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THE NEED FOR LEARNING IN THIS SCIENTIFIC AGE

by
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at the
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It is a great privilege for me to speak here at these Commencement exercises of your urban college. Having graduated from an urban university myself, the City College of New York, I fully appreciate the problems the urban student faces in getting to know classmates well, in traveling between home and campus, in the time spent in such traveling, in the long library hours to avoid extra home-to-school trips, in the problems of setting a reasonable program schedule because of the off-campus living -- generally, the problems of using every available minute.

I appreciate, also, the benefits that are derived from the diverse recreational, cultural, economic, and social activities available in an urban area. The benefits are summed up better in the quotation contained in your College Catalogue by Dr. Harold C. Case, the President of Boston University, that begins with, "The city is the best setting for today's student..." I am sure you have all read it; but, if you haven't, it is available to you.

All of these things are about the same as they were when I received my Bachelor's degree almost two decades ago. However, you are leaving your undergraduate training at a time and in an atmosphere very different from the one that existed in 1944. We now live in an age of science and of rapid change.

The dramatic changes that have occurred in the last two decades are obvious when I think back to my first work for the National Advisory Committee for Aeronautics, which was the predecessor of the National Aeronautics and Space Administration. At that time, I was doing applied research on reciprocating engine superchargers. We were at war and among the superchargers we studied were various German and Japanese designs. We were still trying to develop scientific design techniques for supercharger air compressors. About a year after I began this work, we started doing research on somewhat different air compressors to be used in gas turbine engines. The turbojet engine research in this country, started in those early Forties, has now found application in our long-range,commercial, high-speed jet aircraft. Compared to the 3,000 or 4,000 pound thrust turbojet engines with which I worked in 1945, the present jet engine in the 720 Jet, that I took from Washington, D. C., with its thrust of 17,000 pounds is, of course, a remarkable achievement in an astoundingly short time.

From the nuclear weapons research of the early Forties and the first chain reaction, the applications of nuclear energy in medicine, agriculture, ship propulsion and, of course, civilian electric power generation are astounding developments, also accomplished in a remarkably short time.

In this scientific age of change, the university becomes the logical focal point for translation of new and advanced developments in all of the sciences into productive output for the community around the university. In a metropolitan area such as Portland, the needs of local business and industry will particularly benefit from the catalytic effect of the university to quickly transmit, for ready application, the results of research, technology developments, and advanced study. But to provide this linking of scientific and technological developments to the general good, the university must be aware, through participation in research efforts, of the rapidly changing state of knowledge and must continuously adjust its programs and facilities to the change. This new age puts upon the university the responsibility to recognize that training, advanced or graduate education, curriculum review and adjustment, evening adult sessions, teacher training and advanced study, research in all areas, are never-ending tasks involving ever broadening areas of science and understanding.

In addition to the increased influence of the college on the community and the increased responsibility of the college to the community, this new age in which we live puts on each of you who graduate the responsibility to recognize that Commencement means only the beginning of study, learning and training, as well as a beginning of major opportunity for contribution to your community and country. The rapid changes that have taken place since I received my first degree and the rapid changes that have taken place in the past few years forecast an even accelerated rate of change in the years to come.

Dr. Glenn Seaborg, Chairman of the Atomic Energy Commission and Nobel Prize winner, talked recently of, "...a tomorrow which in appearance will be vastly different from today. In that tomorrow it is not the strong who will survive but the strong and the educated." He predicted, "...that man's knowledge of nature and himself will more than double in the next three decades; that is, the scientific discoveries and advances of the next 30 years will be more than equal to all those of past years and centuries."

This rapidly changing society will force you to keep learning and studying to keep intact the foundations that have been laid here. I think it has been well-phrased by a medical friend of mine who told the 1962 Graduating Class of the George Washington University's School of Medicine that even after all their many years of training and study, they were not finished. He said, "Our main objective is to give you effective tools to accommodate yourselves to the only thing that is certain - change.

"The training in your past four years of medical school can be likened to a bridge which we have built together so that you can cross a high and wide chasm to permit, but not necessarily assure, your continued forward progress. This ceremony marks the completion and the crossing of the bridge, but you cannot pause to view the vastness of the beckoning horizon nor contemplate the scene below or behind, because the bridge will inexorably dissolve, melt into the limbo that has engulfed the archaic dicta and the so-called truths of yesterday. By continuing self-education, you must build and rebuild new bridges, incorporating parts of the old, to span new chasms to insure your advancement."

The excitement, drama, accomplishment, rapid progress, and rapid change typical of our times are effectively and, I think, best represented by the achievements of our space program. It is an area in which engineering and scientific accomplishment are obvious, -- it is presented openly and is known to all. It is also an area in which we are working hard to establish our pre-eminence because we recognize that our strength in the world will be enhanced by clear superiority in this area of broad scientific and technological effort. Furthermore, the stimulus provided by the space program should result in increased activity and accomplishment in many other areas in education, business, science, engineering, and in other fields of research. The excitement generated in one area generally spills over into other areas and results in a general forward movement that provides benefits to all mankind.

