

guest comment

Focusing applied research on global problems

By Robert E. Marshak

My thesis is simple: the impact of science and technology on our post-industrial global society is so great that unless our universities are willing to accept much greater responsibility for applied multidisciplinary research on the larger societal problems, more and more of our social decision-making will be based on the self-serving needs of government and industry, the blandishments of well-intentioned but uninformed citizens' groups and the pervasive emotionalism of the mass media. The present-day American university is the prime institution where intellectual discourse and research remain relatively free of political pressure and ideological expediency; one might therefore enquire whether these beneficent conditions that have been so conducive to outstanding American performance in pure science would also improve American performance in certain types of applied research.

We acknowledge that applied research is driven by the desire to satisfy human needs. It is only natural that much of this applied research be carried on in governmental laboratories to meet national goals established by the political process and in industrial laboratories to satisfy the needs of the marketplace. When we turn to the needs of our complex interdependent world, however, we enter a realm where there is an inadequate knowledge base. A great deal of research must be done simply to define the problems, and the best minds must be brought together in an intellectual environment where national pride and profit-making are not the determining factors. A university or consortium of universities, working either independently or with the private sector and government, seems to me to be the most appropriate mechanism for mounting an attack on those problems that transcend national boundaries and the immediate interests of multi-national corporations.

Several years ago Henry Kissinger conceded that we are entering a climac-



teric of civilization in which no one can have more without someone having less. It was not until he was leaving office, Kissinger said, that he realized the enormity and grimness of our global problems. He admitted that when he came to Washington in 1969, it was inconceivable to his advisers that there would be a shortage of energy. As late as 1972, he was told that the United States had inexhaustible food surpluses. But, as early as 1968, a courageous physicist from the Soviet Union, Andrei Sakharov, had pinpointed the global problems threatening disaster for mankind in his now famous essay, "Progress, Co-existence and Intellectual Freedom." The crucial paragraph in that essay is:

The division of mankind threatens it with destruction. Civilization is imperiled by: a universal thermonuclear war, catastrophic hunger for most of mankind, stupefaction from the narcotic of "mass culture," and bureaucratized dogmatism, a spreading of mass myths that put entire peoples and continents under the power of cruel and treacherous demagogues, and destruction or degeneration from the foreseeable consequences of swift changes in the conditions of life.

It is a pity that when Professor Kissinger came to Washington in 1969 he did not pay more attention to the concerns Pro-

fessor Sakharov had expressed the previous year.

I am urging that American higher education take a leadership role in dealing with the global problems about which Sakharov spoke in 1968 and with the stark realities that must now be faced by every man, woman and child on planet Earth. With all due respect to the contributions that government and the private sector have made and can continue to make toward the solution of these problems, the time has come for American universities to accept the primary responsibility in forging a new set of value systems for our own society and to help generate a new set of long-term global goals for all mankind. American higher education can accept this larger responsibility because it, more than any other institution in our society, has demonstrated in the past several decades that it is the bastion of "pluralism, humanism, tolerance, openness to alternative truths and ability to distinguish prejudice from error" (Eric Ashby, *Adapting Universities to a Technological Society* refers to both American and Western European universities).

American universities can take this giant step forward in the research enterprise if they identify these newly emerged global problems of staggering proportions and fully recognize the crucial role the United States, as Superpower No. 1, must play in helping to carry the world into the next century without disaster. American universities, however, will only be able to discharge these responsibilities if, to quote again from Ashby's book, "faculty members are willing to reconcile the intellectual detachment essential for good scholarship with the social concern essential for the good life." Ashby has put the same thought another way: "If students do not learn from their teachers that the academic tradition can coexist with concern for society, they will reject the academic tradition." Above all, American universities will be able to discharge their heightened responsibilities by superimposing applied research and mission-oriented studies onto the present structure of professional and discipline-oriented programs. The applied research and mission-oriented studies would deal with the global problems that confront the US and the rest of the world and

