12

The Final Countdowns

"Columbia, Houston, you're go at throttle up"
Dan Brandenstein,
Ascent Capcom STS-1, April 12, 1981.

Fast forward 30 years…

'*God Bless America*' wake-up call played for all
"the men and women who put their hearts and souls into the Shuttle program for all these years"
Shannon Lucid, Planning Capcom,
Final shift, STS-135 July 20/21, 2011

A total of 11,057 days (or 30 years, 3 months and 9 days) elapsed between Dan Brandenstein's calls to *Columbia* during the STS-1 launch on April 12, 1981, and the final conversations between the crew of *Atlantis* and Shannon Lucid a few hours before STS-135 landed on July 21, 2011. It was a generation that encompassed the whole operational phase of the American Space Shuttle Program, one which members of the Class of 1978 had both witnessed first-hand and actively participated in. Their contributions began well before that first departure from the launch pad at LC-39A and continued with the International Space Station (ISS) for some years after the final wheelstop of *Atlantis* on Runway 15 at the Shuttle Landing Facility (SLF).

History records, by some strange twists of fate, that the first Shuttle launch occurred on the 20th anniversary of the event which took the first [Soviet] human into space, while the final Shuttle landing was completed within hours of the 42nd anniversary of the first moonwalk by American astronauts, which was also the 50th anniversary of Gus Grissom's sub-orbital flight on the Mercury-Redstone 4 mission. Most of the participation on Shuttle missions by the Thirty-Five New Guys (TFNG) occurred during the first 15 years of the program, and

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towards the end of that period came the first missions to reunite the U.S. and Russia (formerly the Soviet Union) in space since 1975. The 1995 mission of STS-71, commanded by TFNG pilot astronaut Robert 'Hoot' Gibson, saw *Atlantis* docking with Mir and bring home the first American (TFNG Mission Specialist (MS) Norman Thagard) to work with Russian cosmonauts on a space station.

Following the retirement of the Shuttle fleet, the ISS has taken center stage, and for several years one member of the TFNG (MS Anna Fisher) remained involved both in that program and in the embryonic development of the vehicle to replace the Shuttle. Though the 1990s proved to be the final years in which the remaining members of the Class of 1978 journeyed into orbit, they were by no means pushed into the background. During the final decade of the 20th century, the Shuttle program was reinvigorated by a renewed hope for the struggling Space Station, even as it included the final countdowns for the remaining TFNG.

INTO THE TWILIGHT OF AN ERA

By the spring of 1991, the Space Shuttle program had been flying orbital missions for a decade. However, five of those years had been completed under difficult conditions, with the loss of the *Challenger* crew, the recovery from that tragedy, and in overcoming a number of hardware issues that had significantly reduced the number of missions that could be flown. The belief in the early 1980s that a Shuttle would leave the launch pad every two weeks proved enormously over optimistic. In the first decade of operations, only 37 missions had been flown successfully, and despite renewed optimism, the next decade would bring its own challenges in keeping the Shuttle flying, as the accountants, diplomats, engineers and politicians wrangled over the fate of Space Station *Freedom* and the format of its replacement.

Having lived through the highs and lows of the Shuttle program, the euphoria of their own space flights and the triumphs and tragedies within the Astronaut Office, the new decade dawned with the TFNG significantly reduced in number and thus their involvement as a group within the program somewhat lessened. By January 1991, half of the group had departed to pastures new or were now assigned to managerial positions within the agency. Once the largest contingent in the office, outnumbering even the pioneering veterans of the 1960s, the TFNG were now surpassed in number by members of more recent selections. At the start of this new decade, it was also a whole new era for NASA and a time of change within the agency, which would, in time, focus on establishing greater international partnership and dependency to create and maintain the much anticipated and long awaited Space Station Program.

Into the second decade

The 17 members of the 1978 selection who remained active in the Office in 1991 were at the forefront of this new era, with eight of them already assigned to the seven different Shuttle crews scheduled to fly over the coming 12 months. However, their numbers would gradually diminish in the months which followed, as more of them decided to move on to seek new goals away from the Astronaut Office. By the end of the decade and the start of ISS assembly, all of the TFNG were out of crew training, although five remained at the Johnson Space Center (JSC) or other NASA field sites. Another would return to NASA within a few years.

STS-37 (April 5 – 11, 1991)

Flight Crew: Steven R. NAGEL (CDR), Kenneth D. Cameron (PLT), Linda M. Godwin (MS-1), Jerry L. Ross (MS-2), Jerome Apt (MS-3)
Spacecraft: Atlantis (OV-104) 8th mission
Objective: 39th Shuttle mission; deployment of the Gamma Ray (Compton) Observatory; EVA Development Flight experiments
Duration: 5 days 23 hours 32 minutes 44 seconds
Support Assignments: In SPacecraft ANalysis (SPAN), Dave WALKER worked on the 06:00–12:00 shift, while Hoot GIBSON followed in the 12:00–18:00 slot. Mike COATS worked on the first shift in the Shuttle Mission Simulator (SMS), while Transoceanic Abort Landing (TAL) support was provided by Fred GREGORY at Morón Air Base in Spain. Loren SHRIVER returned to the Massachusetts Institute of Technology (MIT) as Mishap Representative. [1]

On this mission, the astronauts deployed the Gamma Ray Observatory (GRO), one of NASA's Great Observatories, which required the Extra-Vehicular Activity (EVA) crew of Ross and Apt to assist with the deployment of the observatory's antenna during their initial EVA, the first unscheduled EVA since STS-51D in April 1985. On their second spacewalk, the two astronauts evaluated the Crew and Equipment Translation Assembly (CETA), a motorized cart device which ran along a track and was designed to save the astronauts' energy when moving over long distances. CETA was intended for use with the Space Station. The crew evaluated other space station technology, with a middeck experiment simulating the space station's heat pipe radiator element. The GRO deployed by Nagel's crew was subsequently renamed after physicist Dr. Arthur Holly Compton, who won the Nobel Prize in Physics in 1927 for his work on the scattering of high-energy photons and electrons.

One day prior to the 10th anniversary of the launch of *Columbia* on STS-1, Steve Nagel brought *Atlantis* home to complete the STS-37 mission, neatly bookending the first decade of Shuttle orbital flight operations. Despite some early

in-flight problems, the Compton Gamma Ray Observatory was able to complete its primary mission of an all-sky survey by November 1992. It continued to gather data until it was safely de-orbited in June 2000, nine years after its deployment.

STS-39 (April 28 – May 6, 1990)
Flight Crew: Michael L. COATS (CDR), Blaine L. Hammond (PLT), Gregory J. Harbaugh (MS-1), Donald R. McMonagle (MS-2), Guion BLUFORD (MS-3), C. Lacy Veach (MS-4), Richard J. Hieb (MS-5)
Spacecraft: Discovery (OV-103) 12th mission
Objective: 40th Shuttle mission; unclassified Department of Defense (DOD) mission devoted to military scientific experiments
Duration: 8 days 7 hours 22 minutes 23 seconds
Support Assignments: For this mission, Loren SHRIVER was on call for SPAN (18:00–24:00) and was again the Mishap Representative at MIT. TAL support at Ben Guerir in Morocco was provided by Dave WALKER, and the Weather Pilot (WX) for the Kennedy Space Center (KSC) and Edwards Air Force Base (AFB) was Dan BRANDENSTEIN. [2]

The next Shuttle mission, and the first to have a full crew of seven NASA astronauts, was again commanded by a veteran member of the Class of 1978, Mike Coats. He and fellow TFNG Guion Bluford (MS) were both flying their third missions. This flight was a very complicated DOD mission but this time remained mostly unclassified. The primary objective was to gather data on the development of an advanced missile defense system, with the crew working in two teams around the clock. Bluford was assigned to the Blue Shift with Harbaugh and McMonagle, while Coats worked with the remaining crewmembers on the Red Shift.

STS-40 (June 5 – 14, 1991)
Flight Crew: Bryan D. O'Connor (CDR), Sidney M. Gutierrez (PLT), James P. Bagian (MS-1), Tamara E. Jernigan (MS-2), M. Rhea SEDDON (MS-3), Francis A. 'Drew' Gaffney (Payload Specialist (PS)-1, physician), Millie E. Hughes-Fulford (PS-2, biochemist)
Spacecraft: Columbia (OV-102) 11th mission
Objective: 41st Shuttle mission; Spacelab Life Sciences 1 program (using Long Module #1)
Duration: 9 days 2 hours 14 minutes 20 seconds
Support Assignments: While some members of the eighth selection left NASA to pursue new goals, others moved into managerial roles within the agency. For this

mission, Management Support from the Flight Control Operations Directorate (FCOD) was provided by Dick COVEY for launch. In SPAN, Dave WALKER worked on the 24:00–06:00 shift, Loren SHRIVER on the 06:00–12:00 shift (once he had returned from TAL support at Morón, Spain) and Kathy SULLIVAN on the 12:00–18:00 shift. Dick COVEY also provided weather support at KSC, while Dan BRANDENSTEIN did so at Edwards. SMS support was provided by John CREIGHTON on the second shift. [3]

During their nine-day dedicated space and life sciences mission, the STS-40 crew worked a single shift, performing a number of experiments which explored how humans, animals and cells responded to microgravity and then re-adapted to Earth's gravity on their return. Other payloads included experiments designed to investigate materials science, plant biology and cosmic radiation, and tests of hardware proposed for the Space Station *Freedom* Health Maintenance Facility.

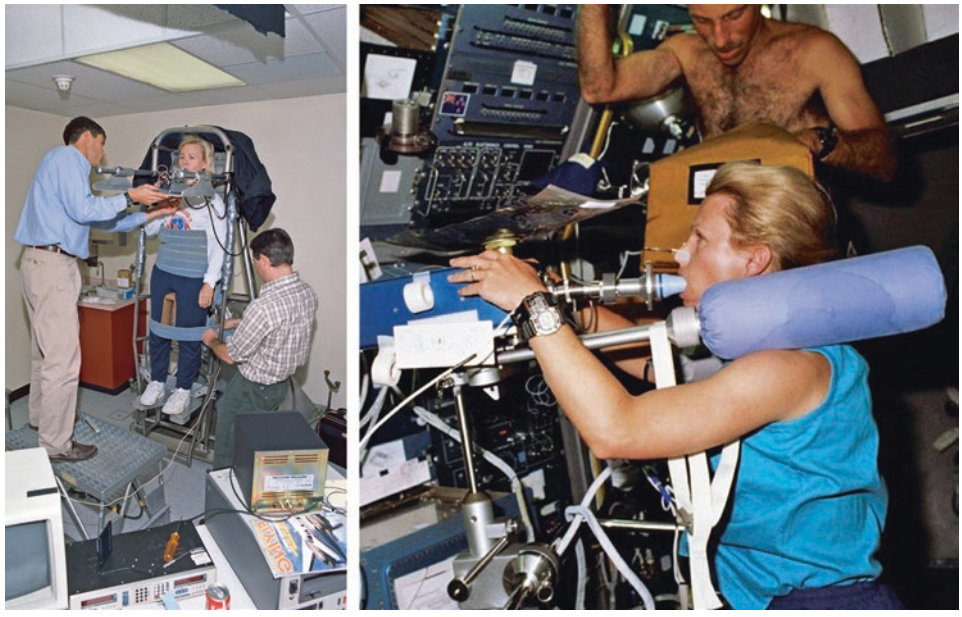

Fig. 12.1: (left) Rhea Seddon participates in pre-flight medical tests in support of her Spacelab Life Science mission and to provide baseline data for the Space Station Program. (right) During STS-40 (and the subsequent STS-58), Seddon and her colleagues gathered a wealth of life science data.

CO-OPERATING WITH THE SOVIETS

On July 31, 1991, NASA announced that the U.S. and the USSR had agreed to expand their respective civil space cooperation programs within an agreement reached by U.S. President George H. Bush and Soviet Premier Mikhail Sergeyevich Gorbachov during the U.S./USSR Summit of July 30–31 in Moscow. The plan was to conduct joint life sciences research by flying a U.S. astronaut on a long duration mission on the Soviet space station Mir, and reciprocally a Soviet cosmonaut as a crewmember on a Space Shuttle crew. [4] However, the following month saw dramatic events in the Soviet Union, which resulted in the eventual fall of the USSR and the emergence of a new Russia and a commonwealth of former Soviet states. This upheaval naturally suspended these plans while domestic issues took precedence in Russia.

Back at JSC, Mike Coats formally left NASA on August 1 and retired as a Captain from the U.S Navy (USN). He had announced his intention to leave the agency in July to assume a position as Director of Advanced Programs and Technical Planning at Loral in Houston. [5] "My years at NASA have convinced me that the finest folks in the world are attracted to the space program. I am extremely pleased to be able to change career directions and still be involved with this wonderful group of people," Coats said on leaving the agency. Director of Flight Crew Operations, Donald R. Puddy, noted at the time that he was sorry to see Coats leave but pleased that he would continue to work with NASA in his new capacity. In fact, the former astronaut's future involvement with JSC would be a lot closer than even he probably envisaged in 1991, as he would return as the Center's tenth Director in 2005, serving in that capacity for seven years.

STS-43 (August 2 – 11, 1991)
Flight Crew: John E. Blaha (CDR), Michael A. Baker (PLT), Shannon W. LUCID (MS-1), G. David Low (MS-2), James C. Adamson (MS-3)
Spacecraft: Atlantis (OV-104) 9th mission
Objective: 42nd Shuttle mission; deployment of fifth TDRS
Duration: 8 days 21 hours 21 minutes 25 seconds
Support Assignments: SPAN support was provided by Steve NAGEL and Fred GREGORY during the 21:00–05:00 shift. Weather support was fulfilled by Dick COVEY (launch and Edwards End of Mission (EOM) support) and Dan BRANDENSTEIN (KSC EOM). Dave WALKER provided TAL support at Banjul in The Gambia, West Africa. SMS support was provided by John CREIGHTON on the first shift and Fred GREGORY on the second, while Loren SHRIVER again fulfilled the role of Mishap Representative at MIT. [6]

During this flight, the crew deployed the fifth Tracking and Data Relay Satellite (TDRS-E). These TDRS deployment missions rarely captured the headlines in the media, unlike the more involved scientific research missions or those including a spacewalk, but were nevertheless important stages in developing an understanding of regular and 'routine' space flight operations, both in orbit and on the ground. In addition to deploying TDRS-E, the crew conducted 32 physical, material and life science experiments, mostly relating to the Extended Duration Orbiter (EDO) and Space Station programs. It is also noteworthy that two of the crew (John Blaha and TFNG Shannon Lucid) would later participate in long-duration residencies on the space station Mir, while a third crewmember (Mike Baker) would command one of the Shuttle docking missions with the Russian station.

