NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Washington, D. C. 20546

FOR RELEASE:
IMMEDIATE

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US/USSR RENDEZVOUS AND DOCKING AGREEMENT

The National Aeronautics and Space Administration today released the text of an April 1972 agreement with the Academy of Sciences of the USSR on the organization, development, scheduling, and conduct of a test docking mission for manned spacecraft in 1975. The agreement will be the basis for implementing those sections of the space accord reached by the President this week in Moscow which relate to the test docking mission.

The April agreement builds on three previous agreements of October 1970, June 1971, and November-December 1971, on the design and flight testing of compatible rendezvous and docking systems. The April meeting was requested by NASA to satisfy management and operational considerations attaching to a joint mission prior to possible commitment at a government-to-government level.

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May 24, 1972

flight plans and mission rules for normal and contingency situations; the immediate transmission of flight television received in one country to the other's control center; the level of reciprocal language familiarity; and the need to develop public information plans taking into account the obligations and practices of both sides.

Beyond the test mission which is planned for 1975, the accord announced in Moscow provides that future generations of manned spacecraft of both the United States and the Soviet Union will be capable of docking with each other. That capability will facilitate emergency assistance to astronauts in difficulty and will make possible the conduct of cooperative projects, with attendant economies.

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Phone: 202/755-8370

FOR RELEASE:

BACKGROUND ON RENDEZVOUS AND DOCKING AGREEMENTS

Objectives:

1. To design compatible rendezvous and docking systems for future spacecraft of the US and USSR.

2. To test the technical requirements and solutions for compatible systems for docking of future manned spacecraft and stations using existing spacecraft. The testing will include the rendezvous and docking of Apollo/Soyuz with the active use of all the new equipment required for compatibility available for the mission. The test mission will include:

(a) Testing of a compatible rendezvous system in orbit.

(b) Testing of androgynous docking assemblies.

(c) Verifying techniques for transfer of astronauts and cosmonauts.

(d) Activities by US and Soviet crews in docked flight.

(e) Development of experience for the conduct of joint flights by US and Soviet spacecraft, including aid in emergency situations.

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Apollo Spacecraft:

In order to perform the experimental test mission, the US will use an Apollo-type spacecraft and a new system referred to as the docking module. The Apollo spacecraft will be a modified version of the command and service module flown during the first several lunar landing missions. This basic spacecraft has been manufactured and checked out and is presently in storage. Some modifications will be required as a result of unique mission requirements. The major modifications will include additional propellants for the reaction control system, testers for thermal control, and the controls and displays required for the proper operation of the docking module.

The docking module is a cylindrical shaped structure, approximately 5 feet in diameter and 10 feet in length. It will serve as both an airlock for the internal transfer of crewmen between the different atmospheres of the two spacecraft and much of the new compatible equipment will be located in this structure. On the forward end of this module, the new peripheral docking system will be located. Radio communications, TV docking displays and antennas will also be mounted on the module.

The docking module will be equipped with the necessary stored gases, a thermal control loop, and the displays and controls necessary for safe operation of the two different pressure levels. For this operation, hatches with manual controls will be installed on either end of the module, which is scaled to handle two suited crewmen.

The Soyuz Spacecraft:

The Soyuz-type spacecraft has been selected as the Soviet vehicle for the experimental rendezvous and docking test mission. This type of spacecraft has been the primary manned vehicle for the Soviet space program since it was introduced in 1967. Various versions of the basic design have been used over a range of Earth orbital mission applications such as solo flight, manned and unmanned rendezvous flights, long-duration manned flight (18 days) and as a transport to the orbital scientific station, "Salyut."

This type of spacecraft consists of three basic modules:

1) Descent Module
2) Orbital Module
3) Instrument Module

The descent module is a pressurized compartment of segmented conical shape located between the orbital and instrument modules. The crew couches and main control panels are located in this module, and the crew occupies this compartment during launch into orbit, descent and landing, and during certain maneuvers and exercises performed in Earth orbit. This descent module is connected by a hatch to the orbital module, located above or in front of the descent module. This orbital module is used as a crew rest and work area during the Earth orbit phase of its missions. The orbital module is approximately spherical and can also be operated as an airlock to perform extravehicular activity. The instrument module is an unpressurized compartment at the bottom or rear of the spacecraft and contains the various sub-systems required for power, communications, propulsion and other functions.

