

Science & Technology Program



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Coping with Rapid Change

The Science and Technology Program (S&T) helps government and private decisionmakers assess opportunities and challenges created by innovation and rapid technological change. S&T's research agenda is diverse, covering such topics as the policy implications of advances in cloning, threats to the U.S. information infrastructure, innovative energy technologies for the developing world, and the mapping of planetary surfaces throughout the solar system. In addition, information tools, such as the RaDiUS database of federally supported research and development, underpin a variety of RAND activities. Much of S&T's work is conducted within the Science and Technology Policy Institute (S&TPI—formerly known as the Critical Technologies Institute), a federally funded research and development center. During 1998, S&T added another research center, this one focused on environmental studies: the Environmental Science and Policy Center.

Selected Research Highlights

Fourth National Critical Technologies Panel Report.

Congress requires the president's science adviser to issue a biennial report on the state of critical technologies in the United States. The fourth such report, drafted by S&TPI, examines the challenges facing U.S. industry in exploiting its technology base. Based on the views of industrial leaders, the report presents an encouraging picture of U.S. industry as an originator and cutting-edge user of technologies. The information revolution is seen as key in shifting the U.S. perspective from a fear of falling behind in the world marketplace to a sense of being fully able to meet global challenges. A recurring theme was praise for the U.S. university system and, conversely, concern over the K-12 system. The latter is seen

as crucial to training a technologically literate workforce, preserving the health of crucial higher education institutions, and promoting broader national goals, such as economic growth, international competitiveness, and the ability of all Americans to contribute fully to society.

The Scientific and Policy Implications of Cloning.

The well-publicized cloning of a sheep named Dolly raises the possibility that human beings could be similarly reproduced. This development created a storm of debate over the ethical and legal ramifications. The National Bioethics Advisory Commission asked S&TPI to analyze the responses of 60 scientific and medical organizations to a survey about their views on cloning. The respondents generally agreed that reproducing humans via cloning should be prohibited, but that cloning in research was beneficial in two ways: It could revolutionize understanding of basic developmental biology and lead to effective therapies for degenerative diseases. Most respondents also preferred oversight by the scientific community to federal legislation as the best way to regulate cloning.

Partnership for a New Generation

of Vehicles. In 1993, amid concerns that the U.S. auto industry was losing ground to Japanese

About the Science and Technology Policy Institute

The Science and Technology Policy Institute is a research center that provides policy analysis to the White House Office of Science and Technology Policy (OSTP), the cabinet-level National Science and Technology Council, and government agencies concerned with policies affecting science and technology. S&TPI is a federally funded research and development center that operates under a contract administered by the National Science Foundation for the benefit of OSTP. Originally known as the Critical Technologies Institute, the institute formally adopted its new name on October 1, 1998, in accord with recent congressional legislation. Bruce W. Don is the director of S&TPI. The institute's operations are based at RAND's Washington, D.C., office.

About the Environmental Science and Policy Center

In July 1998, RAND acquired Science & Policy Associates (S&PA), an innovative research firm with offices in Washington, D.C., and Boulder, Colorado. S&PA's staff forms the core of a new Environmental Science and Policy Center (ESPC) within S&T. RAND now has significant expertise in the environmental sciences, ranging from global warming to air and water pollution and issues of sustainability, as well as public- and private-sector clients in the U.S. and abroad. The ESPC is directed by Chris Bernabo.

Highlights of recent and current projects include: **Alternative Emission Management Scenarios for the Grand Canyon.** The Grand Canyon Visibility Transport Commission was required under the Clean Air Act to examine the effects of growth and development on air quality and visibility in the Grand Canyon region. ESPC assessed options for managing airborne pollutants that impair visibility in national parks and wilderness areas in the Western United States. It also examined direct costs, emissions, and the administrative ease of

implementing the various options, and considered other consequences, including economic, social, equity, air-quality, and health effects and implications for land and water use, wastes, endangered species, ecosystems, and the climate.

