Air and Space this Week

Item of the Week

THE HANDSHAKE IN SPACE: THE APOLLO-SOYUZ TEST PROJECT

Originally appeared July 11, 2022

KEY WORDS: Apollo-Soyuz Test Project Handshake in Space Stafford Brand Slayton Leonov Kubasov

The United States and the Soviet Union were competitors in the Cold War's Space Race. Both sides made the Moon their objective. The USA got there with six Apollo missions, and the USSR had three successful robotic sample return missions. Within six years of Apollo 11*, it was time for the two countries to cooperate, rather than compete, in Space operations, a partnering that continues with the* International Space Station*. Recent developments have strained, but not broken, this relationship.*

The big moment in the initiation of Space cooperation occurred on ***July 17, 1975****, forty-seven years ago this week, with the launch of the Apollo-Soyuz Test Project. NASA and the USSR counterparts had designed and built a docking adapter that would fit an Apollo capsule on one side and a Soyuz capsule on the other. Astronauts and cosmonauts could use it to move from one capsule to the other. The iconic pictures of spacemen from both sides meeting in orbit and sharing a handshake and some food illustrated the international cooperation that Space exploration makes possible, at least when both sides desire it.*

THE POLITICAL ENVIRONMENT OF 1975

The 1970s were a time of change in many areas, but particularly in geopolitics. Vietnam was winding down, and *détente* was becoming the word of the day (a French word meaning "release from tension" and applied to geopolitics). Détente had the possibility of easing international tension, reducing the prospects of nuclear war, and creating new economic opportunities for all concerned. Its start is generally regarded as the first Strategic Arms Limitation Talk and the summit meeting between Presidents Nixon and Brezhnev in Moscow in May, 1972. Nixon and Brezhnev signed seven different agreements at that first summit, adopting the agreements reached in the SALT as well as others concerning cooperative research, including Space. The U.S. Congress approved the SALT treaty, and also agreed to a three-year agreement to sale grain to the USSR. A second summit was held in the US in 1973, and reaffirmed the two superpowers' commitment to SALT principles, but international comity slackened by the time of the third summit meeting, in June, 1974. Nixon was deeply embroiled in Watergate by then, and Congress was angry with the USSR's treatment of Soviet Jews. President Carter conducted a human rights campaign backed by a military buildup, which

Copyright 2022 by Steven H. Williams
Non-commercial educational use allowed

further diminished détente, and President Reagan's pro-defense approach to foreign policy killed it.

Apart from the first Nixon-Brezhnev summit, the high point of the détente period came in 1975, when President Ford and Brezhnev, along with 33 other countries, signed the Helsinki Accords. The signatory nations recognized the permanence of the post-WWII boundaries (including Ukraine) and to "respect human rights and fundamental freedoms, and to cooperate in economic, scientific, humanitarian, and other areas."

The Helsinki three-day conference concluded on August 1, 1975. I like to think of the conference as the exclamation point on a demonstration of post-Cold War cooperation, the Apollo-Soyuz Test Project (ATSP).

COOPERATION PRELIMINARIES

A large, international Space effort does not leap into being overnight. The groundwork for what to come actually began in 1969. The U.S. was going to win the race to the Moon, but the Soviets were making strides forward in building a viable Space Station. NASA Administrator Thomas Paine began a correspondence with his Russian counterpart, Soviet Academician Keldysh, aimed at finding a way for the superpowers to cooperate in Space endeavors. The Soviets seemed interested, and President Nixon publicly confirmed his support for the concept on July 10, 1970. NASA geared up to study how to best accomplish and coordinate some sort of joint mission. It's not like the two sides had never cooperated in scientific explorations before; the International Geophysical Year in the late 1950s is a great example.

Cost and time constraints and other considerations precluded the joint development of a totally-new spacecraft. Rather, NASA's Office of Manned Spaceflight (OMSF) began to work in earnest on the technical aspects of joint mission scenarios. This was not a simple problem. Apollo hardware was designed for a lunar mission, with a lot of maneuvering and docking capabilities; the Soyuz capsule then in use was designed to go into low-Earth orbit only, but they were capable of rendezvous and docking without on-board cosmonaut control. The two capsule's hatch and docking equipment were quite incompatible. The capsule air pressure was a problem, too; the Soviets used standard atmospheric composition and pressure, while NASA used pure oxygen at ~5 PSI.