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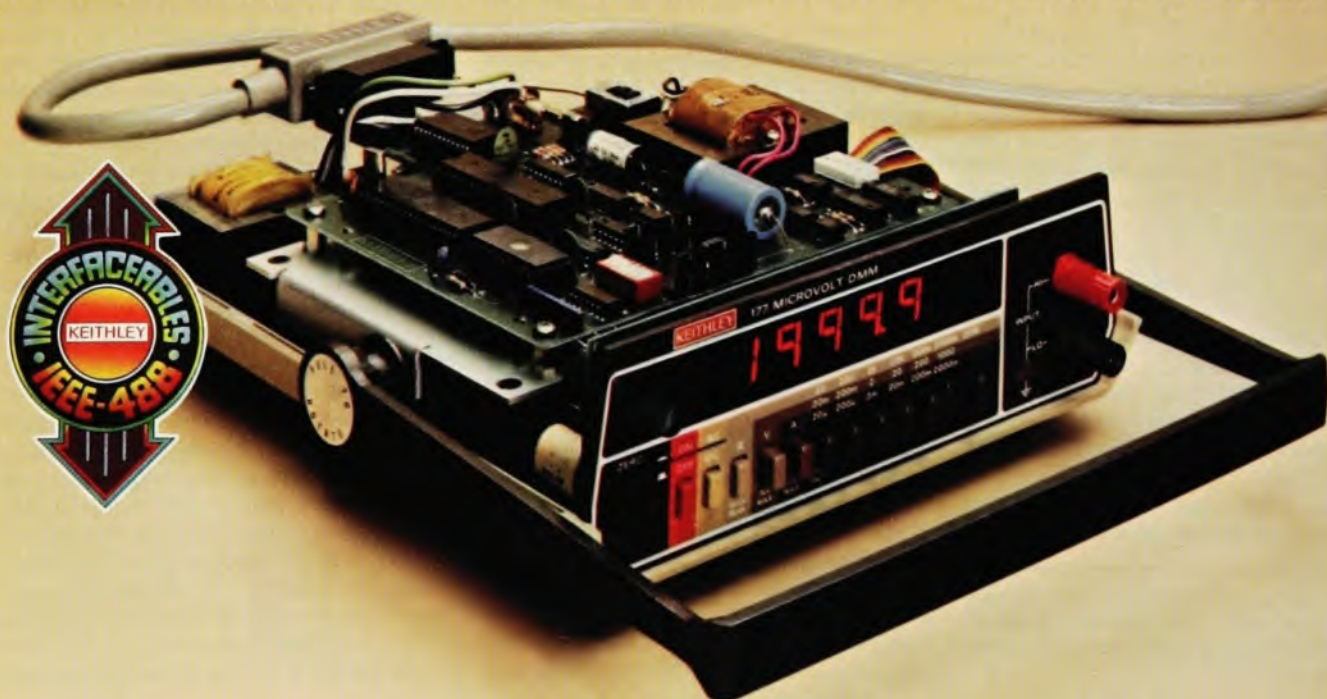
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would have in common the attempt to firmly implant the usual professional and discipline-oriented career goals in a humanistic, multidisciplinary context. The hoped-for result would be a student who is trained to serve society in the broadest possible sense.

The global mission of American higher education could be partially implemented via a network of applied inter-disciplinary research institutes on various campuses throughout the United States. Examples of what I have in mind are:

An Institute on "Peace and International Security" (including arms control, disarmament, limitations on national sovereignty, and so on)

An Institute on "Problems of Developing Countries" (including transfer of technology, industrialization, mechanization of agriculture, control of population, and so on)

An Institute on "Problems of Post-Industrial Societies" (including transportation, communication, housing and urban planning, and so on)

An Institute on "Energy, Ecology and Environment"

An Institute on "International Policy" (including international management and administration, economic and social indicators, management problems in nation building, and so on)

As I have already said, a key advantage of establishing applied interdisciplinary research institutes at universities is the possibility of creating academic programs that would educate students who are motivated and concerned to serve the world community through either a professional career or postgraduate program in a social or natural-science discipline applied to global problems. Such programs would, for example, lead to master of philosophy degrees in applied social science or applied natural science. It would also be possible to develop doctoral-level programs that would have similar outputs of trained manpower.

Let me be more explicit. Suppose a student is working on his doctoral thesis in the chemical-engineering department at City College; it is likely that his research problem will be on coal gasification, now the dominant program in the department and of great importance in providing an alternative energy option. When the student is awarded his PhD, he will probably secure a job in one of the companies interested in new coal technologies. I am suggesting that some of the students doing discipline-oriented research on coal gasification might spend an additional year or two extending their knowledge of global energy problems, both from the technological and policy points of view. When these students receive their PhD's (perhaps they would also receive the degree of "Doctor of Practical Philosophy"), they would be

more qualified for international, governmental or private sector assignments. Or, as another example, a student working on a discipline-oriented doctoral thesis in chemistry might choose to spend an additional year or two taking interdisciplinary seminars on chemistry's role in the world's food supply and in improving the quality of life. In a word, the educational strategy would not be to train a generalist who is incapable of completing the normal discipline-oriented doctoral thesis but to educate the talented individual doing doctoral research to help the solution of pressing world problems.

It is evident from the above that the many-faceted global mission proposed for American higher education will involve scholars from various disciplines in science, engineering and social science in cooperative efforts to help solve major world problems through research and advanced training. The placement of such highly significant applied research undertakings in university environments should not only lead to more integrated multi-disciplinary studies, but should profit from the presence of graduate students eager to relate their disciplinary knowledge to policy formation within a global framework. The involvement of government and the private sector is not precluded in the performance of applied research activities of the above character, but would indeed be encouraged. I believe, however, that society will best be served in these areas if the university assumes the leadership role.

