Association for Artificial Intelligence and by individual contributions.
Winner: Joshua Ledenberg, Rockefeller University.

Distinguished Service Award. Awarded on the basis of value and degree of service to the computing community.
Winner: Doris K. Lidtke, Towson State University.

Outstanding Contribution to ACM Award. The award may be given to up to three individuals a year. They are selected based on the value and degree of service to ACM.
Winner: A. Joseph Turner, Clemson University.

Doctoral Dissertation Award. Presented annually to the author(s) of the best doctoral dissertation(s) in computer science and engineering. The award includes $1,000 and publication of the dissertation(s) by Springer-Verlag.
Winners: Sanjeev Arora, University of California at Berkeley, and Dan Spielman, Massachusetts Institute of Technology.

NAE elects 78 new members

The National Academy of Engineering recently elected 78 new members and eight foreign associates. This brings the total US membership to 1,841 and the number of foreign associates to 156.

NAE membership is among the highest professional distinctions accorded to engineers, and membership is given to those who have demonstrated "unusual accomplishment in the pioneering of new and developing fields of technology," according to NAE. Newly elected engineers in computer science and related fields are:

Leonard M. Adleman: Henry Salvatori Professor of Computer Science, University of Southern California. For contributions to the theory of computation and cryptography.

Marc A. Auslander: Fellow, IBM Thomas J. Watson Research Center. For contributions to reduced instruction-set computing (RISC) systems.

Barry W. Boehm: TRW Professor of Software Engineering, University of Southern California. For contributions to computer and software architectures and to models of cost, quality and risk for aerospace systems.

David D. Clark: Senior research scientist and leader, Advanced Network Architecture Group, Massachusetts Institute of Technology. For design and development of efficient implementation techniques for Internet protocols.

Douglas C. Engelbart: Director, Bootstrap Institute. For work in computer user interfaces and the collaborative work systems they enable.

William H. Gates III: Chief executive officer, Microsoft Corp. For contributions to the founding and development of personal computing.

Andries van Dam: T.J. Watson Jr. Professor of Technology and Education and professor of computer science, Brown University. For contributions to computer graphics research and computer science education.

John E. Warnock: Chief executive officer, Adobe Systems Inc. For the invention and implementation of technologies for computer graphics, printing and publishing.

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CISE Special Projects	Rita Rodriguez 703-306-1980 rrodrigu@nsf.gov
CISE Education Infrastructure	Tse-Yun Feng 703-306-1981 tfeng@nsf.gov
CISE Research Infrastructure	Tse-Yun Feng 703-306-1981 tfeng@nsf.gov

Continued on Page 6

1997 Federal Budget

Budget from Page 1

The detailed numbers for the Computer and Information Science and Engineering Directorate show some indication of priorities (see Table 2).

NSF's three research divisions are each slated to receive significant boosts at the expense of the two infrastructure divisions: Advanced Scientific Computing, and Networking and Communications Research. The Cross-Disciplinary Activities Program receives the largest increase in terms of percentage and increment. CDA increased 33%, from $24 million in 1996 (estimated) to $31.9 million in 1997. This increase is due mostly to a $6 million rise in funding for instrumentation, part of an NSF-wide program initiative.

Although it does not show up explicitly in Tables 1 and 2, the CISE budget contains a $4.5 million reduction in its share of the funding for the High-Performance Computing and Communications (HPCC) program. Overall, NSF's contribution is down by $1 million, although the total interagency budget is up slightly. It is unclear whether this drop in NSF support also reflects a reduction in administration enthusiasm for HPCC.

Table 2. CISE Program Funding (in millions of dollars)

	1995 Actual	1996 Planned	1997 Request
Computer & Computation Res.	39.8	39.5	43.4
Info., Robotics & Intelligent Sys.	31.9	32.4	35.6
Microelec. Info. Processing Sys.	25.4	26.0	28.4
Advanced Scientific Computing	80.2	78.4	80.6
Net. & Commun. Res. Infrastruc.	56.9	54.8	57.1
Cross-Disciplinary Activities	23.7	24.0	31.9
Total CISE Funding	**257.8**	**255.0**	**275.6**

Table 3. HPCC Funding (in millions of dollars)

Agency	1995 Actual	1996 Planned	1997 Request
Commerce	30	31	34
DARPA	375	315	337
Education	16	12	18
Energy	119	121	125
EPA	12	12	6
HHS	68	81	87
NASA	131	116	104
NSF	297	291	280
Transportation	24	23	43
Veterans Affairs	24	21	16
Total HPCC Funding	**1,096**	**1,023**	**1,050**

HPCC

The HPCC program, a cross-agency initiative of the National Science and Technology Council, has been given a small increase of 3% overall. More interesting is the slight shift in funding priorities. As noted above, NSF participation is down by 4%, while Defense (DARPA) spending is up by 7%. The Transportation Department is nearly doubling its contribution, from $23 million to $43 million (see Table 3 for a breakdown by agency).