The U.S. Skylab program was well underway at that time, and there was little interest in making late modifications to it to allow a Soviet visit, although there was interest in developing a compatible docking mechanism in the future. But the technical issues over building some sort of adapter that would dock with Soyuz on one side and Apollo on the other, using Apollo's on-board maneuverability, was do-able, as was solving the air pressure issue.

Talks between NASA and their Soviet counterparts began in late 1970 in Moscow. Robert Gilruth, head of the Manned Spaceflight Center, was to bring along with Caldwell Johnson, an expert on mechanical/electrical engineering, and Glynn Lunney, a flight control expert. They would be joined by Marshall SFC's George Hardy, Chief of Program Engineering and Integration

Copyright 2022 by Steven H. Williams
Non-commercial educational use allowed

for Skylab (to cover the possibility the mission would involve a Soyuz docking with Skylab), a NASA HQ International Affairs person, Arnold Frutkin, and a State Department interpreter, William Krimer.

The problems faced by *Apollo 13* earlier that year illustrated the possibility that astro/cosmonauts might require rescue from Earth orbit. A rescue mission from the crew's home country might not be able to get ready in time, but there might be a rescue craft available from the "other side" IF the rescue capsule could dock with the one in distress. That issue was an undercurrent affecting the meeting planning.

The Moscow meeting took place in late October. The Americans were greeted warmly with a fine dinner and tour of Moscow, engendering optimism on both sides for positive cooperation. They toured Star City the next day, where they were shown around the facilities, including the Soyuz flight simulation training facility. The Americans had limited prior knowledge of the details of the Soyuz capsule and its operation, and the demonstrations they saw, given by cosmonauts who had flown in Soyuz, was a welcome eye-opener.

The Soviets really rolled out the red carpet. Not fancy and expensive, but rather technological, and with a strong statement that Space operations should be kept peaceful. They also toured several Space museums and a Rimsky-Korsakov opera. Extensive technical discussions followed in the next few days, including a discussion of the Apollo docking techniques. Both sides were using a probe and drogue type docking mechanism – a problem if the two objects to be docked had the same half of that system. NASA had earlier rejected a cone/ring design that would be more compatible, but it was brought back and updated to be used on Skylab.

The Soviet docking system did not allow for internal transfer of personnel (they were in the process of developing an upgrade), but it could be used repetitively; NASA's system was "success in the first two tries or failure."

Skylab was built around Apollo technology, and it was designed for revisits and resupplies, a capability that intrigued the Soviets, who had already manned an early station for an 18-day mission.

The mission to Moscow generated considerable good will among the participants. Both sides considered it more than fully successful, and plans to share technical data further were drawn up. A follow-up meeting was planned for January, 1971. The results of this meeting were (SP-4209):

1. To improve the current exchange of data from meteorological satellites and consider alternative possibilities for coordinating systems;
2. To formulate cooperative provisions for a program of meteorological rocket soundings;
3. To study the possibility of conducting natural environment research by coordinated surface, air, and space measurements over international waters and specific ground sites;

Copyright 2022 by Steven H. Williams
Non-commercial educational use allowed

4. To define and exchange information on the objectives of space, lunar and planetary exploration, to consider the possibility of coordinated lunar exploration, and to exchange lunar surface samples already obtained; and
5. To develop procedures whereby detailed space biology and space medicine data could be more regularly exchanged

These objectives were more specific than those proposed by the Soviets, but everything went well with negotiations. NASA Acting Director Low and Academician Keldysh met privately to discuss NASA's desire to develop compatible docking systems for use by both Soyuz and Apollo. NASA's position that the Soviets consider using existing systems to give engineering specialists from both sides concrete technologies to build upon. The Soviets agreed to "kick the idea upstairs," and NASA began working up engineering concepts.

