

THE NEW EUROPE: HIGH-TECH JINGOISM WORRIES BROMLEY AND US SCIENTISTS

As James Holderman, president of the University of South Carolina, tells it, the US isn't ready for 1992—a year many Americans think of as the 500th anniversary of Columbus's voyage to the New World. Holderman considers 1992 more significant for the nation's future than for its past. He is chairman of the National Science Board's newly established Task Force on EC-92, a group commissioned to examine the implications for US science, technology and education likely to come from the economic integration of the Old World of Western Europe.

"Everywhere the alarm bells are ringing," he told about 200 scientists, engineers, educators and government officials on 5 March at the National Academy of Sciences, "but we're not reacting with any sense of urgency."

EC-92 is the code term used by the 12 nations in the European Community for the implementation of a "common market"—when nations will no longer discriminate against each other's products and services by way of taxes, duties and different standards. In 1992, European countries will remove, reduce or restructure all trade barriers to a single economic market. Anticipating the event, the community has already created science and technology policies and programs that are intended to strengthen Europe's economy. These include cooperative R&D megaprojects with such evocative titles as Eureka, Esprit, Epoch, BRIT and RACE, which pool the talents and funds of corporations and governments in a wide range of technologies from aeronautics to high-performance data telecommunications (PHYSICS TODAY, March, page 67). One of the most recently launched EC projects, bearing the name COMET, calls for academic and industrial exchanges and other university-business linkages.

In December the European Commission approved a five-year research program called Framework. It covers



Holderman: Hearing alarm bells.

all the high-technology projects jointly sponsored by governments and businesses. Commission officials last August had proposed a Framework budget of \$8.6 billion, which would have made up about half the total \$16 billion that many commercial companies and individual governments sought to pour into the quest for high-technology products and services between 1990 and 1994. But some countries, most vocally Spain and the United Kingdom, objected that their share would be too costly, and in the end the commission approved a budget of \$6.25 billion (see page 67). Framework obligates the largest outlays to nearly a dozen "enabling technologies" such as semiconductors, computers and data networks.

Mixtures of hope and fear

Europe's rush toward R&D with commercial applications strikes US science and technology policy makers with intense mixtures of hope and fear. Both reactions were expressed during the first major public forum for US and European scientists, business leaders and government officials on EC-92, held on 5-6 March at the

National Academy. In an effort to calm concerns, Filippo Maria Pandolfi, vice president of the European Commission and the commissioner responsible for R&D, declared that the US had no reason to fear EC-92. He sought to assure the audience that Europe will maintain open research relationships with American scientists. US bilateral agreements with European governments will be sacrosanct, he noted, enabling American researchers to work at CERN, for instance, or the *Institut-Langevin* or the *Max-Planck Gesellschaft*. "Of course, we aim to achieve the maximum benefit to Europe for the taxpayer," Pandolfi said. "But maximum benefit to Europe does not mean to the detriment of someone else."

Pandolfi's statements did not persuade Erich Bloch, director of the National Science Foundation and, before that, an IBM computer engineer. He worries, he said, that EC-92 would disrupt the traditional ties between US science and Western Europe's universities and research laboratories. Bloch stated that D. Allan Bromley, President Bush's science adviser, has organized a panel in the interagency Federal Coordinating Committee on Science, Engineering and Technology (FCCSET) to examine the likely consequences of Europe's economic integration on international R&D and that the National Science Board has established a special committee under Holderman to study the implications of NSF policies and programs.

Bloch observed that with the arrival of EC-92 the nature of government-to-government relations in science and technology are apt to change. "Today our contacts are at the bilateral level. As the EC becomes a larger factor in research funding, what should be the nature of US contacts with the integrated community?" Bloch asked.

"Generally stated, the question is whether the single-market momen-

tum will lead European researchers and their program administrators to look inward and inadvertently disrupt the relationships that have been developed on a bilateral basis," said Bloch. "There is no doubt that in the past the scientific relationships of some countries were stronger with the United States than with their neighbors. . . .

"Until recently, a regular sharing of ideas and approaches among European and American scientists was ensured not only by contacts among senior scientists but also by the fact that many Europeans received at least a part of their training in the US. That is changing. Among scientists between the ages of 45 and 54, 21% obtained their doctorates in the US, while for those between 30 and 35 only 12% received PhDs here. This change is occurring simultaneously with the emergence of a European community of scholars, more oriented toward intra-European communication. This could result in greater pressure on research administrators to redirect resources, including grants, fellowships and travel costs, to European-centered activities—to the exclusion of cooperation with scientists and engineers from other countries," said Bloch.