It has, I think, been put well by Dr. Lloyd V. Berkner, President of the Graduate Research Center of the Southwest. In an article on the knowledge to be gained from the space program, he writes, "Human society - man in a group - rises out of its lethargy to new levels of productivity only under the stimulus of deeply inspiring and commonly appreciated goals. A lethargic world serves no cause well; a spirited world, working diligently toward earnestly desired goals, provides the means and strength toward which many ends can be satisfied. If the challenges growing out of man's vision of space achievement increase his productivity by a hundredth, then the whole bill for space exploration is paid; any additional effort becomes a margin for advancement toward other goals".

The fact that our space accomplishments started only in 1958, with the launching of our first satellite, is dramatic indication of the rapid growth of capability in this area. In our space sciences program, we are providing knowledge about the nature of the universe, our Earth, about the relationship between the Earth and Sun, about the other planets around us, about the Moon as an indicator of where it all started, and about the characteristics of the atmosphere and the space beyond. As part of this search for knowledge, we may also discover life of some sort on one of the other planets.

Why is it important to have this knowledge? The nature of man demands that he understand, that he be able to explain the physical phenomena around him. This is fortunate because this need for understanding has led to the basic scientific data upon which our technology and our advanced standard of living are based. When we consider that we sit on one of nine planets, and a small one at that; that we circle the sun which is one of a billion, trillion stars within the range of our large telescopes; when we consider that the Earth is a few billion years old, we begin to comprehend how little we really know about how we got here and what is really around us. Our very successful space science satellites, such as the Orbiting Solar Observatory and the Explorer series; our space probes and planetary shots, such as the 180,000,000 mile trip of Mariner II past Venus; and, our sounding rockets, have been providing us with the kind of information required to understand our universe and our planet.

In our applications program, we have been developing the capability to use satellites for useful applications that can serve mankind by already known means, such as providing intercontinental communications and providing the means for long-range and accurate weather predictions. I am sure you have all seen the Echo satellite which was used to bounce signals around the Earth between distant points. We have already demonstrated the communications capability of satellites such as Telstar and Relay and have seen the excellent TV pictures that are possible. These systems will lead to operational communications systems that will permit telegraph, telephone, and television transmission to all parts of the earth. In addition, the six successful Tiros satellites have demonstrated the advantages that result from the use of satellites to photograph the Earth's cloud cover and to obtain other data in order to improve our means of weather observation and prediction. Before the Tiros weather observations, less than 20 per cent of the Earth's atmosphere was adequately observed. An operational weather satellite system could observe the whole world. So far, our Tiros satellites have transmitted over 200,000 cloud cover pictures used in normal weather predictions. Tiros IV took pictures of tropical storms on more than 50 separate occasions. It discovered Hurricane Esther on September 10, 1961, while the hurricane was still forming. The result was additional warning time to the coastal areas hit by the storm.

The most dramatic, most exciting, best known, and largest part of our space program is the manned space flight program. Gordon Cooper's 22-orbit flight, combined with the flights of five other Astronauts, is demonstration of the remarkable progress made in a short time and the thoroughness of the development and preparations made. It also demonstrates the importance of man in making scientific observations and judgments in new environmental conditions. If you think back, you will realize that our first manned flight was the ballistic flight of Alan Shepard in May 1961. That was only a little over two years ago. You were already well along in your college programs. In these two short years, our technology has advanced to permit man to float in space for well over a day and control his return accurately.

All of these accomplishments that I have listed have been made over a period of less than five years since NASA was established. Some of you may already have been here at Portland State College at that time. If so, the race to keep up with the progress of science and technology is most apparent to you. But the pace will not let up, it will undoubtedly grow. Within six years, we hope to land men on the moon. The three Astronauts will be propelled on their course for the moon using a 7.5 million pound thrust rocket, the Saturn V, now being developed. Two of the Astronauts will descend to the surface of the moon and conduct initial exploration while the third Astronaut will wait in the return spacecraft that will be orbiting the moon. When their exploration is completed, the two lunar explorers will return to the orbiting spacecraft so that all three can then make the return trip to the Earth. The mission is exciting, challenging, demanding and will undoubtedly capture the imagination of the entire world just as Project Mercury has done. Certainly the enthusiasm and excitement of the crowds that have greeted Gordon Cooper demonstrate the acceptance of the goals that have been set for manned space flight. It is, I think, also indicative of the fact that the space effort does provide the kind of stimulus that is needed to provide the "spirited world" referred to by Dr. Berkner which will yield increased productivity and advancement in many varied fields of activity.

