Software maintenance objectives*

by NED CHAPIN
InfoSci, Inc.
Menlo Park, California

ABSTRACT

Recent survey work indicates that the objectives held by managers of maintenance for application software are partially out of step with the managers' own perceptions of the demands on them. This is a possible cause of maintenance difficulties, to the extent that maintenance managers do guide their behavior by their professed objectives. It is a likely cause of maintenance difficulties if software maintenance is regarded as a service function in an organization, which the survey indicates is the case.

*This paper was presented at the 1982 National Computer Conference, but it was mistakenly omitted from the 1982 Proceedings and thus appears in this year's Proceedings. It was not presented as part of a 1983 NCC session. AFIPS appreciates Dr. Chapin's contribution to NCC 1982 and regrets the omission of the paper from last year's publication.
INTRODUCTION

The management of software maintenance for application software affects what maintenance is done, when it is done, and how it is done. Software maintenance is managed by supervisors, team leaders, project leaders, programming managers, maintenance managers, and sometimes even by programmers. For convenience and briefness in wording, the term maintenance manager is used here for any person, whatever his or her job title, who manages software maintenance.

By software maintenance is meant work performed on existing computer programs and systems to correct their performance (for example, to restore to operation after a failure), to adapt them to changed operating environments (for example, to fit with a change in the operating system), to enhance their performance, to include new or different functions, or to delete functions (for example, to add a new output report). The most important influence on this definition of maintenance is the administrative judgment of how large an enhancement must be to be classified as new development instead of maintenance.

As the total amount of maintenance to be done gradually grows, so also grows the effect of the way that the maintenance work is managed. The swelling backlog of work waiting to be done, the relatively high cost of maintenance, and the lag from request to completion, have all been pointed to as evidence of increasing problems in managing maintenance.

As part of a study of the causes of maintenance problems, 15 managers from 12 organizations were surveyed about the demands on them and their objectives in managing maintenance work. The report that follows describes the character of the response, and discusses its implications. This study is a companion to one reported previously at the 1981 National Computer Conference.

RESPONSES

The respondents (maintenance managers) were asked two questions. The first question was what their objectives were in managing maintenance work. Later on the same day, a second question was put: What were the demands made on them in managing maintenance work? Both questions sought open-ended responses and gave the respondents freedom to frame, organize, and order their responses as they saw fit. Essays were not expected but were acceptable, and multiple-choice and true/false responses were neither asked nor encouraged.

In making their responses, the managers had the opportunity to discuss their possible responses with one or two other maintenance managers, and they were encouraged to do so.

The responses were also sometimes orally commented on by still other maintenance managers; the respondent was allowed to reply orally but not to change the response. In general, nearly all maintenance managers spoke of their jobs just as they saw them, and were respected for that by the other maintenance managers.

The responses fell predominantly into five categories, but with some notable exceptions as described later. Which category a response fell into depended partly on how the response was expressed, partly on its implications. Some responses fell into more than one category.

The first category focused on the managers' supervisors. The objectives here were to secure recognition of accomplishment. The demands seen from this source were to use resources well and make do with existing conditions.

A second category focused on the organization. The objectives of maintenance managers here were to exercise control to keep systems running. The demands seen from this source involved schedules and budgets, and keeping up communications.

A third category of response focused on the user community. The objectives here were aimed at keeping the user satisfied or even happy. The demands seen from this source mostly concerned how maintenance service was provided.

A fourth category focused on the managers' subordinates. The objectives here dealt with providing acceptable work conditions. The demands involved morale.

A fifth category focused on closely related organizational units, such as computer operations, systems, and procedures, EDP auditing, and data entry. The objectives here dealt with avoiding difficulties. The demands seen involved performance aspects of the software.

Table I lists some representative objectives, and Table II lists some representative demands. For convenience in reading, the table entries shown have been classified by category. Note that the numbering assigned to the categories is arbitrary, though reflective of general management thinking. The ordering of the items within each category, however, is totally without significance and entirely arbitrary.

FINDINGS

The findings here, as in many other studies, depend in part on the manner of collecting the responses. The objectives and demands were separately solicited without first pointing out to the respondents any connection or relationship between them. Both sets of responses were solicited from the same respondents in the context of examining management practices affecting maintenance.
TABLE I—Representative held objectives identified by maintenance managers

<table>
<thead>
<tr>
<th>Category 1. Toward supervisors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do maintenance effectively</td>
</tr>
<tr>
<td>Reduce costs for work accomplished</td>
</tr>
<tr>
<td>Get recognition for job done</td>
</tr>
<tr>
<td>Use resources effectively</td>
</tr>
<tr>
<td>Keep within estimates</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Category 2. Toward the organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Keep systems running</td>
</tr>
<tr>
<td>Act to fit plan, do not react</td>
</tr>
<tr>
<td>Keep control over maintenance</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Category 3. Toward the user community</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improve communication with users</td>
</tr>
<tr>
<td>Keep users happy</td>
</tr>
<tr>
<td>Provide good estimates promptly</td>
</tr>
<tr>
<td>Satisfy users' requests</td>
</tr>
<tr>
<td>Provide a smooth transition from development</td>
</tr>
<tr>
<td>Get recognition for a good job done</td>
</tr>
<tr>
<td>Increase users' involvement</td>
</tr>
<tr>
<td>Reduce problem areas</td>
</tr>
<tr>
<td>Make changes in a timely fashion</td>
</tr>
<tr>
<td>Prevent users from moving the target</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Category 4. Toward subordinates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improve morale</td>
</tr>
<tr>
<td>Keep people motivated</td>
</tr>
<tr>
<td>Provide growth potential</td>
</tr>
<tr>
<td>Make maintenance work desirable</td>
</tr>
<tr>
<td>Keep subordinates happy</td>
</tr>
<tr>
<td>Provide training</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Category 5. Toward related organizational units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use less computer time</td>
</tr>
<tr>
<td>Do less testing</td>
</tr>
<tr>
<td>Satisfy EDP audit requirements</td>
</tr>
<tr>
<td>Analyze production problems</td>
</tr>
</tbody>
</table>

Unclassified

Before being asked for held objectives and seen demands, the respondents were each asked to what extent they believed that in their organizations the unit charged with doing maintenance work on application software was a "service unit." All of the respondents indicated that they regarded themselves as working in service units. By a "service unit" was meant a unit whose mission, function, and task is to support the functioning of other organizational units of the same parent organization—not, for example, to operate as a profit center selling software maintenance in the open market to any customer. Most maintenance units (but not all) also had software development responsibilities.

The findings from the survey showed much variation in the degree of correspondence between managers' held objectives and seen demands. Some managers displayed a close match. Others displayed large discrepancies. The results reported here are for the aggregate; hence they are not necessarily fully applicable as a picture of the way any one particular maintenance manager sees himself or herself.

An interesting aspect of the findings was the scant attention most maintenance managers gave to ordering either their held objectives or seen demands. Apparently, they do not usually think of them in terms of a hierarchy of priorities. Rather, maintenance managers think of them as associated, sometimes causally; hence the managers take a linear or sequential view of them. Thinking of one objective or demand reminds them of another, which in turn calls to mind still another, and so on, with scant attention to their relative importance.

