Preliminary Remarks
by
Vice Admiral H. G. Rickover, U.S. Navy
at the
1969 Convention
of the
Mississippi Manufacturers Association
Biloxi, Mississippi
Friday, October 10, 1969

I am honored to be here in the home territory of my good friend, Senator Stennis, and to speak to his many friends. I should like first to pay tribute to him and to the members of the Senate Armed Services and Appropriations Committees. As a senior member of both these Committees, he reviews all programs that have to do with national defense. I speak from personal experience when I say that without the support he and members of these Committees have unfailingly given to the Navy, conversion of our fleet to atomic energy would have been delayed, and might have come too late to be of use to the United States.

We now have a nuclear fleet of 85 attack and Polaris submarines, a small submarine capable of exploring the ocean bottom, a nuclear aircraft carrier, a cruiser, and two destroyers. In addition, we have under construction 21 attack submarines, a second aircraft carrier, and two frigates. Much credit for this must be given to Senator Stennis and to his colleagues.

The Senator, as Chairman of the Senate Armed Services Committee and member of the Aeronautical and Space Sciences Committee, is exceptionally well-informed of all developments in military and space matters. As a member of the Special Committee on the Central Intelligence Agency he is

one of seven senators who regularly receive highly classified briefings on the world situation. And, as a ranking member of the Senate Subcommittee on Labor, Health, Education and Welfare he is influential in educational programs to better our nation and our youth. In all he does, he exercises the highest degree of integrity and patriotism.

Senator Stennis has constantly and wholeheartedly supported the Naval Reactors Program and devoted much time and effort to helping us. It is a comfort to be able to go to him for his wisdom, his objectivity, and kindly advice.

When he ran for the Senate in 1947, the Senator promised to "plow a straight furrow right down to the end of my row." His furrow has always been arrow straight.

I am proud to be associated with so fine a gentleman and patriot who does such honor to his native state.

May I add that Congressman William M. Colmer has asked that I give you his best wishes. As Chairman of the House Rules Committee he is one of the most influential members of Congress. He has helped immeasurably in making our nuclear navy possible. He is an experienced and hardworking representative from your state. You are indeed fortunate to have him represent you in Washington.

Now to the topic of my speech: A HUMANISTIC TECHNOLOGY

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THE DEPARTMENT OF THE NAVY

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My subject tonight is of utmost importance and great urgency--nothing less than keeping our small crowded planet habitable. If I may use a legal expression, the "last clear chance" to avert catastrophe may soon be upon us. We have been brought to this critical situation by the scientific-technological revolution, and we can extricate ourselves only by a change of direction in thought and action so drastic it would rate the term counterrevolutionary.

To the historian, this is a familiar sequence of events. During revolutions--social, political, technical--long established patterns of living are swiftly and radically altered by concentration on the attainment of a single objective, without regard to cost. Eventually the cost is revealed, and if it is too high, there is a counterrevolution. But this takes time, perhaps more than is available to us. Few laymen, as yet, have any conception of the true price we pay for the marvels of

technology, although the mass media are now full of stories of poisoned water, air, and soil; of depleted resources and of overcrowding--all clearly among its adverse effects, all crying out for remedial action.

What chiefly delays public recognition of the costs of the scientific-technological revolution is, I submit, the universal popularity of its objective: material abundance, and an easing of man's earthly lot through mastery of nature, the "empire of man over nature" of which Francis Bacon dreamed three and a half centuries ago. Modern technology, solidly based on accurate scientific knowledge, comes remarkably close to this goal. Even the poorest in technically advanced countries are better fed, housed, and clothed; work in safer, more comfortable surroundings; enjoy greater leisure and more varied entertainments; live longer and healthier lives, than they could ever hope for in the vast backward regions of the earth. This accounts for what W. H. Ferry calls the "stupid love affair" of the general public with technology. "Breaking up the love affair," he said, "does not mean abandoning technology, but replacing infatuation with an understanding of its toxic qualities, and finding ways to direct it to humane ends."

