"They are using gunships to reduce whole valleys to rubble. Soviet tactics have two objectives: the rubblization of Afghanistan and migratory genocide," says Dupree. The number of refugees in Pakistan, less than 500,000 at the time of the Soviet invasion, has now reached more than 1.5 million people, an extraordinary 10 percent of the total population, and in January 1981 the monthly exodus reached 143,000, the highest on record. Another 300,000 to 400,000 Afghans are refugees in Iran.

It was a year before the Russian intervention that Dupree finally left Afghanistan. Told in August 1978 that his resident's visa would not be renewed, he approached Taraki and Amin, both of whom he had known personally in the 1960's. They refused to see him, and he and his wife Nancy left for Pakistan. But Dupree had not been forbidden to return. A few weeks later he received a visa and drove back to Kabul to test the waters. For a few days everything seemed normal. The day after Thanksgiving, while his wife was out shopping, he was arrested and taken to jail. Six days of interrogation followed. Though not physically abused himself, he was made to watch others in the Kabul jail undergoing intimidation and torture. He was accused of working for the CIA and was urged to name all his associates in Afghanistan. When this didn't work, his interrogators confronted him with a former Afghan colleague, badly tortured, who denounced him as a CIA agent. Dupree denied all charges and named no names. After 6 days he was released, the reason for his arrest remaining as obscure as ever, and he and Nancy were escorted back to the border. They were fortunate to escape. Probably 8000 people were executed during the period of the Taraki-Amin purges.†

Soviet tactics, Dupree believes, are unifying the different peoples of Afghanistan in a way that no previous government has been able to do. With their villages destroyed, Afghans are settling their families in Pakistan and returning to fight the invader. Without the usual ties to place, the guerrillas are free to join larger, multi-ethnic units. Dupree hopes that local units, in the manner of the Yugoslav partisans, will ultimately combine into a national liberation movement: "Such a movement, given the necessary weapons, could force the Russians, who already know they can't conquer Afghanistan, only destroy it, to settle the matter peacefully at the negotiating table."—NICHOLAS WADE

†The events of the Taraki-Amin regime, and of his own imprisonment, are described by Dupree in a six-part report "Red Flag over the Hindu Kush," published by the American Universities Field Staff, Wheelock House, Post Office Box 150, Hanover, New Hampshire 03755 ($1.50 per part).

Attempts to Safeguard Technology Draw Fire

The government wants to keep foreign students and scientists away from unclassified high-technology research

A major struggle is shaping up between universities and the government over research with strategic and commercial implications, particularly in microelectronics. The issue also affects scientists in industry, many of whom are as much concerned as are those at universities.

The crux of the issue is the perennial problem of how to preserve for the United States the fruits of research in high technology while at the same time avoiding restrictions on researchers' freedom. No one has yet devised a perfect solution to the problem but new steps taken by Congress and the Administration to prevent technical data being transferred overseas have brought the issue to the fore.

On 27 February, a letter of protest was sent to the Secretaries of Commerce, State, and Defense. The letter was signed by the presidents of five of the country's leading universities—Donald Kennedy of Stanford, Marvin Goldberger of the California Institute of Technology, Paul Gray of the Massachusetts Institute of Technology, Frank Rhodes of Cornell University, and David Saxon of the University of California. They claim that the government, in its attempts to restrict the export of technology, has resorted to measures that could irreparably harm university-based research.

The presidents tried to avoid publicizing their letter, hoping to quietly reach a compromise with the government. But the letter has been given to the press.

The university presidents are concerned about the implementations of existing regulations designed to limit technology leakage. The rub is that the regulations are so vague and so all-encompassing that, if they are strictly applied, they could shut down high technology research in both universities and industries.

The Defense Department regulates the export of technology through the International Traffic in Arms Regulations (ITAR). According to the ITAR, technical data are exported when they are "disclosed through visits abroad by American citizens (including participants in briefings and symposia) and disclosed to foreign nationals in the United States (including plant visits and briefings and symposia)." Technical data include unclassified data that can be used to manufacture or design an article with military applications. For example, since computer chips are being used in weapons, information on the design of certain microcircuits may be considered technical data. A license is required to export technical data.

The Commerce Department has a similar set of regulations, called the Export Administration Regulations (EAR), which deal with technologies that have both commercial and military applications. Both the ITAR and EAR are difficult to interpret. George Dummer, who is director of the Office of Sponsored Programs at MIT, characterizes them as, "the most bewildering set of regulations I've ever had to deal with."

If strictly interpreted, these regulations could prohibit university engineering departments from admitting foreign students into their graduate programs, could forbid foreign scientists from attending certain scientific meetings and could prohibit United States corporations from hiring foreign engineers or even from communicating technical in-

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formation to their overseas subsidiaries—unless, in each case, a license was obtained. Says Larry Sumney of the Defense Department, "The ITAR, if enforced to the letter, would cover virtually everything done in the United States. But people understand they are written very generally." He believes that industries, at least, have learned to live with the ITAR, accepting the necessity of such regulations and realizing that they will not be capriciously enforced.

