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STATEMENT OF

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

before the

Committee on Aeronautical and Space Sciences
United States Senate

Mr. Chairman and Members of the Committee:

I am very happy to have this chance to report on NASA's international space activities which are conducted in accordance with Section 102(c) of the National Aeronautics and Space Act of 1958. I shall try, in the briefest possible way, to give you some sense of the extensive and rewarding international program which we have had underway for some years. Then, I would like, again very briefly, to describe the even more promising current breakthroughs to major international space projects.

I think that the simplest way to convey an impression of the variety and substance of NASA's international space activities is to review their place in the agency's program in the last calendar year. NASA put up 19 spacecraft in 18 launchings during 1972, every one of them successful. Of the nineteen

spacecraft, all but three had some significant international aspect and only one lacked any international involvement of a civil space character.

The table on pages 3 - 5 of this statement lists each of the 1972 missions and notes its international aspect. I will not take the time here to go through each, but I will comment on the listings so as to illustrate their pattern.

TABLE 1

INTERNATIONAL ASPECTS OF NASA LAUNCHINGS 1972

MISSION	LAUNCH DATE	INTERNATIONAL ASPECT
INTELSAT IV F-4	22 Jan.	Reimbursable launch for global communications satellite system.
HEOS A-2	31 Jan.	Reimbursable launch for European Space Research Organization (ESRO). Data generally available.
PIONEER - 10	3 Mar.	Scientists in Australia and West Germany collaborated on two experiments.
TD-1	12 Mar.	Reimbursable launch and data acquisition for ESRO. Data generally available.
APOLLO 16	27 Apr.	Carried Biostack experiment contributed by German and French scientists. Carried solar wind experiment contributed by Switzerland. Lunar samples returned for analysis in program which included 340 foreign scientists supported by 20 countries.
INTELSAT IV F-5	13 June	Reimbursable launch for global communications satellite system.
ERTS 1	23 July	38 nations and 2 international organizations are funding 148 foreign experiments selected on their merits by NASA for analysis of ERS data.
MTS (Exp. 46)	13 Aug.	(Italian launch team studied use of new Algol stage to prepare for their conduct of launchings for NASA.)

TABLE 1 (Cont'd)

MISSION	LAUNCH DATE	INTERNATIONAL ASPECT
OAO-3	21 Aug.	Carried stellar X-ray telescope contributed by UK. Satellite named to commemorate tercentenary of Polish astronomer Copernicus. Polish Ambassador witnessed launch.
TRANSIT (INS-1)	2 Sept.	(Launching for US Navy)
IMP-H (Exp. 47)	22 Sept.	U.S. satellite contributed to International Magnetospheric Survey.
ITOS-D AMSAT-OSCAR 6	15 Oct.	ITOS METSAT carried APT which more than 70 Nations use daily to receive regional weather data as indicated by cloud cover. Oscar satellite carried as piggy-back for international use in amateur frequency bands.
TELESAT-A (ANIK)	9 Nov.	Reimbursable launch of Canadian domestic comsat. Available also to US users.
SAS-B (Exp. 48)	16 Nov.	Reimbursable launch by Italian team from Italian San Marco Platform in Indian Ocean off Kenya, permitting use of smaller Scout vehicle vs. Thor-Delta.
ESRO IV	21 Nov.	Reimbursable launch for European Space Research Organization. Data generally available.
APOLLO 17	7 Dec.	Carried the Biostack experiment contributed by French and German scientists. Lunar samples returned for analysis in program which included 340 foreign scientists supported by 20 countries.

TABLE 1 (Cont'd)

MISSION	LAUNCH DATE	INTERNATIONAL ASPECT
NIMBUS 5	11 Dec.	Carried selective Chopper radiometer contributed by UK for sensing atmospheric temperature profiles on global basis. Also carried APT for direct local reception day and night of cloud cover.
AEROS	16 Dec.	Cooperative launching of German-contributed aeronomy satellite to investigate solar influence on upper atmosphere. (18th cooperative satellite launching by NASA.)

In six cases, NASA conducted launchings for international organizations or foreign governments on a reimbursable basis. Here, NASA used its own launch vehicles to put international or foreign spacecraft into orbit for a fee covering our costs and overhead. Two of the launchings were for the purpose of placing additional communications satellites in orbit for the global Intelsat service, of which the United States is the largest user. A third launching put a Canadian domestic telecommunications satellite into orbit; I understand that various US firms are seeking to utilize this satellite for our domestic purposes.

The remaining three reimbursable launchings put into orbit satellites of the European Space Research Organization, or ESRO, which is a sort of NASA established by 10 European nations. These ESRO satellites were all scientific in character and all produce data which is of interest to us and is made directly or publicly available to us.

There was also a unique seventh reimbursable launching. In that case, an Italian team used Italy's unique sea-platform off the coast of Kenya to launch a NASA satellite on our behalf. This launch site permits us to use the smaller and cheaper Scout vehicle in place of the Thor-Delta where an equatorial orbit is required.