A number of technical problems arose once specific design concepts were analyzed. For example, the air pressure/composition issue was serious; the Apollo capsule's maximum air pressure was 8 PSI, requiring an enriched-oxygen atmosphere, while reducing the Soviet air pressure to that level increased the danger of fire – a major concern on both sides but especially so for the Americans remembering *Apollo 1*. Ongoing Space operations, such as the remaining Apollo missions, slowed work on a joint flight concept. The Soviets were very busy with their *Salyut 1* space station, launched in April. The first flight to it, *Soyuz 10*, had experienced serious docking problems to the point that cosmonauts failed to enter *Salyut 1*. But none of that stopped a major joint meeting in Houston in June, 1971. Both sides were in basic agreement, but there were many, many technical details to be worked out.

Official joint meetings of this type were a novelty, and the Americans made sure the Soviets would return home with stories of life in everyday America. They were taken to the best shopping malls around, where many bought consumer items scarce at home. A little girl at one store gave the Soviets an impromptu, spontaneous welcome that impressed the guests greatly. [Rumor has it that at least some of the Soviets went to several local eateries, and received a warm reception from one of the servers who gave them a welcome flash.] Various working groups were set up to work on the technical problems, and everyone was pleased with the progress being made.

The press was very interested, too. They were aware of the previous meetings in Moscow, but could not cover them extensively from afar. In Houston, however, they could give much more detailed coverage, and did so. And then, tragedy struck.

The *Soyuz 10* mission had failed because they could not dock with the *Salyut 1* space station. The next mission, *Soyuz 11*, was able to dock and enter the station in early June. The crew had conducted a variety of experiments over the next several weeks. They loaded up their gear on the afternoon of June 29, and undocked. They orbited separately three times, then signaled their orientation for an automated retrorocket burn in the wee hours of the 30th. The parachutes opened on schedule and the descent vehicle landed normally. Alas, the three cosmonauts were found dead in their seats. Both nations and the world were shocked.

Copyright 2022 by Steven H. Williams
Non-commercial educational use allowed

Soyuz 11 at *Salyut* was the longest duration mission conducted at the time. Was prolonged exposure to free-fall conditions the cause of the crew's demise? Speculation built, but the crew seemed to have performed normally throughout the entire mission, up to the point of re-entry. Detailed analysis showed that a valve seal failed, causing a rapid loss of cabin pressure, and the asphyxiation of the crew. Astronaut Thomas Stafford went to Moscow to represent the U.S. at their state funeral.

NASA had communicated with the Soviets about the causes of their loss, and although they were concerned about the safety of the Soviet software, they were convinced that the problem was not free-fall, and the soon-to-be-launched *Apollo 15* continued on schedule.

The flush of public attention and Congressional support NASA's aggressive programming had waned considerably after *Apollo 11*, and it was becoming clear that there would be no manned missions to Mars as an Apollo follow-on; even the remaining Apollo flight schedule would be trimmed by three flights. [An example of the drop of the public attention was TV programming. All three networks carried lunar surface activities live, but by the later Apollos, the networks wouldn't even pre-empt the daytime soaps to show people walking on the Moon! Sigh.] NASA was far from dead; *Skylab* would fly in 1973, and the Space Shuttle and what would become the *International Space Station* were well-along in the planning process. NASA attention was also focused on looking at Earth from Space – the first of the Landsat spacecraft would be launched soon. Another focus was on the robotic exploration of the Solar System, as exemplified by the fabulously-successful Viking missions in 1976 and the Voyager missions launching in 1977.

The budget-imposed changes meant that there would be a hiatus in NASA's manned spaceflights between the final Apollo Moon mission in late 1972 and the first flight of the Space Shuttle, which would come in 1981. The planetary missions would cushion the blow, but NASA needed a flight or flights in the interim to retain public interest - and funding.

Three Apollo command modules had been earmarked for the cancelled Apollo missions, and one other had been prepared to get astronauts to *Skylab*. The Skylab program was expanded to three missions, leaving a fourth command module available…

APOLLO-SOYUZ TEST PROJECT

NASA's Working Groups had been conducting numerous technical studies on creating a joint mission, overcoming docking, atmosphere, and other problems. Next came an analysis of the costs of the program, which produced an avalanche of paperwork. NASA had to find a way to get the appropriate personnel in place without messing up work on the final Apollo missions and the Space Shuttle, AND how to pay for it all. The task of developing hardware for the ASTP fell to the Manned Spacecraft Division and its new director, Chris Kraft, a veteran from the NACA days in 1945. The technical plans were sufficiently developed by spring 1972 for NASA to contract out much of the development work to North American Rockwell.

