NEWS RELEASE

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
400 MARYLAND AVENUE, SW, WASHINGTON 25, D.C.
TELEPHONES: WORTH 2-4155 — WORTH 3-1110

FOR RELEASE: ON DELIVERY
FRIDAY, OCTOBER 4, 1963

19p.

Address
by
James E. Webb, Administrator
National Aeronautics and Space Administration

AMERICAN COUNCIL ON EDUCATION
Washington, D. C.
October 4, 1963

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EDUCATION IN THE SPACE AGE

As this audience well knows, the National Aeronautics and Space Administration places great reliance upon the university community for guidance in determining the future course of its programs, and for active participation in the vital scientific research and engineering programs which will determine its success in the years ahead. This opportunity to meet with the administrative officials of our nation's universities is, therefore, a most welcome one.

When he extended your invitation to be here today, Dr. Logan Wilson suggested that I discuss the impact of federal research and development activity upon the nation's institutions of higher learning, with emphasis on NASA activity. I am sure that familiarity with the budgets of your respective institutions, coupled with earlier discussions during your deliberations here, make it unnecessary for me to dwell on the rapidly accelerating federal support of university research, so I shall not belabor this point.

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CORRECTION

In text of address by Mr. James E. Webb, Administrator, National Aeronautics and Space Administration, to American Council on Education, Washington, D.C., October 4, 1963, please make the following correction:

Page 15, first paragraph, in sentence beginning: "Frankly, it frequently appears more important x x x," make it read "x x x to concentrate on large engineering systems than to x x x" (large instead of long.).

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Rather, with your indulgence, I shall try to give you some thoughts on the role of the university in space exploration, as viewed by a federal administrator; outline some of the objectives of the NASA university program, and describe some of the ways in which we are seeking to implement these objectives.

Dr. Frederick Seitz, President of the National Academy of Sciences, and head of the Department of Physics at the University of Illinois, noted recently that he could "think of no aspect of university activity relating to science or technology which is not involved in a fundamental way in the space effort."

No one in this audience, I am sure, would quarrel with that assertion and, in fact, I suspect that many of you would broaden it to emphasize the impact of space activity--of man's ability for the first time to venture out from Mother Earth into the solar system--on the social as well as the physical sciences.

The exploration of space has created new opportunities for the scientist, the engineer, and the scholar, in virtually all of the fields with which the university is traditionally concerned. It requires highly advanced and sophisticated engineering applications in areas such as power sources, materials and structures, and extremely complex guidance, control and communications systems. It involves the development of specialized knowledge to enable man to survive and do useful work in the hostile space environment--knowledge which inevitably will add significantly to our understanding in fields such as medicine and the behavioral sciences.

In the basic sciences, space research is opening the way to vast increments of knowledge of the upper atmosphere, of the inorganic composition of the moon and the planets, of the basic laws of physics. As more advanced spacecraft are developed astronomy will benefit increasingly from extra-planetary observations. And, most exciting prospect of all, there exists the potential discovery of another form of life elsewhere in the universe.

Finally, the impact of space exploration will offer untold challenges to the sociologists, the economists, and in the field of law, as man adjusts to the concept that he is no longer bound to one small planet in a vast universe.

Dr. Seitz presents a point-of-view which is perhaps as representative of the attitude within the National Aeronautics and Space Administration as any words I could use. He point out:

"It is hardly necessary to add that the universities can make an enormous contribution to the space program. At the very least, the output of graduates is indispensable if the program is to accelerate and be sustained in the way which is envisaged. These graduates must have the best preparation the academic system can give them.

"Furthermore, the history of science in the United States demonstrates quite clearly that strong university participation in a field of research, whatever it may be, helps to assure the health of that field. First, a certain proportion of the most gifted individuals finds a university, with its freedom and flexibility, the most suitable environment in which to work. Then, too, the presence of many promising students in a formative period adds a particular freshness and vitality to research."

As a mission-oriented agency, the first responsibility of NASA is the accomplishment of the specific tasks assigned to it by the Congress. As a consequence, unlike the National Science Foundation, or the National Institutes of Health, we have no charter to sponsor basic research except as it is related to our specific mission. Within the framework of that mission, however--and it is sufficiently broad to touch on virtually every scientific discipline--NASA is exerting every effort to encourage conditions conducive to the conduct of its research within the natural home of science, the university, and to do so on a broad basis throughout the country.

