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# Thirty Years Together: A Chronology of U.S.-Soviet Space Cooperation



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## Introduction

This chronology provides a background briefing on cooperation between the two leaders in space exploration. It covers about thirty years. Where possible, it is broken into sections of a common theme. It lists some events, astronomical and otherwise, which do not relate directly to space cooperation. These are set apart in italics, and are included to give context.

Compiling entries for the 1961-1984 period was straightforward. The events leading toward important milestones in cooperation are clear. But for the period from 1985 to October 1992, too little time has passed for trends to be clearly identifiable. Worse, the breakneck pace of political events makes impossible informed guesses about which events will turn out to be seminal. To contend with these problems, this chronology presents a broad sampling of events, any one of which could come to be considered seminal by compilers of future chronologies. It doubtless omits some events which will turn out to be of seminal importance.

Until August 1991 we could write about "U.S.-Soviet" space cooperation. But the attempted coup in Moscow led to the collapse of the Soviet Union. In its place today are 15 independent countries. Most are enrolled in the Commonwealth of Independent States (C.I.S.). Formerly Soviet space facilities exist in several countries of the C.I.S., but among the former Soviet republics the Russian Federation is the leading space cooperation partner of the United States.

The chronology concludes with a bibliography of the sources used to compile it. The bibliography includes some works relevant to U.S.-Soviet space cooperation not used in the compilation of the chronology.

The author bears sole responsibility for any errors. Special thanks are due Clarke Covington, Special Assistant to the Director of the Johnson Space Center, and Joseph P. Loftus, Jr., Assistant Director (Plans) of the Johnson Space Center, for taking time to review the first draft of the manuscript and for sharing of their experiences with building toward U.S.-Soviet/C.I.S. cooperation in space.

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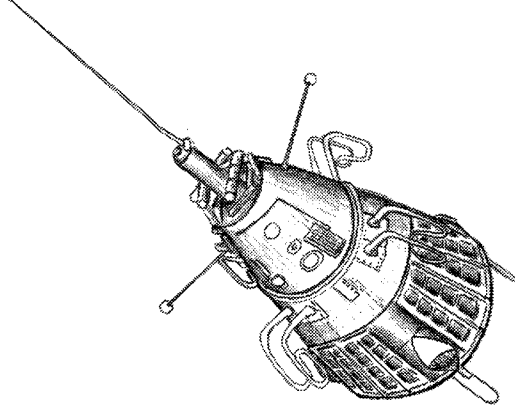
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## I. The Dryden-Blagonravov Talks

April 1961 - August 1963

The Soviet Union launched Sputnik 1, the first artificial satellite, on October 4, 1957. Sputnik 1 set up a competitive dynamic which dominated the first decade of space exploration. Sputnik 2 reinforced this dynamic. It carried the first living test subject into space, a dog called Laika. It became clear the Soviet Union had plans to put a human into space when it launched Sputnik 3, which weighed 1327 kilograms. The United States responded with Vanguard and Explorer. After the Soviets launched Vostok 1, President John F. Kennedy put the U.S. on course for the Moon. Against this backdrop unfolded the first formal effort at U.S.-Soviet space cooperation, the Dryden-Blagonravov talks.



Early Soviet spacecraft dwarfed their U.S. counterparts. Sputnik 3 (shown here), weighed 1327 kilograms when it reached orbit in May 1958. The heaviest U.S. satellites up to that time were Explorers 1 and 3, which each weighed 14 kilograms.

## 1961

April 12 *Yuri Gagarin becomes the first human to travel into space. His Vostok 1 spacecraft orbits Earth once.*

May 25 *President John F. Kennedy calls for a U.S. expedition to the Moon.*

December 20 U.N. General Assembly Resolution 1721 (XVI) demonstrates agreement between the U.S. and the Soviet Union on a limited range of space activities. The Resolution took nearly five years to negotiate. It calls for countries that launch objects into space to promptly advise the U.N. Secretary General, so he can inform the U.N. Committee on the Peaceful Uses of Outer Space. It also makes recommendations concerning space law, communications satellites, and the founding of a World Meteorological Organization to coordinate weather satellite activities.

## 1962

February 20 Soviet Premier Nikita Khrushchev congratulates U.S. President John F. Kennedy on John Glenn's orbital flight. In his letter, Khrushchev declares: "If our countries pooled their efforts. . . to master the universe,



this would be very beneficial for the advance of science and would be joyfully acclaimed by all peoples who would like to see scientific achievements benefit man and not be used for 'cold war' purposes and the arms race."

**March 7**

Kennedy answers Khrushchev, suggesting cooperation in five fields: creating a world weather satellite system; exchanging tracking services; mapping the Earth's magnetic field; exploring the feasibility of intercontinental communication satellite systems; and exchanging knowledge in the field of space medicine. Kennedy also mentions cooperative unmanned lunar exploration and joint efforts to define the requirements of Venus and Mars exploration.

**March 20**

Khrushchev replies to Kennedy, suggesting cooperation in six problem areas: communications satellites; weather satellites; the observation of objects launched toward Mars, Venus, the Moon, and other bodies in the solar system, and the study of planets and the physics of interplanetary space; provisions for aid in searching for and rescuing spaceships and satellites which have accidentally fallen from space; charting Earth's magnetic field; and space law.

**May 29 -**

**June 7**

Dr. Hugh L. Dryden, NASA Deputy Administrator, and Academician Anatoli A. Blagonravov, Soviet Academy of Sciences, conduct negotiations on cooperative space efforts in Geneva. Discussed are weather satellites, passive communications satellite experiments, and studies of Earth's magnetic field using satellites.

**June 8**

The Dryden-Blagonravov weather satellite agreement is concluded. It calls for cooperative meteorology efforts in two stages. The years 1963-64 would be an experimental period, and 1964-65 would see coordinated launches of operational weather satellites.

**June 13**

Dryden reports to the Senate Space Committee on his talks with Blagonravov. He testifies that the agreements concern "a form of cooperation. . . beneficial to both countries in the sense that we each only have to launch half the number of weather satellites if the cooperation really works." He calls the planned joint activities "not a very intimate form of cooperation in the sense that there is no access to launching ranges, no real access to details of instrumentation. There are no plans for exchange of instrumentation."

**August 29**

The U.S. State Department notifies the Soviet Foreign Ministry that the weather satellite agreement is acceptable, and requests Soviet concurrence.

**October**

*Cuban Missile Crisis*

**October 12**

The Soviet Foreign Ministry assents to the weather satellite agreement.





**October 18** Academician Mstislav V. Keldysh, physicist and President of the Soviet Academy of Sciences, writes to NASA Administrator James Webb to say the Soviet government considers the Dryden-Blagonravov weather satellite agreement in force. Keldysh later plays a key role in discussions leading to the 1975 Apollo-Soyuz Test Project.

**December 5** The U.S. and the Soviet Union make a joint announcement of the weather satellite agreement at the U.N.

## 1963

*Anatoli Blagonravov becomes Chair of the newly created Commission for the Exploration and Use of Outer Space, Soviet Academy of Sciences. It is chartered "to coordinate and direct all work concerned with solving the problems of mastering cosmic space."*

**March 20** Dryden and Blagonravov meet in Rome to establish Joint Working Groups to fulfill the terms of the June 8, 1962 agreement, and to continue discussions on joint passive communications and magnetic field satellite experiments.

**March 25** At a press conference upon his return from Rome, Dryden assesses his negotiations with Blagonravov. He reports that the parts of the agreement concerning coordinated weather satellite launches and exchange of weather data were reached with ease, but that difficulties were encountered in discussion of passive communications and magnetic field satellite experiments.

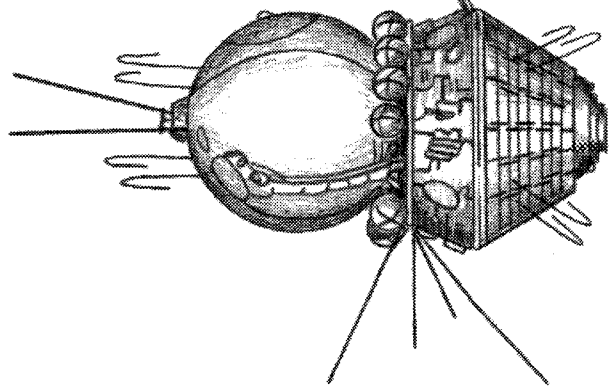
**April 9** *Pravda* prints a story on space cooperation. "The day is not far off when scientists in various countries will combine their efforts to study outer space," it opines, and goes on to declare that the "first steps" toward this were taken in the agreements reached in Rome.

**May 24** The Geneva meeting between Dryden and Blagonravov produces a "First Memorandum of Understanding" expediting the coordinated weather satellite program. It also makes provisions for joint magnetic field research using satellites and for a passive communications satellite experiment using the U.S. Echo II satellite.

**June 20** *The U.S. and the Soviet Union agree to establish a telephone "hotline" linking their leaders, in an effort to avoid misunderstandings involving nuclear weapons.*

**August 5** *Partial nuclear test ban treaty between the U.S. and the Soviet Union*





Vostok 1 carried the first human into orbit in April 1961. A month later President John F. Kennedy put the U.S. on course for the Moon.

## II. A Joint Expedition to the Moon

*August 1963 - December 1963*

In the summer of 1963, rumors surfaced that the Soviet Union had dropped out of the Moon race. Some politicians responded by calling for the U.S. effort to be abandoned. Others saw the end of the Moon race as an opportunity for lunar exploration in cooperation with the Soviets. Response from engineers, politicians, and the Soviet government was mixed, despite President Kennedy's decision to elevate the debate on the proposal to the international political arena.

### August 9

U.S. Senator Joseph Clark proposes an amendment for action authorizing NASA to spend money on cooperative programs. He says, "this is an expression of a congressional willingness and intent to match funds – dollar for dollar – with the Russians in a joint venture to reach the Moon. . ." He later withdraws the amendment.

### September

In a private meeting at a luncheon held by the U.N. Committee on the Peaceful Uses of Outer Space, Blagonravov tells Dryden, "Once the two nations have landed instrumented payloads on the Moon, discussions of cooperation in a manned lunar landing should begin."

### September 17

Manned Spacecraft Center Director Robert Gilruth, speaking at a luncheon meeting of the National Rocket Club in Washington, reacts to calls from Congress for a joint lunar expedition by saying, "I tremble at the thought of the integration problems of a Soviet rocket with a U.S. spacecraft. . . when I think of the problems we have experienced with American contractors who all speak the same language." He goes on to say, "the proposal would be interesting and significant – but hard to do in a practical sort of way. . . but I'm speaking only as an engineer, not an international politician."



**September 18** Senator Hubert Humphrey cites President Kennedy's planned September 20 address to the U.N. General Assembly, and urges him to call for joint U.S.-Soviet lunar exploration.

**September 20** President Kennedy proposes a "joint expedition to the Moon" before the U.N. General Assembly.

**September 28** The Soviet newspaper *Za Rubezhom* reports that "American propaganda... is pushing to the forefront the President's idea of sending a joint Soviet-U.S. team to the Moon. In lavish headlines American newspapers describe the grandiose character of the project although it seems it is somewhat premature."

**October 11** *Life* magazine, working with Thomas Turner, an engineer with Republic Aviation Corporation, describes a joint lunar mission. The Soviets would provide a large command ship and two cosmonauts, while the U.S. would provide a small lunar lander and one astronaut. Turner claims that only a common docking device, common communications, and a common spacecraft atmosphere would need to be negotiated.

