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Statement by Arnold W. Frutkin

Director

Office of International Programs

before the

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INTRODUCTION

It is a privilege to have been asked to speak to you today about the international programs of the National Aeronautics and Space Administration (NASA). This is particularly so because our country's first steps in space exploration, in both planning and execution, were taken in concert with other nations in the Americas. It was scientists from both North and South America, meeting in Rome in 1954, with their colleagues from Europe and Asia, who initiated the chain of events which have now extended man's reach beyond his immediate environment. There in Rome, at a meeting of the World Committee for the International Geophysical Year (IGY), it was agreed that the technology required to place scientific satellites in orbit was available and that the effort should be made. Later, the cooperation of governments and scientific communities in Latin America made it possible to establish the tracking and telemetry stations which

were required to follow the first U. S. satellites. I will have more to say about these stations later. I should like now only to express again our thanks to our Latin American colleagues for the very valuable assistance which has been given to us in this work.

THE PHILOSOPHY OF COOPERATION

One may well ask why it is that NASA, while heavily committed to a difficult and ambitious program of space research, nevertheless seeks to engage in cooperative efforts with other nations. My first remarks suggest at least two reasons:

-- First, man's first ventures into space were taken in the context of international cooperation in science -- as part of the program of the International Geophysical Year. The IGY operation captivated men's minds. It has achieved a dynamism which almost demands that we continue to work within the same sort of framework.

-- Second, the technology of operations in space research virtually requires global efforts. No country can be satisfied with tracking and telemetry efforts which are restricted to its own borders. Even the Soviet Union has requested the services of tracking stations located in your countries, in South Africa, and in Australia in order to cover the movements of its satellites over the Southern Hemisphere. Soviet scientists have also made important use of the great radio telescope at Jodrell Bank in England.

But there are other considerations.

-- We recognize that scientists in all countries can make important contributions to the theory and practice of space research.

-- Ultimately, more ambitious efforts to push our knowledge ever further into space will become so costly and complex that the burdens will be too great for any one nation to carry. It will be desirable to pool energies and contributions as well as costs.

-- Above all, perhaps, we know that space is inherently international in character. It is already a widely accepted principle that no one nation should appropriate to itself regions or natural bodies in space. There is strong feeling everywhere that we must not extend cold wars and armaments competitions into the vastness of space. We, for our part, hope to demonstrate by the openness of our program and our readiness to participate in cooperative projects, that we subscribe in fact as well as in word to these principles.

Each of the considerations which I have just mentioned was reviewed by the Congress of the United States when, in the Spring of 1958, it debated the establishment of a civilian space agency in the United States. The records of these Hearings show very clearly how conscious our legislators were of every one of these points. So, it is not surprising that the Congress wrote into the Act establishing NASA that one of its purposes should be "Cooperation by the United States with other nations and groups of nations in work done pursuant to this Act and in the peaceful application of the results thereof..." NASA has accepted this objective not as a pious pronouncement but rather as a substantive obligation.

In order to provide for aggressive support of international objectives within NASA in response to the Congressional mandate, the

Administrator established the Office of International Programs. It is the function of this office to generate, to encourage, to coordinate, and to provide necessary supporting services for, NASA's cooperative activities. I should like now to tell you what principles we mean to follow in cooperative programs. Then I propose to tell you something about those programs in which we are already engaged.

We feel that programs of international cooperation should be substantive in character, contributing toward the technical and scientific objectives of space research. This suggests that the programs themselves should grow out of, or be capable of integration with, NASA's own operating and research programs. But we do not wish to suggest to other nations' scientists what projects or programs they should adopt, or, indeed, that they should enter into space research at all. If cooperation is desired, however, we are eager to discuss the possibilities. In such cases, we believe that consideration should be given to specific, limited projects, for it is too early in this new science to chart broad general programs. The essential criterion should be that the projects have scientific or technical validity. We would hope that proposals would represent experiments or other projects which we ourselves would wish to carry out if they were not to be done jointly.

Generally speaking, we cannot at this time consider programs which would involve an exchange of funds. Rather, each nation should be able to support its own contribution. However, it is not necessary that contributions be of equal scope and magnitude. Beyond these

particular points, it goes without saying that the free exchange of information, and especially the results of our experiments, should be made available to the scientists of all nations. To this end we support the activity in the United Nations regarding the peaceful uses of outer space. Similarly we are, through our National Academy of Sciences, giving full support to the International Committee on Space Research (COSPAR), one of the permanent offshoots of the World Committee for IGY.

TYPES OF PROGRAMS

I should like to tell you now of the types of international programs which NASA is already conducting. It is convenient to distinguish four basic types of international activity in which NASA is engaged:

(1) Operational -- This involves the acquisition and/or operation of tracking and telemetry stations and services as necessary to meet operating requirements for a global range.

