

Avoiding Nuclear War

The time has come to put much more emphasis on risk reduction and "confidence-building" measures to supplement arms control agreements, according to speakers at a 10 September congressional seminar organized by the AAAS.

Joseph Nye, director of the Center for Science and International Affairs at Harvard's John F. Kennedy School of Government, observed that there has been an "imbalance in the national debate, which has focused almost entirely on big ticket items." Ronald Lehman of the National Security Council pointed out that this is a particularly important front to push on now that a large portion of the Congress and the public has become disaffected with formal arms control agreements.

The meeting was led by David Hamburg, president of the Carnegie Corporation and chairman of the AAAS board, who noted that improved rapprochement with the Soviets "doesn't have to rely on mutual affection." He outlined four types of measures that need to be taken: improved communications to "avoid nasty surprises"; "rules of the road" such as the U.S.-Soviet Incidents at Sea agreement; clarification of vital interests in sensitive areas; and strengthening of mechanisms for information and consultation—such as the "nuclear risk reduction centers" proposed by Senators Sam Nunn (D-Ga.) and John Warner (R-Va.).

Barry Blechman, founder of Defense Forecasts, Inc., pressed the case for risk reduction centers, saying "there is no real locus in government" where people can contemplate the range of risks and options regarding nuclear war. The centers would be established in both Washington and Moscow to serve as forums to discuss issues such as nuclear terrorism and treaty compliance, to clarify American and Soviet perceptions of the role of nuclear weapons, and to serve as "supplementary negotiating channels."

Lehman, who is serving as deputy U.S. negotiator for strategic nuclear arms, offered tentative Administration support for the idea. He said that although some regard risk reduction measures as "arms control junk food" supplanting needed arms agree-

ments, the President regards the two approaches as complementary. He noted that the Washington-Moscow hot line is being upgraded and that the Accidents Measures Agreement of 1971 has been extended to facilitate communication between the superpowers in the event of terrorist or "unauthorized" use of nuclear weapons. He said the Administration favors an "evolutionary" approach to risk reduction centers, starting with a Joint Military Communications Link between the Pentagon and the Soviet Defense Ministry. The Soviets have so far resisted this idea, although Blechman reported that the Soviet general staff and Prime Minister Gorbachev responded well to overtures made by Nunn and Warner on a recent visit to Moscow.

Nye contributed some additional ideas, which are contained in the first report of his center's Project on Avoiding Nuclear War, called *Hawks, Doves and Owls* (an attempt to inject a new kind of nonpolarized, smart bird into the arms control lexicon). Its recommendations include reduction of reliance on short-range nuclear systems, improved safety devices on nuclear weapons, measures to handle "decapitation" strikes, and crisis training for nuclear decision-makers.

—CONSTANCE HOLDEN

Congress Urged to Approve China Nuclear Agreement

The People's Republic of China will buy nuclear technology from the West Germans, French, or British, if American vendors are prohibited from selling there. Although there is concern with the lack of specificity on safeguards in the proposed "Agreement for Nuclear Cooperation" proposed by the Reagan Administration on July 23, there is little point seeking further written assurances. The United States, Administration officials say, cannot prevent the Chinese from acquiring the technology.

That was the message delivered by witnesses appearing on 12 September before a special House commerce subcommittee on U.S.-Pacific Rim Trade. This position was largely supported by an interim report issued by Congress' Office of Technology As-

essment. Alan T. Crane, OTA's project director, notes that the technology transfer resulting from dealing with U.S. companies would not be appreciably different from that derived by trading with the French, Germans, British, or Japanese. These countries, Crane notes, in many instances use American technologies under license.

"China has much to lose in future technical assistance and good will," if it applies imported technology to military projects or assists nonnuclear states in developing weapons, says Tao-tai Hsia, Chief of the Library of Congress' Far Eastern law division. Although China has taken a strong stand against nuclear proliferation only in the last 2 years, Hsia asserts that the country is likely to display greater concern in the future.

The Chinese government's refusal to accept International Atomic Energy Agency (IAEA) inspection on imports of U.S. technology needs to be understood in the context of internal political pressures and the country's maturation within the international community, he says. While China as a member of IAEA allows the international safeguards to be imposed on its dealings with nonnuclear countries such as Brazil, Argentina, and Japan, it does not feel compelled to open up its own facilities for inspection because it is already a weapons state.

But members of the Senate Foreign Relations Committee (*Science* 23 August, p. 737), which is scheduled to examine the agreement on 9 October, are concerned about the precedent the China agreement may set. House members also have argued that the vague language of the China agreement may make it impossible to impose tougher standards on nonnuclear nations in the future.

Congressional endorsement of the Agreement for Nuclear Cooperation must come soon if American firms are going to have a shot at the Chinese market, says James R. Phillips, the Commerce Department's deputy assistant secretary for capital goods and international construction. Framatome of France, KWU of West Germany, and GEC of Great Britain have been negotiating for years with the Chinese on two units to be located at Daya Bay and two slated for Sunan.