**October 14** *Missiles and Rockets* magazine, in an editorial entitled "A Lunar Proposal," says that a joint lunar landing is unlikely at this stage as U.S. planning is too far advanced to permit the necessary changes. Further, military security constraints make cooperation on hardware development impossible, and cooperation could sap the spirit of competition driving the national lunar efforts forward. The editorial suggests deferring cooperation to a future goal, such as a joint lunar base.

**October 25** Khrushchev addresses the Third World Meeting of Journalists in Moscow. He avoids mention of space cooperation, and declares that U.S. plans to land astronauts on the Moon before the end of the decade, "without careful preparation," are dangerous and foolhardy.

**November 22** *President John F. Kennedy is assassinated.*

**December 2** U.N. Ambassador Adlai Stevenson informs the U.N. Political Committee that President Johnson has instructed him to reaffirm the U.S. proposal for a joint U.S.-Soviet Moon mission. However, later in December, Congress passes the FY 1964 NASA budget carrying an amendment stating that "No part of any appropriation made available to the National Aeronautics and Space Administration by this Act shall be used for expenses of participating in a manned lunar landing to be carried out jointly by the United States and any other country without consent of Congress."



## 1964

### III. Joint Echo II Experiments

January 1964-February 1966

NASA launched Echo I on August 12, 1960. It was a passive communications satellite, a large aluminum-coated balloon carrying no transponder for repeating signals aimed at it, no antennas, no power system, and no attitude control system. Signals bounced off its skin could be received across thousands of miles. Echo I was experimental, but it brought home the reality of space travel to millions of people around the world, as it could easily be seen as a shining star moving across the sky at dawn and dusk.

The Soviet Union became receptive to U.S. proposals for joint experiments using the planned Echo II satellite during the Dryden-Blagonravov negotiations. At the same time, the Soviet Union showed little interest in providing data which would betray its space tracking capabilities to the world.

**January 25** The Echo II passive communications satellite is launched from Vandenberg Air Force Base in California. It inflates out of U.S. view, over the Soviet Union.

**January 27** Blagonravov reports that the Soviet Union is tracking Echo II. Several Soviet optical facilities observed satellite inflation, and three observatories photographed it. NASA receives tracking data immediately, and receives photographs and an analysis of orbital data after a few days. The Soviet Union does not provide the radar data asked for by the U.S., but this is not required by the terms of the May 24, 1963 Dryden-Blagonravov "First Memorandum of Understanding."

**February 22** A series of 34 communications exercises using Echo II as a relay between the Jodrell Bank radio telescope in the U.K. and Zimenki Observatory at Gorki University in the Soviet Union begin and continue into March. The Soviets call Echo II "Friendly Sputnik." Technical problems at Jodrell Bank and in the Soviet Union and delays in receiving Soviet data reduce the utility of the experiments.

**October** *Kruschev is ousted. He is replaced by Alexei Kosygin as Premier and Leonid Brezhnev as First Secretary of the Communist Party of the Soviet Union.*

**December 8** NASA proposes exchanges of teams to visit deep space tracking and data facilities in the U.S. and the Soviet Union.

## 1965

In a book called *International Cooperation in Space*, published this year, NASA Associate Administrator for International Programs Arnold W. Frutkin calls the development of U.S.-Soviet cooperation in space "slow but heartening" and states that "Soviet performance has warranted a steady growth in personal trust."



- August 13** The Soviets reply to NASA's proposal of December 8, 1964, calling it "not feasible."
- September** At the 17th International Astronautical Federation Conference, Dr. Frank J. Malina of the International Academy of Astronautics proposes a Lunar International Laboratory (L.I.L.). The L.I.L. Committee has members from the Soviet scientific community. The proposal calls for an international manned laboratory on the lunar surface from which the Sun and the Earth's weather would be studied.
- October** The U.S. and the Soviet Union conclude an agreement to exchange information on space biology and space medicine. They agree to set up a U.S.-Soviet editorial review board to coordinate publication of joint volumes on space medicine and space biology. However, the first information exchange does not occur until January 1970, four years later.

## 1966

During House hearings on the FY 1967 NASA appropriations, James Webb describes the state of U.S.-Soviet space cooperation, saying: "We have... looked for evidence that they were interested and found none. In fact, I would say the evidence has been the other way." He adds, "They show no evidence of any kind of giving us a key, or even a partial key, that might unlock the door to cooperation."

- February 10** The Soviet Luna 9 probe carried out the first soft landing on the Moon on January 31, driving the U.S. to pick up the pace in the race for the Moon. At the Luna 9 press conference in Moscow, Mstislav Keldysh expresses his personal opinion that, in the field of space exploration, "there should be cooperation, not competition."

## IV. The Outer Space Treaty *February 1966 - December 1968*

Space law was a new field in the mid-1960s. Legal issues, such as defining the term "outer space," proved thorny in the atmosphere of Moon race competition. But the space law negotiations in the U.N. which took place against this background produced treaties which govern the space activities of their signatories to the present day.

- May 7** U.S. President Lyndon B. Johnson issues a personal statement from San Antonio, Texas, calling for an international treaty to regulate space exploration. His call is welcomed as an attempt to establish the rule of law in space.
- May 9** U.S. Ambassador to the U.N. Arthur Goldberg presents to Kurt Waldheim, chair of the Outer Space Committee of the U.N., a draft treaty meant to realize Johnson's call. It becomes known as the Outer Space Treaty.



- May 11** The U.S. presents the Soviet Union with a written outline of the main points of the proposed treaty. It includes the stipulation that the Moon and other celestial bodies should be open to exploration by all; that astronauts and spacecraft should be returned to their country of origin in the event of accident; that countries which cause damage through their space activities should be liable to pay compensation for that damage; and that celestial bodies should not be subject to claims of sovereignty.
- May 30** Soviet Foreign Minister Andrei Gromyko requests that the U.N. General Assembly take up the question of “an international agreement on legal principles governing the activities of states in the exploration and conquest of the Moon and other celestial bodies.”
- June 16** The Soviet Union submits a letter to the U.N. Secretary General proposing its own space treaty. The U.S. and Soviet versions are very similar, the differences being mostly in emphasis.
- August 18** In keeping with the terms of the Dryden-Blagonravov agreements, the Soviet Union provides weather data to the U.S. – hand-drawn cloud analyses.
- September 7** The U.S. begins transmitting cloud analyses and television and infrared meteorological images to the Soviet Union.
- September 11** The Soviet Union begins transmitting television and infrared meteorological images to the U.S.
- September 22** During negotiations to reconcile the U.S. and Soviet versions of the proposed Outer Space Treaty, Arthur Goldberg tells the U.N. General Assembly, “If the Soviet Union desires to provide for tracking coverage from U.S. territory, we, for our part, are prepared to discuss with Soviet representatives the technical and other requirements involved, with a view to reaching some mutually beneficial agreement.” The Soviets never reply.
- December 19** The U.N. General Assembly adopts Resolution 2222 (XXI), incorporating the “Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space” (the Outer Space Treaty).

## 1967

- January 27** The U.N. opens the Outer Space Treaty to signature. The U.S., Soviet Union, and more than 60 other nations sign the treaty, which focuses on issues of extraterrestrial sovereignty and territoriality. The treaty avoids the divisive issues of damage liability and the rescue of astronauts and return of spacecraft to their country of origin in the event of accident.

- January 27** *Apollo 1 fire*



- April**            *Soyuz 1 crash*
- October 10**    The Outer Space Treaty comes into force.
- November 9**    *The U.S. tests the Saturn V rocket and an Apollo Command Module heat shield for the first time. The unmanned test is a complete success.*
- December 19**    The U.N. General Assembly adopts Resolution 2345 (XXI), incorporating the "Agreement on the Rescue of Astronauts, the Return of Astronauts, and the Return of Objects Launched Into Space." The new treaty addresses one omission of the Outer Space Treaty, but the damage liability issue remains divisive.

## 1968

- April 22**        The U.S., Soviet Union, and 41 other nations sign the "Agreement on the Rescue of Astronauts, the Return of Astronauts, and the Return of Objects Launched Into Space."
- August 20**     *Warsaw Pact forces invade Czechoslovakia.*
- November 1**    The Moscow Domestic Service, reporting on Brezhnev's meeting with the cosmonaut crew of Soyuz 3, quotes him as saying: "Outer space must be an arena of scientific research and international cooperation, and not an arena of hostile clashes."
- December 3**    The "Agreement on the Rescue of Astronauts, the Return of Astronauts, and the Return of Objects Launched into Space" comes into force.

## V. The End of the Race to the Moon

*December 1968 - March 1970*

Recent revelations about the extent and nature of the Soviet manned lunar program show that the Soviets aspired to manned lunar exploration at least as late as 1972. But the Moon race, which dominated the activities of the two great space powers in the 1960s, essentially ended when the U.S. used a Saturn V rocket to send the Apollo 8 Command Module to orbit the Moon at the end of 1968. With Apollo 8's ten lunar orbits, the space rivalry which began with Sputnik 1 and Vostok 1 began to relax. 1969 saw the beginning of a change in attitudes toward cooperation in both the U.S. and the Soviet Union. At the same time in the U.S. it saw shrinking space budgets and the beginning of a redefinition of space goals.

**December 24**    Tass quotes Academician Blagonravov as saying he hopes international cooperation will be part of the U.S. Apollo 8 lunar mission, which is under way at this time.



## 1969

**February 21**

*The Soviet Union launches the first N-1 rocket, the equivalent of the U.S. Saturn V, on an unmanned flight. The mission objective is to deliver a prototype lunar spacecraft to low Earth orbit, then place it on a trajectory which will take it around the moon and back to Earth. The booster catches fire, however, and 70 seconds after ignition onboard automation shuts down the 34 first stage engines. Telemetry contact is lost after the launch escape system ejects the payload module. The fully fueled rocket impacts 30 miles downrange and explodes.*

**May 24**

The Prague (Czechoslovakia) Domestic Service quotes Blagonravov as saying that U.S.-Soviet space cooperation is not extensive, but that the two countries are “collaborating very successfully in the field of meteorological research.” He goes on to say that continued cooperation would save “considerable financial means.”

**July 20**

*Apollo 11 lunar landing*

**July 21**

On the day (Moscow time) of the first piloted lunar landing by the Apollo 11 spacecraft, Blagonravov calls “feasible” Apollo 8 astronaut Frank Borman’s proposal for astronauts and cosmonauts to work together aboard a space laboratory. He says this is in keeping with the concepts of late 19th/early 20th century Russian space flight pioneer Konstantin Tsiolkovskii. Blagonravov goes on to say that international tensions interfered with past cooperation, but that when “the means are found to liquidate these reasons, Frank Borman’s idea would be realizable, I think.”

**July 21**

The President of the Soviet Academy of Sciences, physicist Mstislav V. Keldysh, is among the well-wishers sending congratulations to the U.S. for its Apollo 11 achievement. He calls the landing “a great contribution to the opening up of the cosmos.”

**August 21**

NASA Administrator Dr. Tom Paine writes to Keldysh, suggesting he lead a Soviet delegation to NASA briefings in Washington on September 11 to discuss proposed instruments for the Viking Mars probes. Keldysh is unable to attend, but he asks for copies of the materials distributed at the briefings, “in order that Soviet scientists could develop possible proposals. . . [so] later it would be possible to exchange opinions on this question.”

**September 15**

Paine writes to Keldysh, suggesting a broad discussion of U.S. and Soviet plans for planetary exploration.