Restored to flight status

On August 23, 1991, NASA named crewmembers and changes to crew assignments for no less than eight future Shuttle missions. Within those assignments, relevant to the Class of 1978, Hoot Gibson was named to command STS-47 (Spacelab J) and Dave Walker to command STS-53 (DOD), joined on that mission by fellow TFNG Guion Bluford as MS. Gibson and Walker had both been restored to T-38 flying status and were once again in line to return to flight crews, just a year after both had been grounded for flying infringements. [7]

STS-47 was planned as a joint mission with the Japanese Space Agency (then known as NASDA, later changed to JAXA) due in August 1992. Gibson was named with Pilot (PLT) Curtis Brown (Class of 1987), and joined previously assigned crewmembers. The research to be conducted on Spacelab J was dedicated to materials processing and life sciences experiments. The STS-53 DOD mission was due to be launched in October 1992, with Walker leading a crew of PLT Robert Cabana (Class of 1985), and MS Bluford, James Voss (Class of 1987) and Rich Clifford (Class of 1990).

August also saw Dick Covey taking on the challenging dual role of Acting Deputy and Acting Chief for the next three months, until Steve Nagel took on the role of Acting Chief of the Astronaut Office pending Dan Brandenstein's return after flying STS-49. At one point in late 1991, Covey was Acting Director of Flight Crew Operations as well.

Senior roles in the office

A decade into the Shuttle program, TFNG pilot astronauts were now regularly taking either the command seat on Shuttle missions, senior MS roles, or moving into managerial roles in the agency. This vindicated the potential the Astronaut Selection Board had seen in choosing the 35 new astronauts back in 1978. Over a decade after qualifying from the first Ascan training and evaluation program, the TFNG were certainly living up to expectations, having established a strong presence in the Astronaut Office, the Shuttle program and with NASA itself.

STS-48 (September 12 – 18, 1991)
Flight Crew: John O. CREIGHTON (CDR), Kenneth S. Reightler (PLT), Charles D. 'Sam' Gemar (MS-1), James F. BUCHLI (MS-2), Mark N. Brown (MS-3)
Spacecraft: Discovery (OV-103) 12th mission
Objective: 43rd Shuttle mission; deployment of the Upper Atmosphere Research Satellite (UARS)
Duration: 5 days 8 hours 27 minutes 38 seconds
Support Assignments: SPAN support was provided by Kathy SULLIVAN (06:00−12:00) and Loren SHRIVER (18:00−24:00), the latter repeating his dual assignment as Mishap Representative at MIT. Weather support was fulfilled by Steve NAGEL for landing at KSC, while Fred GREGORY was on duty in the SMS for the first shift. FCOD Management Support for this mission included Dick COVEY for launch at KSC/Operations Support Room (OSR), orbit at JSC, and landing at Dryden (he was also FCOD Management Representative for the Crew Recovery Team), and Steve NAGEL at JSC for launch and landing. [**8**]

Following his second space flight, STS-36 in 1990, John Creighton had headed up the Operations Development Branch within the Astronaut Office. This was a one-year appointment prior to resuming full-time training for his next space flight as Commander (CDR) for STS-48. During the mission, the crew deployed the research satellite UARS, which had a design life of just three years but was still providing data a decade after its deployment, with six of its ten instruments still operating. In May 2005, UARS surpassed 5,000 orbits of Earth, but its batteries began to fail over the next few months, signaling the end of its operational life in August of that year. It was decommissioned due to budget cuts that December after 14 years and three months of operational life. The satellite finally re-entered Earth's atmosphere in September 2011, 20 years after it had been placed in orbit. In addition to the UARS deployment, the STS-48 crew also conducted numerous secondary experiments, ranging from growing protein crystals to studying how fluids and structures react in microgravity. On the middeck of *Discovery*, Buchli worked with Mark Brown in assembling scale models of the proposed space station truss, to test vibration characteristics on the structure's joints in the microgravity environment on orbit.

On October 23, Rhea Seddon was confirmed as Payload Commander (PC) for Spacelab Life Science 2, manifested for STS-58 and due to launch in July 1993. As PC, Seddon assumed overall crew responsibility for long-range planning and integration of the numerous payloads, and provided her experience in coordinating the science activities during the mission. [**9**] According to the press release, this mission was "dedicated to continuing research on the adaptation to microgravity in preparation for the Space Station *Freedom* program and future planetary exploration."

Jim Buchli also completed his post-STS-48 assignments in October and resumed his position as Deputy Chief of the Astronaut Office, releasing Dick Covey from that role.

STS-44 (November 24 – December 1, 1991)
Flight Crew: Frederick D. GREGORY (CDR), Terence T. 'Tom' Hendricks (PLT), James S. Voss (MS-1), F. Story Musgrave (MS-2), Mario Runco Jr. (MS-3), Thomas J. Hennen (PS-1, U.S. Army)
Spacecraft: Atlantis (OV-104) 10th mission
Objective: 44th Shuttle mission; deployment of the Defense Support Program (DSP) satellite; Military Man-in-Space experiments (Terra Scout)
Duration: 6 days 22 hours 50 minutes 44 seconds
Support Assignments: On this flight, the system for SPAN changed, requiring the astronauts to be on 24-hour call (08:00−08:00 daily) for their particular mission days. The Group 8 astronauts fulfilling this assignment were Hoot GIBSON and Shannon LUCID for Flight Day (FD) 1, with LUCID also working FD3 and FD4. TAL support included Dave WALKER at Morón, Spain, who travelled back to California after the launch for assignment as Shuttle Training Aircraft (STA) Weather Pilot for EOM at Edwards. Steve NAGEL was STA Weather Pilot for launch and KSC EOM. Loren SHRIVER was again assigned as Mishap Representative, but this time was based at JSC. [**10**]

One of the final Shuttle DOD-dedicated flights, this mission deployed *Liberty*, one of NORAD's (North American Air Defense Command) Tactical Warning and Attack Assessment System satellites.

On December 6, NASA released the names of the Payload Crew for SLS-2/STS-58, in addition to the three PS shortlisted for the single seat available. Joining PC Seddon were fellow TFNG Shannon Lucid and David Wolf (Class of 1990). [**11**]

INTERNATIONAL SPACELABS

The new year opened with another Spacelab pressurized module flight carrying an international crew and science payload, giving an indication of what might be expected in the forthcoming Space Station Program.

STS-42 (January 22 – 30, 1992)
Flight Crew: Ronald J. Grabe (CDR), Stephen S. Oswald (PLT), Norman E. THAGARD (MS-1), William F. Readdy (MS-2), David C. Hilmers (MS-3), Roberta L. Bondar (PS-1, Canada), Ulf D. Merbold (PS-2, European Space Agency (ESA), Germany)

Spacecraft: Discovery (OV-103) 14th mission
Objective: 45th Shuttle mission; International Microgravity Laboratory-1 (IML-1) research program flying the Spacelab Long Module Unit #2
Duration: 8 days 1 hour 14 minutes 44 seconds
Support Assignments: This was the first mission for some time to include a Group 8 astronaut at the Capcom console in Mission Control Center-Houston (MCC-H), with Rhea SEDDON as one of the Orbit 2 Capcoms on the 'Antares' team. [**12**] On 24-hour callout for SPAN were Guion BLUFORD (FD3), Loren SHRIVER (FD4, and again having a dual assignment as Mishap Representative at JSC), and Shannon LUCID (FD6 and 7). Weather Support was provided by Dick COVEY at KSC and Edwards. TAL support came from Steve NAGEL at Ben Guerir in Morocco and Dave WALKER in Zaragoza, Spain. Dan BRANDENSTEIN, who was back in training for STS-49, was in the SMS for the second shift, and Fred GREGORY was one of the Immediate Family Escorts. [**13**]

With Norman Thagard as PC, the IML-1 crew investigated the effects of microgravity on materials processing and life sciences while working two shifts, with Thagard on the Blue Shift. In total, there were 55 experiments devoted to research in space medicine and manufacturing, an interesting preview of future space station operations.

This mission was flown at a time when a new Russia was slowly emerging from the collapse of the Soviet Union the previous year, with the growing prospect of even closer international relations with Russia in space exploration. A few years later, Thagard would become the first American and only TFNG to be launched and fly on a Russian spacecraft (Soyuz) from Russia (Baikonur) and serve as a resident crewmember on one of their long duration missions aboard Mir. Ironically, on January 24 during STS-42, that same station passed within 39 nautical miles (44.85 miles or 72.16 km) of *Discovery*, with the crew reporting the reflected sunlight from the solar arrays of the station "as bright as the planet Mercury."

IML-1 was another milestone in the Shuttle program. The extensive science program encompassed investigations supplied by the space agencies of the United States (NASA), Europe (ESA), Canada (CSA), France (CNES), Germany (DARA) and Japan (NASDA), as well as smaller Get Away Special (GAS) experiments provided by Australia, China, the Federal Republic of Germany, Japan, Sweden and U.S. students, plus the IMAX camera and a host of smaller middeck investigations. Over 200 scientists from 16 countries were deeply involved in this one flight and its investigations. At the time, the long-term plan was to fly four or more of these IML missions every couple of years, within a program devoted to life and material sciences over the next decade, to provide important data and experience in planning and preparing advanced experiments for Space Station *Freedom*. Despite the success of IML-1 and advanced planning for IML-2, however, *Freedom*

was in serious trouble by the early 1990s due to its escalating costs and growing complexity. Ironically, when the revived and redesigned ISS program emerged along with a new partner in Russia, the limited resources available and the need to devote several Shuttle missions to assembling and supplying the station signaled the demise of the Spacelab Long Module program. This also saw the plans for IML (and other Spacelab-type missions) reduced from a ten-year multi-flight program to just two missions.

When crew assignments to three Shuttle missions were announced on February 21, 1992, they included Steve Nagel being named as CDR for STS-55/Spacelab D-2, scheduled for launch early in 1993. Spacelab D-2 was a second cooperative mission with the German Space Agency, to conduct research into robotics, materials processing and life sciences. Also selected with Nagel were PLT Tom Henricks (Class of 1985) and MS Charles Precourt (Class of 1990), who joined the previously assigned crewmembers. [**14**]

STS-45 (March 24 – April 2, 1992)
Flight Crew: Charles F. Bolden (CDR), Brian Duffy (PLT), Kathryn D. SULLIVAN (MS-1), David C. Leestma (MS-2), C. Michael Foale (MS-3), Dirk D. Frimout (PS-1, ESA, Belgium), Byron K. Lichtenberg (PS-2, United States)
Spacecraft: Atlantis (OV-104) 11th mission
Objective: 46th Shuttle mission; Atmospheric Laboratory for Application of Science-1 (ATLAS-1) research program
Duration: 8 days 22 hours 9 minutes 28 seconds
Support Assignments: Rhea SEDDON continued her tour as Capcom on Orbit 2, this time on the 'Falcon' team. [**15**] FCOD Management Support was provided by Dick COVEY at JSC for both launch and landing, while Loren SHRIVER again fulfilled the role of Mishap Representative at JSC. Weather Support was provided by Steve NAGEL at KSC and Edwards and Fred GREGORY for OSR and landing at Edwards. Dan BRANDENSTEIN was back in the SMS, this time on the first shift, honing his skills in preparation for his forthcoming flight after "flying a desk" for a couple of years. [**16**]

On her third and final mission, Dr. Sullivan served as PC and a member of the Blue Shift on STS-45, the first Spacelab mission dedicated to NASA's Mission to Planet Earth program. During this nine-day mission, the crew operated the 12 experiments that constituted the ATLAS-1 payload. ATLAS-1 obtained a vast array of detailed measurements of atmospheric chemical and physical properties, contributing significantly to improving our understanding of our climate and atmosphere. In addition, this was the first time an artificial beam of electrons had been used to stimulate a man-made aurora discharge. The mission was extended by a day in order to continue the science experiments.

STS-49 (May 7 – 16, 1992)
Flight Crew: Daniel C. BRANDENSTEIN (CDR), Kevin P. Chilton (PLT), Richard J. Hieb (MS-1), Bruce E. Melnick (MS-2), Pierre J. Thuot (MS-3), Kathryn C. Thornton (MS-4), Thomas D. Akers (MS-5)
Spacecraft: Endeavour (OV-105) 1st mission
Objective: 47th Shuttle mission; maiden flight of Endeavour; capture, repair and redeployment of Intelsat VI (F-3); Assembly of Space Station by EVA Methods (ASSEM) demonstration
Duration: 8 days 21 hours 17 minutes 38 seconds
Support Assignments: Dick COVEY again fulfilled the FCOD Management Support role at JSC during both launch and landing. Fred GREGORY was entry Capcom in MCC-H. Norman THAGARD was on 24-hour callout for SPAN during FD2. Weather Support for launch and EOM at Edwards was provided by Steve NAGEL. Loren SHRIVER was Mishap Representative again at JSC and also worked the second shift in the SMS. [**17**]

Chief Astronaut Dan Brandenstein commanded the newest (and final) Shuttle Orbiter on this mission, becoming the only TFNG pilot astronaut to lead a crew on the maiden flight of a new Orbiter. And what a flight it turned out to be. During the mission, the crew had to rendezvous with the stranded Intelsat VI satellite, capture it using the Remote Manipulator System (RMS), install a new Perigee Kick Motor (PKM), and then redeploy the satellite. While this sounded straightforward, it proved to be anything but. When the capture bar could not be secured automatically, an ingenious three-person EVA was staged to allow the astronauts to grab the satellite physically and then lower it down onto the capture bar. With the new PKM installed and the satellite redeployed, the new motor dispatched it to geostationary orbit the following day. The mission also included a further demonstration of constructing pyramid structures, as another evaluation of space station assembly techniques similar to those conducted on STS-61B in 1985. The demonstration was difficult and was in any case largely redundant, as by now the redesign of the space station was leaning towards deploying pre-fabricated truss structures to form its main backbone, with the least EVA input possible.

