

DIRECTOR'S STATEMENT

Now that a year has elapsed since this country was dramatically brought face to face with the need for critical examination of its national effort in science and technology, it is appropriate to consider our progress and to gauge the follow-through of the President's stirring and realistic messages to the country during November 1957.

In particular, attention was directed to the urgent need for developing to the fullest our capabilities in science and engineering research and our education and training in science and engineering.

Some notable progress has been made and some major accomplishments undertaken. The President's appointment of a Special Assistant for Science and Technology, backed by a distinguished Science Advisory Committee, has been widely acclaimed. The National Defense Education Act constitutes a forward-looking move to assist in the improvement of our system of education. Steps were taken to increase Federal support of basic research, and plans have materialized in the formation of a new agency, the National Aeronautics and Space Administration, to deal with the urgent problem of space research and exploration. Military research and technology have received increased emphasis in keeping with current national defense goals. The President has proposed plans for reorganization of the Department of Defense designed to improve materially the effectiveness of our military potential.

The Government has taken these constructive steps. It is now fair to ask: are these enough? Are we as a nation proceeding forthrightly to accomplish what is necessary for maximum progress in science and technology, and for the improvement in the education and training of our young people? Furthermore,

are we acting with the promptness which the situation demands? Or is there evidence that, as a rebound from our intense interest of a year ago, we are in danger of again becoming complacent? As a single illustration, one need only compare the reaction of the public to the launching of the first sputnik with that manifested at the third launching in May.

The answer is that we have only made a beginning; the major job is still to be done. In the field of education, there seems to be no immediate prospect of adequate salaries for school teachers, of adequate school buildings and facilities, nor of adequate incentives for recruiting the numbers of competent teachers we shall require. Congress shows caution about taking action, as do most of the States; the scientific and educational societies lack funds; and local attempts outside of a few wealthy suburban communities have come up against the realization that adequate funds are not available for the purpose until something is done about taxes.

As for the support of scientific research, it is generally recognized that the modern dependence of a country upon its technology requires thorough attention to its progress in science. The key to the latter lies in the support of basic research. Forward thinking and plans for dealing with important areas of research have not as yet shown indication of full realization in budget terms. The immediacy here lies in insuring the health and strength of science and engineering in the graduate schools of our colleges and universities, which constitute the stronghold for basic research and for the advanced training of scientists and engineers. The pressing problem for science and engineering in universities is to secure modern laboratories and research equipment, including rather costly equipment for the larger institutions, and to provide for large capital research facilities to be used nationally or at regional centers. In the interest of training future scientists, needs extend to undergraduate laboratories and demonstration equipment. Not to be forgotten are the fundamental needs of our colleges and universities for funds freely usable for maintenance and operation; these are the most difficult of all to secure.

In the meantime, the evidence from other countries and nota-

bly the U. S. S. R. shows a determination and a national spirit on the part of the people which seems to be relatively absent from the American scene. The recent educational group which went to the U. S. S. R. with the Commissioner of Education, and likewise the group of university presidents, came away with the conviction that the Russian people see their way clear to world leadership in science and technology. They are apparently dedicated to this—not in the sense of military competition, but rather of achieving world supremacy without the need of military domination. Among other nations, we shall ultimately have to reckon with the genius for organization and the industry of the German people, the industry and learning ability of the Japanese and the industry and potentialities of the Chinese.

As a nation we appear to forget that we live in a competitive world and shall continue to do so. It seems abundantly clear that we shall rapidly lose in competition, unless we can show more determined and constructive efforts than we have during the past years.

It is clear that success in the requisite effort depends fundamentally upon the understanding of the problem by our people and our determination to achieve these goals. Under our democratic system, no segment of Government, whether Federal, State, or local, can succeed in securing necessary action programs or funds to carry them out unless our citizens understand, actively endorse, and indeed participate in the steps that need to be taken. In short, the wholehearted cooperation of the people of the country is necessary to achieve the goals which the President has pointed out so clearly. Most important here is a realization that this is not a single emergency but a continuing—possibly a permanent—one. In this modern world there can be no relaxation of a determination to compete successfully and continuously.

Admittedly these questions are complicated by several issues: (a) the need and extent to which the Federal Government should take action and provide funds for education and for educational institutions in the face of a traditional policy of leaving such matters to State and local authorities; (b) the development of our full capabilities for national security and world competi-

tion without jeopardizing our economy; (c) the realization of national goals while maintaining individual initiative and achievement of individual wants and ambitions; (d) attainment of full development of individual talents and aptitudes while dealing satisfactorily with the demands for education for all.