**October 10**

Paine sends Keldysh copies of the NASA Space Task Group report *America’s Next Decades in Space*. In his cover letter he says the document suggests “possibilities for moving beyond our present very limited cooperation to space undertakings in which the Soviet Union and





the United States could undertake major complementary tasks to the benefit of both our countries.”

**October 22** Upon the return to Earth of the crews of the ambitious Soyuz 6, 7, and 8 three spacecraft flight, Soviet leader Leonid Brezhnev declares, “we are supporters of international cooperation in the study of outer space.”

## 1970

**January** Exchange of information on space biology and medicine begins as agreed in October 1965. Five chapters for the joint volumes on space medicine and biology are exchanged. They include information on human adaptation to space conditions, future internal environments of spacecraft, radiation effects on humans, and future directions and methods for space biology studies.

**February 17** Paine comments on the January information exchange, saying, “this step was rather modest, and we have a long way to go.”

## VI. Apollo-Soyuz and Detente

*March 1970 - December 1979*

Apollo-Soyuz emerged from discussions about a common docking system. Both sides benefited. The Soviets became interested in the prospect of docking with a U.S. spacecraft in Earth orbit because of the insights they would gain into U.S. technology (albeit old, Apollo-era technology) and NASA management methods. They also sought to appear as the equal of the U.S. in space exploration. For NASA the mission filled the gap between Skylab in 1973-74 and the Space Shuttle. It also let the U.S. penetrate some of the secrecy surrounding the Soviet space effort.

**March 7** President Richard Nixon says he considers international cooperation in space a specific objective of the U.S. space program. He begins his speech by saying, “I believe that both the adventures and applications of space missions should be shared by all peoples.”

**April 24** Paine meets with Blagonravov in New York City. They discuss ways of ensuring astronaut safety, and touch on the possibility of dockings between future U.S. and Soviet space shuttles and space stations.

**May 11-12** Dr. Philip Handler of the U.S. National Academy of Sciences meets at Paine’s request with Keldysh and other Soviet officials to discuss scientific cooperation between the two countries. Handler confronts the Soviets with articles from *The New York Times* and *Science* which describe the “rather disgraceful history of their failure to react to the many initiatives offered by NASA.” The Soviets respond by saying that they plan a series of letters to Paine outlining future cooperation. The issue of a common docking system also emerges at the discussions.

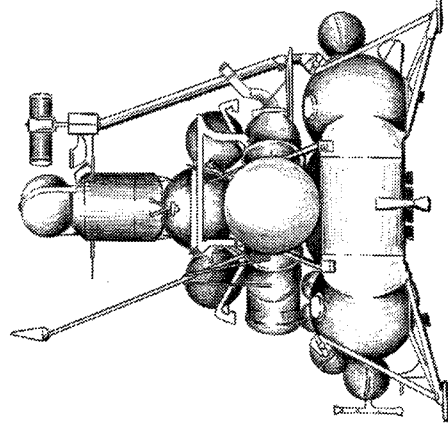


**May 13**

While in Japan, cosmonaut Alexei Leonov (the first person to walk in space) tells an interviewer, "I think it may be possible for the United States and the Soviet Union to jointly build a spaceship in the future and send men to outer space together." He adds that international cooperation is imperative for the development of space science.

**July 11**

Soviet Ambassador to the U.S. Anatoli Dobrynin asks Handler to receive Ye. A. Belov, the newly appointed Scientific Attache to the Soviet Embassy, who carries a letter from Keldysh. Keldysh says the Presidium of the Soviet Academy is prepared to discuss common docking mechanisms for space stations.



The small sphere on top of the Luna lander depicted here was designed to return pieces of the Moon to the Soviet Union. A total of 320 grams were collected by the Luna 16, 20, and 24 landers. A portion was traded for a few grams of the approximately 400 kilograms collected by the Apollo astronauts.

**July 31**

Paine writes a letter to Keldysh suggesting that the U.S. and the Soviet Union meet to discuss development of a common docking system.

**September 4**

Paine writes to Keldysh, suggesting a Soyuz rendezvous with Skylab.

**September 23**

Acting NASA Administrator George Low receives a letter from Keldysh agreeing to talks on a common docking system.

**September 25**

Low replies to Keldysh, proposing October or late November for a meeting to discuss a common docking system.

**October 19**

Keldysh replies to the September 1969 letter from Paine. He suggests that a meeting to discuss a broad range of cooperation take place in Moscow at a time chosen by NASA. Low replies, suggesting January 1971.

**October 26-28**

Soviet and U.S. space officials, led by Robert Gilruth, meet in Moscow to discuss joint space projects, including a common docking system. Three working groups are established to study docking of U.S. and Soviet spacecraft.



**October 28**

At a press conference on the Luna 16 lunar sample return spacecraft, Keldysh refers to the October 26-28 meeting. He says that "Both sides consider it expedient to unify, or, to put it more precisely, to make the docking units of orbital spacecraft compatible." Samples collected by Luna 16 are later exchanged for samples collected by the Apollo 11 and 12 astronauts.

**October 29**

At a press conference NASA negotiator Arnold Frutkin describes the October 26-28 negotiations as "straightforward, open, and forthright." He says the Soviet and U.S. negotiators had agreed on areas requiring more study, and had called for future exchanges. He attributes the success of the talks to mutual self-interest, and says that "people who put other people up into space certainly want to take advantage of every opportunity to provide for their rescue if that is necessary."

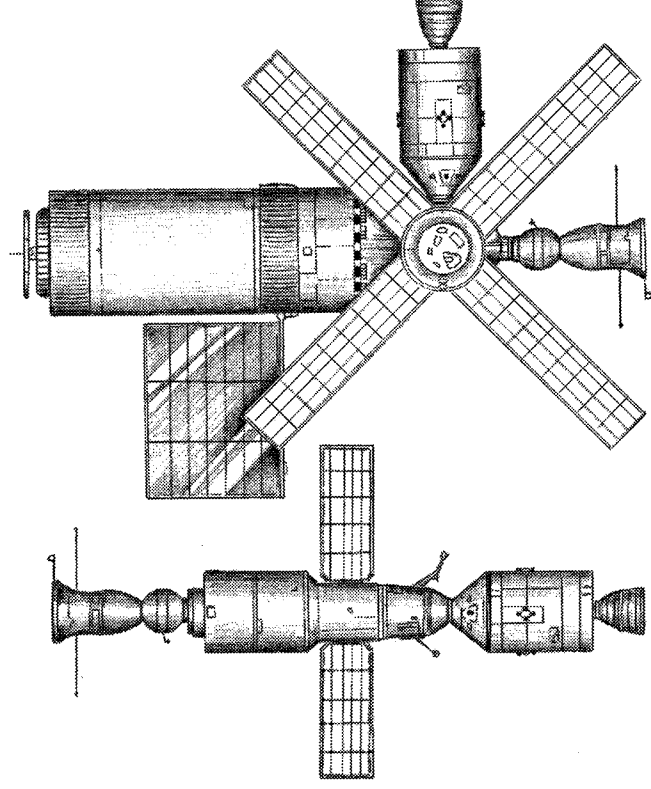
**December 9**

The text of the October agreement is released.

**1971**

**January  
16-21**

A U.S. delegation led by Acting NASA Administrator George Low meets with Soviet officials in Moscow to discuss broadening U.S.-Soviet space cooperation. On January 21 the U.S. and Soviet Union announce their agreement to exchange lunar samples and biomedical and weather data. The agreement sets up Joint Working Groups to expedite other



Before the U.S. and Soviet Union agreed to carry out the Apollo-Soyuz Test Project, an Apollo docking with a Salyut space station (left) was favored. A Soyuz-Skylab mission (right) was also considered. The spacecraft in this conjectural drawing are drawn to scale.



cooperative ventures. Discussion of a docking between U.S. and Soviet spacecraft is limited to a report that the docking working group talks are going well.

**March 31** The text of the January 21 agreement is released.

**April** *Leonid Brezhnev affirms that Soviet foreign policy is aimed at "peaceful coexistence."*

**April 19** *The Soviet Union launches Salyut 1, the first space station.*

**April 23** *Soyuz 10 docks with Salyut 1, but its crew is unable to enter the station.*

**June 7** *Soyuz 11 docks with Salyut 1. Cosmonauts Georgi Dobrovolskii, Vladislav Volkov, and Viktor Patsyev successfully enter the station and begin an experimental program.*

**June 21-25** The three U.S.-Soviet docking working groups meet in Houston to continue discussion of a docking between U.S. and Soviet spacecraft. They consider designs for an international docking mechanism, and look into the difficulties of docking an Apollo with a Salyut space station, an Apollo with a Soyuz, or a Soyuz with Skylab.

**June 29-  
July 3** Space damage liability agreement negotiations are held in Geneva under auspices of the U.N. Space Committee.

**June 30** *The Soyuz 11 spacecraft separates from Salyut 1 and returns to Earth. When the ground crew opens the hatch they find Dobrovolskii, Volkov, and Patsyev dead in their couches.*

**July 1** *U.S. astronaut Thomas Stafford serves as President Nixon's representative to the funeral of the Soyuz 11 cosmonauts.*

**July 12** *A Soviet commission reports that "a loss of the ship's sealing" caused the deaths of the Soyuz 11 crew.*

**August 6** The Joint Working Group on Near-Earth Space, the Moon, and the Planets meets in Moscow. They recommend continued exchange of moon samples, joint working seminars, and exchange of significant data from unmanned spacecraft traveling to Mars at this time (the U.S. Mariner 9 and the Soviet Mars 2 and Mars 3 spacecraft).

**October 20** Agreement on the exchange of Mars data is signed. "Real-time" exchange of Mariner 9 and Mars 2 and 3 data takes place between November 16, 1971 and May 5, 1972.

**November 29-  
December 6** The three docking working groups meet in Moscow. They agree that a docking between an Apollo spacecraft and a Salyut space station is feasible. Working Group 1 completes general documentation of life support systems, coordinate systems, spacecraft configuration



constraints, and communications between ground centers. Group 2 develops a list of guidance and control systems aboard Apollo and Salyut which will have to be made compatible. Group 3 continues work on an international docking mechanism. After the meeting, NASA recommends to the White House that a formal agreement on an Apollo-Salyut mission be included on the agenda of the May 1972 summit between Nixon and Kosygin. Secretary of State Henry Kissinger asks for a firm recommendation by April 15, 1972.

## 1972

**January 19** Lunar samples collected by the Apollo 14 astronauts are handed over to Soviet scientists at the Manned Spacecraft Center in Houston.

**February 19** NASA sends a lunar sample collected by Apollo 15 astronauts to the Soviet Union.

**March 2** At the request of the Soviets the Manned Spacecraft Center in Houston initiates a telephone conference with the Soviet Academy of Sciences in Moscow. The telecon concerns details of the proposed international docking system. After the telecon the two sides exchange transcripts in order to avoid misunderstandings.

**March 19** John Noble Wilford of *The New York Times* becomes the first U.S. journalist permitted to visit the space installations at Zvezdny Gorodok (Star City) outside Moscow. He interviews Major General Vladimir Shatalov, Chief of Cosmonaut Training and a veteran of three Soyuz flights. At a dinner in the reporter's honor, Shatalov raises a toast to better space cooperation between the U.S. and the Soviet Union.

**March 27-  
April 3** Working Group 3 meets in Houston to expedite development of the international docking system. The meeting produces four sheets of engineering drawings. (The docking system used in the Apollo-Soyuz Test Project was little different from the one designed at this meeting.)

