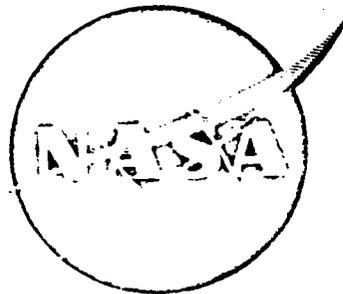

OFFICE OF MANNED SPACEFLIGHT

**APOLLO - SOYUZ
TEST PROJECT**

**PROJECT APPROVAL
DOCUMENT**



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

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

PROJECT APPROVAL DOCUMENT

RESEARCH AND DEVELOPMENT

Hardware Development/Flight

1. Code Number:

Apollo Spacecraft (CSM)	96-930-966-11
Docking Module and Mechanism	96-930-966-20
Experiments	96-930-966-30
Launch Vehicle	96-930-966-40
Launch Operations	96-930-966-50
Mission and Flight Operations	96-930-966-60
Mission and Flight Support	96-930-966-70

2. Program: Apollo/Soyuz Test Project (ASTP)

3. Project Title: Apollo/Soyuz Test Project (ASTP)

4. Objectives:

The primary objective of the joint flight of an Apollo spacecraft and a Soyuz-type spacecraft is to develop and test systems for rendezvous and docking of future manned spacecraft and stations that would be suitable for use as a standard international system. This will include the rendezvous and docking of Apollo and Soyuz using new equipment as required for compatibility. The conduct of this test mission will include the following:

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

(b) Testing of androgynous docking assemblies.

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

(d) The performance of certain activities of USA and USSR crews in docked flight.

(e) Gaining of experience in conducting joint flights by USA and USSR spacecraft, including, in case of necessity, rendering aid in emergency situations.

(f) Performing experiments (to be determined)

General Mission Description:

This test mission will use presently operational Soviet and American space equipment to test the technical requirements and solutions agreed to by the USA and USSR for compatibility of rendezvous and docking systems for future spacecraft and space stations. This mission will involve the rendezvous and docking of the USA Apollo spacecraft with a USSR Soyuz-type spacecraft, using a USA docking module which will be designed to adapt between the present incompatibilities of the two operational space vehicles.

The Apollo spacecraft will be launched on the Saturn IB. The docking module will be stowed in the SLA and extracted while in earth orbit in a manner similar to that performed with the LM on a lunar mission. The docking module will have the new androgynous docking mechanism on its forward end which will mate with a compatible unit mounted on the

Soyuz, and the docking module will serve as an airlock for atmosphere adaptation for crew transfer.

The docked duration of the mission will be approximately two days, during which time American crewmen will visit in the Soyuz spacecraft and a Soviet crewman will visit in the Apollo spacecraft. Joint activities will be conducted, such as television transmissions, photography, and eating.

After final separation of the two space vehicles, each will continue its own activities independently.

5 ~~2~~ Technical Plan:

Apollo Spacecraft

To perform the rendezvous and docking test mission the USA will use the Apollo spacecraft CSM 111 and will incorporate such modifications as are necessary to accommodate unique mission requirements.

Docking Module and Docking Mechanism •

To permit a USA CSM to dock to a USSR Soyuz spacecraft and to provide for crew transfer between two such spacecraft, a docking module and an androgynous docking mechanism are to be developed. A similar androgynous docking mechanism will be developed by the USSR and will be mounted on the Soyuz spacecraft.

The proposed docking module will serve as an airlock for the simultaneous internal transfer of two crewmen

between the different atmospheres of the two spacecraft and will contain some of the new equipment required for the mission. It will be equipped with the necessary stored gases, displays and controls for safe operation of the two pressure levels. It will contain a transceiver capable of operating at the USSR frequency to be used for spacecraft to spacecraft communications. Provisions will be made for TV to assist in docking and to provide coverage of activities within the docking module.

The new docking mechanism is to be attached to the forward end of the docking module. The design is such that the alignment and latching mechanisms will be capable of functioning with identical components on the Soyuz-type spacecraft. The shock attenuation and retraction mechanisms of the USA and USSR designs must meet identical operational specifications but are not required to be of identical design. Provisions will be made for two docking modules - 1 flight and 1 backup which may also be used as a thermal vacuum test module. Six docking mechanisms will be provided, 1 flight, 1 spare and 4 test.

Launch Vehicle

The Saturn IB 210 will be used as the launch vehicle. The similarity of the required insertion orbit to those planned for Skylab will make its use in ASTP nearly identical to its use in that program.

Launch Operations

Test and checkout operations of the USA space vehicle will be conducted at KSC. Launch will be from Launch Complex 39.

Mission Operations

The Apollo/Soyuz Test Mission will utilize joint mission control capabilities of the USA and USSR. Flight control of the Apollo spacecraft will be accomplished by Houston Mission Control Center and that of the Soyuz by the USSR Control Center. Appropriate communication links will be established between the USA and USSR Flight Control Centers.

Training

The necessary training will be conducted in each country so that both country's flight crews and ground operations personnel will become familiar with the other country's vehicles and equipment.