The most significant finding from the survey was of a mismatch between the managers' objectives, and the demands they saw placed on them. Although partial overlap was present, both the set of held objectives and the set of seen demands covered areas and specific items not covered by the other. While a perfect match was not expected, the overall magnitude and character of the mismatch was unexpected.

This mismatch showed the maintenance manager as having many objectives and no demands in the category of convenience. In fact, this was the largest category of objectives. A mismatch was expected here, but not to the major extent observed. Examples of some of the convenience objectives cited were not to get home late, to have a better qualified staff of subordinates, to consolidate related requests, to have time to test completely, to make maintenance work easier to manage, and to work on a planned rather than a reactive basis. The picture is one of putting self, not the user and not the organization, first.

The user category had the largest number of seen demands, and the second largest number of held objectives expressed. The tenor of the demands was that the users seemed to be acting as though they were buyers of services. Yet the objec-
tives the maintenance managers held were only in part those of vendors of services. Rather than being a crisp "provide what he wants, when he wants it, and at an agreed price," the objectives were diffuse and means oriented, including such items as increasing user involvement, providing a smooth transition, reducing problem areas, keeping users happy, and getting recognition. When such patterns occur in lines of work other than computer software, the usual interpretation is that the manager is experiencing difficulty in providing performance, either from management incompetence, inappropriate resources, or inadequate work methods used by subordinates, or from some combination of them. Whether this interpretation also applies to software maintenance, or not, is unknown.

The supervisor category suggests that the maintenance managers picture their supervisors as wanting them to make do with what they have, yet to adjust to changing requirements as well. The managers' held objectives focus on keeping within estimates, reducing costs, and getting recognition. The match for this category is the closest of all the categories, yet it still shows some divergence.

In contrast, the subordinates category is very divergent. The only common seen demand is ill-defined: improve morale. The held objectives were generally vague, such as to keep subordinates happy, to keep them motivated, and to make maintenance desirable. The maintenance manager appears to be out of touch with his or her subordinates. Yet subordinates are the means by which the maintenance service is accomplished.

The organization was seen as above average in the number of seen demands but low in the number of held objectives. The demands were specific and involved administrative procedures or practices, such as filling out reports or meeting deadlines. In contrast, the held objectives were very general, such as keeping the systems running and providing control. Apparently there are feelings of psychological distance, and the maintenance managers do not feel themselves to be part of the organizational team.

Finally, the managers had very few held objectives in the related organizational-units category, yet demands were seen as present. No convincing interpretation has been found yet for this mismatch, other than a reinforcement of the psychological-distance interpretation noted above.

In summary, the message that emerges is that the objectives held by the maintenance managers do not focus closely on the demands that they perceive. Apparently the managers see themselves, except as regards their relations with superiors, as concerned with trying to keep afloat and with side issues rather than directly with providing service to the user community. This is consistent with the findings of another survey.

A hint of confirmation is available from informal conversations with user representatives. About a third of the user organizations contacted complained that they were not being adequately serviced. Their maintenance needs were not being attended to at a level commensurate, they believed, with their financial contribution (implicit or explicit) to paying for the maintenance effort. They believed that they were paying for more service than they were getting; the most frequent culprit they saw was the maintenance managers' “misdirected ef-

forts.” It would be interesting to compare the maintenance managers' held objectives with what the users and others in their organizations regard as their claims upon the maintenance managers.

DISCUSSION

The most probable causes of a self-view of the sort just noted are the maintenance managers' choices of objectives, the emphasis they give to achieving them, and the constraints that are beyond their abilities to affect. Let us look at each cause.

The constraints on the managers in the very near term (such as this week) are real and intractable. The code is what it is, the subordinates' skills are what they are, and the computer programs to be run are mostly set. In the face of this fixity, bugs appear unpredictably, changes requiring unpredictable amounts of effort are to be made in the software, and other work may take away from the available staff and computer time, according to the maintenance managers. Many maintenance managers appear to set as their objectives what will let them live with these constraints from day to day, indefinitely.

Many of the constraints on the managers in the longer term, say a year from now, are tractable. For example, in a year's time subordinates' skills and work practices can be drastically changed, code can be made more maintainable, and user needs can be in part anticipated and deliberately scheduled for satisfaction—if the maintenance managers so choose. However, informal conversation indicates that many maintenance managers believe themselves to be powerless or their hands to be tied—"Who's going to pay for it?" and "They won't let me do it," they say. In other lines of management work, such views are often regarded as focusing on the problem rather than on the opportunity, a sign of weakness in management. Whether or not this is also true in software maintenance has not been established.

Managers always give more emphasis or attention in their performance to meeting some objectives than to others. The choices managers make reflect personal preferences, personality, and the mix of skills, as well as a conflict between lip-service and performance. It is just human nature for managers to emphasize what they are comfortable with and what they like to do. The element of job security also affects the emphasis too. The old saw about programmers creating job security by documenting nothing and writing opaque code seems also to apply to some maintenance managers. Keeping a big backlog of unsatisfied user demands is apparently seen by a few maintenance managers as not only ensuring job security but also strengthening requests for increases in the manager's pay and status.

Managers' choices of objectives are really statements of the terms in which the managers see their jobs. Managers can express these in any way they like. Managers may elect to ignore nearly all of the demands they see and to concentrate objectives on other matters. Or at the other extreme, managers can match, nearly one-for-one, objectives against demands. Managers set their own objectives, because other objectives—such as those they hear their bosses pushing—are
by definition not the managers' objectives but rather just some more demands upon them. The critical factor is the extent to which their behavior is guided by the held objectives. Managers who profess one thing and then do something inconsistent with it usually get unfavorable attention from their supervisors and associates. Whether or not this is also true for maintenance managers has not been established.

CONCLUSION

The survey reported here has highlighted a discrepancy between the objectives and the demands that maintenance managers see as defining their jobs. The reality that the managers live with is the reality they see—the seen demands, and their choices of objectives. In a service organization, the held objectives and the seen demands should match fairly closely, if objectives direct or guide performance. The survey reported here found a mismatch, with differences in the type, number, and quality of the held objectives and those of the seen demands. Under the assumption just noted, this mismatch is a significant cause of difficulty in managing maintenance.