Copyright 2022 by Steven H. Williams
Non-commercial educational use allowed

Working with existing hardware and planning could be accomplished readily, but Congressional authorization and funding would be required for the next step. A bilateral agreement between the US and USSR government would be required before Congress could act.

Another meeting in Moscow in late 1971 was successful, and NASA recommended that a formal agreement of a joint mission be included on the agenda of the summit conference between President Nixon and Premier Kosygin that was scheduled for May, 1972. Henry Kissinger asked NASA for a firm recommendation concerning the feasibility of such a joint mission, well in advance of the summit. NASA management required three basic agreements, covering the project technical proposal, the organization plan, and the project schedule, from the Soviets before making the feasibility recommendation. NASA would send a team to Moscow in early April to get agreement on those points, and kept it quiet in case of failure. A *New York Times* reporter sniffed out the meeting and wrote a piece on it, but to NASA's relief, nobody followed up on the story. Concern arose in the U.S. delegation when they learned that the U.S. ambassador and his son would be joining a luncheon at the embassy prior to the meeting with the Soviets, and that the son was a reporter for the *Washington Post*. Our guys were immediately concerned about keeping their presence and meetings semi-secret, but couldn't avoid the situation. Fortunately, nothing bad happened.

However, the Soviets sprang a surprise on their visitors. Up until then, U.S. planning was built around an Apollo capsule docking at a Salyut space station. The Soviets felt that was infeasible from a technical point of view and offered up a Soyuz space capsule instead. They accepted the plans for project organization and schedule, but Salyut was a no-go. Both sides worked on the design of a Docking Module (DM) that would serve as a "tunnel" between the two docked capsules.

The negotiations were difficult, in part due to the difference in language, but both sides were motivated and came up with a list of 17 points of agreement for the joint mission (see Ezell and Ezell, NASA SP-4209, "April in Moscow" chapter). A series of joint meetings of the various working groups followed. NASA informed Kissinger that a joint mission in 1975 was feasible, and no additional high-level NASA/Soviet Academy of Sciences meetings would be needed before the May summit conference.

The summit conference was a very Big Deal. Not only did Nixon and Kosygin sign the "Agreement Concerning Cooperation in the Exploration and Use of Outer Space for Peaceful Purposes," they also signed the first SALT agreement (but without a timetable) and a number of other agreements concerning environmental protection, trade, maritime commerce, medicine, and other areas.

With the summit agreement in hand, NASA and the USSR began work in earnest on a joint mission. There was a TON of engineering problems to be overcome and a myriad of other details that all had to be worked out, in the proper sequence. It took the talented efforts of thousands of engineers and other professionals on both sides to make a joint mission happen on schedule. Part of the problem was that NASA was scaling back on the technology that would

Copyright 2022 by Steven H. Williams
Non-commercial educational use allowed

be used in the *ATSP*, while the Soviets planned on using Soyuz technology well into the future (and indeed they did).

High-level meetings continued as planning and development progressed. A Preliminary Systems Review (Stage 1) was held in Moscow in October, 1972. Atmospheric compatibility issues were addressed at that meeting, too. Afterward, a series of hardware reviews with North American was held, followed by a visit by the Soviets in Houston in late November. The Americans went back to Moscow in December for the Stage 2 of the PSR meeting. All involved, and the press, were impressed by the degree of cooperation evident in the ASTP planning.

Apollo 17 returned to Earth successfully in mid-December, 1972. The Office of Manned Space Flight was re-organized in preparation for the Skylab and ASTP programs. As Ezell and Ezell put it, "Years of Intensive Activity" followed in 1973 and 1974 to make the Apollo-Soyuz Test Project a reality. Many technical problems were identified and overcome, but one would come up in October, 1973 that was different.