Chlorofluorocarbon (CFC) Alternatives Research

Management. ESPC serves as the administrative organization for a consortium of international chemical manufacturers sponsoring research on the potential effects of CFC alternatives on the environment and on human health. The Alternative Fluorocarbons Environmental Acceptability Study and the Programme for Alternative Fluorocarbon Toxicity Testing were established in the late 1980s as cooperative efforts to accelerate the evaluation of new chemicals that were developed in the early phase-out of CFCs. ESPC provides financial and contractual administration, project coordination, administrative support for committees, communication and outreach efforts, and workshop and conference services.

competitors, the federal government and the (then) Big Three U.S. automakers (Ford, Chrysler, and General Motors) entered into a unique alliance: the Partnership for a New Generation of Vehicles (PNGV). The PNGV arose from the belief that giving industry access to technologies generated by federally supported research would allow it to develop a high-efficiency, low-emission car that would match today's vehicles in performance, cost, and safety. The PNGV has faced considerable skepticism as well as political and organizational challenges. This

project looked at the program's beginning, its attempts to deal with these challenges, and its progress, which remains ahead of schedule. It also detailed lessons that may be useful to managers of similar partnerships in the future.

Studies in Physical Volcanology. This NASA-funded project addresses several topics in physical volcanology with an emphasis on Venus, Mars, and Earth-analog studies. Studies of physical volcanologic processes provide insight into the evolution of a planet's surface and interior. This work combines theoretical modeling, field observations, and studies of planetary surfaces in an integrated approach to understanding the mechanical and dynamic processes associated with volcanism.

The "Cyber-Posture" of the National Information Infrastructure. How vulnerable is the U.S. information infrastructure to attacks and other kinds of disruptions? This project assessed the data available for measuring this threat and concluded that energy supplies, telecommunications, and computer-based systems should have top priority for attention and remedial action. It also suggested steps to reduce national vulnerability. The information security posture in both government and the private sector needs immediate attention. Analytic studies should be performed to determine sources of resilience, to characterize normality, and to specify research and development requirements. In addition, the nation should establish a warning mechanism and a supporting coordination center.

The Costs and Implications of High-Technology

Hardware Crime. RAND was asked by the American Electronics Association to study the magnitude, costs, and consequences of high-tech hardware thefts that affect manufacturers of electronic components and finished products. The project evolved from meetings between RAND and security executives from high-tech companies, who were concerned that the lack of systematic information about the magnitude of high-tech hardware theft was impeding industry efforts to tackle the problem. The study found that total direct costs of replacing stolen merchandise were about \$250 million

annually, but that indirect costs may be as high as \$5 billion. Past investments in security have paid off and more are probably warranted.

Information Technology, Customer Management Strategies, and Sales Performance. Competition is forcing service companies to reinvent their sales functions. The traditional sales paradigm has relied on informal networking to develop client contacts and personal relationships to close deals. By contrast, the emerging sales paradigm is based on effective management of customer information, which is made possible largely by advances in information technology. Innovative companies are developing decision-support tools to analyze and manage customer information. RAND is currently working with three large service companies to understand how they are using technology to redesign their sales organizations.

Selected Publications

The Cosmos on a Shoestring: Small Spacecraft for Space and Earth Science, Liam Sarsfield, RAND MR-864-OSTP.

Cyberpayments and Money Laundering: Problems and Promise, Roger C. Molander, David A. Mussington, Peter A. Wilson, RAND MR-965-OSTP/FinCEN.

The Cyber-Posture of the National Information Infrastructure, Willis H. Ware, RAND MR-976-OSTP.

E-Mail Communication Between Government and Citizens: Security, Policy Issues, and Next Steps, C. Richard Neu, Robert H. Anderson, Tora K. Bikson, RAND IP-178.

International Agreements on Cooperation in Remote Sensing and Earth Observation, Caroline S. Wagner, RAND MR-972-OSTP.

The Machine That Could: PNGV, a Government-Industry Partnership, Robert M. Chapman, RAND MR-1011-DOC.

Monitoring for Fine Particulate Matter, Elisa Eiseman, RAND MR-974-OSTP.

New Forces at Work: Industry Views Critical Technologies, Steven W. Popper, Caroline S. Wagner, Eric Larson, RAND MR-1008-OSTP.

Major Clients of S&T Research	
U.S. Government	National Oceanic and Atmospheric Administration
Department of Commerce	National Science Foundation
Department of Defense	Office of National Drug Control Policy
Defense Advanced Research Projects Agency	Office of Science and Technology Policy
Department of Energy	U.S. Intelligence Community
Federal Energy Technology Center	
Department of Health and Human Services	Other
National Institutes of Health	American Electronics Association
Department of the Treasury	The LEADS Corporation
Environmental Protection Agency	The John and Mary R. Markle Foundation
Federal Aviation Administration	The Pew Charitable Trusts
National Aeronautics and Space Administration	

