LETTERS

Innovation

During hearings held jointly by four congressional committees on 31 October 1979, the Administration revealed the long-awaited report of its Domestic Policy Review on Innovation (News and Comment, 16 Nov. 1979, p. 800). This review has been of central interest to industry, and many key research leaders participated in its formulation. Numerous workshops on the topic have been conducted (with participants from government, industry, and academia) resulting in the primary recommendation that the government take immediate and effective steps to enhance innovation. To do so means to establish a national policy and to support it with sufficient financial resources to make a significant impact on a broad base of innovation in industry.

Financially, the Administration's recommendation would provide virtually no wherewithal to carry out a policy, even if such a cohesive plan had been developed. The addition of $20 million per year to the budget of the National Science Foundation (NSF) is a proper augmentation of NSF's traditional role of creating manpower and basic research. Beyond that, the recommendations give no major support to "centers for cooperative research and development," as were developed in Japan and many European countries during the 1950's under the financial aid and political pressure of the Marshall Plan. The contention here is that the nonexistence of such centers is a major reason for the relative decline in innovation in the United States.

This lack of innovation is centered in the spectrum of industries that manufacture consumer products (*1*). The weakness in this sector is best indicated by our trade balance in machinery and machine products, which represent 75 percent of our trade in manufactures. In 1978, the 20 most negative trade categories for machines amounted to a total loss of $34 billion—effectively equal to our loss in oil. If one ignores the trade in cars, trucks, and aircraft, then machines account for 60 percent of our manufactures trade. This trade is protected by not more than 6 percent of our nation's research and development (R & D) for manufactures (both federal and industrial). The conclusion is that not more than 6 percent of our nation's scientific manpower is being used in mechanical manufacturing. Except for isolated cases, this manpower is either too poorly trained (the weakness is in academia) or too overworked to integrate new technological innovations, such as those available from the space program or from major centers in other countries.

Another unique feature of this 60 percent of our manufactures trade is that not more than 0.7 percent of the federal R & D expenditure for manufactures is being spent on new mechanical technology. The conclusion is that not more than 0.7 percent of our research effort is now being expended to produce new manpower in the manufacturing sector. Hence, while other countries are vigorously pursuing new and more efficient manufacturing technologies, our industrial base is not being refreshed by a sizable infusion of manufacturing technologists.

One portion of the manufacturing spectrum that is being considered here is light machinery (*2*) and the products of those systems. (The intelligent robot would be the highest level of this technology.) In 1978, we lost $11 billion in our trade in this area. The conclusions are

1) We are exporting our base for clean industry to other countries.

2) We are exporting jobs associated with these industries.

3) The pressure on our technological institutions to produce new manpower capable of creating competitive technology is substantially reduced.

4) We are losing a significant tax base (not less than $0.5 billion) and the associated multiplying effect of an important economic sector.

Other trade categories (for example, cars and trucks) are experiencing similar and growing intrusions into our home markets.

Part of the solution to the innovation deficit in the United States is the demonstrated effectiveness of cooperative research and technology centers such as the Production and Engineering Research Association in northern England, which serves 2000 companies with a staff of 350 and an annual budget of $15 million. Such a center represents a focus for fragmented industries that need help implementing new evolving technologies. Furthermore, when associated with a university, a center can enhance existing manpower in industry by means of specialized training programs or generate new manpower through sponsored research.

It may be argued that government should not participate in establishing such centers to help industry. In fact, it already supports 20 federally funded

R & D centers primarily in high energy physics, of which the top ten receive an average of more than $125 million each per year in governmental funding. Hence, the precedent is clearly there. The need is essentially as important for the United States as is our trade deficit in energy. The effectiveness of such cooperative centers on the neutral grounds of universities has been broadly demonstrated in other countries. Federal agency leaders have uniformly acknowledged that our technological edge has deteriorated. Industry is showing a new willingness to cooperate with government to create an effective national policy. Why, then, has the Administration failed to seize the opportunity to act decisively? Action to create a cohesive national policy is not only "desirable," it is necessary for our economic well-being. Industry and academia cannot operate to resist foreign competition in a policy vacuum. Such a vacuum during the next decade could do irreversible damage to the productive capacity of U.S. industry. The Administration is urged to immediately reconsider its position on this question.