"Because of the centrality of research to the economic competitiveness of individual nations, cooperation and competition in the sciences and engineering have a different meaning today than they have had over the last 40 years," he continued. "Not surprisingly, cooperation in science and technology is becoming a political question."

Sharing 'megaproject' costs

The issue of cooperation is more important than ever, Bloch asserted, because the need for open communication of research "is driven in part by the pace and richness of the discoveries and capabilities." Moreover, said Bloch, "the escalation in the costs of doing research makes cooperation on major research problems and in the use of large capital-intensive facilities, like drillships, telescopes and accelerators, increasingly attractive . . . and at the same time subjected to practical and economic political concerns."

Slow growth in most European countries during the 1970s and early 1980s led governments to skimp on basic research and university support. But with most economies booming since the mid-1980s and free markets looming in the early 1990s, Europe's governments have plunged into high-technology projects, such as

those devised by the commission.

Currently, according to Bloch, R&D spending by the EC, under the Framework program, constitutes less than 4% of all R&D outlays in Europe. To support technology, it is probable that EC's basic research will increase, a situation Bloch endorses but leaves him wondering whether "greater pressure on basic research [will result in] diminished contacts between US and European researchers."

Similar themes ran through Bromley's talk the next morning. His remarks were described by White



Bromley: Urging more coordination.

House sources as defining Bush Administration science and technology policies on EC-92. Bromley's speech, in fact, carried the White House seal of approval. In it he declared that the move toward economic integration "threatens to substantially weaken US-European ties in science and technology, as European researchers look inward to the new challenges and opportunities of a common marketplace. I believe that any weakening of the links between the United States and Europe is a mistake . . . Even in aspects of R&D closely related to commercialization, cooperation in science and technology can pay great dividends."

He then set out the Bush Administration's science and technology principles: "First, it should be understood that we support the free market of ideas and researchers as they flow back and forth across the Atlantic. The vast majority of science and technology interchanges take place without government intervention or even knowledge. That is the way it should be.

"For those interactions in science and technology that occur under for-

mal government-to-government agreements, a more formal set of criteria apply. We in the United States believe that there should be shared responsibilities for both basic and applied research, access to R&D programs and facilities that are comparable to those granted foreign researchers in the US, adequate protection of intellectual property rights and effective protection for sensitive knowledge."

In discussing basic research, Bromley suggested that some R&D megaprojects are well beyond the financial capacities of any single country, no matter how rich it is. He called for coordinated planning and collaborative funding for such "big science" ventures as the Superconducting Super Collider, Space Station Freedom, global climate research, the Compact Ignition Tokamak and human genome mapping. He noted that NASA's \$30 billion space station will derive more than \$7 billion worth of laboratory modules and other hardware from the European Space Agency (an organization independent of the European Community), Canada and Japan. As for the SSC, the Departments of Energy and State are working closely with OSTP to involve other nations in the "planning, building, using and managing" of the giant particle accelerator. Various estimates put the cost of the machine at somewhere around \$7.6 billion to \$8 billion, of which Congress wants non-Federal sources to put up one-third of the total cost. (So far, only India is committed to contributing \$50 million "in kind" for the SSC—though the Department of Energy plans to send a team to Japan in the next month or two to solicit support.)

Admitting a NASA imbroglio

Somewhat surprisingly, Bromley took the occasion to admit that "because of shifting commitments by the US government, we have developed a reputation as a somewhat unreliable partner in cooperation on large science projects." He undoubtedly had in mind the recent imbroglio over NASA's design changes of the space station, made without involving ESA, Canada and Japan.

In an effort to be conciliatory and to avoid such contretemps, Bromley has directed his staff to design an "umbrella agreement" that will facilitate large science and technology projects with the EC and other international partners. "It might be desirable, in this effort, to look at the megaprojects not one at a time but as a whole," said Bromley. "We also need to develop more stable and credible agreements

to cover megaprojects. At some point, we may even consider new approaches to treaty agreements to accomplish this end. We are not yet ready to make recommendations...but we are working within the Administration and with Congress on this subject."

Bromley also spoke about the US commitment to "open and equitable access to our educational institutions, not only for the students of this country but for students of any country. Many countries have been eager to take advantage of this access, because it remains a fact that the US has the best system of graduate education anywhere in the world. As a result, nearly half of the engineering students in this country are foreign citizens. The proportions are about the same for mathematical sciences and computer science and just a little less for the physical sciences...As it is, without the very large fraction of foreign students who remain following their graduation to pursue careers in the US, the shortages that we foresee in many of our scientific and technological fields would be vastly worse than is now the case. The US economy already depends on an influx of bright young people from abroad for its health and vitality.