**April 4-6** Low and Kotelnikov chair an executive-level meeting in Moscow. The purpose of the meeting is to finalize the organizational structure and timetable of the joint mission. The Soviets announce that an Apollo docking with a Salyut station is neither technically nor economically feasible. Modifying Salyut to include a second docking port would be expensive and technically difficult. They propose an Apollo docking with a Soyuz instead. After initial surprise, the U.S. side agrees to the change. A "Summary of Results" is agreed on, which formalizes the agreements reached and provides a basic outline for the joint mission. After his return from Moscow, Low tells Kissinger that the joint space mission is ready to be added to the agenda of the May summit between Nixon and Kosygin.



**May 19-20**

S. I. Rasool, NASA Deputy Director of Planetary Programs, and G. I. Petrov, Director of the Science Institute of Space Research, Soviet Academy of Sciences, chair a meeting in Madrid of the "Special Session of U.S. and Soviet Scientists." Among topics the scientists reach agreement on are the need to determine the chemical and physical properties of the surface of Mars, the need to search for martian life, the need to determine the atmospheric composition and the role of water on Mars, and the desirability of "jointly defining promising landing sites" on Mars.

**May 24**

At the Moscow Summit President Richard Nixon and Premier Alexei Kosygin sign the "Agreement Concerning Cooperation in the Exploration and Use of Outer Space for Peaceful Purposes" (the Space Cooperation Agreement). It builds on the October 1970, June 1971, and November-December 1971 agreements, and is to run for five years. The agreement includes a plan for U.S. and Soviet spacecraft to rendezvous and dock in Earth orbit.

**June 13**

Dale Myers, Associate Administrator for Manned Space Flight, distributes a memorandum to the NASA centers outlining the NASA organizational policy decisions for the planned joint space mission. He advises the centers that, as of June 11, management was transferred to the Office of Advanced Missions of the Apollo Program Office in Houston. Glynn Lunney, Special Assistant to the Director of the Apollo Spacecraft Program Office, is made Project Director of the U.S. side of the joint mission.

**June 13-15,  
20, 21**

Low, Handler, Frutkin, and other scientific advisers and scientists testify before the House Subcommittee on International Cooperation in Science and Space. They provide an overview of agreements made to date and answer questions on budgetary, technical, and political issues associated with joint U.S.-Soviet space projects.

**June 30**

The joint U.S.-Soviet space mission becomes known officially as the Apollo-Soyuz Test Project (ASTP).

**July 6-18**

ASTP Working Groups meet in Houston. It emerges that the Soviets wish to launch their Soyuz spacecraft first despite its inability to stay in orbit more than five days. The U.S. side favors launching Apollo first, as it can stay in orbit for up to two weeks waiting for a successful Soyuz launch. However, when the Soviets reveal they have committed a backup Soyuz to ASTP, the U.S. agrees to the Soviet plan. The sides lay out the basic mission profile. Crew and flight controller training, environmental control systems, the effects of Apollo spacecraft atmosphere leakage on the Soyuz air supply, communications systems, and detailed docking mechanism specifications are also discussed.

**September 1**

The treaty on space damage liability, negotiated in June 1971, comes into force.



- October 9-19** The ASTP Working Groups meet in Moscow. Taking into account the inherent limitations of the Soyuz launch vehicle, orbital altitude for the joint mission is set at 222 kilometers. Crew training and docking target discussions begin. Other issues addressed include compatible atmospheres, docking mechanisms, contingency external transfer, and contingency return of mixed crews.
- November 23** *The fourth and last Soviet N-1 rocket launch attempt ends in structural failure and explosion 107 seconds after ignition, 40 seconds before nominal first stage burn out. The program was finally canceled in 1974.*
- November 24-** The ASTP Working Groups meet in Houston to discuss tracking requirements, docking targets, docking simulations, communications  
**December 6** compatibility, and contingency docking procedures to be used in the event the Soyuz docking antenna fails to deploy.
- December** *Apollo 17, the last manned lunar expedition*
- ## 1973
- January** Chester Lee, Apollo Mission Director, takes over the Apollo Program Office. Glynn Lunney becomes Manager of the Apollo Spacecraft Program Office, in charge of ASTP and the Command Modules to be used in the Skylab program.
- January 30** The U.S. announces the crew roster for its part of the ASTP mission. Prime crew commander is Thomas Stafford; Donald Slayton is Docking Module Pilot; and Vance Brand is Command Module Pilot. The backup crew is Alan Bean, Ronald Evans, and Jack Lousma. Richard Truly, Robert Overmyer, Robert Crippen, and Karol Bobko will assist the crews with training.
- March** *The U.S. completes withdrawal from Vietnam.*
- April** Rockwell International begins fabrication of the ASTP Docking Module. NPO Energia is responsible for fabrication of Soviet docking hardware.
- April 3** *The Soviet Union launches the Salyut 2 space station. While the Soviets maintain the station is performing normally, U.S. tracking indicates it is breaking up. The Soviets send no crews to Salyut 2, and later claim it was an experimental station not meant to be manned.*
- May 14** *The U.S. launches the Skylab orbital workshop. Shortly after launch its micrometeoroid shield tears loose, ripping away one solar wing and jamming the other shut. Soaring temperatures in the workshop and a power shortage endanger the mission, but astronaut EVAs save Skylab.*
- May 24** The Soviet Union announces the crew roster for its part of the ASTP, coincident with the start of the Paris Air Show. Prime crew for the first



Soyuz is Alexei Leonov, commander, and Valeri Kubasov, flight engineer. Prime crew for the second Soyuz is Anatoli Filipchenko and Nikolai Rukavishnikov. Vladimir Dzhanibekov, Boris Andreev, Yuri Romanenko, and Alexander Ivanchenko are backup crew. The announcement is a first for the Soviet Union, which before always waited to identify crews until after they were launched.

**May 25-  
June 3**

The U.S. and the Soviet Union display a full-scale model of an Apollo spacecraft with Docking Module docked to a Soyuz. *Aviation Week & Space Technology* (May 28) calls it “the focal point of the . . . Paris Air Show.”

**June-July**

The ASTP cosmonauts visit the Johnson Space Center in Houston for the first time.

**August 14**

Low writes to Keldysh suggesting discussions on Soviet hardware failures, including Salyut 2 and Soyuz 11.

**August 30**

Keldysh replies, welcoming discussion of Soviet hardware failures.

**September 27**

The Soviet Union announces the duration of the Soyuz 12 flight at launch, the first time they announce flight duration before the conclusion of a mission. The gesture is part of Soviet efforts to build U.S. confidence in their ability to carry out their part of the upcoming Apollo-Soyuz Test Project.

**October 2**

Low, Apollo 17 astronaut Gene Cernan, and Lee brief the Manned Space Flight Subcommittee of the House Committee on Science and Astronautics on the ASTP. Representative Don Fuqua voices widespread concerns about Soviet reliability when he says, “in the event of any reason it were not possible to conduct a joint mission with the Soviets, NASA should be prepared to justify the mission on its merits.” Low states that the experiments scheduled to be carried on Apollo for the ASTP, worth \$10 million, would not justify flying the \$250 million mission by themselves. When Subcommittee Chair Olin Teague asks if NASA should develop alternate mission plans in the event of a Soviet failure to fly, Representative John Wydler advises against it, as it might be seen as a lack of trust which could endanger the mission.

**October 1-20**

The ASTP Mid-Term Review (MTR) is held in Moscow. Low visits the place where moon samples collected by Luna 16 and 20 and the Apollo astronauts are housed. He then tours Zvezdny Gorodok (Star City), where he notes new construction, including a training building dedicated to ASTP. At the MTR the Soviets assure the U.S. delegation that Soviet space hardware is safe. They provide details of the Soyuz 11 accident. When explosive bolts separated the orbital module from the descent module, a vent, normally opened low in the atmosphere, opened at a height of 168 kilometers. The air in the descent module escaped. The cosmonauts wore no pressure suits, so they died within 30 seconds. They explain that modifications to avoid similar accidents were flight-





tested on Cosmos 496 and 573, and on Soyuz 12. The sides also discuss accommodating the press and providing public access to information about the ASTP, a difficult subject for the Soviet side. Discussions of future joint spacecraft compatibility requirements also resume at this meeting. They had languished after negotiations became dominated by the ASTP. (Clarke Covington, Senior Project Engineer with the Spacecraft Design Division of the Engineering and Development Directorate at the Johnson Space Center, tells Shuttle managers in August 1974 that the discussions centered on changing previously agreed upon U.S.-Soviet compatibility requirements to bring them into line with Shuttle designs of the time. The next future requirements meeting is scheduled for June 1974, then postponed to September 1974 at the Soviets' request.)

**October 6** *The Yom Kippur War breaks out between Israel and the Arab states. The U.S. and Soviet Union airlift weapons to opposing sides.*

**October 17** *The Organization of Petroleum Exporting Countries (OPEC) imposes an oil embargo on countries supporting Israel in the Yom Kippur War, including the U.S.*

**November** The ASTP astronauts pay their first visit to the Soviet Union. They spend 11 days familiarizing themselves with Soviet hardware and cosmonaut training facilities.

## 1974

**January 16-23** Joint tests of the Docking Module environmental control system are held in Houston.

**February 13** *The Soviet Union expels Nobel Prize winner Alexander Solzhenitsyn for intellectual dissent.*

**March 4** The U.S. ASTP crews begin intensive Russian lessons.

**April 8-May 3** The ASTP Working Groups meet in Houston. The cosmonauts and astronauts come together, addressing the media, planning future training to get ready for the July 1975 target launch date, and practicing docking and use of each other's languages in the Apollo spacecraft simulators.

**August** *Richard Nixon resigns the office of President of the United States. Vice President Gerald Ford succeeds him.*

**August 26-September 20** The Working Groups meet in Moscow to complete review of contingency situations, documentation, and arrangements for post-flight data exchange. Future requirements talks begun in October 1973 are indefinitely postponed at Soviet request. NASA and the Soviet Academy of Sciences agree that NASA will track the Soyuz 16 ASTP precursor mission. However, the Soviets are unwilling to see data on the flight released to the public by NASA prior to launch. The issue is left unresolved.



**September 27** The U.S. ASTP flight controllers complete ten days of familiarization training sessions in Moscow.

**October** The ASTP docking mechanism jams during acceptance testing at Rockwell International. Lunney suggests changes in the design.

**October 11** Lunney informs Professor Konstantin Busheyev, the Soviet ASTP Project Director, that NASA cannot keep secret any information the Soviets might provide to it on the Soyuz 16 mission. They agree NASA should not be given details on the mission until just before launch, at which point the tracking exercise will proceed as planned.

**November 6** Soviet ASTP flight controllers complete ten days of familiarization training sessions in Houston.

**November 8** The Soviets declare that they will be unable to rework their docking mechanisms without affecting the planned launch date. By this date the Soviets had already flown ASTP-type docking mechanisms in space without incident.

**November 19** After joint discussions concerning the likelihood of a docking mechanism jam in orbit, the sides agree to modify only the U.S. part of the ASTP docking system.

**December 2** Busheyev telephones Lunney to inform him that Soyuz 16 will launch later that day. Soyuz 16 carries Nikolai Rukavishnikov and Anatoli Filipchenko aloft on a six-day mission designed to test Soyuz systems modified for the ASTP. NASA tracks the mission as planned.