The exact configuration of the vehicle used in the test mission will be a modification to the basic Soyuz design including the compatible rendezvous and docking equipment and possibly other requirements unique to the test mission. The compatible rendezvous and docking systems include:

- Radio communications on the US and USSR frequencies.
- Radio guidance equipment.
- Optical tracking beacon.
- Peripheral-type docking system.
- Docking aids and targets.
- Equipment for crew transfer.

Most of the new compatible systems will be located on the orbital module; for example, the new docking system will be installed on the existing structural docking ring on the front end of the spacecraft.

Some basic characteristics of the Soyuz vehicle planned for the test mission are:

Number of crewmen - 2
Weight - 15,000 pounds
Overall length - 24 feet
Diameter of the habitable modules - 7.5 feet
Cabin atmosphere - 14.7 psi (Nitrogen and oxygen mixture)
Partial pressure of oxygen - 3.5 psi
Consumable loading for a nominal flight of 5 days.

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Mission Description:

A possible mission profile would include the launching of an Apollo-type spacecraft on a Saturn IB from Cape Kennedy, Fla. The vehicle would be inserted into a low Earth orbit, on the order of 110 nautical miles. After separation from the second Saturn stage (S-IVB), the command and service module would turn around, dock and extract from the S-IVB, the docking module internally mounted in the adapter area, in essentially the same fashion as the lunar module is extracted on current lunar missions. The plane of the orbit will be inclined 51.6° to the equator, in order to pass over the USSR launch site. The Apollo altitude will be selected and adjusted periodically, if necessary, in order to provide daily launch opportunities for the Soyuz spacecraft. As soon as practical after the Apollo launch, the Soyuz spacecraft would be launched and maneuvered into a target orbit on the order of 145 nautical miles. Once the Soyuz spacecraft is in orbit, the Apollo would begin an active rendezvous sequence to arrive in the vicinity of the Soyuz within one, or perhaps two days, after the Soyuz launch. The Apollo radio and optical guidance systems would be used in this sequence. At the time of station keeping, the Apollo spacecraft would be maneuvered to dock with the Soyuz, using a new TV docking alignment system and the new peripheral-type compatible docking system.

Once the two vehicles are docked, a period of up to two days is planned for joint activities. The exact duration of the docked phase would depend upon further definition of specific crew activities, including the possibility of joint operation of scientific experiments. It is expected that American astronauts would enter the Soyuz internally through the docking module, carrying voice communications equipment and an additional television camera. After an initial visit, an American astronaut would accompany a Soviet cosmonaut back to the Apollo. This return visit would require an intermediate stop of approximately two hours in the docking module while both crewmen perform the necessary oxygen prebreathing to safely go to the lower operating pressure of Apollo. The length of this visit and the precise sequence of subsequent crew transfers would be defined as more complete understanding of the operational, equipment and experimental factors indicate. For this purpose, the docking module will be provisioned to permit two additional round trip transfers by two crewmen.

Once the docked phase is completed, the two vehicles will separate and possibly perform further tests of the docking system and the optical and radio aids and equipments. The vehicles will then be maneuvered to separate orbits for return to Earth.

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Organization:

The organizational arrangement between the US and the Soviet sides at present consists of three joint working groups on (1) overall methods and means, (2) guidance systems and communications, and (3) docking assembly. The three JWGs are under the direction of Joint Project Managers, Dr. Glynn S. Lunney for NASA and Prof. K. D. Bushuyev for the Academy of Sciences of the USSR. Additional working groups and operational arrangements will be introduced as required on the basis of mutual agreement.

Within NASA, the project team will be located in the Manned Spacecraft Center in Houston. It will be under the direction of the NASA Headquarters Office of Manned Space Flight.