REFERENCES

1983 NATIONAL COMPUTER CONFERENCE COMMITTEES

PROGRAM COMMITTEE

Chairman
Allen N. Smith
Atlantic Richfield Company
Los Angeles, CA

Vice-Chairman
Daniel J. Drageset
Atlantic Richfield Company
Los Angeles, CA

Members
Lorette L. Cameron
ARCO Metals
Rolling Meadows, IL

Tom Fox
Foxware Systems Corp.
Irvine, CA

Donald R. Hyde
IBM
San Jose, CA

David L. Holzman
Holzman & Associates, Inc.
Manhattan Beach, CA

Richard Lampman
Hewlett-Packard Company
Cupertino, CA

Ronald S. Lemos
California State University
Dominguez Hills
Carson, CA

Lance Leventhal
Emulative Systems Co.
San Diego, CA

Bennet P. Lientz
University of California, Los Angeles
Los Angeles, CA

Randy J. Piel
American Bell, Inc.
Lincroft, NJ

Toni Shetler
TRW
Redondo Beach, CA

Eugene B. Smith
U.S. Department of Agriculture
Beltsville, MD

Todd Ziesing
Ross Systems, Inc.
New York, NY

CONGRESS STEERING COMMITTEE

General Chairman
Don B. Medley
California State Polytechnic University
Pomona, CA

Vice-Chairman
James J. Keil
Xerox Corporation
El Segundo, CA

Program Chairman
Allen N. Smith
Atlantic Richfield Company
Los Angeles, CA

Professional Development
Seminars Chairman
George R. Eggert
DCASR, Chicago
Department of Defense
Chicago, IL

Donald R. Hyde
IBM
San Jose, CA

David L. Holzman
Holzman & Associates, Inc.
Manhattan Beach, CA

Richard Lampman
Hewlett-Packard Company
Cupertino, CA

Ronald S. Lemos
California State University
Dominguez Hills
Carson, CA

Lance Leventhal
Emulative Systems Co.
San Diego, CA

Bennet P. Lientz
University of California, Los Angeles
Los Angeles, CA

Randy J. Piel
American Bell, Inc.
Lincroft, NJ

Toni Shetler
TRW
Redondo Beach, CA

Eugene B. Smith
U.S. Department of Agriculture
Beltsville, MD

Todd Ziesing
Ross Systems, Inc.
New York, NY

Finance Chairman
Richard B. Blue, Sr.
TRW
Redondo Beach, CA

Operations Chairman
Mary L. Rich
PFS, Inc.
El Segundo, CA

Registration Chairman
Ron Colman
California State University, Northridge
Northridge, CA

Human Resources Chairman
C. E. Dettman
City of Burbank
Burbank, CA

Special Activities Chairman
Harvey Marks
Transaction Technology Inc.
Santa Monica, CA

Communications Chairman
Ted E. Lorber
Cochrane, Chase, Livingston & Co.
Irvine, CA

Advisor
Herbert B. Safford
GTE Data Services, Inc.
Marina Del Rey, CA

NCC Liaison
Jerry L. Koory
The Rand Corporation
Santa Monica, CA

AFIPS Representative
Jim Kroell
AFIPS
Arlington, VA

Secretary
Bill Fowler
The Rand Corporation
Santa Monica, CA

From the collection of the Computer History Museum (www.computerhistory.org)
ADVISOR COMMITTEE

Chairman
Herbert B. Safford
GTE Data Services, Inc.
Marina Del Rey, CA

Members
Linda T. Taylor
Gaskell & Taylor Engineering, Inc.
Los Angeles, CA

Barbara McNurlin
Canning Publications
Torrance, CA

OPERATIONS COMMITTEE

Chairman
Mary L. Rich
PFS, Inc.
El Segundo, CA

Members
Cheryl Chapman
Xerox Corporation
El Segundo, CA

Steve Herold
Ford Aerospace
Costa Mesa, CA

Virginia Lashley
Glendale Community College
San Marino, CA

Sam Lippman
AFIPS
Arlington, VA

Barbara McNurlin
Canning Publications
Torrance, CA

Robert L. White
Bureau of Census
Washington, DC

PIONEER DAY COMMITTEE

Chairman
Robert V. D. Campbell
The MITRE Corporation
Bedford, MA

Members
Peter McKinney
Harvard University
Cambridge, MA

Richard M. Bloch
R. M. Bloch Associates
Newton, MA

Mort Bernstein
System Development Corporation
Santa Monica, CA

William Aspray
Harvard University
Cambridge, MA

I. Bernard Cohen
Harvard University
Cambridge, MA

Robert L. Ashenhurst
University of Chicago
Chicago, IL

Henry S. Tropp
Humboldt State University
Arcata, CA

Gwen Bell
The Computer Museum
Marlboro, MA

J. A. N. Lee
Virginia Polytechnic Institute and State University
Blacksburg, VA

From the collection of the Computer History Museum (www.computerhistory.org)
### PROFESSIONAL DEVELOPMENT SEMINARS COMMITTEE

**Chairman**  
George R. Eggert  
DCASR, Chicago  
Department of Defense  
Chicago, IL  

**Members**  
Evelyn Teed  
Data Entry Specialists  
Phoenix, AZ  

Sonya (Sam) Anderson  
T. H. Garner Co., Inc.  
Claremont, CA  

Newell Moore  
Coast Industrial Exchange  
Chatsworth, CA  

Evelyn Babler  
Defense Logistics Agency  
Cameron Station, VA

### REGISTRATION COMMITTEE

**Chairman**  
Ron Colman  
California State University, Northridge  
Northridge, CA  

**Members**  
Robert L. White  
Bureau of Census  
Washington, DC  

Shirley Taylor  
Property Tax Service  
Newport Beach, CA  

Barbara Mandell  
Barbara Mandell & Associates  
La Habre, CA

### SPECIAL ACTIVITIES COMMITTEE

**Chairman**  
Harvey Marks  
Transaction Technology Inc.  
Santa Monica, CA  

**Members**  
Carol Johnson  
U.S. Department of Agriculture  
Beltsville, MD  

Lora Meise  
Comprehensive Software  
Los Angeles, CA  

Stuart Shaffer  
Litton Industries  
Woodland Hills, CA  

Mike Marks  
Transaction Technology Inc.  
Santa Monica, CA  

Robert V. D. Campbell  
The MITRE Corporation  
Bedford, MA
## NCC '83 SESSION LEADERS