"Regarding exchanges with Europe, we have not yet begun to see the decreases in students from abroad that some predict might be a consequence of European unification. But there is an impression in the scientific community that exchanges of all scientists and engineers between Europe and the US are declining."

He said the US must encourage and support exchanges of American and European scientists and engineers and pointed out that the West German government provides funds for 70% of the exchanges between both countries "in both directions." Bromley used the occasion to propose a US foundation or some similar organization to bring European scientists and technologists to the US "at our expense. Such a program would begin to balance the costs of this exchange with the shared benefits that both we

and the Europeans derive from it."

Beyond basic research, Bromley stated, to the extent that work is done prior to actual product development, "international cooperation will benefit all collaborators." He urged that "cooperative agreements affecting precompetitive R&D should be negotiated on a case-by-case basis. These agreements, however, should be predicated on a relatively simple assumption—that individual investigators and private firms are able to participate in R&D endeavors in the other party's territory to the same extent that domestic researchers can do so. Although there may be projects for which these rules do not apply, we should strive to achieve a level playing field, not only between Europe and the US but around the world."

Opening precompetitive R&D

During a panel discussion at the academy, Paolo Fasella, director general of the EC's science, research and development directorate, told how North American Philips, the US subsidiary of the giant electronics firm in the Netherlands had been prohibited from joining SEMATECH, the US research organization in semiconductor processing, jointly funded by US companies and the Pentagon. By contrast, Fasella observed, IBM Europe has been invited to participate in JESSI, the semiconductor research project in EC's Eureka program. "We should be discussing free and open access to research in the US, not bashing Europe," said Fasella with obvious anger. Jean-Jacques Duby, an executive at IBM Europe, made an attempt to calm the debate by calling for reciprocity.

The instinct for governments to "do something" about developing technologies is understandable but often misguided for both political and economic reasons. Politicians have an urge to protect new technologies for the same reasons they defend their country—the welfare and security of the people. Businessmen are restrictive to protect their company's interests. The fears expressed by Bromley

center on high-technology jingoism, leading to trade barriers and cutting scientists off from other scientists.

In his speech Bromley pointedly observed that "The basic position of the US government toward European unification is that we commend the EC's efforts to increase competition and stimulate economic growth within Europe by removing international barriers. However, we want to be sure that the unification of the European market does not decrease competition between Europe and the rest of the world. In other words, we want to be sure that when trade barriers are removed within Europe, new barriers are not erected between Europe and the rest of the world." He was concerned, he said, about two matters in particular—standards and regulations required of goods and services, which might be set to exclude competition from outside the EC, as in the case of US biotechnology products.

Bromley noted that delegations from Czechoslovakia, East Germany, Hungary and the Soviet Union had appeared suddenly at OSTP "to explore the possibility of upgrading or starting new exchanges and cooperative research programs... The countries of Eastern Europe hunger for Western science and technology. The challenge we both face is to transform and adapt existing arrangements and multilateral institutions so that they can accommodate new relations with Eastern Europe."

Indeed, with EC-92 and with Eastern Europe moving toward democracy and, of all things, capitalism, there is a palpable excitement in Europe—a belief that the Age of Europe may be dawning. Only six years ago, William A. Nierenberg, then director of the Scripps Institution of Oceanography, informed the National Science Board after a trip abroad that Europe's scientists and engineers spoke of a pervasive "Euro pessimism." At the academy conference, Josef Rembser, director general for research in West Germany's Federal Ministry for Research and Technology, expressed the current attitude as "Europhoria."

—IRWIN GOODWIN

SCIENCE FRICTION: FUROR OVER FUSION PROMPTS DOE TO SEEK EXPERT ADVICE

Robert O. Hunter Jr is gone but not forgotten in Washington. Soon after he arrived at the Department of Energy's Office of Energy Research in August 1988, Hunter quietly devised a scheme to redirect the controlled

fusion program. It included cutting \$50 million from magnetic confinement fusion and transferring the funds to a rival approach, inertial confinement fusion. It also called for postponing construction of the Com-

pact Ignition Tokamak at the Princeton Plasma Physics Laboratory while more theoretical and experimental research is done on plasma confinement in tokamaks, compact toroids and reversed-field machines.