Mission Backup Provisions

The ASTP Project has identified Saturn L/V 209 and CSM 119 as backup vehicles. These vehicles are those currently assigned as the Skylab backup rescue vehicles. In the event these are utilized in the Skylab Program, the status of the available Apollo, Skylab and ASTP hardware will have to be reviewed at that time to determine whether

provisions for backup can be provided. The current plan only includes the costs of manufacture of kits required to modify the backup CSM 119 into ASTP configuration but does not include the costs of mod kit installation, checkout, launch and mission operations for the backup vehicle. Backup launch options currently being studied for possible future management decisions are:

- (a) Backup launch using CSM 119/LV 209 in the 1975 launch window which ends 1 October 1975.
- (b) Backup launch using CSM 119/LV 209 in the early 1976 launch window which begins April 1976.
- (c) Backup launch using CSM 115/LV 211 in July 1976 assuming Skylab uses the currently assigned backup vehicle.

The Soyuz Spacecraft

The exact configuration of the USSR spacecraft to be used in the test mission will be a modification to the basic Soyuz design. It will include a compatible androgynous docking mechanism and will carry an Apollo VHF transceiver which will provide ranging data and communications between the two spacecraft. In addition, the Soyuz will contain provisions for attachment of the Apollo crew communication harness, biomed harness and USA TV camera. These will be linked to the Apollo spacecraft communication system by means of a built-in harness and connectors in the docking

module. The docking module will also provide similar connectors for use by the USSR crew when located in either the docking module or the CSM.

6. Facility Plan:

Apollo/Skylab test, launch, and flight control facilities will be used. The facilities may require modifications to adapt to the testing and handling of the new components of the docking system. The Apollo docking test facility at MSC will be modified to enable development and joint testing of the androgynous docking systems.

7. Procurement Strategy:

The ASTP will utilize both in-house and contractor support in the definition, design, development, testing and operation of hardware required for the program.

Modifications to spacecrafts CSM 111 and CSM 119 selected for flight and backup operations will be accomplished by the CSM development contractor North American Rockwell (NR). The docking module and docking mechanism have been awarded to NR by noncompetitive procurement using a CPFF type of contract. Launch vehicles SA 210 and 209 have been selected for flight and backup operations. Currently approved modifications will be installed by the prime contractors as the stages are being processed through the post storage and modifications checkout. For modifications approved subsequent to this,

the mod kits will be designed and manufactured by the prime contractors until the last flight of Skylab, after which the mod kits will be designed and manufactured in-house MSFC. Mod kits installation will then be accomplished by KSC.

A change in concept for launch vehicle support and launch operations will be required from the present Apollo method of operation necessitating major contractual changes. MSFC will provide necessary launch vehicle support making principal use of in-house civil service capabilities with minimum contractor support for flight program software, logistic spares and documentation. KSC will make use of a level of effort contractor support contracted with each of the stage, spacecraft, and ground support contractors to provide the technicians required and the minimum level of engineering required. KSC will make use of in-house civil service personnel to perform most launch vehicle, spacecraft and GSE subsystem operations and engineering as well as integration within the stages.

8. Program/Project Management Plan:

The Associate Administrator for Manned Space Flight (AA/MSF) is responsible for the planning, direction, execution, and evaluation of assigned projects and activities concerned with manned space flight. He exercises institutional management authority over George C. Marshall Space Flight Center,

the Manned Spacecraft Center and the John F. Kennedy Space Center. His role and responsibilities are prescribed in NMI 1138.1A dated April 23, 1971.

The Apollo Program Director is responsible to the AA/MSF for carrying out the Apollo Soyuz Test Project. He is responsible for establishment of overall technical requirements, program standards and management policies and procedures to accomplish program objectives. He directs and coordinates the Apollo/Soyuz Test Project activities of the three MSF Centers through the Apollo Program Manager at each center. Center Program Managers report organizationally to the Center Director but are responsible to project direction from the Apollo Program Director.

The Apollo/Soyuz Test Project responsibilities of the three MSF Centers are:

Manned Spacecraft Center (MSC) is responsible for modification of the Apollo Command and Service Module (CSM), the docking module and docking system, and associated ground support equipment, flight crew training, crew equipment development, development and implementation of manned space flight experiments, launch support and mission planning and operations.

MSC is responsible for the required interfaces with the USSR within the constraints of the Low-Keldysh agreement (Attachment C). The Apollo/Soyuz Test Project Director

within the Apollo Spacecraft Program Office at MSC is responsible for carrying out direct negotiations with the USSR through the use of joint technical working groups. In those areas required for overall program control, the Apollo Program Office will be responsible for establishing guidelines within which the Project Director will negotiate agreements with the USSR. These guidelines will be coordinated as necessary with other NASA organizational elements by the Apollo Program Office.

Subsequent to the signing of the agreements by the respective USA and USSR Project Directors, the Apollo Program Office will process the agreements for review and concurrence of necessary NASA elements for forwarding by AA/OMSF to the Deputy Administrator for approval with the USSR Academy of Sciences.