A summer of departures
With the new Shuttle flying its first mission, the fleet once again comprised four vehicles to support the manifest of the 1990s and hopefully beyond. The nature of the payloads had also changed, from mainly commercial to a more scientific orientation, including both NASA's topical Mission to Planet Earth program and preparations for the Space Station. Exactly what that Space Station would be was now mired in debates and wrangles on Capitol Hill, in the halls of NASA and at the contractors. While this was making its uncertain way through the various

political and legal stages and re-design processes, several members of the Class of 1978, now 14 years into their service with the agency and with a significant number of newer astronauts occupying the Astronaut Office, decided it was time to move on.

Fred Gregory left the Astronaut Office, but not NASA, during May. He became the Associate Administrator at the Office of Safety and Mission Assurance, a position he would hold until 2002. That same month, Jim Buchli was replaced by Dave Leestma (class of 1980) as Deputy Chief of the Astronaut Office, a position Buchli had officially held since March 1989. On May 29, it was announced that Buchli would be retiring from the U.S. Marine Corps (USMC) and NASA in August (effective September 1), to take up a position with Boeing Defense and Space Group in Huntsville, Alabama, as Manager of Station Systems Operations and Requirements. Buchli had flown four times on the Shuttle during his 14 years at NASA and had completed a number of technical assignments, including in the Astronaut Office Development Branch working on the display and controls for the Shuttle and Space Station *Freedom*. His significant contributions were described as assets for Boeing in their support of the Space Station program. On his decision to leave the Astronaut Office, Buchli said: "I'm grateful for my years of active service as a Marine and as part of the NASA team. It has allowed me to be part of two of the finest organizations in the world. I'm looking forward to changing career directions and remaining involved with the outstanding people who make up our space team." [**18**]

The following month, STS-50 was launched on the first U.S. Materials Laboratory mission, with *Columbia* flying the first EDO mission kit to provide the capability of extending the duration of the mission to 14 days. This kit of additional cryogenics and consumables was used on several missions in the 1990s to stretch the capabilities of the Shuttle Orbiter on science missions and acquire further baseline data, research results and experience in flying longer missions as a prelude to Space Station. STS-50 was also just the third Shuttle flight since the initial TFNG mission, STS-7 in 1983, to be launched without a member of Group 8 among the crew (the others being STS-51F in July 1985 and STS-41 in October 1990). This shows the dominance the 1978 group held in the Astronaut Office during the first decade of the Shuttle program, both before and immediately following the loss of *Challenger*.

As normal, several of the non-assigned Group 8 astronauts fulfilled support roles during this mission. FCOD Management Support was provided by the retiring Jim Buchli at JSC for launch and landing, while Shannon Lucid was on 24-hour call for SPAN during FD3. Weather Support was provided by Steve Nagel and Dick Covey for launch, with the latter also supporting EOM at Edwards. Dave Walker was at KSC for EOM. Loren Shriver was the Mishap Representative at JSC again, and was also in the SMS for the first shift. [**19**] Rhea Seddon was at the Capcom console for Orbit 2 on the 'Antares' team. [**20**]

On June 25, with her STS-45 responsibilities completed, Kathy Sullivan was formally nominated as Chief Scientist at the National Oceanic and Atmospheric Association (NOAA), succeeding Sylvia Alice Earle. Pending Senate confirmation to make this a permanent assignment, she would assume the new position effective August 17, 1992. "My 14 years at NASA have been immensely rewarding, both professionally and personally," she said. "I will take many cherished memories with me, particularly the superb people who make up the Shuttle team. I know they can craft this country an exciting spacefaring future, and I will watch their exploits with great interest and pride." [**21**]

On the very same day of Sullivan's appointment, John Creighton announced that he, too, was leaving the Astronaut Office and NASA, and retiring from the USN, effective July 15, to join the Commercial Airplane Group of the Boeing Co. in Seattle, Washington, where he would be working as a production test pilot and as an instructor pilot in the customer support area. "I have thoroughly enjoyed my time at NASA," Creighton said, "especially working with the outstanding people there. I feel privileged to have flown on three Shuttle missions – each unique and rewarding – but there comes a point when it's time to look for a new and different challenge. I'm looking forward to returning to Seattle where I grew up, and to beginning my new career at Boeing." [**22**]

On July 1, Dan Brandenstein, the Chief of the Astronaut Office for the past five years, also announced his intention to leave the agency and retire from the USN on or about October 1, to pursue other interests. "For the past 14 years I have had the opportunity to have the most challenging and interesting job in the world," Brandenstein explained. "It has been exciting, rewarding, and a pleasure to work with the many talented and motivated people who make up this country's space team. Although I have chosen to change careers, I will always be an avid supporter of the space efforts which I feel are essential to the advancement of knowledge and technology in this country." [**23**] With effect from December 8, 1992, Brandenstein was replaced as Chief Astronaut by Robert 'Hoot' Gibson, who had missed out on the position in 1987.

STS-46 (July 31 – August 8, 1992)
Flight Crew: Loren J. SHRIVER (CDR), Andrew M. Allen (PLT), Claude Nicollier (MS-1, ESA, Switzerland), Marsha S. Ivins (MS-2), Jeffrey A. HOFFMAN (MS-3, PC), Franklin R. Chang Díaz (MS-4), Franco Malerba (PS-1, Italian Space Agency)
Spacecraft: Atlantis (OV-104) 12th mission
Objective: 49th Shuttle mission; deployment of ESA's European Retrievable Carrier (EURECA); Tethered Satellite System-1 (TSS-1) demonstration
Duration: 7 days 23 hours 15 minutes 3 seconds
Support Assignments: Dick COVEY was back at JSC as FCOD Management Support for launch and was also Weather Support at the Cape for launch and OSR/

landing. Weather Support at Edwards was provided for EOM by Dave WALKER. Hoot GIBSON was in the SMS for the first shift, while Norman THAGARD was on 24-hour call for SPAN during FD1. [**24**]

The STS-46 mission included the deployment of the ESA-sponsored free-flying science platform EURECA and the first test flight of the TSS, a joint project between NASA and the Italian Space Agency. Jeff Hoffman had worked on the Tethered Satellite project since 1987 as a technical assignment. TSS was an experiment to generate electricity to provide spacecraft with power using tethered satellites lowered into the upper reaches of the atmosphere, at greater altitude than balloons and lower than orbiting satellites. It was intended to provide data for future operations in space broadcasting, atmospheric research and conducting microgravity experiments. Though the TSS was deployed successfully, several failures were encountered with unplanned halts of the deployment mechanics. Instead of being deployed to 20 km as planned, the TSS reached only 256 m out from the payload bay. In this two-shift mission, Hoffman was assigned to the Red Shift, while fellow TFNG and mission CDR Loren Shriver worked with either the Blue or Red Shift as required.

A Plus One

In the midst of all the departures among the Class of 1978, there was one arrival. On August 1, Steve Hawley returned to JSC from Ames Research Center – not to the Astronaut Office, but to take the position of Deputy Director of Flight Crew Operations. "This is a unique opportunity to return 'home' and play a part in running my old organization," he said. "I have enjoyed my two years at Ames and seeing a unique part of the agency. I will miss the Ames people very much." Don Puddy, the Director of FCOD, said that Hawley's experience as an "outstanding manager" made him well qualified to help lead the flight crew functions at JSC. These included recommending astronaut selections, aviation operations, domestic and international PS activities, and operational contributions to the design and development of manned spacecraft, payloads, equipment and systems. [**25**]

In an interview with the authors, Steve Hawley expanded upon his decision to return to JSC after two years at Ames. "I was lucky because when I went out there, I did it at a specific request from headquarters. It was [William B.] Bill Lenoir [Associate Administrator for Space Flight] that called me up and asked me to do it. At the time, I remember it was a tough decision, but I remember thinking [that] my plan was to spend my career at NASA and if I was going to spend my career at NASA then it might be more beneficial for me to get this experience as a manager in different parts of the agency than it would be to fly a fourth mission. They don't care if you've flown three times for four times, and so I said 'Yes, I'll do this, and if I don't like it. I will just come back'. That's more or less what happened. It wasn't that I didn't like it, I just found that [it] was really interesting and

I was learning a lot, but while I was out there I was still wanting to fly Shuttle missions. And it occurred to me that people were managing to do that without my help and that was tough to take back then. I realized that I shared this with some of my other colleagues: don't leave unless you are really prepared to watch somebody else do this. You know, if you're not really ready to go, don't leave. So I decided that I really wanted to get back into operations, I wasn't really ready to step aside, but in the time it took me to leave JSC and be at Ames for a year, or a year and a half, Bill Lenoir was gone, and two or three other people who were involved in asking me to go there had gone. [Richard H. (Dick)] Truly [former astronaut and the eighth Administrator of NASA] might have left too and gone back to the Navy, I don't remember, but anyway, all of the people that knew why I had gone out there were no longer around. Aaron Cohen [Deputy NASA Administrator] was still around, but suddenly I realized that if I tried to go back to JSC, there were going to be a lot of people who are going to go, 'who is this guy that wants to work JSC?' And so I decided that if I was going to go back, I really needed to go back now, so I got in touch with Aaron and I said, 'Hey, I would like to come back'. I think the first thing he did was offer me the job of deputy project manager for the CRV crew rescue vehicle for station. I didn't really want to do that, I wasn't sure that project was going to go anywhere, and then he said, 'Well, come back and be Don [Donald R.] Puddy's deputy' and I said 'Yes, I'll do that'. I don't remember how much longer Aaron was there afterwards, but basically all of the people that had asked me to go do this [work at Ames] had gone. I felt this window of opportunity [to return to JSC] shrinking in front of me, but the experience was great, I learned a lot, met some good friends, and learned about different parts of the agency. I learned some management skills maybe, but back in the early '90s I wasn't ready to give up flight operations." [**26**]

On August 27, NASA announced crew assignments for STS-58 (SLS-2) and STS-61 (Hubble Service Mission 1). There were no further TFNG assignments on STS-58 to join the previously named PC Rhea Seddon and MS Shannon Lucid, but there was one for STS-61. Three MS with spacewalking experience were named to join Story Musgrave in preparing for the first servicing mission to the Hubble Space Telescope (HST). The three were Tom Akers (Class of 1987), Kathy Thornton (Class of 1984) and TFNG Jeff Hoffman. [**27**]

STS-47 (September 12 – 20, 1992)
Flight Crew: Robert L. GIBSON (CDR), Curtis L. Brown (PLT), Mark Lee (MS-1, PC), Jerome Apt (MS-2), N. Jan Davis (MS-3), Mae C. Jemison (science MS), Mamoru M. Mohri (PS-1, NASDA, Japan)
Spacecraft: Endeavour (OV-105) 2nd mission
Objective: 50th Shuttle mission; Spacelab J research program flying the Spacelab Long Module Unit #2
Duration: 7 days 22 hours 30 minutes 23 seconds

Support Assignments: FCOD Management Support roles were completed by Dick COVEY at JSC for launch and landing and the recently returned Steve HAWLEY at KSC/OSR for launch, orbit and landing [authorized Crew Transfer Vehicle (CTV)]. HAWLEY also fulfilled the role of FCOD Management Representative for the Crew Recovery Team. Weather support was completed by retiring Chief Astronaut Dan BRANDENSTEIN at KSC and by Dave WALKER at Edwards, who also worked the second shift in SMS. [**28**]

The seven-person crew commanded by Hoot Gibson included the first Japanese astronaut to fly on the Space Shuttle[1]. During eight days aloft, the STS-47 astronauts focused on science and materials processing experiments in 44 investigations aboard a Spacelab module cradled in the Shuttle's cargo bay. Of these, 35 were sponsored by NASDA, seven by NASA, and two were joint investigations. The payload also included four female frogs, 30 chicken eggs, 180 oriental hornets, about 400 fruit flies, 7,200 fly lava and two Japanese carp. In the build-up to the mission, the media soon latched on to the extended 'crew' roster and started calling the mission "Hoot's Ark", referring to the commander's nickname and his extensive zoological 'crew complement'.

Missiya Spetsialist Kosmonavt

On October 6, 1992, experienced Russian spacefarers Vladimir Georgiyevich Titov and Sergei Konstantinovich Krikalev were identified as the two cosmonauts who would undergo abbreviated NASA MS training at JSC for flights on the Space Shuttle, following a recent agreement with the Russians. This closer tie between the two nations was the beginning of acceptance of the new, emerging Russia, and preceded a major review of the Space Station *Freedom* program by President Bill Clinton's administration the following year.

The next Shuttle mission, STS-52/LAGOES II/USMP-1 (October 22 – November 1) lacked any Group 8 members on the flight crew, but once again several of them served in support roles. FCOD Management Support was completed by Steve Hawley (Launch KSC/OSR orbit JSC, and landing KSC [authorized CTV]), while Dick Covey was at JSC for the landing, although he was replaced by Group 9 astronaut Dave Leestma at JSC for launch. He was also replaced in the original memo listing for Weather Support at the Cape and Edwards by Group 9 astronaut Richard Richards. On 24-hour call for SPAN were Steve Nagel (launch), Shannon Lucid (FD6) and Loren Shriver (FD9). Mishap Representative for this mission was Loren Shriver, the Crew Recovery Team FCOD Management Representative was Steve Hawley, and Dave Walker worked on the first shift in the SMS. [**29**]

[1] The first Japanese citizen to fly in space was Toyohiro Akiyama, a journalist who had been selected to fly a one-week mission on Soyuz TM-11 to Mir in December 1990.