## 1975

**January 13** In a letter to John F. Yardley, Associate NASA Administrator for Manned Spaceflight, Johnson Space Center Director Christopher Kraft outlines a possible future course for cooperative U.S.-Soviet shuttle-space station missions. First, a U.S. Shuttle will dock with "whatever craft the U.S.S.R. intends to fly at that time. . . around 1980." He says a Shuttle could carry a Soviet "station precursor module" into orbit in 1983. The Shuttle would have a mixed U.S.-Soviet crew, or a Soviet spacecraft could dock with the Shuttle-Soviet space station combination. The "final step" would be for Soviet space station modules to augment "established onorbit [sic] capability, and would include manned U.S.S.R. flights to the station in their own spacecraft or as Shuttle passengers." Kraft concludes with a disclaimer, stating that "this proposal. . . does not concern itself with potential Soviet national interests, and the U.S.S.R. will undoubtedly consider some aspects unattractive."

**February 5** The Aerospace Safety Advisory Panel presents the findings of its investigation of ASTP safety to NASA Administrator James Fletcher, other senior NASA officials, and staff members of the Senate Committee



on Aeronautical and Space Sciences and the House Committee on Science and Astronautics. The Panel asserts that, “confidence in crew safety for the joint phases [of the ASTP] is essentially equal to that for prior manned earth orbital flights.”

**February 7**

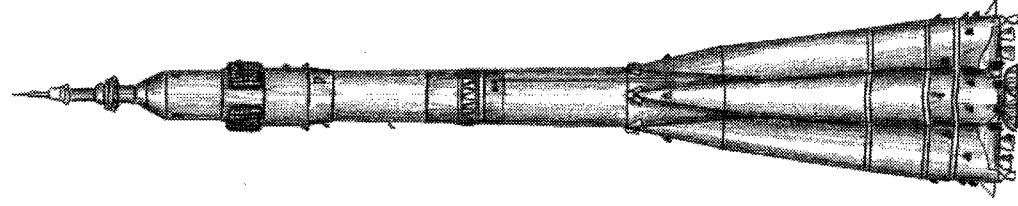
The ASTP cosmonauts arrive in Washington for final training. They travel to Kennedy Space Center and view the Apollo spacecraft and Saturn IB launch vehicle for the mission. Then they travel to Houston for simulator training and joint inflight activities practice.

**March**

NASA discovers cracks in two of the fins on SA-210, the ASTP Saturn IB Apollo launch vehicle. The booster was built in 1967 and stored for eight years. All eight fins are replaced.

**April 5**

The “April 5 Anomaly” is the Soviet name for an inflight accident involving the Soyuz 18A (non-Soviet designation) spacecraft, with cosmonauts Vasilii Lazarev and Oleg Makarov aboard for a 60-day visit to the Salyut 4 space station. A problem develops in the explosive bolts holding together the central core of the first stage and the second stage of their booster. Half the bolts fire prematurely, breaking electrical



The same basic class of booster launched Sputnik 3, Vostok 1, Soyuz 18A, Soyuz 19, and over a thousand other payloads in the past 35 years. It is shown here configured to launch a Soyuz spacecraft.



connections needed to fire the remaining bolts. Consequently, when the first stage burns out it cannot separate from the second stage. The second stage is dragged off course by the weight of the spent first stage, activating the automatic abort system. Using its main engine, the Soyuz 18A spacecraft blasts free of the crippled booster at an altitude of about 140 kilometers. After the Soyuz orbital module is cast away, the main engine brakes the descent module onto a 14-g reentry path. The cosmonauts land safely amid snow-covered mountains about 1800 kilometers from Baikonur Cosmodrome, ending the only suborbital flight of the Soviet manned space program. The accident raises questions in the U.S. about the safety of Soviet spacecraft.

**April 8** Senator William Proxmire asks the Central Intelligence Agency (C.I.A.) to assess Soviet space safety in the wake of the April 5 accident. He tells his Senate colleagues that the failure “reinforces my deep concern that [the ASTP] may be dangerous to American astronauts.”

**April 14-30** The ASTP astronauts arrive in Moscow for final training. They tour Baikonur Cosmodrome, visit the mission control center in Kaliningrad, and practice transfer and other joint flight activities.

**May** NASA and the Soviet Academy of Sciences begin agency-level discussions of a Shuttle-Salyut mission, a joint space station project, a search and rescue system test, and a joint unmanned Mars mission.

**May 14** At a press conference, ASTP astronauts Stafford, Brand, and Slayton confirm that they believe the Soyuz spacecraft is safe and flightworthy despite the Soyuz 18A abort. Stafford points out that the abort system performed exactly as designed.

**May 19** Low visits Baikonur Cosmodrome in Soviet Kazakhstan at the head of a NASA delegation. Upon arrival, the Soviets inform him that Keldysh is gravely ill and is in the hospital. Vladimir Kotelnikov, a radio and electronics engineer with a good command of English, fills in as acting president of the Soviet Academy of Sciences.

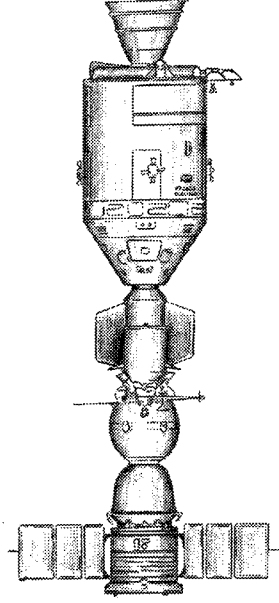
**May 22** Low and Kotelnikov chair the ASTP Flight Readiness Review at the Presidium of the Soviet Academy of Sciences in Moscow. They confirm the July 15, 1975 launch date.

**July 2** William Proxmire again raises objections to the Apollo-Soyuz flight, making public C.I.A. testimony which questions the ability of the Soviets to control two space missions at one time. The ASTP would be contemporaneous with the Soyuz 18-Salyut 4 space station mission.

**July 15** The Soyuz 19 spacecraft, with cosmonauts Alexei Leonov and Valeri Kubasov aboard, lifts off from the Baikonur Cosmodrome in Soviet Kazakhstan. The launch is televised in the U.S. Seven hours later the last Saturn IB launch vehicle lifts off from Kennedy Space Center, carrying the last Apollo Command Module with astronauts Thomas



Stafford, Vance Brand, and Donald Slayton aboard. The Saturn IB also carries the Docking Module. After some difficulty with the Command Module docking probe, hard dock with the Docking Module is achieved, and Apollo begins maneuvering to rendezvous with Soyuz 19.



Soyuz 19 (left), Docking Module, and Apollo.

**July 17**

Soyuz and Apollo dock in Earth orbit. Stafford and Slayton take Leonov on a tour of the Apollo spacecraft, and Kubasov takes Brand on a tour of the Soyuz 19 orbital module. Two days of joint operations follow. The crews observe Earth, visit each other's spacecraft, receive telephone calls from Brezhnev and Ford, and take part in ceremonial activities.

**July 19**

Soyuz and Apollo separate and carry out joint maneuvers and experiments. They redock in a second test of the docking mechanism, then separate for the final time and carry out additional joint experiments. Apollo then performs a separation maneuver, and the spacecraft move apart to conduct independent operations.

**July 21**

Soyuz 19 touches down in Soviet Kazakhstan. Recovery is televised in the United States.

**July 24**

Apollo reenters Earth's atmosphere. During descent gases from the reaction control system invade the Command Module. The spacecraft splashes down in the Pacific Ocean and turns over. Stafford breaks out oxygen masks and rights the spacecraft. The crew spends two weeks recovering in a hospital in Honolulu. Then they spend a month touring the United States and the Soviet Union with Leonov and Kubasov.

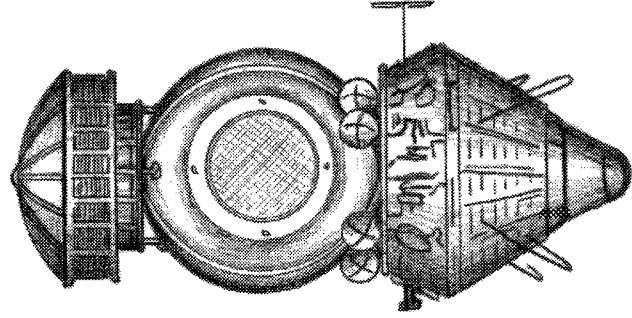
**August 13**

A letter from ASTP negotiator Arnold Frutkin to Academician Vladlen Vershetin formalizes the May discussion of a Shuttle-Salyut docking by summarizing the points considered in writing.

**September 8**

In a NASA "sync-sound" interview Glynn Lunney discounts the project's long-term impact. When asked if he considers it a turning point in U.S.-Soviet relations, he says, "that would be too large a step to expect to occur as a result of the Apollo-Soyuz mission itself. I would, however, say that large steps perhaps are made by a series of smaller steps. . . and in the very largest context of cooperation between the two countries Apollo-Soyuz was a reasonable-size step."





Launched in 1975, the Vostok-based Cosmos 782 biosatellite (shown here) was the first Soviet spacecraft to carry U.S. experiments into space.

### November 25

The Soviet Union launches Cosmos 782, a Vostok-based unmanned biosatellite containing U.S. experiments developed by NASA, as well as Soviet, French, Romanian, Hungarian, Polish, and Czechoslovak experiments. It is recovered in a howling blizzard on Soviet territory 19 days later. The experimental specimens, including crayfish and tobacco plants, reach Moscow within 34 hours of landing. Seven U.S. scientists in Moscow begin immediate research, and other specimens are immediately sent by courier to the United States.

## 1976

### July 20

*U.S. Mars lander Viking 1 makes the first successful soft landing on the Red Planet.*

### October 19-22

Acting NASA Administrator Alan Lovelace, Chairman of the Inter-cosmos Council Boris Petrov, Frutkin, and Verschetin meet to discuss a Shuttle docking with a Salyut station. They look at the possibility of using the ASTP docking system. They also discuss an International Space Platform program and cooperative unmanned planetary exploration (especially Venus exploration in 1978, when both countries plan missions). However, NASA is unwilling to sign a formal agreement ahead of the approaching U.S. presidential elections.

## 1977

### May

The 1972 Space Cooperation Agreement between the U.S. and the Soviet Union is renewed for another five years. The agreement lays the groundwork for the COSPAS-SARSAT system and continued U.S. participation in the Soviet Cosmos biosatellite program.



**May 11**

Anatoly Alexandrov, the President of the Soviet Academy of Sciences, signs the "U.S./U.S.R. Agreement on Cooperation in the Area of Manned Space Flight." Lovelace signed on May 6. The agreement calls for study of a Shuttle-Salyut mission by two Joint Working Groups. Working Group 1 is to focus on basic and applied scientific experiments to be conducted on the mission, and Working Group 2 will consider operations. The agreement points up the apparently complementary nature of the Salyut and Shuttle programs. Salyut is designed for long stays in space, and Shuttle can deliver large cargoes and crews to orbit and return them to Earth. The first Shuttle flight to a Salyut is tentatively scheduled for 1981. The second part of the agreement sets up a Joint Working Group to look into the feasibility of the International Space Platform proposal.

**August 3**

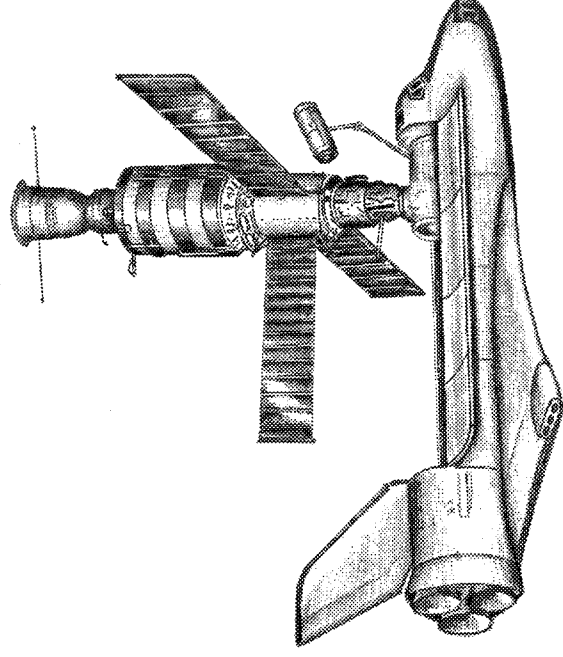
The Soviet Union launches the Cosmos 936 biosatellite with Soviet, U.S., Czechoslovak, East German, Romanian, Hungarian, and French experiments aboard. The Soviet Institute of Biomedical Problems carries out parallel research with the NASA Ames Research Center.