NASA had planned for the Apollo CSM used on the *ASTP* would carry a number of experiments, including Earth observation technology. The Congressional Manned Space Flight Subcommittee wanted assurance that if the Soviets could not complete their part of the mission, that enough benefit would come from the American part of the *ASTP* to justify its $250 million cost. Chester Lee, the Director of the Marshall Space Flight Center, provided an excellent presentation on the new hardware and communications gear developed for the *ASTP* and its utility in subsequent missions, and carried the day.

Several important milestones followed: the Mid-Term Review, reporting to Congress, and the 1973 Paris Air Show.

A program Mid-Term Review was held in Moscow in mid-October, 1972. Much progress had been made on all fronts, but the Americans wanted to discuss four topics: understanding of the loss of *Soyuz 11*'s crew, joint participation in test and flight preparation, project milestones, and project documentation.

NASA was particularly concerned about the fate of *Soyuz 11*. The Soviets had investigated the problem in detail, and understood what had happened. Soyuz capsules have two modules, an orbital module and a descent module. The retrofire initiating the reentry went OK, but ten minutes later, when it was time for the two modules to separate, the explosive bolts that were be fired sequentially instead fired simultaneously. The resulting overpressure between the two modules damaged the pressure equalization valve to be used at lower altitudes, causing a leak that quickly vented the capsule atmosphere. There was no evidence of any other malfunction. It was a readily-fixable problem. The other issues were quickly and effectively addressed. When the Review was over, the Americans got detailed tours of Star City and the Mission Control Cener in Kaliningrad.

Both sides were very aware of the positive publicity that would come from a successful mission. NASA PR people and their Soviet counterparts began working with one another directly at this point in the program. Good thing, too, because several current events were muddying the

Copyright 2022 by Steven H. Williams
Non-commercial educational use allowed

waters: the Yom Kippur War had just broken out, OPEC had begun a coordinated program to lower oil sales to countries that had supported Israel, and the U.S. Academy of Science was up in arms about the Soviets' treatment of dissident scientist Andrei Sakharov.

THE CREWS

Overcoming ongoing formidable obstacles in engineering, politics, cooperation, and public relations was difficult, but do-able. But one other issue had already been settled – Who was going to fly the mission.

NASA had announced the prime and backup *ATSP* crews in January, 1973. The prime crew commander would be three-time veteran Thomas Stafford, Vance Brand, and "Deke" Slayton. Stafford was then Deputy Director of Flight Crew Operations, had flown three missions already (*Gemini 6*, *Gemini 9*, and *Apollo 10*), and he had been the U.S. representative at Yuri Gagarin's funeral. Command module pilot Brand had been on the *Apollo 15* backup crew and the backup crew for *Skylab 2* and *3*. Donald Slayton was one of the original seven Mercury astronauts, but a medical condition had grounded his flight. He became Director of Flight Crew Operations and finally got his medical flight status restored. *ATSP* would be his first (and only) trip to orbit.

The American *ATSP* back-up crew was led by Alan Bean, the Command Module pilot on *Apollo 12,* who would soon command the *Skylab 2* mission. Ronald Evans reprised his *Apollo 17* Command Module Pilot role. Jack Lousma was the third; he would soon fly with Bean on *Skylab 2*.

The Soviet *ATSP* crew was announced on the opening day of the 1973 Paris Air Show. First Spacewalker Alexi Leonov would command, and Valeriy Kubasov would be Flight Engineer, his role on *Soyuz 6*. This was a departure from the usual Soviet policy of not identifying the crew until their flight was over.

The joint PR teams really shone at the Paris Air Show. Four hundred-thousand visitors were treated to a largely-military aviation showcase, but the star of the show, and the first thing the visitors saw as they entered the event pavilion, was a full-scale model of the *ATSP*, with both Apollo and Soyuz capsules attached to their Docking Module. [A similar model was displayed in the former NASM gallery, *The Space Race*.] The centerpiece presence of a BIG example of international cooperation contrasted greatly, and favorably to the audience, with the otherwise-dominant presence of military hardware. Both PR teams smiled.