NASA looks to the universities of the nation for support in two critical areas. First, our program managers in fields such as space science make contract and grant arrangements with universities and groups of scholars in universities to cover their basic research needs. In most instances, the experiments carried aboard NASA satellites and deep space probes are conceived and designed by scientists and engineers within the university community. Those which are flown are selected by NASA on the basis of comparative value, with the advice and counsel of recognized authorities in the scientific disciplines directly concerned.

NASA is aware that its activities will require an increasing supply of highly trained scientists in the years ahead. As a consequence, it also looks to the universities for expansion to fill this need. The very fact that so much of NASA's basic research is performed in universities indirectly stimulates doctoral and post-doctoral instruction. But NASA has gone beyond this to sponsor a pre-doctoral training program with the ultimate objective of assisting in the production of 1,000 Ph.D.'s a year.

NASA recognizes that the conduct of space-related research by multi-disciplinary teams within the universities, and the training of scholars in space-related fields, has placed an increased burden upon already over-loaded university facilities. As a consequence, we have embarked upon a program of facilities grants, to provide laboratory space for NASA work in institutions which are unusually active in the conduct of NASA research. Let me emphasize the words "unusually active." NASA does not provide funds for research facilities in the hope that the university will then undertake research efforts to fill them up. Rather, funds are provided in those instances where active programs are already underway, and it is clear that additional facilities are required to support these efforts.

These, then, are the major ways in which the universities of the nation are assisting the nation's space efforts, and in which NASA is trying to help you to help us. I think it is important to emphasize again that these efforts are not limited to a handful of institutions, but rather, that a sincere effort is being made to broadly utilize and add to the university competence which exists throughout the nation.

Dr. Clark Kerr, in the second of his Godkin lectures at Harvard earlier this year, noted that "the general policy of federal agencies in allocating research grants to universities for the past two decades has been one of 'seeking excellence wherever it is;' one of accepting the established pattern and following it." Today, Kerr notes, there is increasing emphasis on the development of additional outstanding centers of graduate instruction and research.

This, in essence, is the NASA policy toward graduate instruction and research. Our program has sought, and will continue to seek, to broaden the base of competence in scientific research in universities across the country, and in the process to enlarge opportunities for graduate education in space-related fields of study, throughout the nation.

It is scarcely necessary for a Federal official to remind this audience that there are, in the United States, nearly 1,500 colleges and universities equipped to grant at least a baccalaureate degree on the basis of a 4-year course of study, some 1,100 of them granting these degrees in science or technology. Essentially, these make up the total national educational resource pool. Of this number, about 150 grant the Ph.D. degree or equivalent in at least one field of science or engineering.

With few exceptions, original research in engineering and science is closely related to graduate training, so the 150 institutions may be regarded as nearly the total national university research capability.

Further, this group of 150 schools may somewhat arbitrarily be divided into three types:

(1) The large, strong, first-rank schools--the leaders, or if you wish, those who "have it made."

(2) The intermediate institutions with good reputations in at least some areas, capable faculties, usually with student bodies of at least several thousand, and good physical plants.

(3) The remainder suffer critical problems of staff quality, faculty-student ratios, facilities, location, general financial conditions, academic traditions, equipment, etc. They produce Ph.D.'s--often

excellent ones--but in general in institutional quality they suffer by comparison with the first two groups.

What has come to be known as "the base of scientific research competence in the universities" includes all of the first group, some of the second and few of the third. As you know, there are underlying reasons why any given university is of one type rather than another. In by far the majority of cases, these reasons existed long before federal support of research expanded after World War II. It is almost impossible to stress too heavily this causal relationship. There are very few instances of federal support making a university a leader during the past two decades. Federal funds have tended to concentrate in schools which were already leaders and could offer high-quality results for the money spent. Naturally, such a situation is regenerative, and the strong tend to become stronger.

Reports are now available which reflect FY 1960 federal expenditures for research, and some consider their distribution as one indication of what may be called the "leading" universities. Exclusive of agricultural experiment stations or funds for off-campus federal laboratories such as Los Alamos, Jet Propulsion Laboratory, Lincoln Laboratory, etc., the first ten are: Massachusetts Institute of Technology; California; Michigan; Columbia; Stanford; Chicago; New York University; Wisconsin; Illinois; and Harvard. The second ten are: Johns Hopkins; Princeton; Minnesota; Washington; Texas; Yale; Pennsylvania; Pittsburgh; Ohio State; and California Institute of Technology.