The DARPA and NSF numbers, although not the largest increases or decreases in terms of percentage, are particularly important because the two agencies together represent more than 60% of the total program funding and represent the heart of the basic research funding.

Also of interest, the Education Department increased its participation by 50%. This increase in the HPCC line, a reflection of the high priority the administration has placed on educational technology, illustrates the department's opinion that fundamental advances in computing technology will be needed to achieve real educational benefits from information technology.

As the budget is dissected and analyzed in the appropriations process, more details will emerge. Submitting the budget is only the first step in a long process that, as we have seen this year, can turn into an agonizing, never-ending story. But the basic message is hopeful for the short term:

- Despite enormous budget pressures, research is still in relatively good political standing.
- Despite fears to the contrary, computing research is still a strongly supported part of NSF's program.

However, only an extraordinary optimist would take either message for granted over the long term. Long-term prospects still look grim.

Funding from Page 5

CISE Minority Institutions Infrastructure	Harry Hedges 703-306-1981 hhedges@nsf.gov
CISE Instrumentation	Rita Rodriguez 703-306-1980 rrodrigu@nsf.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

Director; Assistant to the President for Science & Technology	John H. Gibbons 202-456-7116 jgibbons@ostp.eop.gov
Associate Director for Science	Ernie Moniz 202-456-6138 emoniz@ostp.eop.gov

CRN, Taulbee Survey on Web

The Computing Research Association has now made available on its World Wide Web server electronic versions of *Computing Research News*.

The service can be reached at http://www.cra.org/CRN/ and offers newsletter archives dating from 1991 to present in Adobe Acrobat and Postscript formats. Individual articles from January 1995 to present also are available in HTML format.

The Web interface allows users to search by keyword, author and section. CRA plans to extend the HTML-based archive back to 1991.

Send comments, criticisms or questions to webmaster@www.cra.org.

Also, the results from the 1995 CRA Taulbee Survey are now available from CRA's home page at http://www.cra.org/ in Adobe Acrobat and Postscript formats.

This is the 25th year of publication of the Computing Research Association's annual survey on the production and employment of Ph.D.s in computer science and engineering. Surveys are mailed to the departments in September.

The response rate continues to be quite high, about 91%, which is excellent for surveys of this kind. Statistical tables based on the survey are published each year in the January and March issues of *Computing Research News*.

An electronic graphical image of the tables published in the March issue is now available. In the coming months, CRA plans to offer survey data in other forms, including a more user-friendly HTML format.

Journals from Page 2

that will work itself out eventually. After all, unlimited growth in any area cannot continue indefinitely without depleting the available resources. Electronic publishing will change the cost structure of research publication and give authors and the reading public more opportunities. It is an exercise that needs to be played out.

A side effect of the high cost of publication is that many publishers are insisting that copyright laws be strictly enforced. Multimillion-dollar awards have been made to publishers by the courts. As a consequence, some universities have become extraordinarily sensitive to this issue.

For example, Brown is warning faculty members that they will be subject to sanctions if they do not follow the law exactly. When the law is explained, many of us find it not only ambiguous but very distracting. The good news is that the Association for Computing Machinery recently changed its policy to allow classroom use of its copyrighted material.

This enlightened policy should be emulated by other publishers—a position taken by the CRA Board at its December 1995 meeting—because it serves them and our research community.

Their copyright statements will be visible to student readers, drawing them to the publishers. Meanwhile the research material, which is supposed to serve the community, becomes more readily accessible.

John E. Savage is a professor of computer science at Brown University. Franco P. Preparata does research in computational geometry and parallel computation and is the Wang Professor of Computer Science at Brown.

WWW from Page 2

tions remains to be seen.