Reactions to the issues raised in the letter vary widely. Government officials seem perplexed. "I have never in my life seen anything get so blown out of proportion," says Sumney. Henry Mitman at Commerce says, "The situation is not nearly so bad as everyone is making it out to be." On the other hand, some university and industry representatives feel the issues are, if anything, understated in the presidents' letter. "We've got a national disaster brewing that has to do with free enterprise in general, of which

Academic Freedom at odds with commercial and military security.

academic freedom is just one piece," says Carver Mead of Caltech. C. Lester Hogan of Fairchild Industries says that the government's plans to restrict the export of technology, "will cause the United States to lose its position of leadership. It's just the wrong thing to do."

No one denies, however, that there is technology leakage and that there are difficult questions of where and how the leaks should be stopped. Universities are involved in the problem because their tradition of open discussions of research results do not allow them to plug leaks. Industries are involved because they employ foreign citizens and have overseas subsidiaries and so they too may be a source of leaks.

Defense and Commerce Department officials explain that technology leakage is a serious problem because the Soviets are making an unprecedented effort to obtain technological data from the United States, particularly in the fields of microcircuitry, lasers, and fiber optics. So eagerly sought is this information, says Sumney, that some law firms are going to the extent of getting copies of grant proposals for research in high technology areas and then passing the proposals to agents in nonaligned countries. From there, the proposals are routed to the Soviets. The lawyers obtain the proposals through the Freedom of Information Act.

There is also concern in the government that U.S.-developed technology is being obtained by economic competitors, such as Japan. No one expects that new technology can be kept in the United States forever. But, says Sumney, "The general feeling is that if we could hold onto newly developed material for about 2 years, we could keep our lead."

The university presidents, however, do not believe that universities are set up to police the export of newly developed technologies. In their letter, they refer to three recent incidents that cause them concern, one involving Cornell University, one involving MIT, and one involving a large number of universities.

Donald Cook, vice president for research at Cornell, explains that earlier this year a Hungarian scientist was scheduled to visit Cornell and study electronic circuitry. Cornell was informed by the State Department, however, that the scientist could only receive information in classroom situations—no private seminars or discussions were allowed—and that he could not be given pre-publication copies of research papers. Under these conditions, says Cook, "the visitor did not come to Cornell."

At MIT, says Dummer, a recent $250,000 Air Force contract for research on computer-aided design contained a clause saying release of the research results was to be controlled for 2 years in order to deny access to foreign nationals. MIT, Dummer reports, declined the contract.

The third incident referred to by the university presidents is the most far-reaching and is the one that brought the whole issue of export controls to a head. It involves the use of the ITAR in the Defense Department's Very High Speed Integrated Circuit (VHSIC) program, which is administered by Sumney. The program is designed to support the development of microcircuits with very fast signal processing speeds and also with the ability to withstand heat and radiation so that they can be used to form the "brains" of military weapons. Research under the VHSIC program is being carried out by both industries and universities and involves studies of circuit design and materials science.

When Congress authorized VHSIC in

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Meltdown Too Hot for Maryland Science Center

"The subject was not too controversial; it was just inappropriate," says Owen Phillips, explaining why he, as chief of the science council at the Maryland Science Center, agreed at the last minute to ban the showing of a play on the center's stage in Baltimore. The play, *Meltdown*, deals with the troubles of a family in Pennsylvania living near the Three Mile Island reactor at the time of the accident in 1979. It was written by a physicist at the University of Maryland, Ivan Kramer, and by a historian of science at Johns Hopkins, Robert Kargon, who holds an undergraduate physics degree from Yale.

The confusion around this theatrical misadventure is, in a sense, a fitting celebration of the real event. As Kargon says, "Back by popular demand: chaos and mismanagement." On 10 April, just 3 weeks before the play was to open, the center's director, James Backstrom, called the authors and told them he had read their script and decided to cancel scheduled performances.

Kramer says that he and his coauthor received grants amounting to $7800 more than a year ago from the Maryland Committee for the Humanities to fund work on the play. As the authors had proposed, they produced a script based heavily on five federal documents dealing with nuclear accidents. Large chunks of dialogue were lifted directly from transcripts of Nuclear Regulatory Commission (NRC) proceedings, but much dialogue is fictional, and Kramer says that he doctored some of the NRC conversations to "eliminate embarrassing slips in physics." The authors claim that they thought they were doing the science center a favor: According to Kramer, the center does not attract adult audiences and needs both public attention and financial help.