Perhaps an illustration from a recent personal experience will clarify what I have been saying. In April, City College hosted a week-long Nigeria-US Workshop on "Technological Development in Nigeria." Consider that Nigeria has a land area larger than that of France and West Germany combined, with a population of approximately 100 million people and a gross national product greater than the total for the rest of West Africa. Since the end of the Nigerian Civil War in 1970 and the subsequent boom in oil production, Nigeria has become the wealthiest country in Black Africa. During this period, Nigeria has experienced a substantial flow of investments from the United States, Western Europe and Japan. These investments have contributed to an explosive growth in the nation's economy. Mindful of the need for indigenous managerial and technical personnel to handle in a well-planned and rational manner the nation's emergent wealth and long-term development, the Nigerian Government instructed its National Universities Commission to seek assistance from the US to help strengthen the capabilities of Nigerian universities to provide training at all levels and in a variety of fields to meet the needs of Nigeria's rapid technological development.

City College met the initial challenge by arranging the aforementioned Nigeria-

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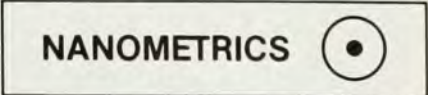
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US Workshop. With the assistance of Roger Revelle from the University of California at San Diego, an American Advisory Committee consisting of representatives from many of our universities interested in the developing nations, as well as the private sector and government, was formed. The Workshop received cooperation and support from the Board of Science and Technology on International Development of the National Academy of Sciences, US AID and a number of foundations and industries. At the sessions, papers on such topics as "Models for Technology Transfer," the "Role of Universities in Science, Technology and Management Education," "Agri-Industrial Technology Transfer," and "Management and Optimum Utilization of Resources" were presented.

The Workshop deliberations led to a series of recommendations for implementation by our respective governments. In the policy statements communicated to the Workshop by Frank Press, Science Adviser to the President, and Dr Leton, the Nigerian Minister of Education, both countries pledged continued cooperation in the application of education and technology to Nigerian development. If Nigeria is to receive appropriate technology, it must be in a position to absorb, assimilate and diffuse the transferred technology within her economy on a self-sustaining basis. There are many areas in agricultural and industrial development where the expertise of Nigerian scientists and engineers is needed to adapt and develop technologies most relevant to Nigerian conditions. It is agreed that the Nigerian National Universities Commission can play a key role in helping to identify the obstacles to the absorption and acquisition of technologies being transferred to Nigeria.

On the American side there remains the problem of selecting the best mechanism to facilitate the technology-transfer process. The Institute for International Scientific and Technological Cooperation proposed by our government can certainly make a contribution to technology transfer in Nigeria by providing a variety of grants to interested individuals and institutions. However, it is my firm belief that a more effective approach to deal with the complexity of technology transfer to a large developing country like Nigeria is to establish some sort of coordinating center or institute under the aegis of a single university or consortium of universities cooperating with the private sector and government. Such an institute would attempt to understand the impact of technology transfer on the economic, social and ecological conditions of the country into which it is introduced, and, conversely, to delineate the effects in the developing nation of government policies, market incentives and institutional and

social constraints on the technology transfer process.

The multi-disciplinary nature of the problem, the need to do research before answers can be given or the proper questions even asked, the necessity to involve educational institutions because they provide the future technical, professional and managerial infrastructure that a developing nation requires—all point to the conclusion that American higher educational institutions must accept the responsibility for organizing centers or institutes for applied research and advanced training that will assist developing nations to overcome as rapidly as possible the gap between them and developed countries.

I fully realize that many centers or institutes with programs for science, technology and human affairs have sprung up at various universities throughout the country. However, I have the impression that these centers are underfunded, insufficiently focussed and unprepared to generate the innovative educational programs that will train our young people to cope with problems of global concern. Let us recall that after World War II the physics community provided the leadership for the creation of the Federation of American Scientists, which played an important role in the establishment of civilian control of atomic energy and moved into the public arena discussions of international control of atomic energy and other issues. The Bulletin of Atomic Scientists and the Pugwash Movement were outcomes of this initiative.

I wish to make it clear that I yield to no one in my love of basic research—its passionate pursuit of truth, its thoroughgoing respect for the inner logic and structure of scientific knowledge, and its unswerving resistance to pressures from officialdom and prejudice. Pure science is unquestionably the jewel of modern culture and will remain the indispensable ingredient of human progress for many decades to come. However, the burden of global challenges mandates that the American scientific-academic community attempt to balance the celebration of scientific creation with the application of scientific knowledge to societal needs and the sensitivity to human values. In particular, the physics community must again take the leadership in developing at our universities a sensible mixture of intellectual detachment, which maintains the integrity of our science, with social concern, which gives humanity some hope for the future. In my opinion, we can make a major contribution to meeting the global challenges facing our nation by organizing applied interdisciplinary research in our universities on the same massive scale as basic research.

Adapted from a talk given at a symposium on "The Future of Research in Universities" sponsored by the Forum on Physics and Society at the American Physical Society meeting in Washington, 23 April 1979. □

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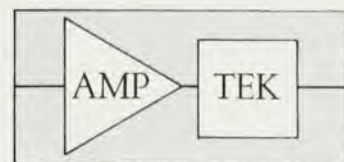
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