Even beyond these already approved program objectives and missions, the space effort includes research work aimed at assuring our ability to undertake the more advanced missions that will inevitably come. It is in these more advanced missions that my own work will be relied upon and will, I am convinced, result in general and accepted use of nuclear energy for rocket propulsion and for generation of electric power in space. We are already testing nuclear rocket reactors which will be used to heat hydrogen to high temperatures providing the high velocity gas that will propel our space vehicles of the future to missions even beyond the moon to the planets.

In addition, the use of nuclear energy sources will be required for the many, long life, high power applications that we visualize in space to provide the kind of environment in which man can survive and function, to collect important space data and transmit it to earth, to power the many experiments that may be performed in space laboratories, and even to accelerate charged gases to high velocities producing thrust that will propel our space vehicles. The fact that in the twenty years since man first initiated a self-sustaining nuclear chain reaction, we have already come to such active and productive effort on high temperature, small size reactors, such as those required for rocket propulsion and space electric power, is again a demonstration of the phenomenal rate of progress made in the sciences.

With all the success and progress and knowledge that has been achieved in the space program and the promise of much more to be learned about space in the future, the full benefits of the program would not be realized unless the new developments made for space use would find early application in other fields. It is necessary for the developments in space to be applied as fully and as quickly as possible to areas of civilian technology to help provide for the accelerated economic growth that is required in this country. Isn't this where this part of the country still has a job to do? The importance of this job is clearly indicated by the Economic Report of the President transmitted to the Congress in January which placed great emphasis on several determinants of economic growth with which all of us here must be concerned. Among these are the need for advancing the level of our technology, covering the range from management and organization to science and engineering; accelerating the dissemination and application of information in technological, commercial and employment opportunities; and, improving the quality, availability, and capacity of our educational programs. All of these factors are considered as a unit when we try to assure that the technology and knowledge developed by the Government in the space and atomic energy programs are rapidly applied in our civilian economy. We are convinced that such applications will provide real benefits to all mankind.

Studies conducted for NASA have shown that space related developments can find substantial applicability in non-space business. The most numerous examples of such transfer of technology are accomplished by the firms that have been responsible for the execution of the space related effort. Some examples are the use of the aluminized mylar skin of the Echo satellite as a low temperature insulator; the development of methods of casting polysulfide printing rollers based on the technology of casting large, solid propellant rocket motors; the use of filament wound, reinforced plastic tanks; and, printed cables for electrical circuits to simplify and reduce the cost of automotive wiring harnesses. These examples indicate the advantages available to firms that participate in space business because of their ability to directly translate the space technology to civilian consumer applications.

The opportunities for such direct space participation are many, particularly when we consider the thousands of subcontractors and suppliers of parts involved in the space program. However, participation requires the existence of competence. We cannot afford to pay for the establishment of competence on a government contract requiring the successful and urgent development of a complex piece of equipment. The importance of strong educational centers in establishing and maintaining competence in a region is, I believe, apparent. It was clearly stated by the President in his Message to Congress on Aid to Education. He said, "We need many more graduate centers, and they should be better distributed geographically. New industries increasingly gravitate to, or are innovated by, strong centers of learning and research. The distress area of the future may well be one which lacks centers of graduate education and research." Only areas of outstanding, advanced educational institutions can attract the scientific and technological competence that is required to accomplish the advanced scientific and technological developments that are required in most of our Government space contracts.

Even if a company is not part of the space effort, it is essential that means be found to assure that the developments of the Government programs are available to increase productivity and efficiency. The latest Report of the Council of Economic Advisors and the studies that have been conducted by and for NASA indicate that very few industrial organizations can take a raw idea from a non-related technical source and put it to work in their business. Furthermore, many business firms are not fully aware of the technological opportunities available to them. An intermediary that has broad scientific background and understands the needs of industry and business is required to accelerate the transfer of Government-sponsored developments and techniques to civilian consumer activities. It is in this capacity that our universities can play a major role and have a real responsibility to satisfy local needs. To satisfy this responsibility, you must have properly trained people available. They must be involved in research in various disciplines. You must present challenging programs to insure the availability of properly trained people to do the university research and to satisfy the needs of business and industry in the area. The number of you who are majors in education have a particularly significant role in keeping pace with the changing times in which we live because it is up to you to insure the flow of talent and capability into every field of activity. No matter what your field of specialization, the need for continued learning in this scientific age will always exist.

For all of you, it is important to recognize the significance of the words of your own President, Branford P. Millar, "Higher education is of central importance to modern existence as it has never been before. In scientific and technologically based industries, for instance, there has been a revolution both in products and the manner of handling them which has stemmed largely from the disinterested scientific researches of the universities and is carried on by the people trained by the universities. There is no question but that such progress will continue, that we have just seen the beginning. Less and less will significant progress and change be wrought by the slow accumulation of practical experience and skill, or patent trial and error, but more and more by the application of highly abstract principles with immediate and far-reaching effects upon practical problems."