In another management reshuffle in November 1992, and after only a few months in the position, Dave Leestma was replaced as Deputy Chief of the Astronaut Office by TFNG Loren Shriver. Leestma was named as the new Chief of the Flight Crew Operations Directorate at JSC.

STS-53 (December 2 – 9, 1992)
Flight Crew: David M. WALKER (CDR), Robert D. Cabana (PLT), Guion S. BLUFORD (MS-1), James S. Voss (MS-2), M. Rich Clifford (MS-3)
Spacecraft: Discovery (OV-103) 15th mission
Objective: 52nd Shuttle mission; deployment of classified DOD payload
Duration: 7 days 17 hours 19 minutes 47 seconds
Support Assignments: FCOD Management Support fell to Steve HAWLEY at KSC/OSR for launch, JSC for orbit and KSC for landing [authorized CTV], and Dick COVEY at JSC for launch and landing. HAWLEY was again the Crew Recovery Team Management Representative. Weather Support was Loren SHRIVER (KSC) and Hoot GIBSON (OSR), with SHRIVER serving as Mishap Representative at JSC and GIBSON doing so at MIT. Steve NAGEL served on the second shift in the SMS. [**30**]

On this flight, the tenth and final DOD Shuttle mission, the crew deployed the classified DOD-1 payload (later identified as the third Advanced Satellite Data System Intelligence Relay Satellite) and performed several Military-Man-in-Space and NASA experiments during their seven-day mission.

Fig. 12.2: The STS-53 'stowaway' known as "Dog Breath," an official member of the "Dogs of War" Shuttle crew. (Image courtesy Ed Hengeveld.)

The Dogs of War

Every crew takes their mission and objectives very seriously, fully aware of the huge investments in their training and in the preparations and importance each expensive mission contributes to the program. But there is usually a little time for some lightheartedness as well.

The Dogs of War is what the STS-53 crew called themselves during training, as all five were patriotic representatives of the four armed forces of the United States and active serving military officers on secondment to NASA. TFNG and mission CDR Dave Walker was a Captain in the USN and a team builder by nature, but also liked to have fun. PLT Robert Cabana was a USMC Colonel, MS Guion Bluford was a Colonel in the United States Air Force (USAF), and Lt. Colonels Jim Voss and Rich Clifford were both representatives of the U.S. Army.

Throughout his military flying career prior to arriving at NASA, red-headed Dave Walker had already acquired the nickname "*Red Flash*." But having such a military-orientated crew behind him, and with his 'dogged' determination, he decided to "dig up the bone" and adopt the 'Dog Crew' callsign. "It's a morale booster," Walker once said, "[giving] us an excuse for parties." Cabana, being a Marine, naturally became "*Mighty Dog*." Clifford, the rookie on the crew, became "*Puppy Dog*", while Bluford became "*Dog Gone*." He was also the one who gave Jim Voss the title "*Dog Face*," after the Army's 'Dogface' infantry soldiers of WWII[2]. They also adopted a mascot called "*Duty Dog*." Walker himself was called "*Red Dog*."

"In order to make training an enjoyable experience," Bluford explained, "Dave [Walker] bought a jalopy (the "*Dogmobile*") and painted our names on the side. The trainers and support people in Mission Control all had dog names. My dog name was "*Dog Gone*" [as] I had been in Europe on PR trip when Dave handed out the dog names. We even had a paper dog mascot stored in the middeck lockers, which we took into space and hung up. Though we had a lot of fun with our dog names, we took our tasks seriously when we trained." [**31**] The stowaway up on orbit was a rubber dog mask hung over an empty orange launch and entry suit, and was known by the name "*Dog Breath*." During preparations for the mission, the STS-53 training team became known as "*Bad Dog*," due to their tough approach with the crew in the simulations, while during the actual mission, the crew often reported that they were "working like dogs."

[2] The term 'Dogface' normally refers to U.S. Army foot soldiers, primarily in WWII. The origin of this is vague, but in the American Civil War, wounded soldiers had tags tied to them to indicate their wounds, similar to those used on a pet dog. During WWII, American infantrymen living in "pup tents" and "foxholes", were often cold, wet and filthy as a hunting hound, with long faces deemed to resemble a sad dog, and always being ordered around and enduring shouted commands like a half-trained dog.

On December 8, 1992, Hoot Gibson took over as Chief of the Astronaut Office at JSC. He would retain the position for the next two years until he began full-time training for his final space mission.

FREEDOM TO BECOME INTERNATIONAL

STS-54/TDRS-F was the next mission to fly with no TFNG among the crew, between January 13–19, 1993. This time, only five of the remaining Class of 1978 were assigned to support roles on the mission. FCOD Mission Support Launch (JSC) and landing (Edwards) [authorized CTV] was again Steve Hawley, with Loren Shriver fulfilling the role for landing at JSC and also serving as Mission Representative at the same field center. Weather Support for launch and KSC EOM was Hoot Gibson, while Dick Covey was over in Morón, Spain, for TAL support. Steve Nagel worked the first shift in the SMS. [**32**]

In early March, it became clear that Norman Thagard was a leading candidate for a 90-day mission to the Mir space station. At the time, he was taking Russian language lessons and had completed several trips to Russia in his role as Astronaut Office Point of Contact (POC) for Russian Manned Mission Operations. According to private sources, Thagard was the candidate preferred by the Astronaut Office and management at JSC, although Washington Headquarters preferred Bill Shepherd (Class of 1984) for the assignment.

During April 7–17, STS-56 flew the ATLAS-2 mission, again without a member of the TFNG on the flight crew. Only two of the Class of 1978 were assigned to support roles for this flight. Once again, FCOD Support for launch at JSC and landing at Edwards was provided by Steve Hawley, while Weather Support at KSC was fulfilled by Hoot Gibson. [**33**]

STS-55 (April 26 – May 6, 1993)
Flight Crew: Steven R. NAGEL (CDR), Terence T. Henricks (PLT), Jerry L. Ross (MS-1, PC), Charles J. Precourt (MS-2), Bernard A. Harris (MS-3), Ulrich Walter (PS-1, DFVLR, Germany), Hans W. Schlegel (PS-2, DFVLR, Germany)
Spacecraft: Columbia (OV-102) 14th mission
Objective: 55th Shuttle mission; Spacelab D-2 research program using Long Module Unit #1
Duration: 9 days 23 hours 39 minutes 59 seconds
Support Assignments: Steve HAWLEY again provided FCOD Management Support for launch (JSC) and landing (Edwards) [authorized CTV]. Weather Support was provided by Hoot GIBSON at KSC. [**34**]

Getting STS-55 off the ground proved to be a challenge. The original launch had slipped from February, and again several times in March, due to hardware issues. On March 22, the first two main engines had ignited at about T-3 seconds, but the launch had been aborted when the third engine failed to ignite. This type of abort was termed a Redundant Set Launch Sequencer, one in which serious problems prevented the launch after the Shuttle's onboard computers have taken over from the Ground Launch Sequencer, but just prior to the ignition of the Solid Rocket Boosters (SRB). If the SRB ignited, the launch had to occur regardless of the issue. Fortunately, this system worked as designed (as it did on the other four occasions it was needed in the program) but the STS-55 mission was delayed into April to allow the replacement of all three main engines. Frustratingly, it was delayed again on April 24 – this time for 48 hours due to a faulty Inertial Measurement Unit (IMU) – before finally leaving the pad on April 26.

This second dedicated German Spacelab mission featured a research program of 88 experiments, investigating materials and life sciences, the application of technology, Earth observations, and astronomy and atmospheric physics. The crew worked the familiar two-shift system, with Nagel working alongside Ross, Henricks and Walter on the Blue Shift and the rest of the crew on the Red Shift. During the flight, the Mission Management Team (MMT) decided that there was sufficient power onboard to extend the mission by one day, so that when Steve Nagel finally brought *Columbia* to a wheelstop on Runway 22 at Edwards AFB in California, just over 12 years since John Young had returned the same Orbiter to Runway 23 at the end of STS-1, the cumulative time logged by the five Orbiters across the 55 missions to date exceeded one year (365 days 23 hours 48 minutes).

Taking a break from training

On May 3, Rhea Seddon was working in Building 9 when she was injured in her training accident while preparing for her flight on STS-58/Spacelab Life Science 2. Seddon broke four metatarsal bones in her left foot but was not expected to be taken off the flight because of the injury. Fortunately, she missed only a couple of weeks of refresher training. As an experienced astronaut and veteran of two previous missions, most of her Space Shuttle training for this flight was mainly familiarization classes. [**35**]

The next mission, STS-57 (Spacehab 1/EURECA retrieval) flew between June 21 and July 2, 1993. The only Group 8 astronauts listed in support roles for this flight (in an Astronaut Office memo dated June 1, 1993) were Weather Pilots Hoot Gibson (launch and Edwards EOM) and Dave Walker (Edwards EOM).

Following the landing of STS-57, a number of managerial appointments came into effect that involved some of the Group 8 astronauts, moving more of the veteran TFNG away from active flight status and into management roles. Brewster

Shaw, the former Deputy Director of Space Shuttle Operations at KSC, became Director of Shuttle Operations at JSC. Loren Shriver, replaced as Deputy Chief of the Astronaut Office by Linda Godwin (Class of 1985), joined the Shuttle Program Office to assist in the management of the program as Manager for STS Launch Integration, while Dave Walker became Chief of the [Space] Station/Exploration Office at FCOD, a position he held until June 1994. [**36**]

On June 15, it was announced that Guion Bluford would be leaving NASA and retiring from the USAF in July 1993 to take a position as Vice President and General Manager of the Engineering Sciences Division, NYMA Inc., in Greenbelt, Maryland. NYMA provides engineering and software support services to the Federal Aviation Administration (FAA), the Justice Department, the Department of Defense and NASA. "I feel very honored to have served as a NASA astronaut and to have contributed to the success of the Space Shuttle program," Bluford stated at the time. "I will miss working with the people at JSC and the team spirit and *esprit de corps* that comes with flying crew members in space." [**37**]

The next mission to fly, STS-51 (ACTS deployment/ORFEUS-SPAS deployment and retrieval), flown between September 12–22, once again saw Group 8 astronauts providing only support rather than crewmembers. Steve Hawley was once more FCOD Management Support for launch and landing at JSC, and Crew Recovery Team FCOD Representative. Hoot Gibson continued his role as Weather Pilot at KSC and Edwards. [**38**]

STS-58 (October 18 – November 1, 1993)
Flight Crew: John E. Blaha (CDR), Richard A. Searfoss (PLT), M. Rhea SEDDON (MS-1, PC), William S. McArthur (MS-2), David A. Wolf (MS-3), Shannon W. LUCID (MS-4), Martin J. Fettman (PS-1, veterinarian)
Spacecraft: Columbia (OV-102) 15th mission
Objective: 58th Shuttle mission; Spacelab Life Sciences 2 research program using Long Module Unit #2
Duration: 14 days 0 hours 12 minutes 32 seconds
Support Assignments: Dick COVEY worked the second shift in the SMS. Steve NAGEL was originally assigned as STA Weather Pilot but in the memo he had been replaced for launch and EOM landing at Edwards by Jim Wetherbee. [**39**]

On this, her third and final space mission, PC Rhea Seddon and her fellow crewmembers received NASA management recognition for their contribution to the most successful and efficient Spacelab flown to date. During their 14-day flight, the second life sciences research mission, the seven-person crew worked a single shift system, similar to that followed during STS-40/SLS-1 two years earlier. The focus was upon 14 experiments across five major areas of neurovestibular, cardiovascular, cardiopulmonary, metabolic, and musculoskeletal medicine, with the

crew conducting experiments on themselves and 48 rats to expand knowledge of human and animal physiology both on Earth and in space flight. The crew also performed a number of engineering tests and Extended Duration Orbiter Medical Project (EDOMP) experiments aboard *Columbia*.

STS-61 (December 2 – 12, 1993)
Flight Crew: Richard O. COVEY (CDR), Kenneth D. Bowersox (PLT), Kathryn C. Thornton (MS-1), Claude Nicollier (MS-2, ESA, Switzerland), Jeffrey A. HOFFMAN (MS-3), F. Story Musgrave (MS-4, PC), Thomas D. Akers (MS-5)
Spacecraft: Endeavour (OV-105) 5th mission
Objective: 59th Shuttle mission; first Hubble Servicing Mission (SM-1)
Duration: 10 days 19 hours 58 minutes 37 seconds
Support Assignments: Hoot GIBSON was STA Weather Pilot for launch, at Edwards, or KSC EOM, as required. [**40**]

During this 11-day flight, the HST was captured and restored to full capacity thanks to a record five EVAs by two pairs of astronauts. They replaced four gyros in the two Rate Sensing Units, two electronic control units, the solar arrays, and installed corrective optics to improve the vision of the telescope. Jeff Hoffman (EV1) logged a total of 22 hours 02 minutes on EVA and was teamed with Story Musgrave for three of the five spacewalks: December 4 (EVA #1: 7 hrs 54 min); December 6 (EVA #3 6 hrs 47 min) and December 9 (EVA #5: 7 hrs 21 min).

1994: A Barren Year
By 1994, there was a growing consistency in the number of Shuttle missions that had been launched since the return to flight (two in 1988; five in 1989; six in 1990; six in 1991; eight in 1992; and seven in 1993). There would be another seven in this year, with each mission continuing to fulfill the manifest of science and research as a precursor to Space Station. However, 1994 would also be notable as the first year since 1982 that no member of Group 8 flew in space, reflecting the changing personnel in the Astronaut Office[3]. Though most of the TFNG had retired from active flight status, there were still some important contributions to come from those in NASA management roles and from those remaining in the Astronaut Office.

[3] 1987 was an exception, as the whole fleet was grounded during the recovery from the *Challenger* accident. In the six decades since human space flight began in 1961, there have only been eight years in which no American has flown into space (1964, 1967, 1976–80 and 1987).