Fortunately we have a means to such an understanding in ecology--a science conterminous with modern technology.

Derived from the Greek oikos (ēkŏs), meaning household or living place, ecology deals with the interrelationships of plants and animals (including man), and their environment. Ecology, until recently a modest academic discipline, chiefly serving agriculture and medicine, is destined to

come the key science for correctly assessing the negative aspects of technology. In my opinion, ecology should be included in the curriculum of our schools. In this connection, I should like to make two suggestions: First, limit the study to plant and animal ecology, which is a fully developed branch of the exact sciences, omitting for the time being what goes under the name of social ecology. We tend in this country to try to do two or more things simultaneously; in consequence we do neither of them as well as we might. Second, consider the possibility of beginning the study at an early age. During a visit to Switzerland for the purpose of familiarizing myself with their educational system, I was much impressed by the way ecology was taught in a one-room village schoolhouse. It was part of the curriculum throughout the primary grades, being presented at first very simply--but always graphically; later, on a more complex level; and always alongside the three R's, and history, and government, so that the children absorb it as part of their general education.

What needs to be developed at the earliest opportunity is a habit of thinking ecologically, of being thoroughly familiar with the balance of nature, which Barry Commoner, the biologist, recently defined in simple words comprehensible to the nonscientist, old or young. All living things, he said, "are dependent on the great interwoven cyclical processes, followed by the four elements that make up the major portion of living things and the environment: carbon, oxygen, hydrogen, and nitrogen. All of these cycles are driven by the action of living things." Green plants convert carbon dioxide into food, fiber, and fuel, and produce the oxygen in the atmosphere. Animals, living basically on plant-produced food,

regenerate the inorganic materials: carbon dioxide, nitrates, and phosphates--all of which support plant life. This vast web of biological interactions "makes up a huge, enormously complex living machine--the ecosphere--and on the integrity and proper functioning of that machine depends every human activity, including technology.....If we destroy it, our most advanced technology will come to naught and any economic and political system which depends on it will founder."

I wonder, too, whether ecology, properly presented at the higher secondary school levels, might not help dissipate the tendency in contemporary thinking of regarding technology as an irresistible force with a momentum of its own, that puts it beyond human direction and restraint. Mere awareness of all the adverse effects of technology may not suffice to mobilize public support for countervailing measures. What is additionally needed is a change of attitude on the part of the public and of its leaders, that is, of the prevailing concepts of what technology is, and what purpose it should serve. Only when viewed humanistically--in other words, as a means to human ends--can technology be made to produce maximum benefit, and do minimum harm to human beings, and to the values that make for civilized living. It may even enable man to become more truly human than it has ever been possible for him to be. Of technology it can rightly be said that it is not "either good or bad, but thinking makes it so."

Technology has been defined as that which covers "the field of how things are commonly done or made" and "what things are done or made." It is tools, techniques, procedures: the artifacts and processes fashioned

by modern industrial man to increase his powers of mind and body. Marvelous they are, but let us not be overawed by these man-made things. Certainly, they themselves do not dictate how we should use them, nor, by their mere existence, do they authorize actions that were not anteriorly lawful. We alone bear responsibility for our technology. In this, as in all our actions, we are bound by the principles governing human behavior in our society. Ethics, I need hardly say, are not only personal; they are social as well.

This surely must be obvious to any reasonable man. Yet it cannot be overemphasized, for a considerable body of opinion propagates what comes close to being the opposite view. The notion is widespread that, having wrought vast changes in the material conditions of life, technology perforce, renders obsolete traditional concepts of ethics and morals, as well as accustomed ways of arranging political and social relationships. Earnest debates are currently taking place as to whether it is possible to act morally in the new technological society, and proposals have been made--quite seriously--that science must now replace traditional ethics! We have here a confusion of means with ends, that should be cleared up.