<table>
<thead>
<tr>
<th>Name</th>
<th>Organization/Institution</th>
<th>City/State</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evelyn S. Arkush</td>
<td>Index Systems</td>
<td>Cambridge, MA</td>
</tr>
<tr>
<td>Gary Arlen</td>
<td>Arlen Communications, Inc.</td>
<td>Bethesda, MD</td>
</tr>
<tr>
<td>Robert Ashenhurst</td>
<td>University of Chicago</td>
<td>Chicago, IL</td>
</tr>
<tr>
<td>Herbert V. Bertine</td>
<td>American Bell, Inc.</td>
<td>Lincroft, NJ</td>
</tr>
<tr>
<td>Naomi Lee Bloom</td>
<td>American Management Systems, Inc.</td>
<td>Arlington, VA</td>
</tr>
<tr>
<td>Grady Booch</td>
<td>Consultant</td>
<td>Lakewood, CO</td>
</tr>
<tr>
<td>Alfred Bork</td>
<td>University of California, Irvine</td>
<td>Irvine, CA</td>
</tr>
<tr>
<td>Louis J. Brocato</td>
<td>U.S. Department of Agriculture</td>
<td>Beltsville, MD</td>
</tr>
<tr>
<td>Howard Bromberg</td>
<td>Bromberg Computer Consultants</td>
<td>Mill Valley, CA</td>
</tr>
<tr>
<td>J. Stephen Brugler</td>
<td>Telesensory Systems, Inc.</td>
<td>Palo Alto, CA</td>
</tr>
<tr>
<td>Lorette Cameron</td>
<td>Atlantic Richfield Co.</td>
<td>Rolling Meadows, IL</td>
</tr>
<tr>
<td>Dr. Ned Chapin</td>
<td>InfoSci, Inc.</td>
<td>Menlo Park, CA</td>
</tr>
<tr>
<td>David M. Chereb</td>
<td>Getty Oil Company</td>
<td>Venice, CA</td>
</tr>
<tr>
<td>I. Bernard Cohen</td>
<td>Harvard University</td>
<td>Cambridge, MA</td>
</tr>
<tr>
<td>Steve Cooper</td>
<td>Intel Corporation</td>
<td>Aloha, OR</td>
</tr>
<tr>
<td>Dr. Daniel J. Cougar</td>
<td>University of Colorado</td>
<td>Colorado Springs, CO</td>
</tr>
<tr>
<td>Thomas B. Cross</td>
<td>Cross Information Company</td>
<td>Boulder, CO</td>
</tr>
<tr>
<td>Dr. Carl Davis</td>
<td>Ballistic Missile Defense</td>
<td>Huntsville, AL</td>
</tr>
<tr>
<td>Dr. Gordon B. Davis</td>
<td>University of Minnesota</td>
<td>Minneapolis, MN</td>
</tr>
<tr>
<td>Larry E. Druffel</td>
<td>Department of Defense</td>
<td>Washington, DC</td>
</tr>
<tr>
<td>Philip Evans</td>
<td>Ferox Micro Systems</td>
<td>Arlington, VA</td>
</tr>
<tr>
<td>Martha Evans</td>
<td>Illinois Institute of Technology</td>
<td>Chicago, IL</td>
</tr>
<tr>
<td>William E. Farley</td>
<td>Lee College</td>
<td>Austin, TX</td>
</tr>
<tr>
<td>James L. Flanagan</td>
<td>Bell Laboratories</td>
<td>Murray Hill, NJ</td>
</tr>
<tr>
<td>Dr. Jason Frand</td>
<td>University of California, Los Angeles</td>
<td>Los Angeles, CA</td>
</tr>
<tr>
<td>Barry Frankel</td>
<td>Applied Data Research, Inc.</td>
<td>Princeton, NJ</td>
</tr>
<tr>
<td>Wayne Green</td>
<td>Wayne Green, Inc.</td>
<td>Peterborough, NH</td>
</tr>
<tr>
<td>Michael Hammer</td>
<td>Hammer &amp; Company</td>
<td>Cambridge, MA</td>
</tr>
<tr>
<td>Hal Hart</td>
<td>TRW</td>
<td>Redondo Beach, CA</td>
</tr>
<tr>
<td>Dr. Paula Hawthorn</td>
<td>Lawrence Berkeley Lab</td>
<td>Berkeley, CA</td>
</tr>
<tr>
<td>David M. Herstad</td>
<td>Arthur Andersen &amp; Co.</td>
<td>Los Angeles, CA</td>
</tr>
<tr>
<td>David Holzman</td>
<td>Holzman &amp; Associates, Inc.</td>
<td>Manhattan Beach, CA</td>
</tr>
<tr>
<td>Dr. David G. Hopelain</td>
<td>Jet Propulsion Labs</td>
<td>Pasadena, CA</td>
</tr>
<tr>
<td>Portia Isaacson</td>
<td>Future Computing, Inc.</td>
<td>Richardson, TX</td>
</tr>
<tr>
<td>Dr. Evan Ivie</td>
<td>Brigham Young University</td>
<td>Provo, Utah</td>
</tr>
<tr>
<td>Alyce Jackson</td>
<td>Technology Research Labs, Inc.</td>
<td>Hawthorne, CA</td>
</tr>
<tr>
<td>Steven M. Jacobs</td>
<td>TRW</td>
<td>Redondo Beach, CA</td>
</tr>
<tr>
<td>Dr. Philip James</td>
<td>Northrop Corporation</td>
<td>Hawthorne, CA</td>
</tr>
<tr>
<td>Dr. Walter Karplus</td>
<td>University of California, Los Angeles</td>
<td>Los Angeles, CA</td>
</tr>
<tr>
<td>Dr. Steven I. Kartashev</td>
<td>Dynamic Computer Architecture, Inc.</td>
<td>Lincoln, NB</td>
</tr>
<tr>
<td>Dr. Svetlana P. Kartashev</td>
<td>University of Nebraska—Lincoln</td>
<td>Lincoln, NB</td>
</tr>
<tr>
<td>John King</td>
<td>DMW Group, Inc.</td>
<td>Carmel, CA</td>
</tr>
<tr>
<td>Name</td>
<td>Organization</td>
<td>Location</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>-----------------------------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>Theodore Klein</td>
<td>Boston Systems Group</td>
<td>Boston, MA</td>
</tr>
<tr>
<td>Dennis K. Knight</td>
<td>Hitt, Hartwell &amp; Knight</td>
<td>San Diego, CA</td>
</tr>
<tr>
<td>Franklin F. Kuo</td>
<td>SRI International</td>
<td>Menlo Park, CA</td>
</tr>
<tr>
<td>Dale Kutnick</td>
<td>The Yankee Group</td>
<td>Boston, MA</td>
</tr>
<tr>
<td>Dr. Daniel T. Lee</td>
<td>University of Hartford</td>
<td>Hartford, CT</td>
</tr>
<tr>
<td>Dr. Bennet P. Lientz</td>
<td>University of California, Los Angeles</td>
<td>Los Angeles, CA</td>
</tr>
<tr>
<td>Rita Gail MacAuslan</td>
<td>Sanders Federal Systems Group</td>
<td>Nashua, NH</td>
</tr>
<tr>
<td>Larry Martin</td>
<td>Raytheon Computer Services</td>
<td>Wellesley, MA</td>
</tr>
<tr>
<td>Kiyohsi Maruyama</td>
<td>IBM</td>
<td>Yorktown Heights, NY</td>
</tr>
<tr>
<td>Richard J. Matlack</td>
<td>Infocorp</td>
<td>Cupertino, CA</td>
</tr>
<tr>
<td>Addie Mattox</td>
<td>The Mattox Group</td>
<td>Los Angeles, CA</td>
</tr>
<tr>
<td>Eleanor G. Maurer</td>
<td>Blue Cross of California</td>
<td>Oakland, CA</td>
</tr>
<tr>
<td>Roy Maxion</td>
<td>Xerox Corporation</td>
<td>Palo Alto, CA</td>
</tr>
<tr>
<td>N. Dean Meyer</td>
<td>N. Dean Meyer and Associates, Inc.</td>
<td>Ridgefield, CT</td>
</tr>
<tr>
<td>Dr. C. Mohan</td>
<td>IBM</td>
<td>San Jose, CA</td>
</tr>
<tr>
<td>Paul Nesdore</td>
<td>Datapro Research</td>
<td>Delran, NJ</td>
</tr>
<tr>
<td>Dr. Jack M. Nilles</td>
<td>University of Southern California</td>
<td>Los Angeles, CA</td>
</tr>
<tr>
<td>J. Michael Nye</td>
<td>Marketing Consultants International</td>
<td>Hagerstown, MD</td>
</tr>
<tr>
<td>Paul O’Grady</td>
<td>Micro Focus</td>
<td>Palo Alto, CA</td>
</tr>
<tr>
<td>Bob Patterson</td>
<td>Intel Corporation</td>
<td>Aloha, OR</td>
</tr>
<tr>
<td>Michael Plesset</td>
<td>Aerospace Corporation</td>
<td>El Segundo, CA</td>
</tr>
<tr>
<td>Steve Puthuff</td>
<td>Fortune Systems</td>
<td>San Carlos, CA</td>
</tr>
<tr>
<td>Arthur Pyster</td>
<td>TRW</td>
<td>Redondo Beach, CA</td>
</tr>
<tr>
<td>Dr. Jock A. Rader</td>
<td>Hughes Aircraft Company</td>
<td>Los Angeles, CA</td>
</tr>
<tr>
<td>William E. Riddle</td>
<td>Software Design &amp; Analysis, Inc.</td>
<td>Boulder, CO</td>
</tr>
<tr>
<td>Ken Ross</td>
<td>Ross Systems</td>
<td>Palo Alto, CA</td>
</tr>
<tr>
<td>John Ruchikas</td>
<td>University of Southern California</td>
<td>Los Angeles, CA</td>
</tr>
<tr>
<td>Jerald Savin</td>
<td>Main, Hurdman</td>
<td>Los Angeles, CA</td>
</tr>
<tr>
<td>Omri Serlin</td>
<td>Itom International</td>
<td>Los Altos, CA</td>
</tr>
<tr>
<td>Dr. Phil Shaw</td>
<td>IBM</td>
<td>San Jose, CA</td>
</tr>
<tr>
<td>George Sonnemann</td>
<td>Nationwide Insurance</td>
<td>Columbus, OH</td>
</tr>
<tr>
<td>John Stidd</td>
<td>Molecular Computing</td>
<td>San Jose, CA</td>
</tr>
<tr>
<td>Lynn Svenning</td>
<td>University of Southern California</td>
<td>Los Angeles, CA</td>
</tr>
<tr>
<td>James C. Taylor</td>
<td>Socio-Technical Design Consultants</td>
<td>Pacific Palisades, CA</td>
</tr>
<tr>
<td>Douglas Theis</td>
<td>Aerospace Corporation</td>
<td>El Segundo, CA</td>
</tr>
<tr>
<td>John Thompson</td>
<td>Index Systems</td>
<td>Santa Monica, CA</td>
</tr>
<tr>
<td>Dr. Rein Turn</td>
<td>California State University, Northridge</td>
<td>Pacific Palisades, CA</td>
</tr>
<tr>
<td>Walter Ulrich</td>
<td>Walter E. Ulrich Consulting</td>
<td>Houston, TX</td>
</tr>
<tr>
<td>Virginia C. Walker</td>
<td>Department of Energy</td>
<td>Arlington, VA</td>
</tr>
<tr>
<td>James F. Ware</td>
<td>Nolan, Norton &amp; Co.</td>
<td>Lexington, MA</td>
</tr>
<tr>
<td>Tom Williams</td>
<td>Computer Design Magazine</td>
<td>Sunnyvale, CA</td>
</tr>
<tr>
<td>Amy Wohl</td>
<td>Advanced Office Concepts, Inc.</td>
<td>Bala Cynwyd, PA</td>
</tr>
<tr>
<td>Eberhard F. Wundertlich</td>
<td>American Bell, Inc.</td>
<td>Lincroft, NJ</td>
</tr>
<tr>
<td>Nicholas Zvegintzov</td>
<td>Zvegintzov Associates</td>
<td>Staten Island, NY</td>
</tr>
</tbody>
</table>