The first mission of the year was STS-60 (Spacehab 2/Wake Shield Facility 1), flown between February 3−11, which featured the first cosmonaut (Sergei Krikalev) to fly on the Space Shuttle. The only support role fulfilled by a TFNG that the authors could find for this flight was that of Chief Astronaut Hoot Gibson, who served as STS Weather Pilot for launch and KSC EOM. [**41**]

A THREE-PHASE PROGRAM

When the ISS Program succeeded the cancelled Space Station *Freedom*, the Russians were welcomed as full partners in what was now a 16-nation venture. As well as the redesign of the station and program, it had been decided to split the creation of ISS into several phases.

- Phase One: Following the flight of a cosmonaut on the Shuttle (Krikalev on STS-60), between 7−10 Space Shuttle-Mir docking missions would take place between 1995 and 1997, with each featuring rendezvous, docking (the first for the Americans since ASTP in 1975) and crew and logistics transfers. The Space Shuttle crew would assist in crew exchange logistics, consumable resupply and payload activities on Mir. In addition, a second Russian cosmonaut (Vladimir Titov) would fly on STS-63 in a near-rendezvous flight, to be followed by four or more NASA astronaut extended stays on Mir (all except the first launching and each landing on the Space Shuttle, to give Shuttle crews much needed rendezvous and docking practice). This would accumulate almost two-years of on-orbit experience, significantly increasing the on-orbit time of the NASA astronaut corps.
- Phase Two: Devoted to the assembly of the 'core' of the ISS, from the launch of the first Russian modules and initial elements of the truss structure, up to the attachment of the U.S. Laboratory, the first elements of the Mobile Base System (MBS) and the U.S. Airlock. This would allow the station to be occupied permanently by a core crew of three, supported by a Soyuz crew rescue vehicle and without requiring the presence of a docked Shuttle.
- Phase Three: Expansion of the station to include all the hardware, facilities and infrastructure from the international partners, to attain the status of Assembly Complete. The permanent crew could then be increased to six (occasionally increasing in the short term to nine), by crew rotation in successive overlapping teams of three.

Orbital operations after Assembly Complete were designed to expand the scientific and research capabilities of the orbital facility, as well as keeping up the maintenance and housekeeping levels to support 24/7 operation, 365 days each year, into the 2020s.

Do You speak Russian?

Before any construction or occupation of the ISS could be addressed, however, the Americans needed to gain experience in long duration space flight, beyond that pioneered on Skylab two decades before. On February 3 came the long awaited and much anticipated news that TFNG Norman Thagard would be the prime American astronaut aboard a Russian Soyuz for a three-month mission to the Mir space station. His back-up (in the first such NASA assignment since 1982) was named as Bonnie Dunbar (Class of 1980). The pair would leave for Russia later that month with a NASA support team, and each would be paired with a two-man cosmonaut team to train as a three-person resident crew. The launch would be aboard a Russian R-7 (Soyuz-U2) rocket and the flight to Mir aboard a Soyuz spacecraft. The return to Earth would be on the Space Shuttle (STS-71), with the next Mir crew flying to the station on STS-71 but returning at the end of their residency on a Soyuz spacecraft. It was also revealed that a number of NASA astronauts were undergoing Russian language training, though this did not necessarily mean that they would automatically be assigned to one of the planned Shuttle-Mir docking missions. [**42**]

An astronaut on Mir

Following STS-42 in early 1992, Norman Thagard had been given a technical assignment working Space Station again, and was thinking about retiring. During that summer, he was discussing his options with Dave Hilmers (Class of 1980) when he learnt of the opportunity to fly with the Russians on Mir. A few days later, Chief Astronaut Dan Brandenstein asked if he was interested in flying the Russian mission. "It was a bolt out of the blue, because I had never gone to him and volunteered," he explained, "and I said 'Absolutely', because I thought it was a neat thing to do." [**43**] Thagard had always wanted to learn Russian, but could not find a reason to do so until now. "It was a ride on a Soyuz rocket, it was training in Russia, and it was [a reasonably] long duration, three months, which would be unlike anything that I'd experienced in the Shuttle program, so I thought it was a great deal." Initially, he started self-studying Russian, and then classes were organized in the Astronaut Office. Shannon Lucid had been studying Russian for about a year, and in July 1993, limited funds became available for more intense lessons at a Russian language school in Monterey, California. Thagard stayed there for about four and a half months, returning to Houston a few weeks prior to the official announcement of his selection to the flight.

An astronaut's training for Mir

Thagard, his back-up Bonnie Dunbar, and their support team, moved into the Yuri Gagarin Cosmonaut Training Center in Russia (Tsentr Podgotovki Kosmanavtov, or TsPK, also known as Star City) to start Phase 1 (Group) training effective

March 1, 1994. This phase of training included technical training on the Soyuz TM spacecraft that would take Thagard and his Russian colleagues to the Mir space station. Over the next seven months, the two Americans received practical classes and numerous training sessions in the Soyuz simulator and part-task trainers; technical training on the Mir orbital complex followed by simulator and further part task training; a program of medical and biological training; simulated microgravity flights in airborne laboratories flying parabolic curves; medical examinations and physical training; and survival and wilderness training. All the training sessions and exams were conducted in Russian which, along with being so far from family and friends back in the United States, added to the challenge. Not only was a Mir assignment challenging technically and professionally, it was also a severe culture shock for the Americans. The first phase of Thagard and Dunbar's training was completed on October 7, 1994, when both astronauts were assigned to their Russian crew colleagues.

As the NASA-1 Board Engineer, Thagard was paired with the Mir-18 crew of Vladimir Nikolayevich Dezhurov, a rookie cosmonaut and CDR of the Soyuz TM-21 spacecraft they were to fly to Mir, and Flight Engineer (FE) Gennady Mikhailovich Strekalov, a veteran of four previous missions to Salyut 6, Salyut 7 and Mir, who had survived a launch pad abort on September 26, 1983. Dunbar was teamed with her CDR Anatoly Yakovlevich Solovyov, a veteran of three missions to Mir, and rookie FE Nikolai Mikhailovich Budarin[4].

The second phase of their Mir training was as part of a resident crew. This continued the practical training on the Soyuz TM simulators and further training on the Mir station, including aspects of the scientific program the crew would conduct aboard the station. There was also a program of joint training with the assigned Shuttle crew (in this case STS-71 headed by Hoot Gibson) at both TsPK and back in the United States. This phase of training was completed between October 10, 1994 and February 21, 1995, three weeks prior to the launch of Soyuz TM-21.

In total, Thagard and Dunbar accumulated 883 hours as a group for Phase 1 of cosmonaut training and 845 hours in Phase 2 Mir resident crew training, totaling an impressive 1,728 hours in the 12 months between March 1994 and March 1995. A detailed account of the training of American astronauts for flights on the Mir station is beyond the scope of this current volume, but a summary can be found in *Russia's Cosmonauts*. [**44**] A summary of the training completed by Thagard (and subsequently Shannon Lucid) for residency on Mir can be found in Table 12.1

[4] Solovyov and Budarin would fly to Mir on STS-71 and take over as the Mir-19 resident crew, returning on Soyuz TM-21 after a flight of 76 days having handed over in turn to the Mir-20 crew. Dunbar flew to and from Mir on STS-71, but unfortunately did not complete a residency, though she was qualified to do so.

Table 12.1: NASA GROUP 8 RUSSIAN CREW TRAINING SUMMARY

TABLE 12.1a: Scope and dates of Mir training for NASA group 8 astronauts

NASA board engineer mission	Prime astronaut	Phase 1 (Group) start/complete	Phase 2 (Crew) start/complete	Total hours in group	Total hours in a crew	Total training hours	Launch date/ mission	Mir expedition
NASA 1	THAGARD	1994 Mar 01–1994 Oct 7	1994 Oct 10–1995 Feb 21	883	845	1728	1995 Mar 16, Soyuz TM-20	EO-18
NASA 2	LUCID	1995 Jan 03–1995 Jun 24	1995 Jun 26–1996 Feb 26	795	1127	1922	1996 Mar 24, STS-76	EO-21/-22

TABLE 12.1b: NASA group 8 astronauts Mir training hours as part of a group

NASA mission	Prime astronaut	Soyuz TM training		Mir training		Medical/ biological	Independent training	Russian language	Total hours
		Technical	Simulators	Technical	Simulators				
NASA 1	THAGARD	134	173	120	50	170	86	150	883
NASA 2	LUCID	20	50	114	60	122	161	268	795

TABLE 12.1c: NASA group 8 astronauts Mir training hours as part of a crew (Prime only)

NASA mission	Prime astronaut	Soyuz TM training		Mir training		Medical/ biological	EVA train-ing	Science training	Pre-flight training	Independent training	Russian language	Total hours
		Technical	Simulators	Technical	Simulators							
NASA 1	THAGARD	35	90	128	68	94	4	311	80	11	24	845
NASA 2	LUCID	80	130	141	142	180	0	266	24	76	88	1127

Taken from: *Russia's Cosmonauts Inside the Yuri Gagarin Training Center*, Rex D. Hall, David J. Shayler & Bert Vis, Springer-Praxis, 2005, pp. 280–281

Adopted from: *Phase 1Program Joint Report*, Editors George C. Nield and Pavel M. Vorobiev, 1999, NASA SP-1999-6108 (in English)

As Thagard and Dunbar were beginning their training in Russia, two Shuttle missions flew over the next two months. STS-62 (USMP-2/OAST-2) was flown between March 4–18 and the astronaut support roles for this mission fulfilled by members of the TFNG included: Steven Hawley as FCOD Management Representative, providing support for launch (KSC/OSR), orbit (at JSC) and landing back at the Cape; Hoot Gibson as STA Weather Pilot for launch and KSC EOM, and Dave Walker also at Edwards for the EOM; Hawley was also Management Representative for the crew recovery team. [**45**] This mission was followed by STS-59 (Space Radar Laboratory 1) between April 9–20, with the only TFNG Mission Support role completed by Hoot Gibson, as STA Weather Pilot for launch and landing EOM at KSC. [**46**]

Two months after STS-59 flew, the Shuttle crew assignments for the first mission to physically dock with the Russian Mir space station and exchange resident crews were officially announced on June 3. A seven-member crew would be led by TFNG Hoot Gibson and included PLT Charles Precourt (Class of 1990) and MS Ellen Baker (Class of 1984), Greg Harbaugh (Class of 1987) and Bonnie Dunbar (Class of 1980). Also assigned were Russian cosmonauts Anatoly Solovyov (Mir-19 CDR) and Nikolai Budarin (Mir-19 FE). The two cosmonauts would replace the Mir-18 crew and remain on the station as the next resident crew. Returning home on STS-71 at the end of the mission would be the Mir-18 crew of Vladimir Dezhurov (Mir-18 CDR), Gennady Strekalov (Mir-18 FE) and TFNG Norman Thagard (Mir-18 NASA-1 Board Engineer). The mission was scheduled for mid-1995 using the orbiter *Atlantis*, which had been specially modified to carry a docking system compatible with the Russian Mir station. As this was the first time since Skylab that an American astronaut would be returning from an extended duration mission in space (three months), *Atlantis* would also carry the Spacelab Long Module configuration, within which various life science experiments and collection of data would take place during the mission. [**47**]

On July 7, Dave Walker, who had been named as the Chief of the JSC Safety Review Board the previous month, was now named as CDR for STS-69. [**48**] Walker's new crew would include PLT Kenneth Cockrell (Class of 1990) and MS James S. Voss (Class of 1987), James Newman (Class of 1990) and Michael Gernhardt (Class of 1992). STS-69 was manifested to fly the SpaceHab-4 mission, which included the second flight of the Wake Shield Facility (WSF) experiment. The day after the STS-69 crew announcement, NASA launched the STS-65 (IML-2) mission, which flew between July 8–23. There were no signs of support roles for any of the TFNG on this flight in the undated Astronaut Office memo researched by the authors, beginning a trend over the next couple of years as the number of active members of the group reduced.

One such reduction of the TFNG in the Astronaut Office occurred on July 11, when it was announced that Dick Covey would leave NASA and retire from the USAF on August 1, 1994. He would take the position of Director of Business Development for Calspan Services Contract Division, an operating unit of Space Industries International, based in Houston. [**49**]

On September 6, Robert 'Hoot' Gibson stood down from the role of Chief Astronaut, as was the tradition, to return to full time training for the STS-71 mission. He was replaced as Chief Astronaut by Robert Cabana. In the last third of the year, the remaining members of the TFNG in the Office supported the final three missions flown. For STS-64 (LITE/SPARTAN 201; September 9–20), FCOD Management Support at JSC for launch was provided by Steve Hawley, while Dave Walker was STA Weather Pilot for Edwards EOM. [**50**] The Weather Pilots for STS-68 (SRL-2, September 30 – October 11) were Hoot Gibson for launch and KSC EOM and Dave Walker again for Edwards EOM. [**51**] For STS-66 (ATLAS-3/CRISTA-SPAS November 3–14), Steve Hawley again provided FCOD Management Support at JSC, this time for both launch and landing. [**52**]

To go or not to go? That is the question

On November 3, 1994, the day STS-66 launched, Shannon Lucid and John Blaha (Class of 1980) were named to training for the second of at least four scheduled astronaut residencies on Mir. The two space flight veterans, who had flown together on STS-58, journeyed to Russia in January 1995 to begin their training at TsPK for a long duration mission to the Russian station. [**53**]

It would be understandable to assume that an astronaut (or cosmonaut) would jump at the chance to fly if given the opportunity, and mostly this is true, but there have been instances over the years when this has not been the case. Rare instances of personality clashes or crew incompatibility aside, some of the original astronauts actually had no interest in taking a flight to the Moon, while others simply had no desire to spend weeks on board a space station, or wait years to fly the Shuttle. Now the Shuttle-era astronauts were faced with Shuttle-Mir. Here was an opportunity to do something different, but the sacrifice was to learn Russian and spend time living in Russia, initially away from family and friends for months on end. To many astronauts in the 1990s, this was not what they had joined NASA for and they had no desire to travel to Russia and train for such a mission. Therefore getting volunteers to put themselves forward for the Mir seats, as few as there were, was difficult. This was also a challenge faced by the Space Station planners early on.