**November  
14-18**

The Shuttle-Salyut Joint Working Groups meet in Moscow. They exchange information on their respective spacecraft, propose an experimental program, and plan the future activities of their working groups. A second meeting is scheduled to be held in the United States in late March or early April 1978.

**December 30**

Petrov sends Dr. Noel Hinners, Deputy NASA Administrator, technical information on the Salyut space stations as requested by NASA at the November Joint Working Group meetings.



This conjectural drawing shows the Space Shuttle, c. 1972, docked with a Soviet Salyut space station. The Shuttle's Remote Manipulator System transfers a joint experiment module to the Salyut. In 1977 NASA tentatively scheduled a Shuttle docking with a Salyut for 1981.



## 1978

**January 16**

In a document entitled "Shuttle-Salyut Operational Considerations for a Joint Experimental Flight," NASA outlines a possible Shuttle-Salyut mission profile.

**January 24**

*The Cosmos 954 military satellite decays from orbit and breaks up over Canada, scattering radioactive debris from its nuclear reactor. Provisions of the September 1, 1972 space damage liability treaty come into play.*

**March 2**

*Vladimir Remek of Czechoslovakia becomes the first non-Soviet/non-American to visit space. He rides the Soyuz 28 spacecraft to the Salyut 6 space station.*

**April**

Clarke Covington, Chief of the System Design Office at the Johnson Space Center, prepares a briefing document on the Shuttle-Salyut mission for Glynn Lunney in anticipation of the resumption of U.S.-Soviet talks. In it he reviews proposed means of docking a Shuttle with a Salyut. He also describes how joint experimental modules carried into orbit by the Shuttle might be moved into position for attachment to the Salyut station by the Shuttle's Remote Manipulator System or by a "teleoperator-free flyer." A Shuttle-Salyut mission with a Spacelab module in the Shuttle payload bay is also mentioned.

**September 7**

After postponement of the Joint Working Groups meeting set for April, and amid increasing U.S. concern over Soviet violations of human rights, transfer of Shuttle technology, and other issues, Robert Newman, NASA Headquarters Public Affairs Office director, issues a memorandum with guidelines for NASA Public Affairs Officers confronted by media inquiries about a Shuttle-Salyut mission. It says, in part: "No further discussions have been scheduled pending a comprehensive review of the entire subject. We cannot predict when this review will be completed or what the outcome will be."

## 1979

**July 11**

*Skylab falls from orbit, raining debris on Australia.*

**September 25**

The Soviets launch the Cosmos 1129 biosatellite with Soviet, U.S., and Czechoslovak experiments aboard. The experimental payload includes rats for the first attempt at mammal breeding in space (it fails) and quail eggs, which do not hatch because their incubator stops operating three days before recovery.

**December**

*The Soviet Union invades Afghanistan.*





## VII. After Detente—Biosats and COSPAS-SARSAT

December 1979 - June 1984

The Soviet invasion of Afghanistan marked the end of Detente. The time was not ripe for space cooperation. But scientists on both sides maintained contacts for the exchange of data and ideas at a low level. The COSPAS-SARSAT program began, creating a worldwide search and rescue service with no exchange of technology and minimal investment. These contacts would help form the basis for new moves toward cooperation in the mid-1980s.

### 1981

**April 12**     *NASA launches the first Space Shuttle, STS-1 Columbia.*

**October 30**     The Soviet Union launches the Venera 13 spacecraft to Venus. The lander touches down near the Phoebe Regio mountains on March 1, 1982. Landing site selection was based in part on U.S. Pioneer Venus Orbiter radar maps and consultation in 1980 with Dr. Harold Masursky of the U.S. Geological Survey. Venera 13 provides the first soil analysis and color pictures of the Venusian surface.

**December**

*The Polish authorities declare martial law in response to calls by the Solidarity movement for a referendum on the continued rule of the Jaruzelski regime.*

### 1982

President Ronald Reagan lets lapse the 1972 Space Cooperation Agreement (renewed in 1977) between the U.S. and the Soviet Union.

**April 19**

*The Soviet Union launches the Salyut 7 space station.*

**June**

The Soviet Union launches Cosmos 1383, a low-altitude navigational satellite, into a near-polar orbit. The spacecraft carries COSPAS 1, a search and rescue transponder. COSPAS 1 had its roots in 1975 discussions between the U.S. and the Soviet Union. In 1979 a treaty between the Soviet Union, the U.S., Canada, and France mandated development and deployment of a space-based search and rescue system. The COSPAS transponder detects signals from a beacon, and is capable of locating downed planes, injured hikers, and sinking ships within three kilometers of their true position.

**December**

*Soviet leader Leonid Brezhnev dies.*



## 1983

### March 24

The Soviet Union launches COSPAS 2, the second international search and rescue satellite, aboard the Cosmos 1447 low-altitude navigation satellite.

### March 28

The U.S. launches SARSAT 1 aboard the NOAA 8 satellite. COSPAS and SARSAT are compatible and are both part of the system laid out in the 1979 treaty. Their acronyms stand for "Search and Rescue Satellite" in Russian and English. In its first five years of operation the international COSPAS-SARSAT system is credited with saving nearly 1000 lives.

### December 14

Ten pregnant rats are passengers on the joint U.S.-Soviet Cosmos 1514 biosatellite. They spend the last half of their pregnancy in space, then are recovered for study. Rat pups of spacefaring mothers suffer from retardation in the development of their vestibular systems.

## VIII. Halley's Comet, Mars, and Gorbachev

*June 1984 - August 1991*

Low-level and informal contacts between scientists and researchers in the Soviet Union and the U.S. continued in the last half of the 1980s. The U.S. elected not to send spacecraft to Halley's Comet, but U.S. researchers were able to put instruments on Soviet spacecraft. The 1985-86 Halley apparition also marked the debut of Europe and Japan as space powers capable of mounting their own interplanetary missions. With the close approach of Mars to Earth in late 1988, people all over the world began to look seriously at the possibility of cooperative Mars exploration. At the same time, Mikhail Gorbachev, bearing the reform policies of glasnost and perestroika, came to power in the Soviet Union.

## 1984

### June

At a meeting in Graz, Austria, leading Soviet and U.S. space scientists discuss bilateral cooperation, including data exchange between U.S. Viking and Soviet Venera researchers, and informal U.S. involvement in the Soviet Vega Halley's Comet and Phobos Mars missions. The meeting helps mobilize support for renewal of the 1972 Space Cooperation Agreement.

### June

Reagan invites the Soviet Union to work with the U.S. to plan a U.S. Shuttle flight to a Soviet Salyut space station. The Soviet response links participation to U.S. abandonment of the Strategic Defense Initiative (S.D.I.) program.

### October

Congress passes, and Reagan signs, a joint resolution calling for renewal of the lapsed Space Cooperation Agreement. The resolution was introduced by Senator Spark Matsunaga of Hawaii.



## 1985

March 11

*Mikhail Gorbachev comes to power in Moscow.*

July 10

The Cosmos 1667 biosatellite carries two rhesus monkeys, ten rats, and ten newts into space. They are recovered after seven days. Specimens from the satellite go to U.S., Soviet, Czechoslovak, French, Bulgarian, Romanian, Polish, Hungarian, and East German researchers for analysis.

July 16

The American Institute for Aeronautics and Astronautics and The Planetary Society present the "Steps to Mars" conference in Washington, D.C., on the tenth anniversary of Apollo-Soyuz. The Apollo-Soyuz prime crews are present, as well as NASA Administrator James Beggs. Senator Matsunaga uses the conference to announce that he will introduce a congressional resolution calling for 1992 to be the International Space Year.

October

The First Congress of the Association of Space Explorers (ASE) is held in Cernay, France. The 25 astronauts and cosmonauts from 13 countries attending this meeting agree that the ASE should be a permanent organization aiming to "bring together astronauts of the world to collaborate on educational, environmental, international cooperation, and space exploration issues."

## 1986

January 28

*Shortly after launch on the STS 51-L mission, the Space Shuttle Challenger explodes, grounding the U.S. Shuttle fleet.*

February

*The Soviet Union launches the Salyut-based core module for Mir, the first permanent space station.*

March

European, Japanese, and Soviet spacecraft encounter Halley's Comet. The European Space Agency's Giotto craft flies nearest the nucleus. Its safe passage is made possible by the NASA Deep Space Network "Pathfinder" effort and Soviet Vega 1 and 2 Halley data.

September

The Heidelberg Conference summarizes International Halley Watch, Vega 1 and 2, and Giotto research findings. Results shared among researchers of many nations include those from the DUCMA dust detection experiment, a joint effort by Dr. John Simpson of the University of Chicago and the Space Research Institute in Moscow.

October 24

The United Nations Association of the United States releases *The Next Giant Leap: An Agenda for International Cooperation*, which calls for future cooperative space efforts to be focused on the Earth and Mars.



## 1987

**April 15**

The U.S. and the Soviet Union sign the "Agreement on Cooperation in Space Science," providing the basis for joint projects. This renews the 1972 Space Cooperation Agreement in modified form.

**May 17**

*The Soviet Union launches its first Energia heavy-lift launch vehicle. The flight is a partial success.*

**September 29**

The Cosmos 1887 biosatellite is launched from Baikonur Cosmodrome. It is recovered after 13 days, 3000 kilometers off target. The Vostok-based spacecraft carries radiation dosimetry, rodent bone growth, and primate calcium loss experiments from several countries, including the U.S.

**October**

To celebrate the 30th anniversary of the Sputnik 1 launch the Soviet Academy of Sciences holds a three-day "Space Future Forum" in Moscow. More than 600 space scientists attend, including more than 150 from the United States. The Soviets also invite international journalists, who are shown the control center for the Mir space station's Kvant astrophysics module. The module, which docked with Mir on April 12, 1987, features instruments from the Soviet Union, the U.K., West Germany, the Netherlands, and other countries. The Forum spotlights Soviet space achievements and the benefits of space cooperation.

**December**

During the Washington Summit with Reagan, Gorbachev calls for a joint U.S.-Soviet manned Mars mission.

## 1988

**February 10**

*Pravda* publishes a letter from Dr. F. Volkov which says Mars missions, cooperative or otherwise, should have a lower priority than the many problems at home in the Soviet Union.

**March 28**

A symposium on U.S.-Soviet space cooperation is held at the University of Alabama in Huntsville. Marshall Space Flight Center Director Rick Chappell moderates discussion between U.S. and Soviet space officials.

**May**

In an interview with the *Washington Post* and *Newsweek* before the Moscow Summit, Gorbachev says, "I will offer to President Reagan cooperation in the organization of a joint flight to Mars. That would be worthy of the American and the Soviet people."

**May 24**

Just before the start of the Moscow Summit between Gorbachev and Reagan, *Pravda* publishes an article entitled "The Way to Mars," by veteran space designers V. Glushko, Y. Semenov, and L. Gorshkov. The article calls for cooperation between the Soviet Union and the U.S. in Mars exploration.