But whether they do or not, another profound change in the evaluation process is coming, courtesy of the Web. As a supplement to letters measuring impact, it is now possible to count hits on a Web document or page. It is time to change "publish or perish" to "get hit or get out."

While counting papers is next to irrelevant because almost anything can be published if one finds the right journal or conference, the Web allows us to measure something that could not before be measured: readership.

It has been argued that it is too easy to stimulate hits on a Web page or even mechanically generate them yourself. Admittedly, telling real hits from bogus ones is not a trivial problem, and I am not going to suggest I have an algorithm that cannot be defeated.

However, if the practice of measuring Web hits becomes important, I suspect there will be adequate study of the patterns of hits that represent real interest. And we shall be able to glean useful information from observed patterns.

Jeff Ullman is professor of computer science at Stanford University. He is a CRA Board member and chair of the CRA Editorial Board.

Professional Opportunities

CRN Advertising Policy

Send copy and payment for Professional Opportunities advertisements to Advertising Coordinator, *Computing Research News*, 1875 Connecticut Ave. NW, Suite 718, Washington, DC 20009. Tel. 202-234-2111; fax: 202-667-1066; e-mail: jbass@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 body text be set in bold; a word set in bold in the body of the ad counts as two.

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 at least 200 free words per dues year. CRA's standard advertising package includes running an ad in *CRN*, sending it to CRA's jobs@cra.org list and posting it to CRA's Jobs Index Web page 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 three-inch minimum. Ads must be submitted in camera-ready, offset (positives or negatives) or mechanical form. Please call for information on placing display ads for products or services.

Computing Research News is published six times per year: in January, March, May, September, November and December. 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.

Massachusetts Institute of Technology
Department of Electrical Engineering and Computer Science

The Telemedia, Networks and Systems Group is initiating new research activities in the areas of wireless networking, active networks and consumer-oriented information appliances. We are looking for a creative individual who is dedicated to leading-edge research in "systems," including networks, hardware, operating systems and programming environments.

This self-motivated researcher will be a key player in one or more of the new activities. This person will plan and conduct his or her individual research with minimal supervision, provide exemplary leadership to the group's graduate students and supervise undergraduate research projects. This person also will represent the group externally through interaction with sponsors, collaborative partners and the research community at large.

Requirements: Individuals applying for this position should have a Ph.D. in electrical engineering or computer science, a strong background in networks and distributed systems and research experience of relevance to one of the group's specific areas of investigation: networking and operating systems; information appliances; software-based signal processing; or digital RF communications, including multiple access protocols, channel coding and modulation. The ability to work both independently and effectively with others is a necessary qualification, as are good communication and writing skills.

Please send resumes (reference Job #95-0868R) to James McCarthy, E19-238, Massachusetts Institute of Technology, 77 Massachusetts Ave., Cambridge, MA 02139.

MIT is an affirmative action employer and welcomes applications from women and minority group members.

Santa Clara University
Department of Computer Engineering

The department anticipates an opening for a one-year visiting faculty position at the assistant or associate professor level for the 1996-97 academic year. Applicants must have a Ph.D. in computer engineering or computer science. The anticipated position is in the software area and, although applicants in any software specialization will be considered, we are especially interested in those who can teach software engineering, graphical user interfaces and Unix tool construction at the undergraduate level.

Santa Clara University is a private, Jesuit university located in the heart of Silicon Valley. The department offers B.S., M.S. and Ph.D. degrees, has nine full-time faculty and 40 adjunct faculty and serves approximately 120 undergraduate majors and 400 graduate majors. Additional information on the university and the department is available through http://www.scu.edu.

Applicants should submit a curriculum vitae and the names of at least three references to Dan Lewis, Chair, Department of Computer Engineering, Santa Clara University, Santa Clara, CA 95053. E-mail: dlewis@scu.edu.

Santa Clara University is an equal opportunity, affirmative action employer, and it actively seeks the candidacy of women and minorities.

Transylvania University
Computer Science Program

The Computer Science Program invites applications for a visiting or tenure-track position commencing in the fall of 1996. Transylvania is a private, liberal-arts college with a strong commitment to academic excellence. Applicants must have a Ph.D. in computer science. Salary and rank will depend on qualifications and experience. Exceptionally well-qualified candidates may be considered for a Bingham Excellence in Teaching Award, which supplements a faculty member's salary by $8,000 to $12,000 per year.

