CONFERENCE DEFINES AGENDAS FOR MODELING, COMPLEXITY

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To help research directors and policy makers set research agendas, about 100 computer scientists gathered Nov. 6-7 in Arlington, Va., to determine the most critical areas in the disciplines of modeling reality and managing complexity and suggest how to improve them. Recommendations covered a wide range, from education to funding priorities.

The ACM, which sponsored the conference, will translate the recommendations into a report for distribution to universities and government agencies.

MODELING ISSUES. The modeling section drew about 40 participants from a range of disciplines, including sociology and economics. The issues discussed represented the group's diverse background and made clear that each discipline followed a different modeling approach. They differed primarily on how they gathered information, how they handled the human element, whether they focused on being predictive or descriptive, and whether they handled uncontrolled external events. Noting these strong differences and the criticism by a sociologist that most models in engineering forget the human element, the participants paid special attention to broad education the human element in their recommendations.

Of the 17 recommendations deemed critical, five encouraged more and better research:

- Research, define, and standardize model accuracy, completeness, and validation processes.
- Encourage both more and better quality research on the role of people and social environments in models.
- Establish a national modeling institute in the US National Science Foundation similar to the NSF's centers of excellence.
- Establish a national repository for models and modeling tools.
- Establish a prize for the best advancement in modeling.

Seven recommendations sought to improve education at all levels:

- Establish an electronic bulletin board to cover issues in modeling reality à la the Risks board managed by Peter Neumann of SRI International.
- Hold a workshop to develop strategies of training for and research on modeling.
- Encourage government funding for research on good practices and a taxonomy for modeling for use in a modeling curriculum.
- Develop new professional education programs at the graduate level for modeling.
- Establish curriculum requirements for modeling in science and engineering, including social perspective, for undergraduate and graduate education.
- Create educational materials for use in elementary school through high school on the use of modeling and approaches to modeling.
- Establish modeling literacy materials for students from kindergarten through college.

Three recommendations aimed to keep the public aware of issues in modeling:

- Encourage the publication of articles and books on the successes, failures, results, limits, and strengths of models.
- Identify and diagnose successes and failures of model development and application and describe them at a level appropriate for the general media and young students.
- Encourage articles on modeling by researchers in the popular press.

Two recommendations sought to help nonscientists use models effectively:

- Promote continuing education (via conferences and workshops) on the strengths and weaknesses of using models for policy making and data interpretation.
- Via professional associations, help developers and users work together at the workplace to ensure that models reflect users' needs.

COMPLEXITY ISSUES. Of the 13 issues that emerged as critical in the complexity section, four dealt with basic research:

- Include in the proposed National Research and Education Network research on the scientific foundations, predictive models, concepts, and languages to describe systems and fundamental limits in NREN.
- Establish research programs that encourage empirical studies on the unification and evolution of complex systems.
- Enhance the NSF's Public Understanding of Science public-awareness effort to include complexity of computer-based projects. The concern created by such a campaign could help increase future funding of complexity research.
- Encourage the US National Academy of Sciences to outline the total interdisciplinary effort needed to address specification, design, and operation of complex systems.

Four recommendations aimed to better capture experience in the discipline:

- Develop a repository of historical data on system development and behavior.
- Encourage government to provide incentives for the collection and analysis of historical project data.
- Research common development schemes for describing project processes and product characteristics for database storag
- Encourage the use of case studies academic programs.

Three recommendations were intenc to improve education:

- Develop introductory courses in co puter science and engineering for probl solving in complex situations.
- Develop recommendations for st training and curricula for special types complex systems, like nuclear power plant
- Have professional societies work wi companies to ensure that continuing educati is a mandatory part of complex-system job

Two policies addressed government polic

- Create an assistant director for con puter-based systems in the US Office for Sc ence and Technology Policy (which advis the president) to establish government initia tives on computer-based systems.
- Encourage the ACM and Software En gineering Institute to recommend changes t the government's acquisition process so it ca fund training and capital investment to hel software engineers with inadequate educa tion in and tools for complex projects.