(2) Informational -- This category includes the dissemination of advance information to foreign scientists so they may prepare to utilize U. S. space satellites in independent ground-based experiments of their own. It also includes the dissemination of results of experiments for the information and benefit of scientists everywhere.

(3) Joint -- This category includes projects, experiments and exchanges of mutual interest and advantage between U.S. and foreign scientists.

(4) Personnel Exchanges and Training -- This refers to programs which provide close working relationships for foreign scientists in NASA laboratories.

Let me describe each of these four types of programs in more detail.

Operational Programs. NASA's foreign operations indicate how widespread our international activities have already become. Coordinated space probe tracking activities are conducted or about to be conducted in a total of 19 countries. Based in our own hemisphere, these now extend to Africa, and the Pacific while additional stations are in prospect in the United Kingdom and Canada.

The backbone of these tracking activities are the radio and optical stations established in South America. (The optical stations, established by the Smithsonian Astrophysical Observatory, are operated now for NASA under grant.) In Chile, Ecuador and Peru, these stations are operated jointly with technicians of these countries. In every case, the governments concerned have generously entered into agreements for the continued operation of these stations.

Other Minitrack and Baker-Nunn Camera stations are operated in South Africa and Australia. Two new Minitrack stations--designed to extend our network latitudinally--are planned in Newfoundland and England, subject to the approval of the Canadian and British governments.

This basic operating network is supplemented in three instances by contract or grant arrangements. The largest steerable radio "dish" in the world, at Jodrell Bank in England, has contributed invaluable

tracking services during the past year under contract with NASA. Grants for tracking and telemetry services, together with necessary U. S. equipment, have gone to the University of Heidelberg in West Germany and to the Radio Research Laboratories of the Ministry of Posts and Telecommunications in Japan.

At the present time, NASA is engaged in establishing a special network of tracking and data acquisition stations abroad in connection with Project Mercury, the first step in the U. S. manned satellite program, Government-to-Government negotiations are in progress for sites in Australia, Bermuda, the Canaries, Canton Island, Mexico, Nigeria, and Zanzibar. At least two of the Mercury stations will be operated by nationals of the host country. Additional participation will be possible to the extent that qualified personnel become available.

This special network is required because of the orbital inclination which the Mercury capsule is designed to take. Tracking and telemetry stations are more closely spaced for this program than for any other yet conducted by NASA. This will permit virtually continuous monitoring of the physiological reactions and condition of the Mercury astronaut. Necessary decisions may then be made at the earliest possible time in the interests of the astronaut's safety.

Finally, as our efforts turn increasingly toward deeper probing into the reaches of our planetary system, we will require specialized stations with high capabilities for very long range tracking. A network of radio telescopes for this purpose is being established.

We hope to supplement installations now within our own borders by locating new 85-foot steerable "dishes" for the tracking of deep space probes in the southern Pacific and in southern Africa, with the permission and participation of the governments concerned.

As I have said, 19 countries or political entities are involved in these network arrangements. It is clear, then, that NASA's global tracking range is truly international in character and that a very considerable input is provided by technicians and scientists abroad. In addition, the land for most of the station sites has been made available without cost.

These far-flung activities of NASA help to broaden scientific interest, participation, and contribution in the exploration of space. It is NASA's desire to encourage further participation by nationals of the countries in which tracking sites are located.

Informational Programs. NASA continues the launching announcements and data exchanges which were instituted during the International Geophysical Year. The launching of sounding rockets is reported in brief flight summaries which are filed with World Data Center A (Rockets and Satellites) at the National Academy of Sciences. The Academy then distributes this material to the other World Data Centers in England and the Soviet Union. At six-month intervals, the material is catalogued for the information of the scientific community.

Announcements of the launching of satellites and space probes are made routinely within a few hours through SPACEWARN, a special world communications net established during the IGY, as well as in the press.

These announcements provide scientists with orbital characteristics, satellite or probe weight, types of instrumentation and experimental objectives.

Results of experiments are published in the recognized scientific journals and distributed also through the World Data Centers. Techniques for interim cataloguing and periodic notification of available results are now under joint study by NASA and the National Academy of Sciences.

NASA is also participating extensively in scientific symposia, in many ways the life-stream of international scientific exchange. During 1960, NASA scientists and technicians have attended, or will attend and contribute to, meetings in Nice, Tokyo, Helsinki, Ottawa, Copenhagen, Madrid, Buenos Aires, and other cities abroad as well as here in the United States. Potentially the most significant of these symposia is the United Nations Space Conference. NASA is preparing to play a central role in organizing the U. S. contribution to this hopeful exchange among pioneers in space from all nations.