There were many astronauts lining up for seats on the Space Station assembly missions, or for flights that did not visit the station, such as the Hubble Servicing Missions, but spending months training in locations around the world (USA, Europe, Canada, Japan and Russia) was not something many wanted to go through. Apart from the separation from their families, the harshness of the Russian winters, learning the Russian language and the amount of worldwide travel required for up to two years before flying a six-month mission were all just too much for some. These types of missions needed a new breed of space explorers, and from the early 2000s, with an all-time high of 149 astronauts in the office, that was what NASA looked to recruit. In 2004, the 11 astronauts selected for Group 19 were the last to undergo Shuttle mission training and fly on the vehicles before they were

retired. Five years later, the nine candidates of Group 20 became the first to focus entirely on the ISS and its supporting vehicles.

Back in the mid-1990s, the Shuttle-Mir docking missions and crewing for the available seats on long duration Mir flights were the focus, with the first element of ISS still three years from launch. At the start of the new year, two of the TFNG were preparing for their historic missions to the Russian space station.

THE FIRST TFNG VISIT A (RUSSIAN) SPACE STATION

On January 3, 1995, Shannon Lucid, John Blaha and their support team began their Phase 1 (Group) training at Star City. This would last for the next six months (completed on June 24) and totaled 795 hours. "People always think that you went over there and you trained with a crew", Shannon Lucid commented in 1998. "You didn't go over there and train with a crew. All my training in Russia was with John Blaha. John Blaha and I trained together. We sat in a classroom together. It was just the two of us and the instructor for whatever classroom it was. We just talked to each other all day long and that was it." [**54**]

Just over three weeks later on January 27, NASA announced the crew for STS-75, which including Jeff Hoffman as MS-1. STS-75 was planned as the second flight of the TSS in early 1996 using *Columbia*. [**55**] The mission also included the third flight of the United States Microgravity Payload (USMP) series. Hoffman would be flying with CDR Andrew M. Allen (Class of 1987), PLT Scott Horowitz (Class of 1992), and ESA MS-trained Claude Nicollier and Maurizio Cheli. They joined Franklin Chang Díaz and the PS named earlier who were already in training.

The first Shuttle mission to fly anywhere near a space station came the following month. STS-63 (February 3−11) was officially known as the SpaceHab 3 mission, but was more commonly referred to as the 'Near-Mir' rendezvous mission. The crew, led by Jim Wetherbee (and including cosmonaut Vladimir Titov), brought *Discovery* to within 11.2 m of the Mir docking port, in practice for the full docking due on the later STS-71 mission. Though the STS-63 crew did not include anyone from Group 8, Dave Walker provided support by working the second shift in the SMS. [**56**] STS-63 was the first mission to bring American and Russian space vehicles into close proximity since the 1975 Apollo-Soyuz Test Project (ASTP) docking mission. It was a remarkable turnaround in the space programs of both countries.

On February 28, Steve Nagel retired from the USAF with rank of Colonel. He also retired from the Astronaut Office, but not NASA, the following day (March 1) to take up a position at JSC as Deputy Director of Operations, Safety, Reliability and Quality Assurance. [**57**] When the next mission flew (STS-67/Astro-2, March 2−18), Dave Walker was again the sole representative of the TFNG to support the flight, assigned to the first shift in the SMS and on 24-hour call for SPAN. [**58**]

Fig. 12.3: Norman Thagard in the Spektr module during his four-month residency on the Russian station Mir.

Soyuz TM-21 (March 14 – July 7, 1995, Landing on *Atlantis*/STS-71)
Flight Crew: Vladimir N. Dezhurov (CDR), Gennady M. Strekalov (FE), Norman E. THAGARD (NASA-1 Cosmonaut Researcher, CR)
Spacecraft: Soyuz TM-21 (7K-M, spacecraft serial #70) for the launch phase and the flight to Mir. The landing would be on STS-71 (*Atlantis*)
Objective: Mir EO-18 resident crew; 1st NASA astronaut resident crewmember; Shuttle-Mir Phase 1
Duration: 115 days 8 hours 43 minutes 2 seconds
Support Assignments: There were no formal support team roles for the astronauts discovered during the authors' research, apart from Bonnie Dunbar as THAGARD's back-up. For about two months prior to his launch, Shannon LUCID and John Blaha were training at TsPK at the same time as THAGARD and Dunbar.

It had been over 15 months since a member of the 1978 selection had been in Earth orbit. There had been nine Shuttle missions in the interim, and though members of the TFNG had supported those missions on the ground, this had been the longest period of flight operations without a member of the 1978 selection flying since the Return-to-Flight. This mission certainly returned a TFNG to orbit, on a far longer mission than any of those previously flown by the group, and initially not on American hardware. As part of the agreement between the ISS partners and

Russia, Thagard's flight would be the first of a series of resident missions flown by seven veteran American astronauts to the Mir station, over what became a four-year period in preparation for residential flights on ISS. It was a chance for NASA and its astronauts to gain a feel for regular station operations, something the Americans were severely lacking in comparison to their Russian counterparts, who had over 25 years' worth of experience from their fleet of Salyut stations and now Mir. It also allowed Americans to log their first long duration flights (those exceeding one month) since the Skylab missions of two decades earlier, giving them much needed practical experience prior to embarking on ISS[5].

Chosen to fly this important first mission to Mir was TFNG Dr. Norman Thagard, on his fifth excursion into orbit. This time, he would not be a member of a Shuttle crew but a Cosmonaut Researcher (CR, or in NASA speak, Board Engineer) on the Russian Mir EO-18 crew, working aboard space station Mir along with cosmonauts Vladimir Nikolayevich Dezhurov (whose personal radio callsign was "Uragan", meaning "Hurricane") and Gennadi Mikhailovich Strekalov ("Uragan-2"). Lift off on board Soyuz TM-21, from the Baikonur Cosmodrome in Kazakhstan, occurred on March 14, 1995. Thagard (using the callsign "Uragan-3") therefore became the first American astronaut since ASTP to train on Russian soil, the first in history to enter space aboard a non-American rocket and spacecraft, and the first American occupant of a foreign space station (Mir). When Thagard and his two colleagues entered orbit, they joined the STS-67 crew who still had four more days of their Astro-2 mission to complete, raising the number of space explorers in orbit during those days to 13 (three on Soyuz TM-21, seven on STS-67 and the three EO-17 cosmonauts aboard Mir).

On March 16, once Soyuz TM-21 had docked with Mir, Thagard became the first American since Skylab 4 to enter and live on a space station. During his stay on Mir he assisted in a program of 28 experiments in the course of the 115-day flight. As the first astronaut to live longer in space than 18 days since Skylab 4 a decade earlier, Thagard found his four-month mission on Mir challenging both culturally and in terms of finding things to do. The delay in delivering the Spektr module to Mir certainly restricted his research capabilities. "I found myself with, really, too much time on my hands," he reported post-flight. At no time did he find the experience claustrophobic, or encounter any compatibility problems with his Russian crewmates as he had trained with them for some time. However, Thagard went days without speaking to controllers in Houston and missed reading newspapers. While he was proficient in Russian, sending English language reports from Earth had not been built into the daily routine on Mir. Thagard reported that boredom could be as depressing as a schedule which was too hectic to keep up with, as the Skylab 4 astronauts had experienced during the early phase of their 84-day

[5] Prior to 1995, the only U.S. human space flights to exceed three weeks (21 days) had been Skylab 2 (28 days in May–June 1973), Skylab 3 (59 days in July–September 1983) and Skylab 4 (84 days from November 1973–February 1974).

mission. As Marsha Freeman wrote in her 2000 book *Challenges of Human Space Exploration* (Springer-Praxis), when Thagard returned, NASA Administrator Dan Goldin offered him a public apology, stating that "We put all of our focus on the physical wellbeing of the astronauts and the success of the mission, [but] we neglected the psychological wellbeing and Dr. Thagard made it clear to us." The oversight was addressed before the next American resided on Mir.

On March 30, two weeks after Thagard left Baikonur to start his residence on Mir, Shannon Lucid was selected as the prime crewmember for a five-month stay on Mir in 1996. She was still in Russia at the time. She would be replaced at the end of her residency by Jerry Linenger (Class of 1992). [**59**] The back-up astronauts assigned were John Blaha for Lucid and Scott Parazynski for Linenger, both of whom would continue training at Star City for later flights to Mir.

On April 14, Lucid was assigned to the STS-76 crew for the launch of her mission to Mir, and to the STS-79 crew for her landing five months later. Launching with Lucid to Mir, the remainder of the STS-76 crew were CDR Kevin Chilton (named in November 1994, Class of 1987), PLT Richard A. Searfoss (Class of 1990) and MS Linda Godwin (Class of 1985), Michael R "Rich" Clifford and Ronald Sega (both Class of 1990).

Lucid would be assigned as MS-4 for the ascent, flying on the middeck and transferring to the main crew shortly after docking and hatch openings. She would remain aboard Mir as NASA Board Engineer-2 when STS-76 departed. Five months later when STS-79 docked, she would transfer to the Shuttle crew once again as MS-4 for entry and landing on the middeck, using the specially installed prone seat recliners. The remaining crew for STS-79 were CDR William Readdy (named November 1994, Class of 1987), PLT Terrence Wilcutt (Class of 1990), and MS Tom Akers (Class of 1987), Jay Apt (Class of 1985), and Carl Walz (Class of 1990). Jerry Linenger would fly as MS-4 for ascent, swapping places on the crew with Lucid. [**60**]

As the program proceeded, several factors affected this plan. Requirements for the individual missions changed, together with varying progress in training, delays with preparing hardware, and difficulties in getting some of the astronauts qualified to fly as a Mir crewmember. There was also a new requirement for Linenger to qualify in a Russian Orlan EVA suit. As Linenger wrote in his 2000 book *Off the Planet*, "John Blaha and I switched positions in the sequence in order for me to do a spacewalk." The added Russian EVA suit training meant that it would be more feasible to have the experienced Blaha fly the third residency (up on STS-79 and down on STS-81) after Lucid and delay Linenger to the fourth residency (up on STS-81 and down on STS-84).

Lucid cosmonaut training

The day before STS-71 left the launch pad destined for Mir, Shannon Lucid and John Blaha began their Phase 2 (Crew) training at Star City, Moscow. This phase alongside their cosmonaut colleagues would last eight months and be completed on

February 26, after 1,127 training hours. In total, Lucid and Blaha logged over 1,922 hours training for the second American residency on Mir (see Table 12.1, p. 437).

In February 1995, they had been paired with their Russian colleagues. Lucid was teamed with Yuri Ivanovich Onufriyenko (Callsign "Skif" meaning "Scythian") and Yuri Vladimirovich Usachev, who had been in training as a crew for two years (and who Lucid called the "two Yuris"). Blaha was initially paired with Gennadi Mikhailovich Manakov and Pavel Vladimirovich Vinogradov on the back-up crew[6]. Lucid noted that her colleagues had assumed that she would train with the cosmonauts she would fly in space with, but this was not the case, at least not at first. Day after day, she and Blaha sat in classrooms learning each specific system from a specialist, taking notes and then taking an oral exam before moving on to the next system. It was only later in their training program that they completed a very few simulations with the cosmonauts. "[Initially], we didn't interface with anybody else," Lucid recalled. "Only towards the end did we do just a few sims with the Russians, but it was very minimal. It wasn't the training with a crew like you would think," which was the way they had been taught at NASA. "You sat in the Soyuz, and my job was to be quiet and not to interfere. That's basically my job. We would do that one afternoon. We did that two or three times. We did one training session in the Mir and we did one training session over in the vacuum chamber together." [**54**] All the astronauts who participated in Mir long duration training said that it was a fascinating experience, but a big undertaking and a challenge.

STS-71 (June 27–July 7, 1995)
Flight Crew: Robert L. GIBSON (CDR), Charles J. Precourt (PLT), Ellen L. Baker (MS-1), Gregory J. Harbaugh (MS-2), Bonnie J. Dunbar (MS-3)
Mir EO-19 crew (up only): Anatoly Y. Solovyov (Russian Cosmonaut #1/Mir-19 CDR), Nikolai M. Budarin (Russian Cosmonaut #2/Mir-19 FE)
Mir EO-18 crew (down only): Vladimir N. Dezhurov (Russian Cosmonaut #1/ Mir-18 CDR), Gennady M. Strekalov (Russian Cosmonaut #2/Mir-18 FE), Norman E. THAGARD (NASA-1 CR/MS-4)
Spacecraft: Atlantis (OV-104) 14th mission
Objective: 69th Shuttle mission; 1st Shuttle-Mir docking; delivery of EO-19 and return of EO-18 resident crewmembers; Spacelab Long Module unit #2
Duration: 9 days 19 hours 22 minutes 17 seconds
Thagard Duration: 115 days 8 hours 43 minutes 2 seconds
Support Assignments: The only Group 8 support assignment was FCOD Management Support at JSC for both launch and landing provided by Steve HAWLEY. [**61**]

[6] During training, Manakov was grounded due to a slight heart irregularity, so the crew was replaced by Valery Grigoryevich Korzun and Aleksandr Yuryevich Kaleri. The change had minimal impact on Lucid, but Blaha later flew a 'difficult' mission with cosmonauts he hardly knew and had not trained with.

It seems appropriate that the CDR of the Shuttle destined to return Thagard from his stellar home was a fellow TFNG, Hoot Gibson, who was also privileged to be the first American to dock with a separate crewed spacecraft in Earth orbit since Tom Stafford linked up his Apollo Command and Service Module (CSM) with Alexei Leonov's Soyuz 19 during ASTP in July 1975. The modified *Atlantis* was launched from KSC on June 27, 1995 and docked with Mir two days later. There was an exchange of crewmembers, and while the Shuttle was launched with seven astronauts, (including the two EO-19 cosmonauts) it returned to Earth after ten days on July 7 with a crew of eight on board (including the three EO-18 crew). This was the 100th U.S. mission to be launched from the Cape and to commemorate the event, Gibson took with him the first American flag flown in space, carried on board with Alan Shepard on the first U.S. astronaut flight in 1961. That flag was subsequently displayed in the U.S. Astronaut Hall of Fame in Florida.