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Costs:

It is estimated that the cost of the project will be $250 million, for development of the docking module, the new docking system, other necessary modifications, the launching and the conduct of the operation. The Apollo CSM and Saturn IB which will be used for the test mission are left over from the Apollo program.

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Summary of Agreements Reached:

October 28, 1970

- Agreed to design compatible rendezvous and docking systems for future manned spacecraft.
- Agreed to a procedure by which the two sides could, through a combination of independent action and coordination, arrive at compatible systems.
- Established three joint working groups.

June 21-25, 1971

- Agreed to study the technical and economic implications of early test missions using existing vehicles.
- Agreed on coordinate systems to be used for rendezvous purposes.
- Agreed on single documentation of requirements for atmospheres, hatches, and crew transfer techniques.
- Agreed on air lock volume.
- Agreed on placement of structural elements and equipment.
- Agreed on optical and radio beacon characteristics.
- Agreed on requirements for communications between spacecraft and between spacecraft and ground stations.
- Agreed on characteristics of control systems.
- Agreed on docking system basic functions and design features, and spacecraft mass properties.

November 29 - December 6, 1971

- Agreed on technical feasibility of a test mission using existing spacecraft.
- Agreed on objectives and preliminary documentation requirements for a possible test mission.
- Substantially completed documentation on life support systems, coordinate systems and constraints on spacecraft configuration.

- Identified guidance and control systems and on-board equipment of US and USSR spacecraft which would need to be compatible.
- Substantially completed documentation on lights, docking targets and contact conditions, control systems and radio tracking.
- Agreed to basic values for a compatible docking system including tunnel diameter for astronaut passage.
- Reached preliminary agreement on the basis for design of an androgynous docking device.

April 4-6, 1972

- Confirmed the desirability of conducting a test mission using existing spacecraft in 1975.
- Accepted, as the basis for joint specification of management and operational guidelines for joint mission, documents on "Proposed Organization Plan for the Apollo/Soyuz Test Mission," "Apollo/Soyuz Test Mission Considerations," "A Project Technical Proposal Document," and "A Project Schedule Document."
- Agreed on specific principles illustrative of those which will apply in the preparatory and operational periods:
    - Frequent direct contact between project personnel on both sides.
    - Detailed commitments to schedules.
    - A comprehensive test, qualification, training and simulation program.
    - Involvement of mission flight and ground crew personnel in joint working groups two years before the mission.
    - Engineering agreement in July 1972.
    - Control of own spacecraft and spacecraft situations, with certain pre-planned guidelines to be worked out.
    - Consultation on control actions affecting joint elements of the mission.
    - Pre-planned in-flight information exchanges, including TV.
    - Reciprocal language familiarity among flight crews.
    - A public information program respecting the policies and practices of both sides.

Key Personnel

Soviet:

M. V. Keldysh, President, Academy of Sciences of the USSR
V. A. Kotelnikov, Vice-President, Academy of Sciences
B. N. Petrov, Academician and President of Intercosmos
K. D. Bushuyev, Apollo-Soyuz Test Project Director, Chairman of Joint Working Group One
V. P. Legostayev, Chairman, Working Group Two
V. S. Syromyatnikov, Chairman, Working Group Three
I. P. Rumyantsev, Intercosmos

United States:

G. M. Low, Deputy Administrator, NASA
D. D. Myers, Associate Administrator for Manned Space Flight, NASA
A. W. Frutkin, Assistant Administrator for International Affairs
R. R. Gilruth, Former Director, Manned Spacecraft Center, Houston, Texas
C. C. Kraft, Director, Manned Spacecraft Center
G. S. Lunney, Apollo-Soyuz Test Project Director, Chairman, Working Group One
D. C. Cheatham, Chairman, Working Group Two
D. C. Wade, Chairman, Working Group Three

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Chronology of Events
US-USSR Negotiations on Compatible Rendezvous and Docking Systems

April 24, 1970 - In an informal meeting in New York, Dr. Paine, then Administrator of NASA, suggested to Soviet Academician Blagonravov cooperation in the area of astronaut safety, including compatible docking fixtures for space stations and shuttles.