The methods, objectives, and standards of international exchange of data were reviewed by COSPAR last month in Nice. It is of some interest that this meeting resulted in renewing the understandings for scientific exchange which had been established during the IGY. In addition, these understandings were enlarged in at least two respects. The Soviet scientists have now agreed to provide the orbital elements of the trajectories of their satellites so that scientists everywhere can compute the appropriate look angles needed to locate these satellites by radio or optical means from any location on earth.

In the past, the Soviets provided this information only for specific locations on the globe. In addition, it has been agreed that launching nations will hereafter give advance notice of satellite launchings where the orbital inclination, the power output, the radio frequency to be used or the opportunities for observation are significantly different from those in past satellites.

NASA seeks not only to comply with but to go beyond the exchanges already agreed on internationally. Even before the COSPAR meeting, steps were taken to provide the world scientific community with an opportunity to participate in a future U. S. experiment in accordance with local capabilities and interests. The experiment is Project Echo, the launching of a 100-foot inflatable, aluminized sphere which will serve as a passive reflector for communications experiments and will also permit studies of atmospheric drag. The details of the experiment have been disseminated not only in the United States but also to COSPAR and individual scientists abroad who may be interested. With this advance information, foreign scientists may prepare the necessary equipment and arrange for such ground-based experiments as are feasible. This procedure will serve as a pattern for future advance notification where appropriate -- in the interests of broad participation, maximum utilization, and, not least, optimum benefits for all.

In the same way, NASA has notified the international scientific community that the telemetry calibrations for Explorer VII will soon be available to them to use for direct reduction of the data provided by that satellite.

Joint Projects. Perhaps the most interesting of the possibilities for international cooperation is participation by the scientists of two or more countries in the design of experiments and in the preparation of payloads for rockets, satellites, and space probes. NASA has already taken a number of significant steps in this direction. Within a very few months of its establishment, NASA was engaged in preliminary technical discussions with representatives of the Canadian Defence Research Board on a proposed joint project to sound the ionosphere from above. The Canadians will also provide the antenna and satellite shell required. Meanwhile, NASA will develop a fixed-frequency sounder. Both will be placed in orbit by the United States. Tracking installations will be modified to acquire data from both, and a coordinated ground-based net will simultaneously probe the ionosphere from below. The British have expressed interest in this phase of the project. Thus, a multi-lateral experiment is already in preparation and will be conducted sometime in 1961.

In March 1959, NASA authorized the National Academy of Sciences' delegate to COSPAR to offer, on behalf of the United States, to place in orbit individual experiments or complete satellite payloads prepared by scientists of other nations. Because the closest possible collaboration is desirable in such efforts, it was stated that the experimenters were welcome to work together with American teams in the development of their projects.

In July, the United Kingdom sent a team to the U. S. under Professor H. W. S. Massey to discuss a British proposal within the

framework of NASA's offer to COSPAR. It was tentatively agreed that British scientists, over a two-to four-year period, would instrument perhaps three satellites for launching, probably by means of NASA's Scout vehicle. Each nation assumes responsibility for its own contribution. Specific proposals for four experiments to be flown in the first joint satellite were agreed upon last month. They will involve studies of solar radiation, electron density and temperature, and cosmic radiation. These will permit unique correlations of the on-board experiments themselves as well as between these and ground-based or air-space experiments. An exchange of notes at the governmental level will formalize this arrangement. The proposed experiments were communicated to COSPAR in January and have been endorsed by that Committee.

The U. S. offer to COSPAR in March 1959, was followed up during September and October 1959 by discussions abroad with scientists of a number of European countries. These discussions were undertaken by Dr. Hugh Dryden, the Deputy Administrator of NASA, in company with Dr. Homer Newell, the Deputy Director of the Office of Space Flight Programs, and myself. The discussions were directed toward those countries which were known to have established, or to be considering establishment of, national space centers or committees. We wanted to learn something of the development of space interests abroad and to offer, without any suggestion of interference, to discuss cooperative programs if, and when, the space interests in each country became organized and endorsed by their governments or major scientific institutions. We described (1) the organization of space activity

in the United States; (2) NASA's special interest in international cooperation in accordance with the National Aeronautics and Space Act of 1958; (3) the progress already made in programs of cooperation; and (4) the kind of cooperation we thought desirable. We said also that cooperative programs might ultimately be formulated at the diplomatic level, if required by reason of magnitude or content, but that in all cases technical discussions on an informal basis should precede governmental agreement. Quite frankly we feel this is necessary to ensure that cooperative programs are technical in character and that any commitments are acceptable to our operating people. Finally, it was proposed that COSPAR be informed of the nature of any agreed scientific programs, so we might benefit from the interest, constructive comment, and auspices of the international scientific community.