The laws disclosed by science must of course be heeded by those who wish to exploit scientific discoveries; in his technological activities man is bound by the laws of science. But it does not follow that he is bound by the laws of science in his purely human relations as well. "Science," wrote Vannevar Bush, "has come a long way in delineating the probable nature of the universe that surrounds us; of the physical world in which we live; of our own structure; our physical and chemical nature.

It even enters into the mechanism by which the brain itself operates. Then it comes to the question of consciousness and free will--and there it stops. No longer can science prove, or even bear evidence. Those who base their personal philosophies or their religion upon science are left, beyond that point, without support."

Through technology man has been relieved of much brutal, exhausting, physical labor, as well as of boring routine work. He has been provided with numerous mechanical slaves who do certain kinds of work faster, cheaper and more efficiently than people. Why should the ease and affluence made possible by technology affect precepts that have guided Western man for centuries? This may brand me as old-fashioned, but I have not yet found occasion to discard a single principle that was accepted in the America of my youth. Why should anyone feel in need of a new ethical code because he is healthier, or has more possessions, or more leisure? Does it make sense to abandon rules one has lived by, because he has acquired better tools for doing his work?

Tools are for utilizing the external resources at our disposal. Principles are for marshaling our inner, our human resources. With tools we alter our physical environment; with principles we order our personal life, and our relations with others. The two have nothing to do with each other.

It disturbs me to be told that technology "demands" an action the speaker favors, that "you can't stop progress." It troubles me, that we are so easily pressured by purveyors of technology into permitting so-called "progress" to alter our lives, without attempting to control it--

as if technology were an irrepressible force of nature to which we must meekly submit. If we reflected, we might discover that not everything hailed as progress contributes to happiness; that the new is not always better, nor the old always outdated.

Perhaps we are receptive to these arguments because we tend to confuse technology with science. Not only in popular thinking, but even among the well-informed, the two are not always clearly distinguished. In consequence, characteristics pertaining to science are attributed to technology. The etymology of the word may contribute to this confusion. Its suffix lends to technology a false aura--as if it signified a body of accumulated, systematized knowledge, when in fact the term refers to the apparatus through which knowledge is put to practical use. The difference is important.

Science has to do with discovering the true facts and relationships of observable phenomena in nature, and with establishing theories that serve to organize masses of verified data concerning these facts and relationships. Because of the care scientists take to verify the facts supporting their theories; because of their readiness to alter theories when new facts prove an established theory to be imperfect, science has great authority. What the scientific community accepts as proven is not questioned by the public. No one disputes that the earth attracts the moon, or that atomic fission produces energy.

But technology cannot claim the authority of science. It has proved anything but infallibly beneficial. Much harm has been done

to man and nature because technologies have been used with no thought for the possible consequences of their interaction with nature. A certain ruthlessness has been encouraged by the mistaken belief that to disregard human considerations is as necessary in technology as it is in science. The analogy is false.

The methods of science require rigorous exclusion of the human factor. They were developed to serve the needs of scientists, whose sole interest is to comprehend the universe; to know the truth; to know it accurately and with certainty. The searcher for truth cannot pay attention to his own or to other people's likes and dislikes, or to popular ideas of the fitness of things. This is why science is the antithesis of "humanism," despite the fact that historically modern science developed out of, and parallel to the humanism of the Renaissance.

What scientists discover may shock or anger people--as did Darwin's theory of evolution. But even an unpleasant truth is worth having; besides one can choose not to believe it! It is otherwise with technology. Science, being pure thought, harms no one; therefore it need not be humanistic. But technology is action, and often potentially dangerous action. Unless it is made to adapt itself to human interests, needs, values, and principles, more harm will be done than good. Never before, in all his long life on earth, has man possessed such enormous power to injure himself, his human fellows, and his society, as has been put into his hands by modern technology.

This is why it is important to maintain a humanistic attitude toward technology; to recognize clearly, that since it is a product of human effort,

technology can have no legitimate purpose but to serve man--man in general, not merely some men; future generations, not merely those who currently wish to gain advantage for themselves; man in the totality of his humanity, encompassing all his manifold interests and needs, not merely some one particular concern of his. When viewed humanistically, technology is seen not as an end in itself, but as a means to an end, the end being determined by man himself, in accordance with the laws prevailing in his society.