May 1970 - Dr. Paine indicated the NASA interest in common docking to President Handler of the US National Academy of Sciences, who relayed the suggestion to President Keldysh of the Academy of Sciences of the USSR.

July 31, 1970 - Dr. Paine suggested to Academician Keldysh that this possibility be considered in a projected meeting.

September 11, 1970
October 10, 1970 - Academician Keldysh and NASA's Acting Administrator, Dr. Low, agreed on an October 26-28 meeting in Moscow.

October 26-28, 1970 - Discussions of possible docking arrangements were held in Moscow, resulting in agreement that the two sides would attempt to design compatible docking systems for future manned spacecraft. Agreement reached on procedures and on a schedule for joint efforts to design compatible rendezvous and docking arrangements. Three Joint Working Groups were established.

January 1971
June 21-25, 1971 - Dr. Low suggested to President Keldysh that Apollo and Soyuz spacecraft be considered for a rendezvous and docking mission.

June 21-25, 1971 - The three Joint Working Groups, meeting in Houston, considered the technical requirements for compatible systems including the general methods and means for rendezvous and docking, radio and optical reference systems, communications systems, life support and crew transfer systems, and docking assemblies. They

agreed in principle or in detail on a number of technical solutions and requirements and identified a number of other problems which required additional development and discussion. They agreed that studies should be made of the technical and economic implications of flight experiments to test the technical solutions for compatible systems.

November 29 - December 6, 1971 - The three Joint Working Groups met again in Moscow and made progress in planning a possible joint test mission as well as advancing the definition of technical requirements for compatible systems in future spacecraft. They agreed on the technical feasibility of such a test mission.

March 27 - April 3, 1972 - Working Group Number 3, responsible for assuring compatibility of docking systems and tunnels, met in Houston. Results to be confirmed in 60 days.

April 4-6, 1972 - NASA delegation headed by Dr. Low met with Soviet delegation in Moscow, confirmed the desirability of a test mission and established understanding on the management and operation of a joint test mission. Agreed to use specified documents as basis for development of joint documentation. Agreed on illustrative principles for preparatory and operational phases.

May 10-17, 1972 - Working Group Number 2 responsible for compatibility of radio guidance systems, optics and other guidance and communications systems, met in Moscow. Results to be confirmed in 60 days.

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SUMMARY OF RESULTS

of a meeting between Representatives of the US National Aeronautics and Space Administration (NASA) and the USSR Academy of Sciences (the Academy) on the Question of Developing Compatible Systems for the Rendezvous and Docking of Manned Spacecraft and Space Stations of the USA and the USSR.

During April 4 - 6, 1972, in Moscow, the Deputy Administrator of NASA, Dr. George M. Low, and the Acting President of the Academy, Academician V. A. Kotelnikov, met to continue discussions of questions relating to the development of compatible rendezvous and docking systems for manned spacecraft and space stations. Official representatives of both sides participated.

Both sides confirmed the desirability of (a) continuing further work to develop such systems and (b) conducting a test mission of such systems during 1975.

NASA and the Academy agreed that the first joint experimental testing of compatible rendezvous and docking systems should be conducted with the use of Apollo-type and Soyuz-type spacecraft employing systems developed by both sides in accordance with the Summaries of Results and related documentation resulting from previous meetings.

During the meeting, the Soviet side presented technical materials on the Soyuz-type spacecraft. Technical materials relating to the proposed joint flight of Apollo and Soyuz type spacecraft shall be forwarded to the American side in May 1972.

NASA and the Academy agree that a common understanding of basic principles for organizing, developing, scheduling, and conducting such a test mission is required as a necessary prerequisite to the possible approval by their governments of such a test mission.

To provide a basis for understanding and developing such principles, the US side has prepared a number of draft documents including, particularly, the following ones:

A. Proposed Organization Plan for the Apollo/Soyuz Test Mission.

B. Apollo/Soyuz Test Mission Considerations (brief summary of document A).

C. A Project Technical Proposal Document.

D. A Project Schedule Document.

These documents are accepted as the basis for the development of jointly prepared documents.