Marshall Space Flight Center (MSFC) is responsible for the Saturn IB launch vehicle, associated ground support equipment, launch and flight operations support.

Kennedy Space Center (KSC) is responsible for the Apollo/Soyuz Test Project launch facilities and common GSE, and for Apollo/Soyuz Test Project launch operations.

The roles and responsibilities of the three MSF Centers are contained in NMI's 1142.1, 1142.2A, and 1164.6A respectively.

Goddard Space Flight Center (GSFC) as the implementation center for the Office of Tracking and Data Acquisition, is responsible for providing tracking, data acquisition, and communications necessary to obtain and reduce orbital data from manned space flight vehicles as prescribed in the Apollo/Soyuz Test Project. Detailed requirements for Space Tracking and Data Network support of the Apollo/Soyuz Test Project will be established through the Program Support Requirements Document (PSRD). GSFC is the responsible agency for testing network equipment to meet operational readiness criteria.

Department of Defense forces, facilities and assets are used for manned space flight support operations. The major services provided are flight crew and spacecraft recovery and range services at the Eastern Test Range. Other support provided by DOD includes specialized facilities at various bases; maps, charts and geodetic data; biomedical research; and launch and tracking support. Detailed requirements will be established through the PSRD. The Secretary of Defense has designated the DOD Manager for Manned Space Flight (DDMS) as the point of contact for NASA with respect to support provided by DOD.

9. Controlled Items:

1. Changes to the Program Objectives as stated in the PAD.

2. Changes to the approved official launch schedule of 3rd quarter CY 75.

3. Changes to the magnitude of direction of the technical plan.

4. Increases to obligations for each fiscal year at the Budget Line Item level, and changes to runout requirements (Attachment B).

5. Changes in assignment of major management or programmatic responsibilities of industry, universities, other agencies and field centers.

6. Changes to Inter-agency and International agreements.

7. Facility projects to support the program above \$250,000.

8. Actions requiring Congressional notification.

10. Attachment A: Project Schedule:

(See Apollo/Soyuz Test Project Schedule Figure 1)

11. Attachment B: Resources:

(a) Funding: See Figure 2

(b) Manpower: All MSF Civil Service and Support Contractor manpower allocations are controlled through the Development, Test and Mission Operations PAD.

12. Attachment C: International and Inter-Agency Agreements:

(a) Summary of Results of Discussions on Space Cooperation between the Academy of Sciences of the USSR

and the US National Aeronautics and Space Administration, Moscow, January 18-21, 1971, (Low-Keldysh).

(b) Summary of Results of Discussions on Space Cooperation between the Academy of Sciences of the USSR and the US National Aeronautics and Space Administration, Moscow, April 4-6, 1972.

(c) US/USSR Space Agreement, Moscow, May 24, 1972.

PAD

Submitted by: _____ Date: _____
Associate Administrator
for Manned Space Flight

Concurred by: _____ Date: _____
Deputy Associate
Administrator (Planning)

Concurred by: _____ Date: _____
Assistant Administrator
for Administration

Concurred by: _____ Date: _____
Associate Administrator for
Organization and Management

Approved by: _____ Date: _____
Deputy Administrator

APOLLO/SOYUZ TEST PROJECT CONTROL MILESTONES

FINAL DESIGN REVIEWS	PDR CDR	10/31 ▼	4/30 ▼		
US/USSR FINAL JOINT REVIEWS	DESIGN ACCEPTANCE PREFLIGHT COMPATIBILITY FRR		12/1 ▼	12/1 ▼	5/1 ▼
QUAL TEST	DOCK MODULE DOCK MECH.			<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">4/1 ▼</div> <div style="text-align: center;">7/1 ▼</div> </div> <div style="display: flex; justify-content: space-around; align-items: center; margin-top: 5px;"> <div style="text-align: center;">4/1 ▼</div> <div style="text-align: center;">10/1 ▼</div> </div>	
HARDWARE DELIVERY KSC	SA 210 (AVAIL FOR SHIP) CSM-III D MOD D MECH		11/1 ▼	<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">9/1 ▼</div> <div style="text-align: center;">11/1 ▼</div> <div style="text-align: center;">12/1 ▼</div> </div>	
LAUNCH					JULY ■
		1972	1973	1974	1975

FIGURE I
(ATTACHMENT A)

APOLLO RESOURCES SUMMARY

Code Number 96

<u>Project</u>	<u>FY 1973 and Prior</u>	<u>FY 1974</u>	<u>Total</u>
Apollo Spacecraft (CSM) Modifications	11.5	28.4	63.2
Docking Module and Mechanism	28.6	15.7	44.3
Experiments	-	5.0	10.0
Launch Vehicle	-	13.0	28.1
Launch Operations	-	20.0	60.8
Mission and Flight Operations	-	.5	3.9
Mission and Flight Support	<u>5.3</u>	<u>12.4</u>	<u>39.7</u>
Total	45.4	95.0	250.0

FIGURE 2
(ATTACHMENT B)