- July 7** The Soviet Union launches Phobos 1 toward Mars.
- July 12** The Soviet Union launches Phobos 2 toward Mars. One of the Phobos spacecraft carries a plaque commemorating the 1877 discovery of Phobos by U.S. astronomer Asaph Hall. The plaque was presented to the Soviets at the Johnson Space Center on March 17, 1988. Ten U.S. scientists participate in the Phobos project. More than 15 countries contributed instruments to the two Phobos spacecraft. The spacecraft carry Long-duration Automated Landers with French, Hungarian, U.S., Soviet, and West German instruments. The landers will be deployed onto the larger of the two martian moons, Phobos, and possibly the moon Deimos. The countries involved have extensive plans for data sharing and joint experiments.
- July 18** *Time* magazine has as its cover story the pros and cons of a joint U.S.-Soviet manned expedition to Mars. The cover shows U.S. and Soviet flags against a background of the planet Mars, with the slogan, "Onward to Mars."
- September** A joint U.S.-Soviet solar observing program is planned for this month, using instruments on the U.S. Solar Maximum Mission satellite in Earth orbit and the Phobos 1 spacecraft bound for Mars. But Phobos 1 fails before the program is set to start, on August 31. Radio Moscow announces the failure October 12.
- September 29** STS-26 Discovery returns the U.S. to manned space flight.
- November 15** *The Soviet Union launches its first Buran space shuttle on the side of an Energia heavy-lift launch vehicle. The unmanned test flight lasts three and a half hours and ends on a runway four miles from the Buran launch pad at Baikonur Cosmodrome.*
- December** NASA awards prime contracts for the International Solar-Terrestrial Physics Program (ISTP) Wind spacecraft to GE Astro Space. The ISTP was started in 1977. It involves participation from NASA, the European Space Agency, Japan's Institute of Space and Astronautical Science, and the Soviet Institute for Space Research. In 1989 the U.S. and the Soviet Union agree that Wind will carry the Konus instrument, the first Soviet instrument to fly on a U.S. spacecraft. Wind is scheduled to be launched on a Delta 7925 launch vehicle from Cape Canaveral in 1993.

## 1989

- February** *The Soviets complete withdrawal from Afghanistan.*
- March** The Soviet Phobos 2 spacecraft fails in Mars orbit before it can rendezvous with the moon Phobos.
- September 15** The Cosmos 2044-Bion 9 international biosatellite carries 80 experiments from the Soviet Union, Canada, the European Space



Agency, the U.S., East Germany, Romania, Poland, Hungary, and Bulgaria into orbit for two weeks. Passengers include two macaque monkeys and numerous small plant and animal specimens. The thermal control system fails in the last days of the flight, affecting the experimental results.

**September 16** Boris Yeltsin, formerly Moscow Communist Party chief, now “prime chairman” of the Inter-Regional Group of Peoples’ Deputies, a dissident bloc of radical reformers in the Soviet legislative body, the Congress of Peoples’ Deputies, visits the Johnson Space Center during his first visit to the U.S. He tours a mockup of Space Station Freedom with JSC Director Dr. Aaron Cohen and other NASA officials.

**November** *The Berlin Wall comes down.*

**November** The U.S.-U.S.R. Planetary Exploration Working Group ratifies a plan to transfer an infrared mapping instrument from the U.S. Mars Observer to the Soviet Mars 94 mission.

**December** *Bush-Gorbachev summit in Malta*

**December** A briefing is held in Moscow on the U.S. Orbital Debris Program. The U.S. delegation visits Zvezdny Gorodok and spends four days in discussions at the Mission Control Center with representatives from the Soviet Ministry of Defense, the Ministry of General Machine Building, the Foreign Ministry, and the Institute for Space Research. A joint Orbital Debris Working Group is set up.

## 1990

**March 13** *The Soviet Congress of Peoples’ Deputies repeals Article 6 of the Soviet Constitution, which gave the Communist Party of the Soviet Union a monopoly on political power.*

**July 15-September 5** The First U.S.-U.S.R. Exobiology Expedition explores Siberia in an effort to locate Mars-like biomes on Earth.

**October 3** *Germany is reunited.*

**October 9** Dr. Bruce Murray, former director of the Jet Propulsion Laboratory, presents the plenary address at the Dresden International Astronautical Federation Conference. The title of the address is “Can Space Exploration Survive the End of the Cold War?” In it he suggests that the end of the Cold War opens new opportunities for cooperation.

**December 10** U.S. Secretary of State James Baker and Soviet Foreign Minister Eduard Shevardnadze visit the Johnson Space Center.



## 1991

**February** *The Salyut 7 space station makes an uncontrolled reentry, raining debris on Argentina.*

**June 12** *Boris Yeltsin is elected President of the Russian Federation.*

**July** The U.S.-Soviet Technical Interchange Meeting at Ames Research Center begins the process of preparing the Cosmos-Bion 10 (also called Cosmos '92) biosatellite mission. (Launch is initially scheduled for July 1992, but actually takes place on December 29, 1992.)

**July 1** *Aviation Week & Space Technology* magazine reports that a major U.S.-Soviet space cooperation agreement is being prepared.

**July 1** *The Warsaw Pact alliance, which abolished its military structure in March, officially ceases operation.*

**June 31** At a summit meeting in Moscow, Presidents George Bush and Mikhail Gorbachev sign an agreement calling for the first U.S.-Soviet manned space flights since Apollo-Soyuz, including a visit by a U.S. astronaut to Mir aboard a Soyuz-TM spacecraft, and a flight by a Russian cosmonaut on a Shuttle-Spacelab mission. They also discuss the possibility – favored by the Soviet side – of a U.S. module for the Mir space station. The agreement establishes a coordinating mechanism to move talks on space cooperation to a higher level in the Kremlin and the White House, and formally invites Soviet participation in the U.S. Mission to Planet Earth program.

**August** The final results of the experiments aboard the joint U.S.-Soviet Cosmos 2044 biosatellite, launched in September 1989, are presented at a conference in St. Petersburg (formerly Leningrad) in the Soviet Union.

**August 11-14** The Second Meeting of the Orbital Debris Working Group is held in St. Petersburg.

**August 17** NASA Deputy Administrator Samuel Keller returns to the U.S. after leading a delegation to the Plesetsk Cosmodrome for the launch of a U.S. ozone mapper on the Soviet Meteor-3 satellite.

**August 18** Representatives of the U.S.-based Planetary Society arrive in the Kamchatka Peninsula of eastern Siberia to take part in Soviet tests of a prototype rover (sometimes called the “marsokhod”) designed for the Mars 96 mission.

**August 18-22** *Failed coup d'etat in Moscow.*

**August 24** *Gorbachev resigns the post of General Secretary of the Communist Party of the Soviet Union and disbands the Central Committee, including the Politburo.*



## IX. The End of the Soviet Union

September 1991 - October 1992

The Commonwealth of Independent States (C.I.S.) was created to coordinate the activities of the politically independent but economically interdependent countries emerging from the collapse of the Soviet Union. The dominant Slavic states (Russia, Ukraine, and Belarus) negotiated formation of the C.I.S., and most of the non-Slavic states signed up out of recognition of economic realities.

Soviet space facilities could be found in all parts of the Soviet Union, though central control remained in Moscow. Russia retained direct control over the Northern Cosmodrome at Plesetsk, from which Earth observation satellites, both nonmilitary and military, could be launched into polar orbits. The cosmonaut training facilities remained at Zvezdny Gorodok, outside Moscow. But the main launch facility, the Baikonur Cosmodrome, fell under control of Kazakhstan. It contains the launch facilities for the Soyuz-TM, the Energia heavy-lift rocket, the Buran space shuttle, and expansion modules for the Mir space station in Earth orbit.

Efforts to market Soviet space hardware and services began before the collapse of the Soviet Union. But after the failed coup the value of the old Soviet currency, the ruble, collapsed, playing havoc with space budgets. C.I.S. space officials turned to the West in search of investment to keep their projects alive. Officials with many of the world's space agencies sought to extend their own shrinking budgets by forming cooperative links with Russia and the C.I.S. The U.S., Japan, the European Space Agency, and some members of the ESA acting alone – notably Germany – competed to cooperate with the former Soviet Union. The traditional bipolar competitive dynamic dating from the days of Sputnik 1 and Yuri Gagarin virtually ceased to exist.

Rumors that the orbiting Mir space station was up for sale were greatly exaggerated – though Mir 2, under construction, was on offer. Two cosmonauts continued to work aboard Mir as their home country fragmented below them. When Sergei Krikalev returned to Earth on March 25, 1992, his Soyuz-TM 13 descent module bumped down on foreign soil, in the newly sovereign country of Kazakhstan. Eight months later, in November 1992, Krikalev would arrive in the U.S. with cosmonaut Vladimir Titov to begin training for a flight aboard the U.S. Shuttle *Atlantis* on STS-60.

**August 26** *Aviation Week & Space Technology* quotes Samuel Keller as saying that NASA has orders to put cooperative space ventures with the Soviets “on hold” in the wake of the attempted coup in Moscow. At the same time, he says, “we’ve been told not to cancel anything.”

**August 31** *Ten of the fifteen republics of the Soviet Union declare independence by this date.*

**October** The Chief Designer of the Mir Space Station, Leonid Gorshkov, visits Houston. Mir life support systems and Soviet experience with orbital debris gained during the Mir program are discussed.

**November** NASA Administrator for Exploration Michael Griffin says NASA has rejected proposals that the U.S. place experiments on the Soviet Mars 94





spacecraft. According to Griffin, NASA thinks the plan is too risky, as it is unlikely the Mars 94 mission will go ahead as planned or that NASA will have experiments ready in time for its launch.

## December

Top Soviet space officials meet their U.S. colleagues in the U.S. to establish bilateral or global communications satellite links for exchanging medical information. This is a follow-on to the Telemedicine Spacebridge satellite link set up after the 1989 Armenian earthquake and the Ufa train explosion. Belgian, Canadian, and Mexican representatives are also present.

**December 25** *Mikhail Gorbachev resigns as President of the Soviet Union. Effective end of the Soviet Union.*

**December 30** *Nine former Soviet republics sign a 12 article agreement on the disposition of the Soviet space program in Minsk, Belarus. The participating republics pledge "proportionate contributions" to support the space program.*

## 1992

This is the International Space Year. According to *Aviation Week & Space Technology* magazine (January 13), some three dozen countries plan about 170 cooperative space projects.

## January

At the 9th Symposium on Space Nuclear Power Systems in Albuquerque, New Mexico, the Russians suggest cooperation with the U.S. in the development of nuclear thermal propulsion systems for the Space Exploration Initiative. Nikolai N. Ponomarev-Stepnoi, Deputy Director of the Kurchatov Institute of Atomic Energy in Moscow, says, "Our technology supersedes American technology in some areas, and it would reduce costs if it were used." Ponomarev-Stepnoi goes on to say that the design team is still together, and that "so long as we believe we will cooperate with the West, the team will stay together." But he adds, "if the West doesn't show some activity, it will be very difficult to keep them from taking jobs in the Third World."

## January

*Aviation Week & Space Technology* magazine (January 27) summarizes U.S. interest in former Soviet space technology as being in the areas of composite materials, boundary layer turbulence and transition, and high speed wind tunnel testing of Space Shuttle tiles. Jerry Thomson, Executive Scientist with Aerojet, is quoted as saying, "They have done things in rocket engines that we had considered considerably beyond the state of the art. We have a number of areas we want to pursue with the Russians, but we badly need clarification about how far we can go."