Both sides agree that the specific content of these documents will be jointly developed and agreed upon at the next meeting of working groups in July 1972, to provide the necessary basis for successful implementation of a joint mission, should such a mission be approved by the two governments.

The following points, to which both sides agree, while not comprehensive, illustrate in summary fashion some of the major requirements which are contained in document B:

A. For the preparatory (pre-launch) period--

1. Regular and direct contact will be provided through communication links and visits as required.

2. A complete project schedule will be developed and commitments will be made on both sides to meet this schedule in order to avoid costly delays to either party.

3. Arrangements will be made for necessary contact and understanding between specialists engaged in developing and conducting the project.

4. A comprehensive test, qualification, and simulation program will be developed.

5. A sufficient level of familiarization and training, where applicable, with the other country's vehicle and/or normal training equipment must be defined and provided for safety-of-flight assurance. The necessary training exercises will be conducted in each country for the other country's flight crew and ground operations personnel.

6. The parties recognize in particular that they must jointly make a concerted effort to arrive at a full agreement on the engineering aspects of the mission during the meeting of working groups in July 1972.

7. Two years prior to the flight, responsible persons who will directly participate in the flight operations should be included in the working groups in order to assure a proper level of mutual understanding and a continuity of personnel into the real-time operation.

B. For the mission operation--

1. Control of the flight of the Apollo-type spacecraft will be accomplished by the American Control Center and that of the Soyuz by the Soviet Control Center, with sufficient communication channels between centers for proper coordination.

2. In the course of control, decisions concerning questions affecting joint elements of the flight program, including countdown coordination , will be made after consultation with the control center of the other country.

3. Joint elements of the flight will be conducted according to coordinated and approved mission documentation, including contingency plans.

4. In the conduct of the flight, pre-planned exchanges of technical information and status will be performed on a scheduled basis.

5. The host country control center or host country spacecraft commander will have primary responsibility for deciding the appropriate

pre-planned contingency course of action for a given situation in the host vehicle. Each country will prepare detailed rules for various equipment failures requiring any of the pre-planned contingency courses of action.

6. In situations requiring immediate response, or when out of contact with ground personnel, decision will be taken by the commander of the host ship according to the pre-planned, contingency courses of action.

7. Any television downlink will be immediately transmitted to the other country's control center. The capability to listen to the voice communications between the vehicles and the ground will be available to the other country's control center on a pre-planned basis and, upon joint consent, as further required or deemed desirable.

8. Both sides will continue to consider techniques for providing additional information and background to the other country's control center personnel to assist in mutual understanding (including the placement of representatives in each others control centers).

9. As a minimum, flight crews should be trained in the other country's language well enough to understand it and act in response as appropriate to established voice communications regarding normal and contingency courses of action.

10. A public information plan will be developed which takes into account the obligations and practices of both sides.

Done in Moscow, April 6, 1972, in English and Russian, both languages having equal force.

George M. Low
George M. Low

Arnold W. Frutkin

Glynn S. Lunney

V. A. Kotelnikov

B. M. Petrov

I. P. Rumyantsev

K. D. Bushuyev

MILESTONES IN US/USSR SPACE COOPERATION

Efforts to develop US-USSR cooperation in space research go back to the first planning of space projects in 1955 for the International Geophysical Year. In a series of international meetings, U. S. scientists and those of other nations sought to develop conventions for wide exchange of space data.

More specific efforts were made at various times but were not generally fruitful until after the successful manned orbital flight of U. S. astronaut John Glenn in February 1962. The US then made specific proposals which resulted in talks between Dr. Hugh L. Dryden late Deputy Administrator of NASA and Academician Anatoly A. Blagonravov. The result was the three-part bilateral space agreement of June 1962. It provided:

1. Coordinated launchings by the two countries of experimental meteorological satellites and for the exchange of data over a Washington-Moscow channel.