Send letter of application, resume, graduate transcripts, three letters of reference and a statement of teaching philosophy to James E. Miller, Chair, Division of Natural Sciences and Mathematics, Transylvania University, Lexington, KY 40508.

The search will remain open until the position is filled. See announcement on our Web page (http://www.transy.edu).

An equal opportunity employer.

State University of New York, Buffalo
Department of Computer Science

The Department of Computer Science seeks applications for a tenure-track faculty position at the assistant professor level. Only candidates with exceedingly high research promise will be considered. We seek candidates in experimental areas of computer science. Applicants with potential to work with researchers in other departments are preferred.

The department has 15 tenure-track faculty, numerous full-time lecturers, and research and adjunct faculty members. Primary research areas include artificial intelligence, computational complexity, computer vision, numerical linear algebra, parallel algorithms, pattern recognition, programming languages, systems and VLSI. Department members are actively engaged in interdisciplinary research with the Graduate Group in High-Performance Computing, Cognitive Science Center, Hauptman-Woodward Medical Research Institute, NSF National Center for Geographic Information and Analysis, and the Center of Excellence for Document Analysis and Recognition.

Address applications, including cover letter, curriculum vitae, a one-page research statement, and names and addresses of three references, to Professor Sreejit Chakravarty, Chair, Recruiting Committee, 226 Bell Hall, Department of Computer Science, State University of New York at Buffalo, Buffalo, NY 14260-2000. Tel. 716-645-3180, ext. 109; fax: 716-645-3464; e-mail: sreejit@cs.buffalo.edu. For more information about the department, visit our home page at http://www.cs.buffalo.edu.

Please request your references to either mail or fax their recommendation letters ASAP.

SUNY is an equal opportunity, affirmative action employer.

University of Western Ontario
Department of Computer Science

The Department of Computer Science at the University of Western Ontario invites applications for the position of chair. Candidates should have a Ph.D. in computer science or related discipline and show excellence in research, administration and teaching in computer science. This position is one of several openings in the department.

The Department of Computer Science currently has 19 regular faculty plus visiting and teaching faculty members. The department offers B.Sc., M.Sc. and Ph.D. degrees in computer science, with a student body of 50 graduate students and 750 undergraduate students. The university has taken the initiative to establish a new undergraduate program in software engineering. The department maintains an in-house, state-of-the-art computing environment consisting of 200 workstations and research facilities for graphics and imaging, parallel computing, distributed computing, multimedia, text processing, AI and vision, and computing facilities for the handicapped.

The department receives funding from NSERC, ITRC, industry and governmental agencies, such as the Canadian Genome Analysis and Technology Program and Agriculture Canada, for research into a broad range of areas including algorithms, artificial intelligence, computer graphics, databases, distributed computing, formal languages and automata, image processing, medical imaging, parallel computation, programming languages, software engineering and vision. NRC is establishing a new Integrated Manufacturing Technology Institute in the university's Research Park.

The deadline for applications is Sept. 1, 1996. The starting date is flexible but targeted as July 1, 1997. Applications should include the names of at least three referees and should be sent to Dr. C. Yong Kang, Dean, Faculty of Science, Western Science Centre, Room 191, The University of Western Ontario, London, Ontario, Canada N6A 5B7.

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.

University of North Carolina, Wilmington
Department of Mathematical Sciences

The Department of Mathematical Sciences has one tenure-track position as assistant or associate professor, to begin in August 1996. A Ph.D. in computer science is required. Preferred specialties are software engineering, image processing and computer networking.

The department has 35 full-time faculty and offers the B.S. degree in computer science, bachelor's and master's degrees in mathematics and several graduate courses in computer science. Screening of applications began March 11.

Send a letter of application, resume and names of three references to Douglas D. Smith, Chair, Mathematical Sciences Department, University of North Carolina at Wilmington, Wilmington, NC 28403-3297. E-mail: csposition@cms.uncwil.edu.

UNCW is an equal employment and affirmative action university.

Colgate University
Department of Computer Science

Colgate University invites applications for a one-year visiting position starting in fall 1996. A Ph.D. degree or equivalent with strong interest in both teaching and research are expected. Applicants are sought from all areas of computer science with preference given to candidates with expertise in operating systems.