If NASA were to make grants only to these schools, it would indeed be guilty of taking the easy course in disregard of a national need to discourage further concentration. If NASA should refuse to do business with them, it

would be accused of placing a premium on mediocrity, of using less than the best and jeopardizing its mission. As an agency on whose success national security and international leadership must rely, NASA cannot undertake as a primary objective a welfare program to reconstruct weak universities. Its contribution to broadening the research base, and lessening concentration, must take the form of a conscious effort to seek out competence in other universities, in addition to the big ten or the big twenty, and fan the spark of creativity in places where even modest encouragement to move ahead can produce large results of national benefit.

NASA is now supporting research at every one of the twenty first-rank schools already cited--but also at about eighty others. Many of these operations are research projects centered about outstanding individuals--"islands" of special competence of particular value in the space program. Several are "seed grants" at places such as Kansas, Maine, and Montana State, which help create a productive inter-disciplinary intellectual as well as science-oriented climate in schools with growing potential. Some grants have provided for expansion of unusual activites at institutions such as Alabama and the Graduate Research Center of the Southwest.

It should be stressed that scientific competence is not "diluted" when some of the less active universities develop into first-rate research centers--any more than one quart of milk is diluted when you place a pint beside it. Such "dilution" of scientific competence occurs only if researchers are lured away from already strong schools to be somehow distributed among those with less competence. NASA avoids such effects by declining to sponsor the organization of new enterprises which propose to proselyte staff from going concerns.

Movement of researchers is, of course, entirely normal and desirable, but NASA does not and will not provide hunting licenses for new activities to deplete established ones.

These concepts are equally applicable to pre-doctoral training programs.

Of the first ten pre-doctoral training grants made in FY 1962, only four went to schools in the "big twenty" cited earlier. This year, nineteen of the twenty are included--but there are training grants at 69 other schools which are not among those twenty leaders. Seventeen of the 69, although capable of training a few Ph.D.'s each, have not yet begun to participate in NASA's research program as such. These include institutions such as Arizona State, Clemson, Missouri, Oregon State, Rhode Island, Texas Tech., and West Virginia, where modest training programs have provided entry into the national space effort. Thus by the use of project research grants, seed grants, and training grants, NASA is working with about 100 universities not in the "big twenty." The base is being broadened--and the research conducted in these areas may be expected to grow as their capabilities increase.

It is worth emphasizing that NASA is attempting to foster a broader base of competence in graduate research by awarding training grants to institutions rather than to individual scholars. Thus the university as an institution is given the opportunity to select its own candidates for instruction on its own campus. This has the effect of preventing the promising scholar, armed with an individual grant, from "shopping" among the leaders for his school, and further concentrating competence in graduate instruction. If the school receiving a NASA grant selects its candidates wisely, it may enhance its chances of retaining the student as a faculty member once he has obtained his Ph.D.

Because of NASA's responsibilities, it does press harder in some areas than in others. This is its job and, by so doing in an enlightened and cautious manner, NASA expects advances in those areas. This is the way progress is attained--by pushing salients into regions of urgent significance and forcing other regions to catch up. To insist upon a uniform advance in all fields would be absurd if it were accomplished by restraining the leaders.

NASA recognizes fully the importance of progress in the social sciences. It has initiated socio-economic studies and urged the incorporation of some social scientists into the personnel structure of some of its large multi-disciplinary grants. But each university must assume responsibility for its internal balance and, if federal influence is to be exerted, agencies other than NASA must take responsibility for specific activity in the "neglected" areas. NASA cannot be held responsible for these omissions, but can only assume responsibility within the framework of its assigned mission.

Speaking for DOD, Dr. Harold Brown, Director of Defense Research and Engineering, has recently stated: "We don't want to sponsor knowledge like the National Science Foundation, noble as that may be...."

Because of the nature of its mission and the broad provisions of the 1958 Space Act, NASA takes a different view. Although our interest is mission-oriented (in contrast to the NSF approach), NASA recognizes that ignorance is the common enemy in space as elsewhere and it does seek new knowledge, the application of which is not always entirely foreseeable, upon which to base future technology. Believing that in our society universities are unique in many ways and that we must work with them in ways they will regard as proper as well as effective NASA has established an organizational group in Headquarters

to deal specifically with universities--to understand and give consideration to their interests and needs as well as NASA's--and to make a conscious effort to deal with them in ways that will strengthen their total competence rather than weaken it. NASA does not ask universities to create off-campus laboratories which draw researchers away from the graduate education environment. Most important also is the policy and direction of both research and training endeavors, to allow the universities maximum latitude to exercise their own discretion and accomodate to special local conditions.