From the collection of the Computer History Museum (www.computerhistory.org)
NCC '83 REFEREES

Ackermann, J.
Anderson, Harold A.
Appleton, Daniel
Barnes, Ben
Bartoli, Paul D.
Beamer, Gary D.
Bengston, Deanna
Bertine, Herbert V.
Borko, Harold
Bowen, John B.
Brey, Hans
Brown, Thomas C.

Hopwood, Marsha D.
Horning, James Jay
Huber, K. M.
Ingrassia, Frank
Ives, Blake

Jaffe, J.
James, Philip
Jaramillo, Plas
Jenner, Steve
Johns, Daniel

Kartashev, Steven
Kartashev, Svetlana
Konysynski, Benn
Kozdrowicki, E. W.

Lobel, Jerome
Losch, Myles
Love, Hubert H., Jr.
Manny, Ben
Maruyama, Kiyoshi
Maxion, Roy
McAllister, David
McCullough, T. L.
Mears, Brian R.
Medley, Don
Minoli, Daniel

Navathe, Sham
Nezu, Koji
Nielsen, Francis H.
Nudd, Graham R.

Ormancioglu, Levent
Penedo, Maria H.
Pfleger, Richard C.
Plesset, Michael
Pramanik, Sakti
Prescott, Bill
Procolla, Maria
Pyster, Arthur

Raiser, Coty
Rine, David

Robb, Richard A.
Rogson, Leon
Rosenbaum, Susan L.
Rosenberg, A. E.
Rosenthal, Soren

Sankar, P. V.
Sastry, K. V.
Schiebe, Lowell H.
Schneidewind, Norman F.
Sealy, David
Shaffron, Nancy
Shaw, Phil
Shoquist, Marc
Shu, Nan
Sibley, Edgar H.
Silver, Aaron N.
Simmons, Dick B.
Smith, Allen N.
Smith, Don D.
Spaniol, Roland D.
Stier, L.
Sulg, Madis

Theis, Douglas J.
Timson, George
Tutelman, D. M.

Vallone, Antonio
Walker, Stephen T.
Wang, C. Charles
Wartik, Steven
Wasserman, Anthony
Wetmiller, John R.
Williams, Donald
Wolfson, Seymour J.
Wunderlich, Eberhard F.

Young, C. E.
Young, Jeffrey P.
Young, Steve

Zucker, Steven
NCC '83 SPEAKERS AND PANELISTS

Adkisson, James
Adleman, Leonard
Alker, Pauline
Alon, Eli
Alter, Steven
Athey, Thomas

Adler, Leonard
Everest, Gordon

Alon, Eli
Feigenbaum, Edward
Fiero, Charles
Fischer, Brian
Florio, Mike
Foster, William
Fox, Steven
Fujiwara, Frank
Fuld, Stephen
Furniss, Mary Ann
Gilb, Tim
Godbout, Bill
Goldell, Robert
Greenlee, M. Blake
Grosz, Barbara J.
Gunter, Tom
Hammer, Michael
Harr, John A.
Harrises, Larry
Hayes, Michael
Heuston, Dustin
Hibson, Peter
Hitchcock, Michael H.
Hoffman, Lance J.
Holli, James
Holmes, Fenwick
Hopper, Grace
Hunke, Horst
Hutchison, John

Iverson, Kenneth E.
Jackson, Alyce
Jackson, Barbara
James, Philip
Jamison, H.
Jeffries, Neil P.
Johnson, Bonnie M.

