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The Relation of Science and Technology

Since World War II, the federal government has selectively supported science and technology on the input side; that is, it has invested money and effort in education and research, which, it believed, would produce the resources for achieving national goals. Although many of these goals were ill defined, there was public confidence that highly educated people and a research beehive would produce what the nation needed. The activities thus supported were connected only loosely with the output side; in fact, relatively few output goals were stated explicitly on the national level. Traditionally, science and technology have been connected only by a thread to the products that had an impact on society. Today, this connection is becoming stronger. What we face now is a society that is beginning to demand that we as engineers and scientists no longer do what we like or what we choose from a long list of societal chores, but that we do the things that the society as a whole demands.

The setting of goals by a society such as ours is not a bad thing in itself. There have been some astounding successes in goal-oriented efforts; however, there have also been some notable failures when major goals were undertaken prematurely and without the fiscal, managerial, and intellectual resources that major goals demand.

The widespread misconception that, simply because we can put a man on the moon, we ought to be able to solve all of mankind's problems on Earth has an element of truth—but just that. It completely ignores the problem of timing and the limits of both the technological state of the art involved and the fundamental knowledge available. Sometimes it even ignores the laws of nature. Such neglect invalidates the argument that a society as technologically well developed as ours ought to be able to tackle anything with a high probability of success. In setting goals for society, we must be judicious in the timing of our commitment. To commit too soon is to risk failure. To hesitate too long deprives society of needed resources.

There is no simple answer to the question of how one matches the state of the art and science with national needs, but one essential element is a sense of unity among science, engineering, national purposes, and day-to-day reality. It is essential that the impact of science on society be viewed not as a linear progression from the discovery of knowledge to technology, leading to innovation and new products and services, but as a complex set of mutually dependent matters. The linear progression is a simplistic one.

It should be axiomatic that technology feeds on science, but it has never been made fully clear that science, in turn, feeds on technology and is often invigorated by goal-oriented enterprises. In fact, the coupling between these two once-disparate elements is far closer than many of us ever realized in the past. This close coupling of science and technology, and the feedback system it implies, carries with it a self-correcting mechanism. Failures in technology often encourage fundamental science.

Let me suggest that the overall national research program of the future be predicated on a balanced coupling of science and purposeful technology. We must forge science and technology as a sum and not as a difference. This overall strategy implies that scientists and engineers must be active in decision-making where goals are set.

—EDWARD E. DAVID, JR., *Science Adviser to the President*