Some have argued that federal scholarship money is already available in such amounts that any competent student can get a grant. And others that NASA is scraping the bottom of the barrel, financing pre-doctoral training for unqualified people. This is not the view of responsible university officials involved in the program. Traineeships are not wanting for applicants that meet the selection standards of the responsible university. None has gone unfilled. Seventy-three of the 88 universities receiving pre-doctoral training grants during FY 1963, requested more traineeships than NASA was able to underwrite. To date, these trainees are maintaining an over-all grade point average of 3.5 on a scale of A=4.0.

Nor is NASA diverting pre-doctoral candidates from their preferred specialties because of the financial lure of NASA support. Potential musicians, artists, clinical psychologists, or surgeons are not likely to be diverted into aerospace engineering by a basic stipend of $2400 per year for a maximum of three years. In addition, space research needs are so pervasive that a broad interpretation of the Space Act is required and training is provided in such diverse fields as political science, psychology, oceanography, economics and space law.

I think I can say categorically that the universities with which NASA works are not becoming so reliant on federal research funds that it is interfering with their traditional role of undergraduate instruction. Although the ratio of graduate to undergraduate effort in many universities may be increasing, those with which we work are not reducing their undergraduate instruction role. In fact, we know that all the major schools are most concerned about keeping up with the undergraduate demand.

In the future, if an imbalance due to federal funds for graduate research should develop, two alternatives may have to be considered: Reduce federal support of graduate research; or provide federal support for undergraduate instruction. The first appears to be no solution at all and would have dangerous social and educational consequences. The second is plagued by political and social problems far beyond NASA's purview. Until some agency, other than NASA, provides undergraduate support, there is no place to leave the responsibility for proper balance except in the hands of the universities themselves thoughtfully monitored by responsible and sympathetic administrators, state and federal. The universities should be the best judges of the extent of the interference, and it must be hoped they have enough wisdom and courage to preserve the essential virtues of their unique institutional environment--even if they must reject research funds.

As federal support of university research continues to expand, it is inevitable that increasing concern will be expressed over the influence of this support on the internal structure of the university. This is a healthy thing, and to the extent that it provokes continuing scrutiny of the impact of federal support, and seeks to mitigate any potentially damaging effects, criticism should be encouraged.

Meanwhile, however, it is equally important that the critics recognize that we are in a changing world, and one to which all segments of society must adapt. Certainly there are dangers inherent in some of the changes which are taking place, but even greater threats are posed if the nation's universities fail to adapt to an age in which a favorable balance of science and technology is more important than a favorable balance in a nation's terms of trade and is crucial in the balance of actual and potential power among the nations of the world.

In general, there is wide agreement among thoughtful leaders that the growth of federal participation in research and development has been good for the universities and good for the country. Dr. Clark Kerr has noted that:

"With all its problems, federal research aid to universities has helped greatly in meeting national needs. It has greatly assisted the universities themselves. The nation is stronger. The leading universities are stronger. As Nathan Pusey reported the unanimous views of the presidents of universities participating in the Carnegie study, federal aid, over-all, has been a 'good thing.'

Kerr continues.

"The partnership of the federal government with higher education...over the past two decades has been enormously productive in enlarging the technological pool of ideas and skills. Now we are entering a new phase of widening and deepening relationships. This new phase can carry the American commitment to education to new heights of endeavor. It can also preserve the traditional freedoms of higher education from excessive control. It can enlarge the margin for excellence. The challenge is to make certain that it does all four."

Similarly, a group of the nation's leading educators participating in a National Academy of Sciences summer study at the University of Iowa last year, expressed a unanimously favorable impression of the NASA university program, and particularly of the NASA "intention to perform its mission in such a manner as to strengthen existing universities, and by its intention to avoid the creation of research institutes of a type that undermine universities."

"In view of the necessity for developing a vigorous academic program in all aspects of the space endeavor, it is recommended that NASA pursue its present policy towards university research at the graduate level, and extend application of the policy to as many universities as possible, large and small," the report said.

A few moments ago I indicated the specific ways in which the universities of the nation are helping to advance our national program for the conquest and use of space--through the performance of basic research and the training of highly competent, imaginative, innovative scientists and engineers to conduct the research and design the instruments of the future. These efforts are of great significance; in fact, they are indispensable to the success of the NASA program.

There are other less tangible ways, however, in which universities and those in the university community can make major contributions to the success of the national space effort. First, it is essential that those of you who are working with us in the universities devote your conscious attention to devising new ways in which NASA-university relationships can be strengthened. If you find fault with the manner in which our programs are being conducted, we want to know it. We want your guidance regarding ways in which NASA

activities can be improved, and the means through which we can assist you in doing a more constructive job for the nation.