Jones, Wendell W., II
Juliusson, Egil
Kahn, Robert E.
Kalow, Samuel Jay
Karplus, Walter J.
Keim, Robert T.
Keller, John H.
Kemler, David
Kildall, Gary
Kimble, Steve
Kinne, Harold
Koffler, Richard

Krishnaswimy, Kris
Kruesi, Elizabeth
Krupp, Marguerite
Kunkler, J. Edward
Kutnick, Dale
LaNerger, Robert
Larson, Judy
Leslie, Mark
Levin, Marsha D.
Loes, Robert
Lowenthal, Eugene I.
Lupin, Ed
McAndrews, Robert L.
McCalmont, Tom
McDermott, John
McEvoy, Dennis
McShan, Clyde
Manara, James A.
Mankin, Donald
Margaret, Barry
Martin, Roger
Mateosian, Richard
Matlack, Richard J.
Mellen, Roger
Meyer, N. Dean
Michael, George
Missikof, Michele
Mohan, C.
Mohrman, Allan M.
Moreland, Thomas W.
Morgan, Howard
Morrow, George
Mostow, Jack
Munson, John
Musa, John
Myers, Dan
Nesdore, Paul
Ness, David
Noble, Chris
Norman, James C.

O'Connor, Rod
O'Grady, Paul
Oettinger, Anthony G.
Orbeton, Peter
Osborne, Adam
Paller, Allan
Parker, Donald M. B.
Parker, Marilyn M.
Piester, Ann
Plain, Harold
Plumlee, Hugh
<table>
<thead>
<tr>
<th>Author Name</th>
<th>Page Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allan, I. Dal</td>
<td>623</td>
</tr>
<tr>
<td>Anderton, Mark</td>
<td>203</td>
</tr>
<tr>
<td>Arden, Bruce W.</td>
<td>539</td>
</tr>
<tr>
<td>Arlen, Gary H.</td>
<td>513</td>
</tr>
<tr>
<td>Arkush, Evelyn S.</td>
<td>415</td>
</tr>
<tr>
<td>Aronson, M. H.</td>
<td>191</td>
</tr>
<tr>
<td>Bailey, Richard M.</td>
<td>655</td>
</tr>
<tr>
<td>Ballard, Bruce W.</td>
<td>39</td>
</tr>
<tr>
<td>Bhadra, K.</td>
<td>671</td>
</tr>
<tr>
<td>Bikson, T. K.</td>
<td>319</td>
</tr>
<tr>
<td>Blanning, Robert W.</td>
<td>395</td>
</tr>
<tr>
<td>Bloom, Naomi Lee</td>
<td>3</td>
</tr>
<tr>
<td>Blum, Bruce L.</td>
<td>743</td>
</tr>
<tr>
<td>Bonczek, Robert H.</td>
<td>421</td>
</tr>
<tr>
<td>Boney, Joel</td>
<td>503</td>
</tr>
<tr>
<td>Brice, Linda</td>
<td>113</td>
</tr>
<tr>
<td>Brodersen, R. W.</td>
<td>645</td>
</tr>
<tr>
<td>Budde, Dave</td>
<td>531</td>
</tr>
<tr>
<td>Burstyn, H. Paris</td>
<td>379</td>
</tr>
<tr>
<td>Butler, Charles W.</td>
<td>155</td>
</tr>
<tr>
<td>Carson, Dave</td>
<td>531</td>
</tr>
<tr>
<td>Chapin, Ned</td>
<td>779</td>
</tr>
<tr>
<td>Chiang, T. C.</td>
<td>387</td>
</tr>
<tr>
<td>Chin, Chi-Yuan</td>
<td>705</td>
</tr>
<tr>
<td>Chusho, Takeshi</td>
<td>73</td>
</tr>
<tr>
<td>Collofello, J. S.</td>
<td>757</td>
</tr>
<tr>
<td>Connell, John</td>
<td>113</td>
</tr>
<tr>
<td>Cooper, Steve</td>
<td>497</td>
</tr>
<tr>
<td>Crochiere, R. E.</td>
<td>639</td>
</tr>
<tr>
<td>Curtis, Gary A.</td>
<td>11</td>
</tr>
<tr>
<td>Daniell, T. P.</td>
<td>219</td>
</tr>
<tr>
<td>Davis, Edward W.</td>
<td>299</td>
</tr>
<tr>
<td>Davis, Gordon B.</td>
<td>261</td>
</tr>
<tr>
<td>DeMarco, Tom</td>
<td>753</td>
</tr>
<tr>
<td>Deutsch, Donald R.</td>
<td>241</td>
</tr>
<tr>
<td>DiGiammarino, Peter F.</td>
<td>21</td>
</tr>
<tr>
<td>Donohue, B. P. III</td>
<td>367</td>
</tr>
<tr>
<td>Easterday, John L.</td>
<td>557</td>
</tr>
<tr>
<td>Fallin, John J.</td>
<td>487</td>
</tr>
<tr>
<td>Finke, Douglas L.</td>
<td>479</td>
</tr>
<tr>
<td>Finn, Nancy B.</td>
<td>353</td>
</tr>
<tr>
<td>Finnigan, Paul F.</td>
<td>373</td>
</tr>
<tr>
<td>Fischer, Herman</td>
<td>47</td>
</tr>
<tr>
<td>Flanagan, J. L.</td>
<td>639</td>
</tr>
<tr>
<td>Ghiasieddin, Nasir</td>
<td>421</td>
</tr>
<tr>
<td>Gibbs, N. E.</td>
<td>757</td>
</tr>
<tr>
<td>Ginosar, Ran</td>
<td>539</td>
</tr>
<tr>
<td>Gruber, William H.</td>
<td>409</td>
</tr>
<tr>
<td>Gulden, Gary K.</td>
<td>415</td>
</tr>
<tr>
<td>Gustafsson, Christian</td>
<td>65</td>
</tr>
<tr>
<td>Gutek, B. A.</td>
<td>319</td>
</tr>
<tr>
<td>Hägglund, Sture</td>
<td>65</td>
</tr>
<tr>
<td>Handler, Gary J.</td>
<td>685</td>
</tr>
<tr>
<td>Harding, R. C. Jr.</td>
<td>219</td>
</tr>
<tr>
<td>Harrington, Carl</td>
<td>403</td>
</tr>
<tr>
<td>Hernandez, J. A.</td>
<td>729</td>
</tr>
<tr>
<td>Hevner, Alan R.</td>
<td>229</td>
</tr>
<tr>
<td>Ho, Tai-Ping</td>
<td>29</td>
</tr>
<tr>
<td>Holsapple, Clyde W.</td>
<td>421</td>
</tr>
<tr>
<td>Honda, Akinori</td>
<td>73</td>
</tr>
<tr>
<td>Horlait, E.</td>
<td>729</td>