The organization of space interests is almost everywhere in early stages. Nevertheless, in addition to the United Kingdom and Canada, Australia, Belgium, France, Japan, Italy, and Sweden are known to have established national space committees. (The U. S. S. R., of course, has had a space commission in existence for some years.) While definitive programs have not yet been announced, and informal discussions suggest that relatively limited programs are in view, there appears to be a strong interest in cooperative programs in the European and Pacific nations. In fact, only cooperation will make possible programs extending beyond relatively limited sounding rocket projects. This is due, in large part, to the very substantial financial requirements involved in more ambitious efforts.

In any event, it is becoming increasingly evident that the NASA offer to COSPAR has generated considerable discussion abroad, with the result that interest in cooperative programs has been expressed formally or informally on behalf of scientists in Argentina, Australia, Belgium, France, Japan, Israel, Italy, New Zealand, Sweden, the United Kingdom, and West Germany. The interest has been both formal and informal and ranges from requests for sounding rockets or the exchange of scientific personnel to full-scale preparation of instrumented satellites.

For example, the Australians have proposed that they prepare instrumentation to study very low frequency emissions above the ionosphere in the regions of the lines of magnetic force. The instrumentation would be launched in rockets or satellites by the United States. There is in prospect also a "multi-lateral" rocket sounding program. The U. S. hopes to purchase British Skylark rockets for which the Australian launching range at Woomera is fitted and to instrument them for the necessary experiments, the rockets themselves to be launched by the Australians. NASA has expressed interest in every case and has invited specific proposals where these have not been provided. NASA considers, therefore, that a very wide range of cooperative activities is in prospect and it is the Administration's intention to encourage these most energetically.

NASA has not confined its interests in cooperation in space research to the West. The possibilities of cooperation with the U.S.S.R. have been explored as opportunity presented. An extensive discussion of preliminary nature was conducted in mid-November with the Chairman of the Soviet Commission for Inter-Planetary Travel, Professor Sedov,

and another member of the Commission, Academician Blagonravov, during the visit of the U.S.S.R. delegation to the American Rocket Society Meeting here in Washington. The Soviet scientists then expressed willingness to consider some form of cooperation in space activity but stated their belief that such cooperation would have to proceed "step-by-step". The only step which they were at that time willing to discuss was the Space Conference under U. N. auspices which had been proposed by their representative in the United Nations. More recently, the NASA Administrator, Dr. T. Keith Glennan, in an address before the Institute of World Affairs in Pasadena on December 7, 1959, offered the services of the Project Mercury tracking network to the Soviet Union when, as, and if it should conduct a man-in-space program. Dr. Glennan then stated that data could be acquired and transmitted in its raw state to the Academy of Sciences in Moscow. He stated also NASA's readiness to utilize Soviet equipment should special recording or data readout be required. The offer was promptly transmitted through the National Academy of Sciences to the Soviet Academy of Sciences. While no response has yet been received, NASA plans to continue exploration of possibilities for cooperation with the Soviet Union in projects of mutual interest as occasion permits.

Personnel Exchanges and Training. In order to provide an opportunity for foreign scientists to develop their interests and capabilities for space research, NASA has established postdoctoral and senior resident research associateships, administered by the National Academy of Sciences. These associateships provide stipends beginning at \$8,000 per year. While not intended primarily for foreign nationals, thus far five

scientists have been accepted for such associateships from abroad. The countries from which they come include Japan, India, New Zealand and Denmark.

NASA's preferred method of operation in connection with joint projects, as well as specific proposals by foreign space committees, will operate to increase the number of foreign scientists working in U. S. space laboratories. Of course, considerations of operating efficiency in the building of our own teams requires that discretion be used in accommodating training and fellowship personnel. At present NASA does not have funds, outside of the associateship program, to make available for the travel and subsistence of scientists. Where, however, their own governments or scientific institutions provide such funds, NASA will make every effort to provide the laboratory support and guidance possible.

SUMMARY

NASA's operational requirements and statutory obligations involve it in a wide range of international activities and programs. These are already generating wide interest and promise to increase participation by foreign scientists in the investigation of Earth's spatial environment and the regions beyond. NASA continues to support the constructive exchange practices of the IGY. Beyond this it has taken a number of positive steps to develop concrete programs of international cooperation. These steps have met with gratifying response and a program of still uncertain yet clearly significant magnitude appears assured. The program includes data and information exchange, operational assistance,

ground-based participation, technical training, and finally joint projects in space exploration. Elements of the program are already in being. The remainder is rapidly taking shape, though the fruits of any efforts in this most demanding of disciplines will be realized only after long and difficult application.

We hope very much that our Latin-American colleagues will consider useful projects of joint interest to expand our existing collaboration in space research.