A word may be in order concerning the disparate meaning of the word law, depending on whether it is used in the ordinary sense--which is also the original sense of the word--or by scientists. Law, as commonly understood, refers to the rules of human conduct prescribed and enforced by society. The scientists have appropriated the term. They use it to describe regularities exhibited by physical phenomena--the rules by which the cosmos governs itself. In the transition, the word has taken on a new meaning.

Law that governs human society is not the result of scientific method, but of wisdom and experience; of consensus as to what is just and fair. In autocracies, law is what the ruler decrees it to be, and what he is able to enforce by naked power. The purpose of human law is to resolve conflicts by the application of definitive rules. These rules are always debatable, and can be changed when there is public demand for a change, or when the rule-maker desires them to be changed.

From the layman's point of view, what the scientist calls law is fact rather than law--immutable fact. Or, if you prefer, it is law operating

in a sphere where man exercises no influence. He cannot alter the laws of the cosmos; he can only discover them.

It has taken a long time to attain this rational attitude toward science, and we are conscious of the consequences of intolerance in the past. Perhaps this is why we have been excessively tolerant toward those who claim the right to use technology as they see fit, and who are wont to treat every attempt by society to regulate such use in the public interest as if it were a modern repetition of the persecution of Galileo!

Assuredly, we have the right to use the instrumentality of law and of government to protect ourselves against technological injury. Yet this simple truth is obscured by the effective way in which opponents of protective measures play upon the layman's respect for science--in a conscious or unconscious attempt to brainwash the public, so it will accept their argument without debate. When attacking legislation that would restrain the user of technology, it is common practice to argue as if at issue were acceptance of a law of science. Yet what is being discussed is not science but the advisability or legality of the technological exploitation of science. The public would not be deceived by such arguments, if it clearly understood the fundamental difference between science--which is pure knowledge--and technology--which is action based on knowledge.

Whether or not a particular technology has harmful potentialities should be decided by competent and disinterested professionals. It is not a proper subject for adversary proceedings and, above all, ought never be left to those who wish to use it. Destructive technologies are often

highly profitable for those promoting them. They have a vested interest in the technology; it may give them money, reputation, power. They are an interested party to the conflict between private and public interest that every potentially harmful technology poses. Moreover, they are nearly always practical men more knowledgeable about efficiency in using a technology, than about the legal and social implications of such use.

I think one can fairly say that the practical approach to a new scientific discovery and its utilization through technology is usually short-range and private, concerned only with ways to put the discovery to use in the most economical and efficient manner, little thought being given to its ultimate consequences. The scholarly approach--if I may use this term--is long-range and public; it looks to the effects which a new technology may have on people in general, on the nation, on the world; on present and future generations. And this, of course, brings us back to ecology and the vital part it could play in assigning to technology its proper place in human affairs.

How we use technology profoundly affects the shape of our society. In the brief span of time--a century or so--that we have had a science-based technology, what use have we made of it? We have multiplied inordinately, wasted irreplaceable fuels and minerals, and perpetrated incalculable and irreversible ecological harm. I have thought much about this, and I can find no evidence that man contributes anything to the balance of nature--anything at all. On the strength of his limited knowledge of nature, he sets himself above it. He presumes to change the natural environment for all the living creatures on this earth. Do we, who are transients, and not

overly wise, really believe we have the right to upset the order of nature, an order established by a power higher than man?

These are complicated matters for ordinary citizens to evaluate and decide. How to make wiser use of technology in future is perhaps the paramount public issue facing electorates in all industrial democracies. A free society centers on man. It gives paramount consideration to human rights, interests, and needs. But once ordinary citizens come to feel that public issues are beyond their comprehension, a pattern of life may develop where technology, not man, would become central to the purpose of society. If we permit this to happen, the human liberties for which mankind has fought, at so great a cost of effort and sacrifice, will be extinguished.