</tr>
<tr>
<td>Hsiao, David K.</td>
<td>293</td>
</tr>
<tr>
<td>Hwang, Kai</td>
<td>705</td>
</tr>
<tr>
<td>Jacobucci, Edward E.</td>
<td>677</td>
</tr>
<tr>
<td>Jacob, Larry</td>
<td>523</td>
</tr>
<tr>
<td>Johnson, Dave</td>
<td>531</td>
</tr>
<tr>
<td>Joly, R.</td>
<td>729</td>
</tr>
<tr>
<td>Jonesjö, Lennat</td>
<td>65</td>
</tr>
<tr>
<td>Joyce, John D.</td>
<td>247</td>
</tr>
<tr>
<td>Kant, Krishna</td>
<td>81</td>
</tr>
<tr>
<td>Kartashev, Steven I.</td>
<td>579, 593</td>
</tr>
<tr>
<td>Kartashev, Svetlana P.</td>
<td>579, 593</td>
</tr>
<tr>
<td>Kerner, David V.</td>
<td>255</td>
</tr>
<tr>
<td>Kota, S. L.</td>
<td>191</td>
</tr>
<tr>
<td>Knight, Dennis K.</td>
<td>735</td>
</tr>
<tr>
<td>Kurosaki, Toru</td>
<td>73</td>
</tr>
<tr>
<td>Lee, Daniel T.</td>
<td>453</td>
</tr>
<tr>
<td>Lee, Edward T.</td>
<td>437</td>
</tr>
<tr>
<td>Lewis, Daniel W.</td>
<td>691</td>
</tr>
<tr>
<td>Liilievik, Sigurd L.</td>
<td>557</td>
</tr>
<tr>
<td>Lintoning, Peter F.</td>
<td>631</td>
</tr>
<tr>
<td>Lo, S. C.</td>
<td>191</td>
</tr>
<tr>
<td>Lusth, John C.</td>
<td>39</td>
</tr>
<tr>
<td>Malhotra, Ashok</td>
<td>255</td>
</tr>
<tr>
<td>Marselos, Nicholas L.</td>
<td>131</td>
</tr>
<tr>
<td>Marsh, Robert E.</td>
<td>145</td>
</tr>
<tr>
<td>Mercer, R. L.</td>
<td>643</td>
</tr>
<tr>
<td>Minami, Takatoshi</td>
<td>721</td>
</tr>
<tr>
<td>Morikawa, Hisashi</td>
<td>721</td>
</tr>
<tr>
<td>Nauckhoff, S. H.</td>
<td>219</td>
</tr>
<tr>
<td>Norman, Alan</td>
<td>203</td>
</tr>
<tr>
<td>Novotny, Eric J.</td>
<td>341</td>
</tr>
<tr>
<td>Nugent, William R.</td>
<td>771</td>
</tr>
<tr>
<td>Nye, J. Michael</td>
<td>647</td>
</tr>
<tr>
<td>Oflazer, Kemal</td>
<td>271</td>
</tr>
<tr>
<td>O’Hara, Robert P.</td>
<td>329</td>
</tr>
<tr>
<td>Okamoto, Eri</td>
<td>73</td>
</tr>
<tr>
<td>Onuegbe, Emmanuel</td>
<td>229</td>
</tr>
<tr>
<td>Pesic, Ivan M.</td>
<td>691</td>
</tr>
<tr>
<td>Peterson, Craig</td>
<td>531</td>
</tr>
<tr>
<td>Pfister, Larry T.</td>
<td>519</td>
</tr>
<tr>
<td>Pramanik, Sakti</td>
<td>283</td>
</tr>
<tr>
<td>Pujolle, G.</td>
<td>729</td>
</tr>
<tr>
<td>Rahimi, Said</td>
<td>229</td>
</tr>
<tr>
<td>Raynor, Randy J.</td>
<td>173</td>
</tr>
<tr>
<td>Richardson, Gary L.</td>
<td>155</td>
</tr>
<tr>
<td>Saib, Sabina H.</td>
<td>57</td>
</tr>
<tr>
<td>Sami, Mariagiovanna</td>
<td>565</td>
</tr>
<tr>
<td>Sandewall, Erik</td>
<td>65</td>
</tr>
<tr>
<td>Schiffman, S. M.</td>
<td>663, 671</td>
</tr>
<tr>
<td>Schneider, G. R. Eugenia</td>
<td>137</td>
</tr>
<tr>
<td>Sibley, Edgar H.</td>
<td>47</td>
</tr>
<tr>
<td>Sonnemann, George</td>
<td>409</td>
</tr>
<tr>
<td>Soucy, Richard C.</td>
<td>655</td>
</tr>
<tr>
<td>Speckmann, Linda D.</td>
<td>173</td>
</tr>
<tr>
<td>Stefaneli, Renato</td>
<td>565</td>
</tr>
<tr>
<td>Stoeller, Willem</td>
<td>309</td>
</tr>
<tr>
<td>Strömfors, Ola</td>
<td>65</td>
</tr>
<tr>
<td>Takahashi, Osamu</td>
<td>721</td>
</tr>
<tr>
<td>Tanaka, Atsushi</td>
<td>73</td>
</tr>
<tr>
<td>Taute, Barbara J.</td>
<td>123</td>
</tr>
<tr>
<td>Terashima, Nobuyoshi</td>
<td>763</td>
</tr>
<tr>
<td>Thomas, M. I.</td>
<td>91</td>
</tr>
<tr>
<td>Thompson, Bozena Henisz</td>
<td>29</td>
</tr>
<tr>
<td>Thompson, Frederick B.</td>
<td>29</td>
</tr>
<tr>
<td>Tinnirello, Paul C.</td>
<td>107</td>
</tr>
<tr>
<td>Touge, Takashi</td>
<td>721</td>
</tr>
<tr>
<td>Turn, Rein</td>
<td>341</td>
</tr>
<tr>
<td>Ulrich, Walter</td>
<td>361</td>
</tr>
<tr>
<td>Wang, R. S.</td>
<td>97</td>
</tr>
<tr>
<td>Warn, David D.</td>
<td>247</td>
</tr>
<tr>
<td>Weingarten, Robert A.</td>
<td>677</td>
</tr>
<tr>
<td>Wetherbe, James C.</td>
<td>261</td>
</tr>
<tr>
<td>Whinston, Andrew B.</td>
<td>421</td>
</tr>
<tr>
<td>Wilson, Kenneth G.</td>
<td>469</td>
</tr>
<tr>
<td>Woodfield, S. N.</td>
<td>757</td>
</tr>
<tr>
<td>Woodward, Mary</td>
<td>21</td>
</tr>
<tr>
<td>Yano, Kenjiro</td>
<td>721</td>
</tr>
<tr>
<td>Young, Charles E.</td>
<td>617</td>
</tr>
<tr>
<td>Zak, Joan R.</td>
<td>163</td>
</tr>
<tr>
<td>Zells, Lois</td>
<td>181</td>
</tr>
</tbody>
</table>
AMERICAN FEDERATION OF INFORMATION PROCESSING SOCIETIES, INC. (AFIPS)