Meanwhile, however, if you in the universities believe the NASA program is sound and of value to the universities and to the cause of scientific research and graduate education in the United States, you have a responsibility to help assure that this value is appreciated and understood. The United States is making a substantial investment in space exploration. As our competence increases and the state of the art in both science and technology advance to make it possible for us to do more things in space, there is an increasing competition for funds. Frankly, it frequently appears more important to decision makers to build and fly rockets, or concentrate on long engineering systems than to support basic research and expanded graduate education. If our activities with the nation's universities are to earn continued support the benefits accruing from them must be more widely understood.

The university can also make a valuable contribution in another way. As I have suggested, a substantial investment is being made in space research, and when federal funds are invested in an undertaking the public, understandably, expects returns. It is apparent that if such returns are to come many must stem from the nation's universities--the one community in which all of the disciplines are brought together, and where competence exists to evaluate the potential for utilization beyond space inherent in the scientific research and technical development now underway.

In my reading recently, I encountered a quotation written more than half a century ago. It reads:

"Nothing in our educational history is more striking than the steady pressure of democracy upon its universities to adapt them to the requirements of all the people.....

"In the transitional conditions of American democracy.....the mission of the university is most important. The times call for educated leaders. General experience and rule-of-thumb information are inadequate for the solution of the problems of a democracy which no longer owns the safety fund of an unlimited quantity of untouched resources....

"The test tube and the microscope are needed rather than the axe and the rifle in this new ideal of conquest. The very discoveries of science in such fields as public health and manufacturing processes have made it necessary to depend upon the expert."

Many of you will recognize those words as coming from Frederick Jackson Turner. Although this great scholar's concern was more with the solution of social problems growing out of the early industrialization of society, the language applies with equal force to the problems of today. How, in an increasingly technical age, can the business and industry of the nation remain abreast of the enormous volume of new knowledge which is becoming available in science and technology? How, indeed, except by turning to the university and its scholars as a trusted source of information? Such trusted sources are hard to find in our society, but are indispensable to our peculiarly American decision making processes.

Dr. Lloyd Berkner put it very well when he wrote that, as a result of the technological revolution which began about 1950, "the graduate university has suddenly been brought to the very focus of future community welfare. The

graduate school must provide the technology leaders and the ideas from which industrial employment and community happiness must flow. The university is no longer a desirable appendage to community life; the university today must be at the very center of community development; it must work as an integral part of the community if society is to survive as a productive and happy group of citizens."

Nowhere, in this scientific age, is Berkner's point more clear than in the NASA program. Unlike many of the large, government-sponsored research and development programs of the past, much of our space program is unclassified. Moreover, under the law, NASA is required to consult with the scientific community in the design of its experiments, and to report to the nation's scientists on the results.

As a consequence, in an era of diverse, complex and extensive research in every scientific and engineering discipline, the nation's institutions of higher learning have become virtually the only center in which the emerging mass of scientific and technical knowledge can be gathered, understood, and disseminated to those who will find it of value, and need to trust its source.

Within NASA, we have sought to encourage closer relationships between our university partners and the business, industry, and government leaders of the regions with which they serve. It is our policy to place research contracts and grants at those universities where the scholars themselves, the consensus of the faculty, and the administration of the university are interested in having the work progress on a broad inter-disciplinary basis.

Further, in those instances in which grants are made for the construction of research facilities, the university must agree to undertake to create in

an energetic and organized manner, a broadly based multi-disciplinary team to explore means of feeding research results into the industries and segments of the economy with which the university normally has close relations.

In addition to these policies, NASA has also developed a technology utilization program in which a group of universities and research institutes are studying potential means through which the burgeoning knowledge of the present age can be more effectively transmitted into the economic life of the country. Although barely underway, this program offers promise of being of real value in the years ahead.

These policies can, we believe, increasingly create situations within which the interdisciplinary groups working with us in the universities, if joined with other forces for progress and growth in the community, can lay the base for more rapid assimilation and use of new knowledge gained from space research.

It is abundantly clear, however, that no activity which NASA itself can undertake, no policy which it can establish, will effectively insure that the nation derives maximum benefit from space related research unless the universities consciously apply themselves to the task.

It seems to me that no longer can the university content itself with its traditional role as a center of advanced education and research. In today's world, with science and technology advancing at an unprecedented pace, the university cannot be just an adjunct to community life, rather, it must assume a position at the very heart of economic and social progress in the years ahead.

It must do so if it is to fulfill its responsibilities in history's most challenging age, for the nation has nowhere else to turn.

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