Backstrom agreed last year to lend them use of the theater, his enthusiasm boosted by the fact that Kargon had served as a consultant on earlier shows. Backstrom says he was at first "delighted" at the idea of having an educational show about Three Mile Island but became worried as the opening night drew near and no script

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1980, it expressed concern that the technology to be developed in this program not fall into the hands of potential adversaries. Thus it specified that the ITAR regulations would apply to this research.

On 12 December, Sumney sent a memo to VHSIC program directors providing guidelines for how the ITAR would apply. First, he said, the directors must distinguish between basic and applied research. Basic research, in general, would not fall under these controls. Applied research would and so could not be presented at open symposia or meetings or disclosed to persons who are not U.S. citizens. Acknowledging that the distinction between basic and applied research is not always easy to make, Sumney suggested that in cases of doubt, the contractors should forward the research results to his office for a decision.

But making distinctions in what Sumney called the "gray area" between basic and applied research is a matter of great concern for the university presidents. In the field of microelectronics, for example, it is becoming increasingly difficult to decide whether such things as the development of techniques for the design and fabrication of circuits and the development of software are basic or applied research. The presidents say in their letter, "There is no such easy separation in any engineering curriculum intended to be relevant to our national needs and problems. Furthermore, producing graduates with no 'hands on' experience in these areas would be of little value to American high technology industries."

Sumney ended his memo with a statement that some administrators found particularly troubling: "In the case of basic research supported by the VHSIC program, although such research and its results are not generally controlled, it is the preference of the Program Office that only U.S. citizens and immigrant aliens who have declared their intention of becoming citizens participate. Where this preference cannot be accommodated, the contractor should be directed to the Program Office for resolution."

Caltech's president Goldberger is appalled by this application of the ITAR. High technology research would be forced out of universities if such controls operated, he says, since university scientists could not work under such conditions. "The only realistic way to contain VHSIC research would be to classify the whole program. It would be catastrophic for them to take that step," he remarks. Sumney, however, notes that the Defense Department could not possibly classify the VHSIC program. "It is not a secret program. It is a general technology development program and it has direct commercial applications as well as military applications," he says.

Mead at Caltech shares Goldberger's concerns but points out that, "The big thing that people need to understand is that it's not just a problem for universities, it's a problem for industry." Industry, he says, is already working on the same technology that is supported by the VHSIC program and is spending 50 times as much money on such research as the Defense Department is. If the ITAR are employed as Sumney's memo indicates they should be, all research on this technology would be subject to controls, no matter who funds it. This means, for example, that industries with foreign subsidiaries would need to get an export license each time they want to discuss this work with their divisions overseas. It also means the industries would need to get a license each time they want to hire a foreign engineer. And, says Mead, "Half of the engineering force in electronics is foreign nationals. Half of our graduate students are foreign nationals."

Hogan, who is director and technical consultant to the president at Fairchild, agrees with Mead. "We are concerned for many reasons," he says. "There is a problem, certainly, in that we want to guard technology that could go to the Russians. But the ITAR regulations hurt, they don't help."

Sumney agrees that the regulations could be burdensome to industries but says, "we must consider the consequences if we don't impose them." George Heilmeier, who is vice president of research development and engineering at Texas Instruments, agrees with Sumney, adding, "we think we can live with these regulations."

At present, matters stand at an impasse. John Crowley of the Association of American Universities, who has been closely following the situation, sums it up by saying, "It is a troubling issue but one with no immediate solution. We're caught in a bind."—GINA BARI KOLATA

The Containment of Research

Why research should not be contained:

It should be recognized that the only realistic way to "contain" VHSIC research is to classify the whole program. In our view this would be a self-defeating effort: the science underlying high technologies cannot be put back into the bottle. Furthermore, most universities have concluded that performance of classified research is incompatible with their essential purposes. University scientists would prefer, for the most part, to change their field of interest rather than have their research and teaching so constrained. Forcing high technology research out of universities would decrease our nation's competitive position, since the research would have to be carried out more slowly and less effectively in a classified atmosphere. Moreover, we would foreclose future research directions that would be otherwise discovered by having a continuous flow of new graduates from the university programs which have been flourishing up to this point. Elimination of such teaching and research from academic laboratories would endanger the future of graduate programs in engineering, computer science, and related fields, and would result in a tremendous loss of potential high technology otherwise available to American industry. The new restrictions represent the worst possible direction: they fail to protect the status quo and virtually guarantee that there will be no future.—*From the 27 February 1981 letter sent to the Administration by the five university presidents.*

Why research should be contained:

"The inherent contradiction of capitalism is that it develops rather than exploits the world. The capitalistic economy plants the seeds of its own destruction in that it diffuses technology and industry, thereby undermining its own position. It raises up against itself foreign competitors which have lower wages and standards of living and can outperform it in world markets."—*A quotation, supplied by the Department of Defense, from the works of V. I. Lenin.*