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From Helsinki to Hamburg

The latest news from Yuri Orlov, the imprisoned organizer of the Moscow Helsinki Watch Group, is that a supervising KGB officer said to him: "Forget that you are a scientist." Orlov will not forget it while he is living. The question is, Will it be forgotten by the scientists who convene in Hamburg on 19 February 1980 for what is called "the Scientific Forum"? The purpose of this representative meeting is to support "the multilateral process initiated by the Helsinki Accord," and to tie to it some exchange agreements, as if the leaders of the Soviet Union were not openly violating that accord and have not imprisoned more than 20 citizens whose only crime was to take the human rights provisions of the Helsinki Final Act seriously.

I believe the delegations of the Western countries should demand the release of Orlov, Shcharansky, and Kovalev as a precondition for their participation in the forum. Many scientists, especially in this country and France, have boycotted scientific contacts with the Soviet Union over the imprisonment of these three men. Others have restrained from boycott, arguing that Western scientists visiting the Soviet Union could help and encourage Soviet dissidents in various ways. I have analyzed the pros and cons of boycotts elsewhere (*1*), and in my view, this argument is not valid. But even if it were, it does not apply to the Scientific Forum. Participation of prominent scientists in the forum will not encourage the dissidents in the Soviet Union; it will only encourage the Soviet bureaucracy to keep dissidents in prisons.

Another usual argument of anti-boycotters is that one should separate science from politics. With respect to the Scientific Forum this argument works in the opposite direction, for the forum is a political event, not a scientific conference. By taking part in it the scientists will appear to approve, or at least to accept the way the Soviet Union "complies" with the Helsinki Final Act. And this is at a time when a prominent physicist, personally known to many physicists in the West, is imprisoned for only *trying to monitor* the compliance of the authorities in his country with the Final Act. Does it not make a mockery of the lofty words to be uttered at the forum? Is it possible to take part in it and preserve one's self-respect and dignity?

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Preparation of DNA Transfer Reagent: Carcinogenic By-Product

Recently a new technique has been introduced for transfer and immobilization of electrophoretically separated DNA fragments to aryldiazonium derivatized paper (DBM paper) (*1, 2*) which may expose workers preparing intermediates to the volatile carcinogen bis-chloromethyl ether. The reagent 1-(*m*-nitrobenzyloxy)-methylpyridinium chloride (NBPC) or NBPC-treated paper (NBM paper) are available commercially (*3*) and pose no bis-chloromethyl ether hazard. Highly pure, crystalline NBPC can be prepared easily in excellent yield through the intermediate *m*-nitrobenzyloxychloromethane by treatment of *m*-nitrobenzyl alcohol with paraformaldehyde and hydrogen chloride gas. However, in the reduced pressure distillation of *m*-nitrobenzyloxychloromethane, a large, low-boiling forefraction is obtained consisting of comparable quantities of bis-chloromethyl ether (normal boiling point, 105°C), bis-chloromethoxymethane (boiling point, 166°C) and paraformaldehyde, all identified by nuclear magnetic resonance and mass spectroscopy. The volatility of the proven carcinogen, bis-chloromethyl ether is such that at the specified pressure (1.5 mm) (*1*) it would not be condensed above 0°C in ordinary water-cooled condensers and only inefficiently condensed in the normal dry ice–acetone pump trap. Even at 15 mm of pressure the pump trap was found to contain a large amount of bis-chloromethyl ether. Any uncondensed bis-chloromethyl ether would be pumped into the room. Consequently, the pump should be placed in a fume hood and provided with several efficient condensing traps for the protection of the worker.

The reagent NBPC appears to be reasonably stable and not likely to be a source of bis-chloromethyl ether by slow decomposition. The NBPC is stable in water (*p*H 5) at 100°C for at least 12 hours. It is stable in aqueous sodium carbonate (*p*H 9) at room temperature over a period of hours but undergoes slow hydrolysis when heated at 100°C. No condensible volatile product is formed when dry NBPC is heated at 200°C for 30 minutes; however, between 250° to 280°C the theoretical quantity of pyridine (and some paraformaldehyde) distills. Therefore, little hazard of bis-chloromethyl ether generation appears to exist in normal use of the NBPC reagent.

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Erratum: In the briefing "Caribbean med school in Washington, D.C.?" (News and Comment, 16 Nov. 1979, p. 799), it is stated that American University hired an instructor from George Washington University to teach students of the displaced University of Dominica. This is not correct. The instructor hired was from Georgetown University.