Ten missions in 1972 all involved international participation on a fully cooperative basis, i. e., with no reimbursement by either side to the other. The best example was the launching of the Germany Aeros satellite by NASA

in December. Here, the Germans proposed, designed, built, and instrumented a scientific satellite, fully-funded by themselves, and offered NASA space for a U.S. experiment. In consideration of the satellite's contribution to our program objectives, NASA contributed the launch vehicle. Thus, we received a cost-free satellite (value about $30 million), and Germany received a cost-free launch (value about $4 million). This was the eighteenth contributed satellite successfully launched over the past decade in our international program.

The Nimbus E, OAO-3, and Pioneer 10 launchings illustrate another pattern of international space program. In these cases, as for virtually all NASA projects, we included the foreign scientific community when we invited proposals for experiments to be carried into space. In the Nimbus case, for example, we selected on its merits a British device, a selective chopper radiometer; this makes it possible to collect temperature profiles down through the atmosphere on a global basis, an extremely important advance in weather research by means of satellites. That experiment was contributed by the British without cost to us. In all, some two dozen meritorious foreign experiments have been contributed for flight on our satellites.

Still other patterns of cooperation are illustrated by remaining 1972 launchings. The satellites ITOS D and Nimbus E carried an APT system which is used by some 70 nations for direct daily reception of cloud cover data from our satellites, an important input to their regional weather analyses. ERTS 1,

the satellite surveying earth resources from space, has brought perhaps the most intensive international participation to date. Roughly 150 foreign experiments, proposed by scientists in nearly 40 countries, were selected. They are now using ERTS data for analysis programs which enlarge our understanding of the potential applications of earth sensing from space. All are funded abroad. Already we are receiving extraordinarily enthusiastic reports of early results in applying these data to correct gross inaccuracies in knowledge of the Amazon region, to utilize snow cover information for water management in Norway, to provide a land-use map of Greece, and so on. Special interest in this work has come from the African nations.

Finally, I might mention the Apollo 16 and 17 launchings. In Apollo 16, the astronauts carried an experiment for measuring the solar wind. This was contributed by Switzerland. Both Apollo 16 and 17 carried biological experiments contributed by Germany and France. In addition, these missions returned quantities of lunar surface material for analysis in a broad program which included 340 experimenters from 20 foreign nations. This very considerable contribution of foreign expertise is fully-funded from abroad.

So much for the missions which matured during 1972. During that year, work continued abroad on additional satellites for future launching in joint programs--in Canada, Germany, the UK, Spain, and the Netherlands. Selection was made on the merits of additional foreign experiments contributed for flight on

Skylab and the 1977 Mariner Jupiter/Saturn mission. New agreements were signed for joint sounding rocket projects with France, Germany, India, Norway, Spain, and Sweden, each making available some scientific experiment or expertise or some location of scientific interest which we ourselves did not have.

In April 1972, an important agreement was negotiated with the Soviet Academy of Sciences on the managerial and operational basis for the Apollo-Soyuz docking mission, and, on several occasions during the year, important progress was made in discussions designed to attract European contributions to the development of the Shuttle. I will say more about these two matters in a moment.

This and more activity in 1972 added to the cumulative value of a program which follows careful consideration of scientific merit and relevance to our national space objectives without any exchange of funds, i. e., with no export of dollars. The net effect has been to reduce our costs in rough proportion to the foreign contribution. At the same time, we have widened the pool of talent upon which we can draw and we have fostered those other tangible and intagible benefits which follow from meaningful cooperation with others.

Let me turn now to the major prospects ahead of us. I will simply note first that in October 1969, in reviewing our progress in international cooperation, we recognized that other countries, particularly in Western Europe, had not yet participated with us in the development of major space systems. Neither had

the Soviet Union, despite considerable effort on our part, entered into any important or effective joint program with us. Since then, we have directed our energies in good part toward filling these two gaps. I am happy to say that we have done this with a good measure of success.

After nearly three years of discussion of possible European participation in the development and utilization of future space-shuttle related systems, the European Space Conference last December endorsed the development of a Sortie Laboratory as a funded contribution to the US space transportation system to operate in conjunction with the space shuttle. In January of this year, the Council of the European Space Research Organization (ESRO) agreed to establish an ESRO Special Project for the study and development of a Sortie Laboratory (called Spacelab in Europe). Germany, Italy, Belgium, and Spain have taken the lead but seven countries have listed themselves for participation and others could join the effort at a later date. An agreement between ESRO and these countries is now open for signature, and we have begun negotiations for an agreement between ESRO and NASA.

The European commitment will carry one condition: Nations can withdraw before August 15 of this year if cost studies show that the Sortie Lab would substantially exceed the estimated cost envelope for the program (about $350 million over a six- or seven-year period).

The European Sortie Laboratory will, in other words, represent a $300-million contribution to the space transportation system in an area not now funded. It will provide the timely availability of a supporting system important to realizing the full value of the shuttle. It will establish, we believe, the largest single international cooperative venture in the development of advanced technology in the civil field. It will also facilitate joint use programs, may entailing the activities of US and European astronauts.