"It is paramount that U.S. service-related firms be allowed to operate in China at the earliest opportunity,"

says Phillips. Opportunities for foreign architectural and engineering firms and equipment vendors likely will be limited to the first four of ten 1000-megawatt units the Chinese plan to erect by 2000. China hopes to build most components domestically by the mid-1990's.—**MARK CRAWFORD**

Universities Urged to Enter the Information Age

Picture a university math building. To many, it conjurs up images of a drab, fluorescent-lit room full of cramped desks. Equations are scrawled across a dusty chalkboard and students with pocket calculators strain to comprehend complex, abstract concepts in black and white.

This is the math lab of the past, but unfortunately it persists in too many colleges and universities. And these surroundings are part of what is causing gifted students and teachers to flee academia for better equipped workplaces in industry, says John H. Hubbard, a professor of mathematics at Cornell University.

The information age, says Hubbard in testimony presented to the House Science and Technology Committee's task force on science policy in hearings held 10 to 12 September, requires that the computer be brought into the math lab in a mass way. Today's manufacturing technologies, notes Hubbard, demand that students know how to employ differential equations to model and design components on computers. Such calculations are tedious, if not impossible, to do manually without computers.

Despite the widespread use of microcomputers, they have not found their way into nearly enough math departments in meaningful numbers, says Hubbard. Where computers have been introduced in a significant way, he adds, new life has been breathed into math curricula. Not only are students and faculty freed to explore theoretical and applied mathematical problems, but computer-driven color graphics aid comprehension and analysis immensely.

Hubbard recommends that every mathematics department be equipped with machines equivalent to a VAX or an IBM 4341 with terminals located in

every faculty office. Minicomputers of the Apple or IBM PC variety are needed for every 15 students, he adds. Not only will more federal and state funds be needed to achieve this, but math buildings that typically get little attention will require expansion to accommodate the space-consuming equipment.

This sketch of math departments being surpassed by the information age is but one aspect of the mushrooming phenomena, which the House Science and Technology Committee is trying to come to grips with. Just as math departments have to scrap chalkboards for computers, computer science itself must look beyond its traditional information processing and computational structures, says John Seely Brown, director of Xerox's Intelligent Systems Laboratories. And universities must be fitted with state of the art equipment to avoid early obsolescence. Nevertheless, equipment life cycles may be shorter than traditional depreciation schedules, Brown notes.

Better software is needed, says Brown, to transform complex computations into data that can be easily comprehended. Furthermore, conceptual theories must be developed on how to search and filter information to allow management of content, rather than bulk information. With computing power expanding at a rapid pace, new computer architectures must be pursued. These should be less bulky to use, allow for faster problem solving, and permit new approaches to information management and computation.

David A. Pensak, a research supervisor with E. I. du Pont de Nemours' central research and development department, echoes Brown's observations. Interactive computing and graphics help researchers understand multidimensional molecular structures, but computer graphics need to be developed further, he says, to depict greater amounts of data and to do it in a three-dimensional way.

To make use of the coming advances in research and computer science, federal funding for basic research in methodology needs to be increased. Finally, Pensak says there should be stronger ties between universities and industry and better access to federal data banks.

—**MARK CRAWFORD**

Ignition Error Blamed for Ariane Failure

Paris. Arianespace, the company responsible for commercial launches of the European rocket Ariane, has announced that some form of ignition malfunction appears to have been the cause of the rocket's failure last week, leading to the loss of two telecommunications satellites.

The company also announced that it is setting up an investigatory committee to discover the precise cause of the failure of the third stage of the rocket to ignite properly, resulting in the decision of flight engineers to blow up both the rocket and its payload 10 minutes after lift-off.

It was uncertain whether the problem had been in the rocket's ignition equipment itself, or whether it was due to a blockage in the fuel supply. A statement issued by the company said that, although the valves feeding the fuel to the rocket motor had functioned correctly, an "abnormal ignition" took place in the combustion chamber 0.4 seconds late and that "since the nominal functioning conditions were not reached, the motor stopped functioning."

Arianespace officials in Paris point out that, despite the failure, Ariane still enjoys a good launch record, having previously achieved nine successful missions in a row. The most recent of these was the European Space Agency's Giotto spacecraft, which is due to rendezvous with the comet Halley next year.

However, the failure is expected to result both in delays to future launches—Ariane's order book is already full for the next 2 years—and to further increases in insurance premiums for satellites, which have already experienced significant rises in recent months due to problems with launches from the U.S. space shuttle.

The failure was also an embarrassment for the French government, which has paid 60 per cent of the development costs of Ariane, since the launch was being attended by President François Mitterrand, who had hoped to use it both as a symbol of French achievement in high technology and to reinforce his commitment to an independent European presence in space.—**DAVID DICKSON**