2. Launchings by each country of satellites equipped with absolute magnetometers and the subsequent exchange of data in order to arrive at a map of the Earth's magnetic field in space.

3. Joint communications experiments by means of the U. S. passive satellite Echo II.

The Dryden-Blagonravov talks also led to a second agreement in November 1965 for the preparation and publication of a joint US/USSR review of space biology and medicine. These agreements were not fully realized.

A new phase of the US/USSR space relationship began in 1969 when NASA Administrator Dr. Thomas O. Paine, in letters to President Keldysh and Academician Blagonravov, invited new initiatives in space cooperation, in general scientific fields as well as in rendezvous and docking of manned spacecraft. President Keldysh agreed to pursue these suggestions.

The first rendezvous and docking talks took place in Moscow in October 1970 and the more general discussions were held in Moscow in January 1971. The October 1970 talks related to the possibility that U. S. and U.S.S.R. manned spacecraft might be designed so as to be able to rendezvous and dock with each other in space.

The NASA group at these discussions was headed by Dr. Robert Gilruth, Director of the NASA Manned Spacecraft Center, and the Soviet side was headed by Academician Boris Petrov, Chairman of Intercosmos, an Academy office concerned with international cooperation in space. The new talks were direct, substantive and businesslike throughout.

The resulting agreement provided for procedures by which the two countries can, through a combination of independent action and coordination, arrive at compatible systems. Joint working groups were established which, in a series of meetings, developed the technical understandings required for design of compatible rendezvous and docking systems. In April 1972, the necessary management and operational understandings were established to warrant a government-level commitment to a joint test docking mission in 1975 and to the use of compatible docking systems in future generations of spacecraft.

The broader talks on cooperation in space science and applications took place in January 1971 in Moscow. Dr. George Low headed the US group. An agreement was reached on the following main points:

1. An exchange of lunar samples obtained in the Apollo and Luna programs.

2. Direct efforts by the National Oceanographic and Atmospheric Agency (U.S.) and the Soviet Hydrometeorological Service to improve the exchange of weather satellite data, which dated from 1964, so as to achieve operational utility.

3. Coordination of networks of meteorological rocket soundings along selected meridional lines.

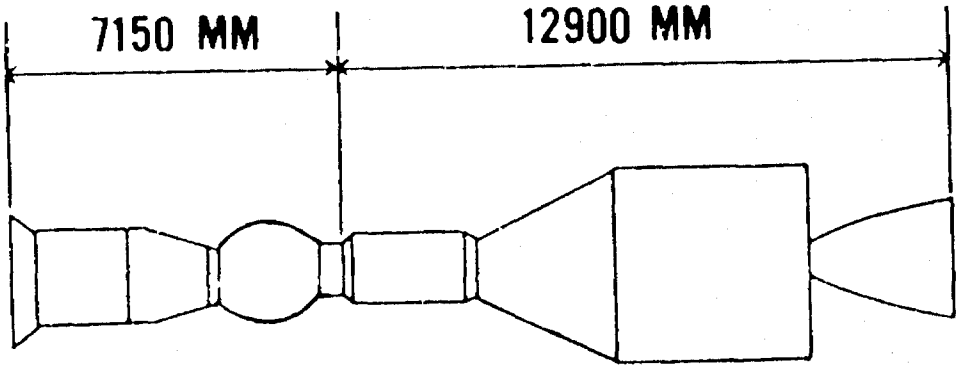
4. Development of a program for coordinated surface, air and space research over specified international water areas and exchange of results of coordinated measurements made by each country over similar land sites in their respective territories. The objective is to utilize space and conventional earth resources survey techniques to investigate the natural enviornment in areas of common interest, beginning with the oceans and vegetation.