Colgate University is a highly competitive liberal arts university situated in upstate New York. The university is committed to promoting excellence in both teaching and research.

Review of applications began May 1 and will continue until the position is filled. Resumes and three letters of recommendation should be sent to Chair, Faculty Search Committee, Department of Computer Science, Colgate University, 13 Oak Drive, Hamilton, NY 13346.

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

Oakland University
Department of Computer Science and Engineering

The Department of Computer Science and Engineering invites applications for two anticipated tenure-track positions at the assistant professor level to begin in August 1996. One position is in the area of software engineering (SE), the other in computer science. The SE position involves research and teaching in a new M.S. program in software engineering. The ideal expertise includes practical aspects of software engineering and its mathematical foundations. The CS position involves active research in computer science and teaching undergraduate and graduate CS courses.

Candidates should have a Ph.D. in computer science or computer engineering and strong interest in both research and teaching. For full consideration, applications should be submitted by May 15, 1996. Applications will be accepted until the positions are filled.

Applicants should send a letter of intent, resume, the names of three references, copies of publications and a statement of research and teaching interests to Professor Ronald Srodawa, Chair, Faculty Search Committee, Department of Computer Science and Engineering, Oakland University, Rochester, MI 48309-4401. E-mail: srodawa@oakland.edu.

For additional information about the department, college and the university, see http://unix.secs.oakland.edu.

Oakland University is an affirmative action, equal opportunity, ADA-compliant employer.

Computists' International
Computists Communique

Twice-weekly alerts to AI/IS/CS jobs, grant competitions, software announcements and advanced technology news. Ask for info or a departmental free trial. Dr. Kenneth Laws, laws@computists.com.

Special jobs issue added

CRA is pleased to announce the addition of a sixth issue of *Computing Research News*. Our first thought was to add a July issue so that *CRN* would be published bimonthly. But readers and advertisers convinced us that they would rather receive the sixth issue in December.

We have heard many times that a Professional Opportunities ad published in *CRN* (and distributed electronically to our jobs@cra.org list and the Jobs Index on our Web page) is an extremely effective way to reach highly qualified job applicants.

Because the end of the year is a busy recruiting time, the December *CRN* will be a special issue that focuses on employment-related topics. But we need your help to make this new issue a success. Readers: What information would you find useful or interesting? Send your ideas and comments to Joan Bass at jbass@cra.org. Advertisers: The deadline for submitting ads for this special jobs issue of *CRN* is November 1. Be sure to mark your calendar so that you don't miss this opportunity.

Conference News

CRA CONFERENCE AT SNOWBIRD ✦ JULY 14-16 ✦ SNOWBIRD, UTAH

The CRA Conference at Snowbird brings together the chairs of Ph.D.-granting departments of computer science and computer engineering as well as leaders from US industrial and government computing research laboratories. A number of other senior people from research groups, government, education and professional societies also attend. It is a relatively small (200-250 people), but very influential, group. The goal of the conference is to provide a context in which attendees can discuss practical and strategic issues facing their organizations. This opportunity to network with their peers is one of the most valuable aspects of the conference.

The CRA Conference at Snowbird '96 is focusing on changing research funding priorities in government and industry. These changes are bringing to a head fundamental questions about the relationship among universities, industry and government and about the missions of each of these organizations. The opportunity and the challenge are before us to rethink the education of our students, the position of computing in the scientific and engineering disciplines, and the nature of computing research and its relationship to the other goals of our organizations.

A special program for industrial research directors will run parallel to the regular conference program. The research directors will attend regular conference sessions and events and lead a joint plenary session as well as attend workshops specifically oriented toward issues of concern to industry.

For more information about the conference, contact CRA at tel. 202-234-2111; e-mail: info@cra.org; URL: http://www.cra.org.

Preliminary Agenda

Sunday, July 14

Registration 3:00PM–6:30PM

Welcome Reception 6:00PM–7:30PM

Dinner and State of the CRA Address 7:30PM–9:30PM
Speakers: David Patterson, chair of the CRA Board of Directors
William Aspray, CRA's executive director

The CRA Distinguished Service Award and the CRA A. Nico Habermann Award will be presented after dinner.