Prior Paris Air Shows had already brought astronauts and cosmonauts together. At first, attitudes were rather frosty, but not always; Gordon Cooper and Pete Conrad had a warm conversation over drinks with Leonov and Belyayev in Athens in 1965. Downright friendly meetings occurred at the 1967 and 1969 Paris events. By 1972, high-level visits were becoming more common. These budding acquaintances really helped when joint training began. Things really began to thaw in June, 1973, when the Soviets invited writers from *Aviation Week* and *Time* access to Star City.

Copyright 2022 by Steven H. Williams
Non-commercial educational use allowed

Joint crew raining was rigorous, and occurred in both countries. Much of the important hardware was new, many of the mission procedures were new, and the language learning efforts were immersive. Nobody involved with this high-profile mission wanted to fail to impress, and mission safety required good communication skills in real-time. The hard work for all concerned was paying off, and confidence was high that the ATSP mission would be successful in all respects.

But there was one more hurdle on the U.S. side.

Changes made in NASA procedure in the aftermath of the *Apollo 1* fire included the creation of an independent Aerospace Safety Advisory Panel, who only reported to the NASA Administrator. They had been involved in the preparation of the *ATSP* spacecraft systems, and would have final go/no-go say over the mission from a safety point of view. They gave all aspects of the mission plan, hardware, and procedures a most thorough review, but the many folks on both sides had done their work well, and NASA past the ASAP panel indeed, ASAP. They even pointed out that the ATSP system was safer than some NASA had previously flown.

The crews held their final two joint training sessions in Houston in February, 1975, and in Moscow in April.

Everything looked to be a "go," until April 5, when the Soviets suffered another Soyuz flight problem. The cosmonauts had to make an emergency separation, but their equipment worked well and the made a safe escape and landing. The problem did not bother either side particularly, especially since the booster was of a different type than the one to be used for *ATSP*.

However. Wisconsin senator William Proxmire grandstanded with a demand that the CIA investigate to make a separate safety estimate of Soviet technical capabilities, citing several relatively-recent mission failures. What could the CIA do that NASA couldn't? The CIA stayed home.

NASA and the Soviets conducted a very extensive Flight Readiness Review in late May in Moscow. Upon returning home, NASA Administrator Fletcher made a detailed report to President Ford, to whom he suggested a Presidential phone call when both crews were together in Space, and to Senator Proxmire.

A few problems remained. Both sides' PR teams deemed it essential that the first meeting of the two crews be televised live, no mean feat with the prevailing technology. Pressure to succeed was high, and both sides worked hard on ensuring that the broadcast would go off without a hitch.

Proxmire struck again one last time, claiming that the Soviets could barely manage one mission, and now they would be handling two. *Soyuz 18* had been launched to the *Salyut 4* space station on May 24, and was scheduled to remain there until well after the end of the ASTP mission. The two missions would be in entirely different orbits, so that Soviet ground-Space communications and control would be sufficient. Fletcher and others had explained the situation and considerations fully to him, but Proxmire wouldn't give up. It was so bad that

Copyright 2022 by Steven H. Williams
Non-commercial educational use allowed

Tom Stafford became convinced (as did many others) that Proxmire hated the manned Space program and was trying to hurt it by any means necessary. Stafford snarked that this was the first time Proxmire had ever shown any concern for the safety of American astronauts.

Final preparations and reviews proceeded apace, aimed at a July 15 launch.

GO!

The Soyuz would be launched first, and was safely on its way at 3:20 PM Moscow time. The launch pad they used was the same one that had been used for both *Sputnik 1* and Yuri Gagarin's flight! The Apollo part of the *ASTP* was going to use a Saturn I booster, and it was fueling at the time of the Soyuz launch. Now it was NASAs turn! Stafford, Brand, and Slayton had a mid-morning breakfast, then suited up and went to the pad. They were inserted into the Apollo capsule, with the hatch closing at 12:22 PM. They launched successfully at 2:50 PM CDT and were safely in orbit ten minutes later.

The mission profile called for the CSM (Command Service Module) to detach from the S-IVB upper stage, turn around, and dock with the docking module and then extract it, just as Apollo CSMs had done with the Lunar Module. Stafford's "driving" was superb; he had lined up with the DM to within 0.01°!