The STS-71 mission was the first to fly a profile that the Shuttle was originally designed for, a shuttling flight to and from a space station. It was a Russian station not an American one, but what was more important was that at last the astronauts could finally practice and achieve rendezvous, proximity operations, docking and undocking with a suitably massive item of space hardware. This mission was key not only to Shuttle-Mir but also to plans for the ISS, and initiated the successful run of nine dockings of the Shuttle with Mir between 1995 and 1998. They led in turn to an impressive 37 Shuttle dockings with ISS from 1998 through 2011 and the end of the Shuttle program. Gibson began this remarkable run of 46 flawless rendezvous and docking operations on June 29, 1995, when he nudged the docking system of *Atlantis* into the forward docking port on the Kristall Module on Mir, restoring the skills of docking in space that had been pioneered during Gemini and Apollo to the Astronaut Office, after a gap of two decades. While docked to Mir, the crew conducted the transfer of hardware, water and fresh supplies into the station, and stowed unwanted items and trash into *Atlantis* for the return to Earth. In the onboard Spacelab Module, over 15 biomedical and scientific investigations were completed. On July 3, which also happened to be his 52nd birthday, Thagard bid farewell to Mir after spending 109 days aboard the station, *Atlantis* was undocked from Mir on July 4 after 4 days 22 hours 9 minutes and 26 seconds together.

Ten days after Gibson brought *Atlantis* home, Shuttle *Discovery* left the launch pad for the 21st time. STS-70, whose designation for once matched its launch order as the 70th Shuttle mission, was launched on July 13, 1995, on a nine-day mission to deploy TDRS-G. From the research by the authors, none of the remaining TFNG served in a support role for this mission.

STS-69 (September 7 – 18, 1995)
Flight Crew: David M. WALKER (CDR), Kenneth D. Cockrell (PLT), James S. Voss (MS-1), James H. Newman (MS-2), Michael L. Gernhardt (MS-3)
Spacecraft: Endeavour (OV-105) 9th mission

Objective: 71st Shuttle mission; Wake Shield Facility-2 and SPARTAN-201-03 operations; EVA Development Flight Test
Duration: 10 days 20 hours 28 minutes 56 seconds
Support Assignments: FCOD Management Support at JSC for both launch and landing was provided by Steve HAWLEY. [**62**]

The original launch date for STS-69 was set for early August, but several delays pushed this back to early September. During the mission, the crew deployed and retrieved two payloads – the second Wake Shield Facility and the SPARTAN-201-03 free flying satellite – and supported the second in an important series of EVA development spacewalks. These were aimed at providing experience and developing the necessary EVA procedures for ISS assembly and future satellite servicing missions, as had been demonstrated during the STS-61 Hubble Servicing Mission in 1993. By 1995, some 12 years after the flight of the first TFNG on STS-7, the crew opportunities for those still active were diminishing, but they continued to remain at the forefront of current operations.

Fig. 12.4: The STS-69 "Dogs of Summer" crew proudly displays the "Dog Kennel" emblem on the shoulder of their flight suits. [l-r] MS Mike "Underdog" Gernhardt; PLT Ken "Cujo" Cockrell; CDR and TFNG Dave "Red Dog" Walker; MS Jim "Dog Face" Voss; and MS Jim "Pluto" Newman.

"Dogs of Summer"

STS-69 was also the flight of the second 'Dog Crew'. Although this time they were a mix of military and civilian crewmembers, they still became great buddies, encouraging Walker to revive the 'dog-tag' names he assigned to his crew as he had on STS-53. Walker remained "*Red Dog*" and flying with him again was Jim "*Dog Face*" Voss. The new "pack members" were "*Cujo*" (Cockrell), after the Steven King novel of the same name and "*Pluto*" (Newman), due to his interest in science, the fact that he was a computer wizard in the Office and, according to his crewmates, his "unique perspective on life." Newman had also told his crewmates that he would kill them if he was called "*Goofy*". The other new boy was rookie Gernhardt, who naturally became "*Underdog*," though this was also due to his previous career as a deep-sea diver prior to becoming an astronaut. Upon arriving at KSC for the mission, the crew displayed an unofficial crew patch featuring a bulldog peering out of a doghouse shaped like a Space Shuttle, with the five "Dog Tag" names listed. And there was a change to the old station wagon too. Walker's 1979 Pontiac "*Dogmobile*" acquired the name "En*dog*vour" during the lead up to STS-69. Having originally been painted flat-black to fit the classified nature of his STS-53 DOD mission, for this second flight of the Astronaut Office "guard dogs" it was changed to a peaceful T-38 training jet white… trimmed in blue but dotted with paw prints and sporting a range of surplus 'flight hardware'. [**63**]

The final two missions flown in 1995 included STS-73 (October 20–November 5), *Columbia*'s 18th mission, carrying the USML-2 LM#1 payload. Only Steve Hawley of the TFNG fulfilled support role, again providing FCOD Management Support at JSC for both launch and landing. [**64**] This mission was followed a few days later by STS-74 (November 12–20), with *Atlantis* flying the second Shuttle-Mir docking mission and delivering a new Docking Module to the station. This became the only Shuttle docking mission at Mir which did not include a NASA exchange or return. None of the TFNG supported this mission in formal roles.

THE LONGEST MISSION

Early in the new year, January 5, 1996, Norman Thagard retired from NASA to return to his alma mater, Florida State University, having accepted the position of Visiting Professor and Director of External Relations for Florida A&M University, Florida State University College of Engineering in Tallahassee. From January 16, the 18th anniversary of his selection as a NASA astronaut, he began teaching electronics, which was a long term hobby for the former astronaut. [**65**]

Between January 11–20, *Endeavour* flew STS-72 to retrieve the Japanese Space Flyer Unit and conduct the deployment, independent flight and retrieval of the OAST-Flyer. For this mission, Dave Walker was assigned as STA Weather Pilot for EOM at Edwards, even though *Endeavour* landed at KSC. [**66**] January 1996 also saw the return to the Astronaut Office of Anna Fisher, after a six-year absence to raise her family. She was assigned to Space Station issues.

More Missions to Mir

On January 30, NASA announced plans to expand the current Phase 1 Shuttle-Mir program with two additional dockings, taking the total to nine, though no further TFNG would visit the station. The emphasis in the Office was on the completion of the Shuttle-Mir missions and moving on to assembly of the ISS. It looked unlikely that any of the 1978 class would remain active long enough to fly an ISS mission, however. Indeed, there were only a handful of TFNG still active in the office at the start of the year. [**67**]

STS-75 (February 22 – March 9, 1996)

Flight Crew: Andrew M. Allen (CDR), Scott J. Horowitz (PLT), Jeffrey A. HOFFMAN (MS-1), Maurizio Cheli (MS-2, ESA, Italy), Claude Nicollier (MS-3, ESA, Switzerland); Franklin R. Chang Díaz (MS-4, PC), Umberto Guidoni (PS-1, ASI, Italy)
Spacecraft: Columbia (OV-102) 19th mission
Objective: 75th Shuttle mission; TSS re-flight; USMP-3 payload
Duration: 15 days 17 hours 40 minutes 21 seconds
Support Assignments: FCOD Management Support at JSC for launch and landing again fell to Steve HAWLEY, while Hoot GIBSON provided STA Weather Support. [**68**]

STS-75 was a 16-day mission whose principal payloads were the re-flight of the TSS and the third flight of the United States Microgravity Payload (USMP-3). The TSS successfully demonstrated the ability of tethers to produce electricity. The crew also worked around the clock performing combustion experiments and research related to USMP-3 microgravity investigations. During this mission, Hoffman, the first TFNG to enter orbit for five months, was a member of the Blue Shift with Nicollier and Chang Díaz, while the others worked the Red Shift. Interestingly, Hoffman joined Allen on the 'White Shift', allowing them to work with either of the other shifts as necessary. On this flight, Hoffman also became the first astronaut to log 1,000 hours aboard the Space Shuttle.

On February 29, Steve Hawley was named MS-2/FE for STS-82, the second Hubble Servicing Mission due in early 1997. Hawley had deployed HST using the RMS as a member of the STS-31 crew six years earlier and would be the first astronaut to return to the telescope since then. He was again assigned as primary RMS operator, supporting the EVAs. [**69**]

In March 1996, Hoot Gibson became Deputy Director, Flight Crew Operations, JSC, a position he held until he retired from NASA in November that year.

STS-76 (March 22 – 31, 1996)
Flight Crew: Kevin P. Chilton (CDR), Richard A. Searfoss (PLT), Ronald M. Sega (MS-1), Michael R. Clifford (MS-2), Linda M. Godwin (MS-3); Shannon W. LUCID (MS-4 up only/EO-21/22 CR/NASA-2 Board Engineer)
Spacecraft: Atlantis (OV-104) 16th mission
Objective: 76th Shuttle mission; 3rd Shuttle-Mir docking flight; transfer of NASA-2 (Lucid) to Mir EO-21 resident crew
Duration: 9 days 5 hours 15 minutes 53 seconds
Support Assignments: FCOD Management Support at JSC for launch and landing was provided this time by Hoot GIBSON, while Dave WALKER was STA Weather Pilot for EOM at Edwards. [**70**]

When he returned from Mir in 1995, Norman Thagard expressed relief that he had not had to endure an extended mission of six months on the aging Russian station. But this is exactly what his Group 8 colleague Shannon Lucid found herself facing when problems with the Shuttle hardware delayed her return. Lucid's journey to Mir began with a lift off aboard *Atlantis* from KSC on March 22, 1996. Following a successful docking, she transferred to the orbiting Mir station two hours after the hatches had been opened between the two spacecraft. The undocking of *Atlantis* signaled the start of a planned two-year continuous presence on Mir by successive American astronauts.

Assigned to the Mir-21 crew as NASA-2 Board Engineer, over the course of the next six months Lucid performed numerous life sciences and physical sciences experiments with two different crews of Russian cosmonauts (EO-21 and 22) during the course of her stay aboard Mir. In doing so, she set the single-mission United States space flight endurance record for a woman. Her return journey to KSC on September 26 was accomplished as part of the crew of STS-79 (*Atlantis*). Lucid was the first American astronaut to be left in space on a spacecraft they had not launched aboard.

Just over two weeks after he had provided weather pilot duties for STS-76, TFNG Dave Walker retired from NASA and the USN, effective April 15, 1996, to become a part owner and executive officer of a telecommunications company, as

Vice President for Sales and Marketing for the new startup company NDC Voice Corporation in Southern California, who were to provide integrated wireless communications and advance processing applications internationally. [**71**] As members of the 'old guard' departed, so new talents arrived at the Astronaut Office at JSC. On May 1, NASA announced the largest selection of Ascans since the 1978 group, with an equal amount of candidates forming the 16th Astronaut Class. [**72**] They began their Ascan program on August 12 and were joined by nine international astronauts, making this the largest group in NASA history to prepare for assignment as Space Shuttle and ISS crewmembers. [**73**]

Over May 19–29, *Endeavour* flew its 11th mission as STS-77. Onboard were the SpaceHab-4 middeck augmentation module and the SPARTAN/IAE free-flyer. For this mission, Hoot Gibson served as back-up STA Weather Pilot (to Robert Cabana) for launch and KSC EOM. [**74**] The following month it was *Columbia*'s turn, flying its 20th mission as STS-78. This was a 17-day Life and Microgravity Spacelab (LMS) flight using Spacelab Long Module #2. Once again, no TFNG were assigned to support this mission.

On September 15, it was announced that Rhea Seddon had been assigned to a part-time post at Vanderbilt University's Center for Space Physiology and Medicine in Nashville, Tennessee. She remained an astronaut but would act as a liaison for Vanderbilt researchers in evaluating flight equipment and developing experiment operating procedures for the 1998 Neurolab mission, which would study the adaptation of the nervous systems to microgravity during a 16-day flight on *Columbia*. Her medical background and extensive experience during two Spacelab Life Science Missions made her uniquely qualified for this position, where she represented the interests of JSC and the Astronaut Office in designing and developing protocols for this mission. [**75**]

STS-79 (September 16 – 26, 1996)
Flight Crew: William F. Readdy (CDR), Terrence W. Wilcutt (PLT), Jerome Apt (MS-1), Thomas D. Akers (MS-2), Carl E. Walz (MS-3); John E. Blaha (MS-4 up only/EO-22 CR/NASA-3 Board Engineer); Shannon W. LUCID (MS-4 down only/EO-21/22 CR/NASA-2 Board Engineer)
Spacecraft: Atlantis (OV-104) 17th mission
Objective: 79th Shuttle mission; 4th Shuttle-Mir docking flight; transfer of NASA-3/EO-22 crewmember (Blaha); return of NASA-2/EO-21/22 crewmember (Lucid)
Duration: 10 days 3 hours 18 minutes 26 seconds
LUCID duration: 188 days 4 hours 0 minutes 11 seconds
Support Assignments: Hoot GIBSON was STA Weather Pilot for EOM at Edwards. [**76**]

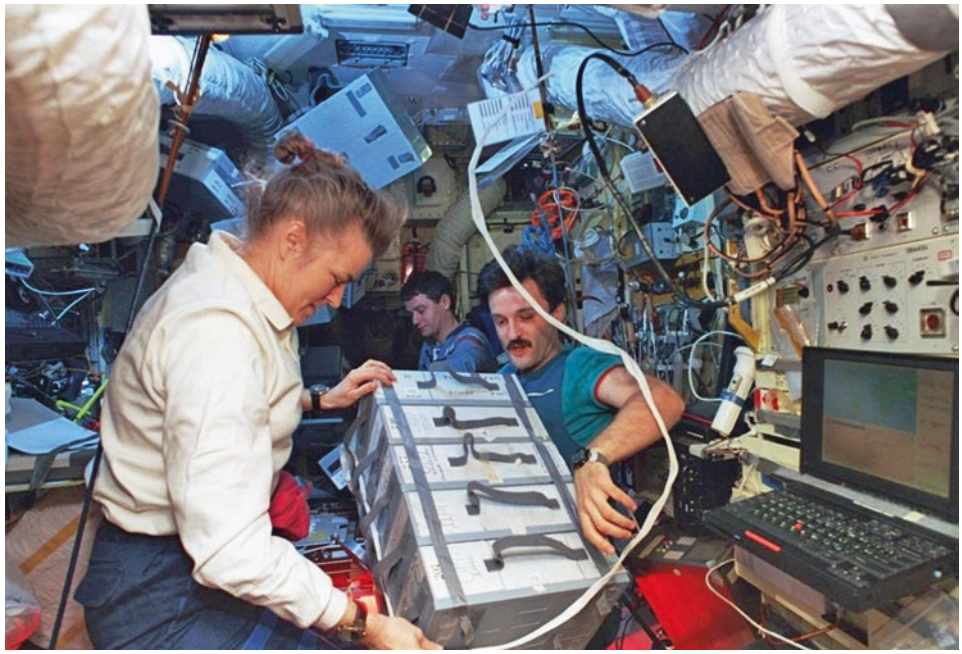

Fig. 12.5: Shannon Lucid during her six-month residency with FE Alexandr Kaleri and station Commander Valery Korzun (in the background).