Monday, July 15

Breakfast Buffet 7:00AM–8:30AM

Plenary Session I: The Future of Academic Research 8:30AM–10:00AM
Speaker: To be announced

Morning Break 10:00AM–10:30AM

Workshop I (parallel sessions) 10:30AM–NOON
A. Discussion of Academic Research Plenary
Organizers: Ed Lazowska, University of Washington
Fred Weingarten, CRA
B. Department Management I: Research Support
Organizer: Greg Andrews, University of Arizona
C. ACM/IEEE-CS Initiative on Software Engineering as a Profession
Organizer: Barry Boehm, University of Southern California

Luncheon NOON–1:30PM
CRA Board members will host at each table and solicit input about conference themes and other issues of concern to the computing research community.

Plenary Session II: The Future of Education 1:30PM–2:30PM
Speaker: To be announced

Workshop II (parallel sessions) 2:30PM–3:30PM
A. Discussion of Education Plenary
Organizer: To be announced
B. Department Management II: Recruiting and Training Faculty and Students from Underrepresented Groups
Organizers: Jan Cuny, University of Oregon
Nancy Leveson, University of Washington
C. Computing, Communications and Public Policy
Organizers: Bill Wulf, University of Virginia
Marjory Blumenthal, National Academy of Sciences

Afternoon Break 3:30PM–4:00PM

Birds of a Feather/Open Time 4:00PM–6:00PM

Reception 6:00PM–7:00PM

Dinner 7:00PM–9:00PM
Speaker: Anne C. Petersen, deputy director of the National Science Foundation

Tuesday, July 16

Breakfast Buffet 7:00AM–8:30AM

Plenary Session III: The Future of Industrial Research 8:30AM–10:00AM
Organizer: Stuart Feldman, IBM T.J. Watson Research Center

Morning Break 10:00AM–10:30AM

Workshop III (parallel sessions) 10:30AM–NOON
A. Discussion of Industrial Research Plenary
Organizer: Stuart Feldman, IBM T.J. Watson Research Center
B. Department Management III: Faculty and Students
Organizer: Mary Jane Irwin, Pennsylvania State University
C. NSF Funding Opportunities
Organizer: John Cherniavsky, National Science Foundation

Luncheon NOON–1:30PM

Workshop IV (parallel sessions) 1:30PM–3:00PM
A. Department Management IV: Equipment and Facilities
Organizer: John Werth, University of Texas at Austin
B. Influencing Government Policy
Organizers: Ed Lazowska, University of Washington
Fred Weingarten, CRA
C. The World Wide Web in Research and Education
Organizer: Jeff Ullman, Stanford University

REGISTRATION

To receive a CRA Conference at Snowbird '96 registration form, contact CRA at tel. 202-234-2111; fax: 202-667-1066; or e-mail: info@cra.org. Specify whether you want a hard copy or an electronic version of the registration form.

The registration fees, which include all conference meals, are as follows:

	By May 31	After May 31
CRA Member	$425	$450
Non-member	$575	$600
Spouse/Guest	$200	$225

ACCOMMODATIONS

The conference hotel is the Cliff Lodge at Snowbird Ski & Summer Resort. All hotel accommodations must be arranged through CRA. Do not contact the hotel directly. Hotel accommodations are limited and available on a first-come, first-serve basis.

The daily room rates (not including meals and 9.63% lodging/state tax):

Bedroom	$89/night
Deluxe Bedroom	$136/night
One-Bedroom Suite	$225/night
Two-Bedroom Suite	$361/night

TRANSPORTATION

Reduced airfares are available to Salt Lake City on Delta Airlines by calling American Express Travel Services. Attendees traveling on Delta will be eligible for a 5% discount off any Delta domestic published fare; all rules apply. Or receive a 10% discount off the Y fares. This special CRA fare can only be obtained by calling American Express Travel Services (AETS) at 800-340-1965. Your tickets will be issued after payment has been received by AETS.

Ground transportation between the resort and airport is available through Canyon Transportation. Round-trip fare is $34. Reservations are required and can be made in advance through AETS. The price is good between the hours of 9AM-10PM on arrival and 6AM-7PM on departure. Before or after those hours, it is a three-seat minimum charge of $48 one way.

Special discounts are available through Avis Rental Car. To obtain these special rates, call AETS and indicate you are attending this conference.

CANCELLATIONS

Cancellation requests received in the CRA office by July 1 will result in a full refund of the hotel deposit and conference registration fee. A $50 cancellation fee will apply. No refunds will be made after this date. You may send a substitute in your place.