Both capsules were aloft safely and operating normally. A couple of minor problems arose, but nothing serious. The next day, July 16, Leonov made a TV presentation to the Soviet public, and the Americans conducted a number of experiments aboard their Apollo CSM. The two spacecraft continued to approach one another fairly slowly, as planned.

The spacecraft rendezvous went well, and they were close enough to attempt docking. They made an absolutely perfect hook-up at 11:14 AM CST. Premier Brezhnev had prepared a greeting message that was read before the crews mingled. Stafford and Slayton entered the DM and closed the hatch to the CSM behind them. The air pressure in the DM was equalized with that in the Soyuz. The meeting was imminent!

At 2:17:26 PM on July 17, 1975, Stafford opened the hatch on the Soyuz side of the DM. The Soviets had put up a hand-written sign saying "Welcome aboard Soyuz" and Stafford and Leonov enjoyed what would become the famous "Handshake in Space," with applause from both mission controls sounding in the background. President Ford did, indeed, speak with the joint crew, at some length. Stafford, Slayton, Leonov, and Kubasov made a symbolic exchange of gifts. Then they enjoyed a meal together. Stafford and Slayton returned to their capsule at 5:47.

Both crews awoke on the 18th after a good night's sleep. They dealt with a minor air leak in the DM, and then conducted two TV programs. First, Brand and Kubasov gave a TV tour in English of the Soyuz capsule, then Stafford and Leonov did the same, but in Russian, from the Apollo CM. Kubasov gave a televised tour of the USSR as the *ATSP* flew over, then he and Brand filmed a number of free-fall demonstrations to be used in school classes in both countries. Then came the big event of the day, a joint press conference. They expressed a lot of heart-felt

Copyright 2022 by Steven H. Williams
Non-commercial educational use allowed

appreciation for the many people that had made the ASTP possible and great optimism for future cooperation in Space, and on Earth.

There had been four exchanges of crew during the flight so far. Slayton, Brand, and Kubasov assembled a medallion commemorating the flight – each side had brought up half of it. A few additional experiments were performed, a few more gifts were exchanged, until finally it was time to "go home." Stafford shook hands with Leonov and Kubasov, and entered the DM for the final time.

A sleep cycle followed, and then both crews continued with on-board experiments. The capsules undocked at 7:12 AM CST and held station on one another while the crews continued with their experiment schedules. They re-docked a few minutes later. Slayton was a bit heavy-handed on the thrusters, but no damage was done. The two craft undocked again at 10:27 and flew in formation while additional tests and experiments were performed. The two capsules went on their separate ways.

Day 6 in Space started early. The Americans had a full day of experimentation, but they were interested in how the news media was playing the joint mission. Their duty CapCom was Robert Crippen, who told them how well their mission was being received, and then pointed out that it was exactly six years on the dot that Neil Armstrong had made "one small step." Stafford laconically replied, "Roger. Remember it well."

The Soyuz reentry went well on the morning of July 21. The Apollo team stayed in Space conducting a number of important experiments and observations until early on July 24, when they, too, started their return home. And then they had a problem.

The drogue parachute was supposed to deploy at an altitude of 7310 meters. It would stabilize any capsule movement and pull out the main parachutes. That didn't happen, so Brand hit the manual releases for the nose cover and drogue deployment. It worked, but the automatic thruster system had not been shut down, and thrusters began firing to counteract the capsule's movement. Fumes from the thrusters were drawn into the capsule.

This was a serious problem. The fumes were toxic. Brand was able to manually deploy the main parachutes, but oxygen masks were needed. Splashdown was rough, and their capsule decided to float in its inverted mode, with the astronauts hanging from their straps. Stafford struggled to get to the oxygen masks, while Brand lost consciousness. Stafford managed to secure a mask on Brand, and all three astronauts breathed pure oxygen to clear their lungs. Brand awoke and activated the system that would bring their capsule upright. Then Stafford could open a vent valve, and the air inside the capsule cleared. It was the last flight of Apollo hardware.

The incident would require a two-week hospital stay for all three. After their full recovery, the ASTP astronauts went "on the road," touring both countries on a massive goodwill tour.