While these questions are important and should be resolved, we dare not allow these to becloud the main issue—we must progress in our science and technology and in the education and training of our citizens with all the effectiveness and thoroughness we can muster. We cannot afford to delay in arguments as to how we do them.

During the past year the recession has brought us face to face with one of our most serious difficulties, namely, how we can develop our full capabilities and still remain financially solvent—in other words, how to provide for the increasingly costly technological developments necessary for national security without endangering the Nation's economy. A grave danger here is that, for reasons of economy, we fall short of developing our capabilities in science and technology.

We can only insure the *possibility* of full protection of national security by giving every encouragement to scientific research (as contrasted with development and production). It is only in this way that we can achieve the ideas and the breakthroughs which promise clear superiority; it is only in this way we can insure that the developments we undertake are modern and up-to-date in every detail. The results of such research, in competent hands, are never without value. Even when no breakthroughs appear, the total effort always brings a possible breakthrough closer.

It should be noted that the costs of research are very small as compared with those of development. Only about four percent of national funds for research and development go into basic research.

As history amply records, the most epoch-making scientific discoveries have come from basic research. But basic research, being exploration into the unknown by its very nature cannot predict exactly where these breakthroughs will occur. There-

fore, comprehensive support of research has to be undertaken in order to overlook no opportunities. This should be regarded as an investment, the precise spots where high returns occur being unknown in advance. With full support of research, both basic and applied, we then have full exploitation of the potentialities for development and production. Incidentally, by the support of basic research we gain as an important byproduct the advanced training of young scientists.

It is worth noting that during the hard times of the 1930's forward-looking technical industries increased their research efforts and this policy paid off.

Then, in order to protect the national economy, the important point is to exercise extreme care beforehand in planning for the costly development and the production which can emerge from among the possibilities identified by research. By careful selection of the developments and undertakings which have most promise and the highest priority, we contribute in considerable measure to the protection of a balanced national budget.

What has just been said in the area of science and technology seems capable of extension to our planning as a nation. The question is whether even under the most favorable circumstances our economy is prepared to cope with the costs in effort and money required for the increasingly many and varied opportunities that lie before us. Speaking literally, this has never been possible. The new factor which has been entering the picture by degrees and is now prominent is that as a nation we shall have to pay even greater attention to our objectives and to the priorities among them.

This point is brought into sharp focus in connection with our present subject. There is an apparent lack of realization and determination on the part of our citizens to advance progress in education and in science. Without this realization and determination it is not possible to act with the promptness which is required. Although the facts have received much publicity and should be pretty generally known, it becomes increasingly clear that these do not at present appear truly to be national objectives, as understood by the people.

Perhaps what is missing is a clear conception on the part of our citizens of what our objectives are as a nation and more importantly how we can achieve them, and most important of all, what each citizen's responsibility is in cooperating. There would probably be found general agreement on our traditional objective of peace and prosperity—"the pursuit of happiness." However, we do not seem to understand that it will be impossible to maintain our own prosperity and world peace unless we do and do promptly the things necessary to compete in a modern world. What is meant by this? Simply to develop our capabilities, both individually and collectively, to the fullest and then, in order to maintain a sound economy, identify and select the areas of endeavor which should engage our fullest attention in terms of money and effort. In science we should put maximum emphasis upon the relatively modest needs of basic research in order to learn all the possibilities of progress in technology and then choose carefully the fields for development that require large capital sums.

To be sure, a preliminary responsibility lies with the Federal Government to take the lead in the solution of these problems, but to provide full solution requires the understanding and the cooperation of all citizens. The responsibility of the Federal Government then is: (a) to insure that the problem is entirely understood by the people; (b) to provide direct support according to carefully devised plans; (c) to consider seriously ways and means of increasing substantially funds from other sources. The responsibility of the people is first to give these problems their careful attention and, second, to determine, as their Government has to do, the degree to which they can contribute by thought, action, and money to our national goals as well as to the satisfaction of their personal needs and desires. In other words, each citizen should be fully and continuously aware of his active responsibilities to the Nation and to its primary goals, in time of peace as well as war, and be prepared to make whatever sacrifices may be necessary to achieve them.

Whether our primary objective as a nation is to deter our enemies, to sustain the Free World's leadership, to extend a helping hand to underdeveloped nations or merely to maintain

our peace and prosperity at home, the first essential is a real determination to achieve better education, better science and technology and, above all, the development of quality in all fields—quality in training and quality in performance. Unless we can succeed in accomplishing these things we can maintain neither our national objectives nor the personal objectives of our people.

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