OFFICERS

President
Sylvia Charp
The School District of Philadelphia
Philadelphia, PA

Vice President
Stephen S. Yau
Northwestern University
Evanston, IL

Treasurer
Walter A. Johnson
Consolidated Papers, Inc.
Wisconsin Rapids, WI

Secretary
Arthur C. Lumb
Procter & Gamble Co.
Cincinnati, OH

Executive Director
Paul J. Raisig
AFIPS
Arlington, VA

BOARD OF DIRECTORS

AFIPS Immediate Past President
J. Ralph Leatherman
Hughes Tool Company
Houston, TX

American Society for Information Science (ASIS)
James N. Cretsos
Merrell Dow Pharmaceuticals, Inc.
Cincinnati, OH

American Statistical Association (ASA)
Jack Moshman
Moshman Associates, Inc.
Bethesda, MD

Association for Computational Linguistics (ACL)
Donald E. Walker
SRI International
Menlo Park, CA

Association for Computing Machinery (ACM)
David Brandin
SRI International
Menlo Park, CA

Michael A. Harrison
University of California
Berkeley, CA

Raymond E. Miller
Georgia Institute of Technology
Atlanta, GA

Association for Educational Data Systems (AEDS)
John Hamblen
National Bureau of Standards
Washington, DC

Data Processing Management Association (DPMA)
George R. Eggert
Defense Contract Administration Services
Chicago, IL

Jerry Knierim
Pioneer Corporation
Amarillo, TX

Donald E. Price
Sierra College
Rocklin, CA

IEEE—Computer Society
Rolland B. Arndt
Sperry Univac
Saint Paul, MN

Tse-yun Feng
Ohio State University
Columbus, OH

Oscar N. Garcia
University of South Florida
Tampa, FL

Instrument Society of America
Chun H. Cho
Fisher Controls International, Inc.
Marshalltown, IA

Society for Computer Simulation (SCS)
Per Holst
The Foxboro Company
Foxboro, MA

Society for Industrial and Applied Mathematics (SIAM)
Donald L. Thomsen, Jr.
SIAM Institute for Mathematics & Society
New Canaan, CT

Society for Information Display
Carlo P. Crocetti
Rome Air Development Center/XP
Griffis Air Force Base, NY

From the collection of the Computer History Museum (www.computerhistory.org)
NATIONAL COMPUTER CONFERENCE BOARD MEMBERS

Chairman and AFIPS Representative
Stephen S. Yau
Northwestern University
Evanston, IL

ACM Representative
Seymour Wolfson
Wayne State University
Detroit, MI

IEEE-CS President—Ex Officio
Oscar N. Garcia
University of South Florida
Tampa, FL

Vice Chairman and AFIPS Representative
Chun H. Cho
Fisher Controls International, Inc.
Marshalltown, IA

DPMA Representative
P. Roger Fenwick
New York Telephone
New York, NY

SCS President—Ex Officio
Walter J. Karplus
University of California, Los Angeles
Los Angeles, CA

Treasurer and AFIPS Representative
Walter A. Johnson
Consolidated Papers, Inc.
Wisconsin Rapids, WI

SCS Representative
Carl Malstrom
North Carolina State University
Raleigh, NC

NCCC Chairman—Ex Officio
Robert C. Spieker
AT&T
New Brunswick, NJ

Secretary and IEEE-CS Representative
Stanley Winkler
IBM Corporation
Armonk, NY

ACM President—Ex Officio
David Brandin
SRI International
Menlo Park, CA

IAP Chairman—Ex Officio
S. A. Lanzarotta
Xerox Corporation
El Segundo, CA

AFIPS Representative
Sylvia Charp
The School District of Philadelphia
Philadelphia, PA

DPMA President—Ex Officio
J. Crawford Turner Jr.
Knoxville Utilities Board
Knoxville, TN

AFIPS Executive Director—Ex Officio
Paul J. Raisig
AFIPS
Arlington, VA

NATIONAL COMPUTER CONFERENCE COMMITTEE OF THE NCC BOARD

Chairman
Robert C. Spieker
AT&T Company
New Brunswick, NJ

OAC '83 Chairman
James F. Towsen
Masco
Harrisburg, PA

Secretary
Arnold P. Smith
IBM Corporation
White Plains, NY

OAC '84 Chairman
Steven M. Abraham
Price Waterhouse
Los Angeles, CA

Members
Morton M. Astrahan
IBM Corporation
San Jose, CA

OAC '85 Chairman
James F. Foley, Jr.
Life Office Management Association
Atlanta, GA

Harvey L. Garner
Moore School of Electrical Engineering
University of Pennsylvania
Philadelphia, PA

NCC '82 Chairman
Russell K. Brown
Benchmark Services, Inc.
Houston, TX

Floyd O. Harris
Life of Georgia
Atlanta, GA

NCC '83 Chairman
Don B. Medley
California State Polytechnic University
Pomona, CA

William H. Sitter
Tenneco, Inc.
Houston, TX

From the collection of the Computer History Museum (www.computerhistory.org)
### OFFICE OF EXECUTIVE DIRECTOR

**Executive Director**  
Paul Raisig

**Executive Secretary**  
Joan Tackett

### COMMUNICATIONS DEPARTMENT

**Director of Communications**  
John Gilbert

**Communications Coordinator**  
Dianne Edgar

**Communications Support**  
Leslie Rodier

**Facilities Coordinator**  
Debra Guazzo

**Secretary**  
Patricia Mayo

**Receptionist**  
Tryphene Miller

### FINANCE AND ADMINISTRATION

**Director of Finance and Administration**  
Janis P. Gemignani

**Administrative Assistant**  
Vacant

### CONFERENCE DEPARTMENT

**Director of Conferences**  
James H. Kroell

**Administrative Assistant**  
Susan Robinson

### AFIPS HEADQUARTERS STAFF

**Accountant**  
Patricia Whiteaker (Acting)

**Bookkeeper**  
Carrol Reid

**Accounting Clerk**  
John Balderson

**Registration Manager**  
Dennis Smoot

**Registration Support**  
Teresa DiMurro

**Fulfillment Administrator**  
Olive Shilland

**Secretary**  
Sharon Conway

**NCC Proceedings Production Editor**  
Elizabeth G. Emanuel

**Conference Operations Manager**  
Sam Lippman

**Conference Operations Coordinator**  
Margaret Dyer

**Conference Secretary**  
Wendy Chin

**Marketing Manager**  
Ann-Marie Bartels

**Marketing Coordinator**  
Loretta Keller

**Marketing Secretary**  
Elizabeth Dollison

**Exhibit Operations Manager**  
Larry Jennings

**Exhibit Operations Support**  
Jill Newman

**Exhibit Sales Manager**  
Richard Dobson

**Exhibit Sales Coordinator**  
Katherine Stormont

**Exhibit Sales Support**  
Molly Finney (Acting)