In retrospect, some die-hard Cold War types felt that the cost of the ASTP and the general uselessness of cooperating with the Soviets made both ASTP and the SALT talks worthless. They were wrong. ASTP met or exceeded all of its pre-mission goals. SALT agreements and the

Copyright 2022 by Steven H. Williams
Non-commercial educational use allowed

satellite reconnaissance that made them monitorable were very valuable in reducing the threat of War, especially accidental War. And, most importantly, the ASTP laid the groundwork for future collaboration, resulting in the creation and continuous staffing of the *International Space Station*.

Recent political events have severely hampered U.S.-Russia relationships and rightly so. But the continuing comradery of the *ISS* crews are an example that yes, the two nations can work productively together.

CODAS

Coda 1: I had a limited personal experience with visiting Soviet scientific delegations in the early 1980s. The 1970s visits to the U.S. described above were followed by increasingly-frequent scientific exchanges. The first few years of them had significant oversight by the U.S. State Department and their Soviet counterparts, and by the CIA and KGB. Later, only the most senior of scientists were involved, but by the early/mid 1980s, the escort duty was pushed further down the academic ladder to the point where graduate students and post-Docs were involved. The Soviets still traveled in pairs, one scientist and one agent loosely-described as a "scientist." Fellow grad student Jim Zimbelman and I escorted one such pair back in the day. The senior member, Ruslan Kuzmin, was obviously a scientist, even though he resembled "Father Winter" – their version of Santa Claus. The other guy, ostensibly a scientist, had an inordinate interest in the various chemical plants in the Houston area…. I would later host Dr. Kuzmin, another Soviet, Misha Zolotov, and the French scientist Francois Costard in my home. We took them to a hockey game (Kuzmin had played hockey and basketball in his youth), where I learned the names of various penalties, and took them by a remarkable display of Christmas lights put on by the late Bob Rix in Phoenix. It took a few minutes for me to get across that the lights were not a community collective effort! Kuzmin already was having a successful career and is now a member of the Russian Academy of Sciences; Zolotov is having a successful career on the faculty of Arizona State, and Costard is the Research Director at the University of Paris. Quite a bunch! I am proud to have gotten to meet them.

CODA 2: Linda Ezell, co-author of NASA SP-4209, would later write a number of NASA historical pieces, then join the National Air and Space Museum. She would quarterback the construction of the Steven F. Udvar-Hazy Center so brilliantly that General Jack Dailey, NASM's Director (who had previously been the Deputy Commandant of the Marine Corps, and the Associate Director of NASA), recommended her to be the first Director of the U.S. Marine Corps Museum, a job she would perform with distinction.

REFERENCES

Everything You Might Want to Know about the ASTP is here: Ezell, Edward Clinton, and Linda Neuman Ezell, 1978, *The Partnership: A History of the Apollo-Soyuz Test Project*, NASA SP-4209, https://www.hq.nasa.gov/office/pao/History/SP-4209/toc.htm

Copyright 2022 by Steven H. Williams
Non-commercial educational use allowed

Dodd, Harvey and Linda Ciccoritti, 1974, U.S. – Soviet Cooperation in Space, https://ardhindie.com/pdf/u-s-soviet-cooperation-in-space-by-dodd-l-harvey-and-linda-c-ciccoritti-with-a-foreword-by-foy-d-kohler

Nixon/Kosygin 1972 Summit: https://en.wikipedia.org/wiki/Moscow_Summit_(1972)

NASA Overview: https://www.nasa.gov/apollo-soyuz/overview

NASA 2020 45th Anniversary of ASTP: https://www.nasa.gov/feature/45-years-ago-historic-handshake-in-space

National Air and Space Museum has the backup Docking Module and other ASTP items: https://airandspace.si.edu/collection-objects/docking-module-astp-backup/nasm_A19800430000

NASM also has a full-scale model of the ATSP spacecraft in docked position: https://airandspace.si.edu/stories/editorial/apollo-soyuz-test-project

Last Edited on 10 July 2022

Copyright 2022 by Steven H. Williams
Non-commercial educational use allowed