## February

Viktor V. Kerzhanovich, deputy for rover science payloads, small surface stations, and the balloon on the Mars 94 exploration mission at



the Institute for Space Research, calls for international funding to save the Mars 94 program. He says runaway inflation in the former Soviet Union is disrupting budgets, making planning impossible.

**February**

*Russian President Boris Yeltsin signs a decree forming the Russian Space Agency. Yuri Koptev is made Director General.*

**February**

*The former Soviet republic of Azerbaijan forms ANAKA, an "aerospace agency."*

**February 28**

Russian military officials suggest a joint Russian Defense Ministry-United States Space Command satellite decay tracking experiment using Pion subsatellites deployed from the Russian Resurs-F Earth observation satellite. As part of the meeting international representatives, including representatives from the U.S., are briefed on Russian space surveillance and are allowed to watch controllers command the destructive reentry of the Gamma astrophysics satellite.

**March**

A group of engineers headed by Arnold D. Aldrich, the NASA Associate Administrator in charge of Space Station Freedom, meets with Russian government officials and Energia Design Bureau engineers in Moscow. They discuss use of the Soyuz-TM spacecraft as a lifeboat for Freedom, and receive a briefing on the Russian automatic docking system in use aboard Progress-M, Soyuz-TM, and Mir.

**March 2**

*Ukrainian President Leonid Kravchuk announces creation of the National Space Agency of Ukraine.*

**March 27**

According to *Aviation Week & Space Technology* magazine, the White House signals an important shift in U.S. policy when it approves the purchase of \$14 million in Russian space hardware. The U.S. buys a Topaz-2 space nuclear power system, four electric thrusters, and several kilograms of plutonium-238 for use in radioisotope thermal generators. The five to seven kilowatt Topaz-2 is purchased by the S.D.I. Organization for study at a special facility in Albuquerque, New Mexico.

**May**

Engineers from the U.S., Russia, France, and Hungary gather in Death Valley to test a Russian prototype Mars rover to be used on the Mars 96 mission. The test is sponsored by The Planetary Society at a cost of \$120,000.

**May**

Germany and France sign agreements to help pay for the Russian Mars 94 and 96 exploration programs. Russian Institute for Space Research chief scientist Viacheslav Linkin says, "The U.S. response has been slower than the European response," as far as taking advantage of opportunities for cooperative ventures is concerned.

**May**

Leonid Kravchuk tours the Johnson Space Center.



**June** Energia Design Bureau of Russia proposes creation of a stockholding company to raise money to complete the development of the Energia-M booster. Universal Trade and Transfer of Denver is authorized to market the rocket in the U.S. An Energia official makes a “conservative” estimate of its first launch date as sometime in 1996.

**June** The Third Meeting of the Orbital Debris Working Group takes place at the Institute of Radio Physics in Moscow. The Russians provide a review of their space surveillance techniques and capabilities. The sides discuss future joint flight projects, including using Russian Pion subsatellites in orbital tracking experiments.

**June 17** In Washington, Presidents Bush and Yeltsin sign agreements calling for far-reaching U.S.-Russian space cooperation. They include plans for a Russian cosmonaut to fly aboard the Space Shuttle; for a U.S. astronaut to fly to the Mir space station; for a Shuttle to dock with Mir; for U.S. participation in the Mars 94 exploration program; and for study of the use of the Soyuz-TM as a lifeboat for Space Station Freedom. The agreements also renew for five years the 1987 “Agreement on Cooperation in Space Science,” which lapsed with the break-up of the Soviet Union.

**June 18** NASA signs a \$1 million, one-year contract with the Russian Space Agency to begin evaluating Russian space technology, including the Soyuz-TM manned spacecraft, for use in the U.S. space program.

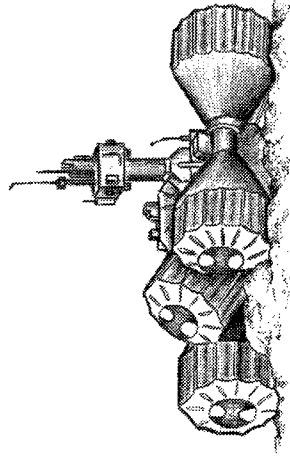
**July 2** The unmanned Progress-M 13 supply ship aborts approach to the Mir space station complex because of a rendezvous system software problem. On July 4 the spacecraft successfully docks with Mir. In late July NASA Administrator Daniel Goldin, who was in Russia when the abort occurred for talks on using Russian space hardware in the U.S. space program, said his Russian hosts did not tell him of the problem.

**July 6** *Aviation Week & Space Technology* magazine reports on a joint manned Mars mission study conducted by Stanford University’s Space Systems Engineering department, with input from Russian scientists. Christopher McKay, of NASA’s Solar System Exploration Office, says the study is important because “they can do what NASA, for political reasons, can’t do – that is plan a joint mission.” The proposed mission depends heavily on the Energia heavy-lift launch vehicle and other Russian hardware. Its \$70 billion cost is much lower than most estimates for a U.S.-only mission. The mission would deliver six astronauts to Mars in 2009 for a 500-day stay.

**August** Officials with Energia Scientific and Industrial Corporation (formerly the Energia Design Bureau) unveil a redesigned version of the proposed Mir-2 space station. The Russians invite international participation in the Mir-2 program. No date is given for the station core’s launch atop an Energia-M booster, but *Aviation Week & Space Technology* quotes an



The prototype semiautonomous Mars rover shown here was tested in Death Valley and on Siberia's Kamchatka Peninsula. The Russians plan to explore Mars with a similar rover – and international financial support – in 1996.



Energia SIC official as saying, “Europe and America must understand that Russia’s space program will go on despite the problems we face.”

**August**

Yuri Koptev, the Director of the Russian Space Agency, tours the Johnson Space Center.

**August 5**

A Russian official confirms a bid of \$35 million for Russia to launch the Inmarsat-3 satellite in the mid-1990s. The bid is 40 percent less than French and U.S. bids. An Arianespace official responds, saying “if Russia offers a cheap price, Russia will win business. If the market falls apart afterward, I hope no one is surprised.”

**August 7**

Samuel Keller is made Associate Administrator for Russian Programs at NASA Headquarters in Washington, D.C.

**August 19**

The Russian Space Agency launches a Vostok-based Resurs-F imaging film return spacecraft. It carries a Beryllium 7 collection experiment designed and built by the U.S. Air Force Space Test Program and the Naval Research Laboratory. Resurs-F also carries two Pion subsatellites for space tracking exercises. Despite Russia’s invitation in February, there is no formal U.S. participation in the tracking project. However, the U.S. Space Command Space Surveillance Center tracks the subsatellites as part of its routine operations, and unclassified data will be made publicly available. According to Nicholas Johnson, an expert on Soviet/Russian space activities and senior scientist with Kaman Sciences, informal cooperation and sharing of unclassified data is virtually assured.

**August 25-27**

Officials of the U.S. aerospace contractor Lockheed meet with their counterparts from Energia Scientific and Industrial Corporation, the builder of the Soyuz-TM. They produce a two-page Memorandum of Understanding, which calls for the two companies to study using the Soyuz-TM as an Assured Crew Return Vehicle (ACRV) for Space Station Freedom.

**August 31 –  
September 2**

As part of the World Space Congress in Washington, D.C., sixteen prototype Mars rovers are displayed outside the Smithsonian Institution. Most are of U.S. design, but the Russian “marsokhod” tested in Death Valley and on the Kamchatka Peninsula is also present.



**September**

The Fourth Meeting of the Orbital Debris Working Group is held in Washington, D.C. The sides exchange catalogs of orbiting objects and continue discussions of Pion subsatellite tracking experiments.

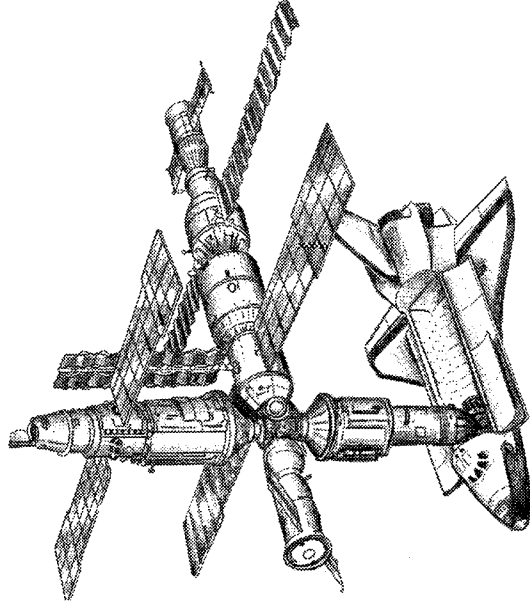
**September**

Japan and Germany agree to join the C.I.S., led by the Russians, in developing reusable space capsules with the potential for carrying crews. According to *Aviation Week & Space Technology*, the agreement represents a "major realignment" for 21st century space projects, with Germany and Japan shifting away from the European Space Agency and the U.S. In the planned program Japan will provide H-2 boosters, Germany will be program lead and will provide advanced technologies, and the C.I.S., led by Russia, will supply reentry vehicle technology and possibly launch support and manned life support systems technology.

**September 12** *NASA launches the Space Shuttle Endeavour on the STS-47 Spacelab J mission. In addition to six U.S. crew members and various U.S. experiments, Endeavour carries more than thirty Japanese experiments in a European-built Spacelab long module, and Mamoru Mohri, a Japanese payload specialist.*

**September 25** *The U.S. launches the Mars Observer toward Mars on a Titan 3 rocket.*

**September 27** In a *Space News* editorial called "Space as a Tool of Goodwill," former Soviet space official Roald Sagdeev (now distinguished professor of physics at the University of Maryland, College Park) comments on the International Space Year (ISY), the future of Russian space exploration, and prospects for space cooperation. He reports that Russian President Yeltsin will not celebrate the 75th anniversary of the Bolshevik Revolution in November. This is one of the events originally linked to the ISY (the



This conjectural drawing depicts a U.S. Shuttle visit to Mir, the planned culmination of the current round of U.S.-Russian space cooperation.



others are the 500th anniversary of the arrival of Columbus in the Americas and the 35th anniversary of the launch of Sputnik 1). Referring to the Buran space shuttle, he says “most individuals will not suffer from the eradication of its mission.” Sagdeev reports that some have compared the Energia heavy-lift launch vehicle to “Tsar Ivan’s Bell,” a church bell commissioned by Ivan the Terrible, which was so big it could not be used in the church tower for which it was intended. But he urges that its potential be more fully explored both inside and outside Russia.

**October 4**     *35th anniversary of the launch of Sputnik 1 by the Soviet Union.*

**October 12**     *500th anniversary of the arrival of Columbus in the Americas.*

**October 12**     Jean-Marie Luton, Director General of the European Space Agency, and Yuri Koptev sign an accord calling for continued space cooperation between Russia and Europe. The accord builds on meetings held between the ESA and “various Russian entities” under terms of an agreement reached in April 1990 between the ESA and the Soviet Union. It calls for the two space agencies to “actively pursue the cooperation in which they have been engaged for several years in the fields of space science, microgravity research and Earth observation.”

**October 12**     Yuri Koptev and Daniel Goldin meet in Moscow for the First Annual U.S./Russian Space Policy Consultations. They sign agreements detailing a Shuttle mission to visit Mir, a stay by a U.S. astronaut aboard Mir on a mission dominated by life sciences experiments, and U.S. participation in the unmanned Mars 94 mission.



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