Meanwhile, anticipating that the space shuttle will be the principal vehicle for space transport and experimentation in the eighties, NASA has invited participation by European scientists in a number of study groups to develop recommendations for early shuttle use and to define the interface and support requirements these uses will impose on the Sortie Laboratory and the Shuttle Orbiter. In parallel, ESRO has organized its own utilization planning groups.

Let us now turn to our progress in filling the second gap in our international programs -- cooperation with the Soviet Union. Here there have been two major developments -- the Apollo-Soyuz Test Project and expanded cooperation in space science and applications.

The Apollo-Soyuz Test Project has its origins in the NASA efforts to engage the leadership of the Soviet Academy of Sciences in a discussion of the opportunities for significant cooperation. This led to an October 1970 agreement under which

the two sides agreed to identify the technical requirements for compatible rendezvous and docking systems for future manned spacecraft. By June 1971, Joint Working Groups had made considerable progress and agreed to study the technical and economic implications of a flight experiment to test the technical solutions they had devised. In December 1971, the Working Groups agreed that a test mission was technically feasible. In April 1972, senior NASA and Academy officials took the next step and agreed that a test mission was desirable. Most important, they established an understanding on the managerial and operational principles to govern such a mission. This paved the way for the May 1972 Summit agreement in Moscow when the US and the USSR agreed to conduct a joint experimental flights in 1975 with Apollo and Soyuz spacecraft to test compatible rendezvous and docking systems.

In the ten months since the Summit Agreement, five Joint Working Groups have made major progress in a series of meetings in Houston and Moscow. They have agreed on basic documents to govern future work, on detailed technical documentation, and among other things, on a launch sequence that promises maximum flexibility in launch and rendezvous opportunities and on a Soyuz atmospheric pressure that will eliminate prebreathing requirements for Soyuz-Apollo crew tranfers. Successful joint tests of two-fifths scale models of spacecraft docking mechanisms have been completed. Preliminary discussions of mission experiments are taking place during meetings presently under way in

Houston, and joint crew training will begin this summer.

Soviet interest in the success of the Apollo-Soyuz Test Project is clearly equal to our own, and veteran observers of the Soviet scene tell us that the close collaboration between members of the Joint Working Groups is unmatched in their experience.

The renewed efforts at cooperation with the Soviet Union in 1969 and 1970 brought additional results in January 1971 when Dr. Low, then Acting Administrator of NASA, and President Keldysh of the Soviet Academy reached agreement for the exchange of lunar samples, for exchanges on scientific results and objectives, for certain coordinated scientific activities, and on procedures for recommending additional cooperation in space science and applications.

Joint Working Groups established under this agreement have been hard at work. The principal results in space science have been the continued exchange of lunar samples, work on a common system of lunar coordinates, a joint working session on active experiments in the magnetosphere, the exchange of detailed physiological data from the Soyuz-Salyut and Apollo programs, and a continuing interest in common problems of planetary exploration which has been reflected in the exchange of findings from the 1971 US and Soviet missions to Mars, joint working sessions on exploration of the planets, and -- just last month -- agreement to exchange data and findings which promise to assist each side in its future missions to Mars and

Venus. In space applications, the principal results have been the exchange of meteorological data from meridional sounding rocket networks in the eastern and western hemispheres, the conduct of a joint program of microwave measurements of surface phenomena in the Bering Sea, and progress in defining coordinated projects in remote sensing of the environment as well as experiments designed to advance knowledge of temperature sounding from satellites.

The cooperation achieved with the Soviet Union is more than a pleasant and useful gesture in an era of political accommodation. If US and Soviet manned spacecraft can rendezvous, dock, and transfer crew members, both countries will have increased their chances of rescuing astronauts in distress without commensurate increases in the costs of standby rescue capabilities. If the test mission is successful, it will point the way to future joint activities which should help both countries gain more in space than they would from separate programs. For the United States, the test mission serves as a constructive way to maintain our national capability in space in the interval between the last of the Skylab flights and the first space shuttle missions. The value of our cooperation with the Soviets in space science and applications may not at first examination seem so direct, but its potential is clear if, for example, data from Soviet flights to Mars can assist in assuring the success of our Viking landers.

To conclude, it seems to me that in this its fifteenth year NASA has gone far toward achieving a well-balanced and diversified international program. This program is in line with the level of our domestic effort and with the interest, capability, and resources of our partners abroad. The cooperative projects we have undertaken bring significant savings in the cost of space research. They bring us rich scientific benefits by associating gifted foreign investigators with our program objectives. Our cooperative projects do not contribute significantly to the transfer of technology abroad, yet they bring us technological benefits when our partners in joint projects advance the state of the art. Beyond these direct benefits to the space program, we believe that the NASA international program contributes significantly to an even more fundamental national objective. Our cooperative projects involve more than the association of scientists and engineers in their personal professional capacities. They require nations -- east as well as west -- to commit themselves and their resources to the accomplishment of joint projects in which they accept an important degree of mutual dependence in the attainment of specific, well-considered national objectives. In this intertwining of interests is some contribution to the forces that work for stability and peace.