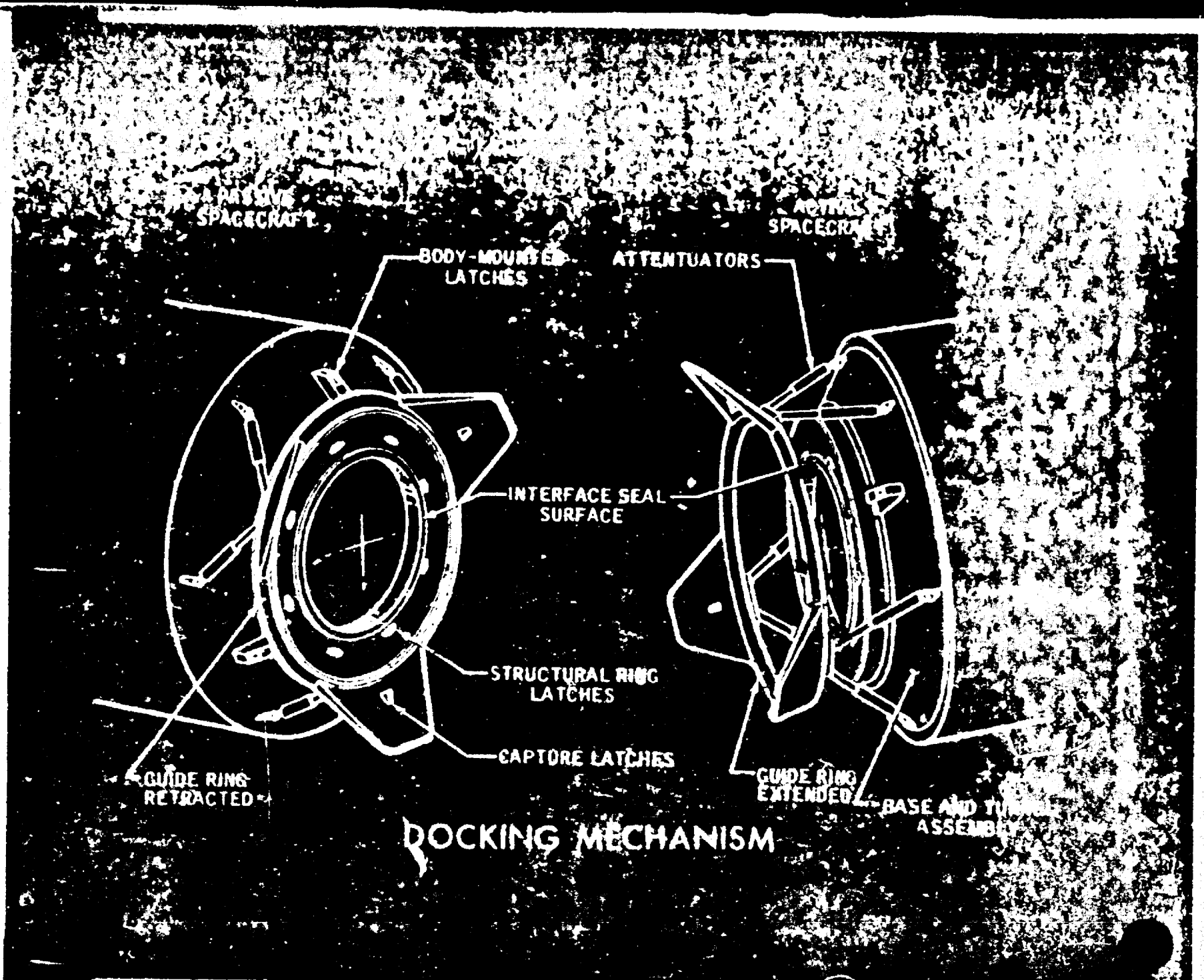
5. Joint consideration of the most important scientific objectives for the rapid exchange of results from the scientific investigation of near-Earth space, the Moon and the planets. This will allow each country to take the objectives and work of the other into account in planning its own program.

6. Exchange of detailed medical information of man's reaction to the space environment.

Joint working groups were established to recommend and work out the necessary steps. These groups have been meeting on a business-like basis. Early results of this January 1971 agreement include the repeated exchange of lunar samples retrieved by both countries and the exchange of information from Mars probes of both countries while in operation about the planet.

APOLLO/SOYUZ CONFIGURATION





DOCKING MECHANISM