Shannon Lucid was the first American female astronaut to live onboard a space station as part of a resident crew[7]. She was certainly kept occupied during her half-year on the station, conducting research into Earth sciences, fundamental biology, human life sciences, advances in technology, microgravity research and the space sciences. She adapted well to living on the Russian station, despite the setbacks and challenges, and kept track of time by wearing her pink socks each Sunday and munching on supplies of her favorite M&Ms ®™ candy. Her sleeping area on Mir was "…like living in the back of your pickup [truck] with your kids… when it's raining and no one can get out." [77] Communication with the NASA team in Moscow was not perfect, and she had not had a shower since she launched, but the best thing about doing the laundry… was not having to do the laundry and just throwing the dirty clothes away[8]. During her relaxation time she read some of the

[7] Shannon Lucid was only the fourth woman in history to be part of a resident station crew, after cosmonaut Svetlana Savitskaya in 1982 and again in 1984, the UK's Helen Sharman in 1991, and cosmonaut Yelena Kondakova in 1994 and 1995.

[8] Jokingly, Lucid's husband said that NASA had told him they were going to hose his wife down after landing before they gave her back to him.

books she had brought with her, although she was a little frustrated to find that the next part of a novel her daughter had given her was not included in her small library: "[I] came to the last page, and the hero, who was being chased by an angry mob, escaped… The End… Continues in Volume Two. And was there Volume Two in my bag? No. Could I dash out to the bookstore? No. Talk about a feeling of total isolation and frustration". [**78**] This shows the little problems encountered so far from home and away from normal life, even in low Earth orbit. At the end of her mission. Lucid refused the offer to help her off the Shuttle on a stretcher, preferring to walk off with some assistance to the Crew Transfer Van nearby. There, she was greeted by her family and a large box of M&Ms®™, a gift from President Bill Clinton. At 189 days, Lucid had set a new world endurance record for a female space explorer, and in doing so inspired a whole new generation of female students to follow in her footsteps.

September also saw Steve Nagel transferred to the Aircraft Operations Division at JSC to work as a research pilot. A few weeks later, towards the end of November, Hoot Gibson retired from NASA to "pursue private business interests". On leaving the office, Gibson said, "While I am looking forward to new challenges and opportunities, I will certainly miss being part of the NASA team. I am grateful for the opportunity to work with so many talented and dedicated people over the past 18 years." [**79**]

The final mission of the year was STS-80 (November 19–December 7), flown by *Columbia*. At 18 days, this was the longest Shuttle mission in the program. STS-80 carried the third Wake Shield Facility experiment and ORFEUS-SPAS II. Had Hoot Gibson remained at NASA, he would have been assigned as STA Weather Pilot for the EOM at Edwards. [**80**] He was also identified pre-flight as a member of the FCOD Management for Launch Support at KSC/OSR and for landing at JSC, as well as FCOD representative for the Crew Recovery Team. [**81**] In fact, Gibson did not remain at NASA for either of those assignments, having left after the two memos were issued and before the STS-80 mission flew. "I was not still with NASA when STS-80 flew on November 19," Gibson recalled to the authors. "My last day at JSC was November 13 and then I showed up in Dallas to begin pilot training with Southwest Airlines. I felt quite a bit depressed after leaving NASA." [**82**]

The penultimate flight

When Anna Fisher returned to the Astronaut Office in 1996, she was certain that her break to look after her family had impacted on her career, commenting later in her Oral History that she would otherwise have probably flown at least one more mission. On her return, she was assigned as Branch Chief of Operations at the Planning Branch until June 1997. She wanted to stay focused on the Shuttle, but with new classes of astronauts coming into the office at

regular intervals to train to fly the Shuttle, she realized that "there weren't the people around who remembered what the early days of the Shuttle were like, so I finally gave in. [In June 1997] They made me Chief of the Space Station Branch." **[83]**

In her 2011 interview, she also noted the considerable changes to the office on her return. "By the time I came back, there were very few people left in the office that remembered the beginning of the Shuttle Program, and we were just really at the beginning of the Space Station Program at that point. I think I was able to provide an insight that they might not otherwise have had. Here we were now in the nineties, and the Shuttle was flying; it was a very proficient and experienced team. Our products, our procedures were all very good, but it wasn't like that at the beginning of the Shuttle Program. I think the expectations, particularly of some of the earlier Expedition crews, were a little unrealistic. I think I was able to provide a perspective to try to get products that were good, but to also make the other folks in the Astronaut Office realize that the Shuttle was just like this at the beginning. The simulators at the beginning didn't work, and I can't tell you the number of times I'd go over for an SMS session and it would crash and you'd go back to your office until they fixed it. That hardly ever happens now. I remember when we worked on our procedures for ascent, orbit, and entry. There were three different teams, and you could have [a] procedure for ascent, which is almost the exact same procedure for entry, and they would look totally different because different people wrote them. During the downtime for *Challenger*, that was one of the things we did; we went through the entire Shuttle Flight Data File [FDF] and tried to make it consistent. So, in a way, that downtime was valuable because I think later crews really benefited from that. The expectation at the beginning of Station was, I think, very unrealistic, and so I think I was able to provide a unique perspective. The other thing that happened at the beginning of Station – because everybody wanted to work on Shuttle – [was that] all the new people that were hired were put on working Station, rather than the experienced people. So then it was kind of like a double hit. Not only were you working a new program, which is always difficult, but it was also an international program and we were trying to work with our Russian colleagues as well as the other international partners." [**83**]

Another of the TFNG to be reassigned at this time was Jeff Hoffman, who became Lead in the Payload and Habitability Branch of Astronaut Office.

The Shuttle-Mir program continued in the new year with the fifth docking mission, STS-81 (January 12–22, 1997), which delivered Jerry Linenger to the Russian station and returned John Blaha. None of the active TFNG were listed in support roles for this mission, nor for the next mission on which Steve Hawley flew. This was the second Hubble Servicing Mission, returning the astronaut to the telescope seven years after he deployed it on STS-31.

STS-82 (February 11 – 21, 1997)
Flight Crew: Kenneth D. Bowersox (CDR), Scott J. Horowitz (PLT), Joseph P. Tanner (MS-1), Steven A. HAWLEY (MS-2), Gregory J. Harbaugh (MS-3); Mark C. Lee (MS-4), Steven L. Smith (MS-5)
Spacecraft: Discovery (OV-103) 22nd mission
Objective: 82nd Shuttle mission; 2nd Hubble Service Mission
Duration: 9 days 23 hours 37 minutes 9 seconds
Support Assignments: No listings found

By 1997, the Shuttle-Mir program was rapidly approaching the halfway point and the focus was shifting more to the assembly of the ISS, planned to begin the following year. Many scientific flights had been cut, but what remained were the servicing missions to the HST, and Hawley had been assigned to the second of these flights. His primary role was to operate the Shuttle's 50-ft (15-m) RMS robot arm to retrieve HST and then redeploy it following the completion of upgrades and repairs. He also operated the RMS during the five spacewalks, in which two teams installed two new spectrometers and eight replacement instruments. They also replaced insulation patches over three compartments containing key data processing, electronics and scientific instrument telemetry packages. HST was then redeployed having been boosted to a higher orbit by the Shuttle's OMS engines.

For the next four missions (STS-83, 84, 94 and 85), none of the Class of 1978 astronauts who remained in the Office were assigned to support roles. However, in June 1997, Anna Fisher was assigned to her new role as Branch Chief for Space Station. Then, on July 9, it was announced that Jeff Hoffman would be leaving the Astronaut Office to become NASA's European Representative in Paris, a position he would occupy until August 2001. [**84**] His responsibilities in Paris were in monitoring the implementation of NASA policies, and the relationships with the European space and aeronautical communities, as well as governmental, industrial and academic institutions.

During the seventh Shuttle-Mir docking mission, STS-86 (September 25-October 6), Steve Hawley fulfilled the role of FCOD Management Support for launch at KSC/OSR. For the landing, he was on call at JSC. [**85**] The TFNG were not involved in supporting or flying the final mission of the year, STS-87 (November 19–December 5), which carried the USMP-4 and SPARTAN-201-04 payload.

DAWN OF A NEW ERA

The 20th anniversary of the Group 8 selection occurred on January 16, 1998, but with only three members remaining on the active list, little fuss was made of this milestone. This new year would see the completion of the Shuttle-Mir docking missions, the return to orbit of 77-year-old John Glenn after 36 years, and the start of ISS assembly, but sadly it was also another year in which no member of the

Class of 1978 flew in space. Indeed, none of the group was assigned to support roles for the next six missions through to the summer of 1999, but that summer would see the final flight of one of the TFNG.

History is made

On March 5, 1998, in an historic announcement by First Lady Hillary Rodham Clinton in the Roosevelt Room at the White House in Washington D.C., the first female Shuttle CDR, Eileen Collins, was named to lead the STS-93 mission in December of that year. *Columbia* was manifested to deploy the Advanced X-Ray Astrophysical Facility Imaging System (AXAF, later called Chandra). Collins would be joined on the five-day mission by PLT Jeff Ashby (Class of 1994), and MS Catherine Coleman (Class of 1992) together with CNES astronaut Michel Tognini, who had been named to the crew in November 1997. There was one other crewman named, and their assignment was also an historic appointment, as the final member of the TFNG still in active flight training was assigned to a Shuttle mission. Steve Hawley was to be MS-2/FE, a position he had occupied on all five of his missions, and would bring to a close the assignment of the TFNG on prime crews that had begun with the announcement of the STS-7 crew 26 years earlier. [**86**] It was also fitting that Hawley had been selected with the first female astronauts in the NASA team, (and at one time he was married to Sally Ride, the first American female in space) and was now going to be in the crew led by the first female CDR. How much had changed since 1982.

In June 1998, following a re-organization of the Astronaut Office, Anna Fisher was reassigned as Deputy for Operations/Training, Space Station Branch, where she had oversight responsibility for inputs from the Astronaut Office to the Space Station Program. After a year in that post, Fisher was named Chief of the Space Station Branch in the Astronaut Office in June 1999. She would be responsible for coordinating the input from 40–50 astronauts and support engineers regarding the design, development and testing of station hardware, in addition to continuing to oversee station operations, procedures and training. She worked with the international partners to negotiate common designs for displays, controls and crew procedures, serving on a number of Space Station boards. With these assignments, Fisher continued the TFNG link between the end of the Apollo era, the transition to the Space Shuttle, and through to the ISS.

THE LAST FLIGHT

There had been 12 other Shuttle missions since Hawley had last flown on STS-82. The docking missions to Mir had been completed successfully, and the ISS assembly missions had begun. This was the beginning of a new era, and at the same time the end of the era in which a member of the TFNG would orbit the Earth. With most of his colleagues retired or in managerial positions, Steve Hawley provided the final milestone in the story of the Group 8 selection flying on the Space Shuttle.

He became the final member of the Class of 1978 to fly in space, 21 years after the group had arrived at JSC to begin Ascan training. Fittingly, this was also aboard *Columbia* which, as a group, they had worked so hard to support on the final push to put that vehicle into orbit back in 1981. With the last of the TFNG making their final flight under the command of the first female CDR, the Astronaut Office had come a long way since the first females and ethnic minorities arrived as part of the TFNG over 20 years earlier. The future now belonged to a new generation of space explorers who would assemble and crew the ISS.

STS-93 (July 22 – 27, 1999)
Flight Crew: Eileen M. Collins (CDR), Jeffrey S. Ashby (PLT), Catherine G. Coleman (MS-1), Steven A. HAWLEY (MS-2), Michel A. Tognini (MS-3, CNES, France)
Spacecraft: Columbia (OV-102) 26th mission
Objective: 95th Shuttle mission; Chandra X-ray Observatory deployment
Duration: 4 days 2 hours 49 minutes 37 seconds
Support Assignments: The final TFNG support assignment on a flight by one of the group went to Shannon LUCID, on 24-hour call (08:00–08:00) in SPAN on FD3

On this, his final flight, Steve Hawley again served as *Columbia*'s FE. The primary mission objective was the successful deployment of the Chandra X-ray Observatory, the third of NASA's Great Observatories after HST and the Compton Gamma Ray Observatory. He also served as the primary operator of a second telescope carried in the crew module, which was used for several days to make broadband ultraviolet observations of a variety of solar system objects. Dr. Hawley became the only astronaut to be involved in the deployment of two of NASA's great observatories (Hubble and Chandra) which, for a professional astronomer, was additionally rewarding.

Steve Hawley flew on the Shuttle five times and on each flight he served as MS-2/FE from on Seat 4 on the flight deck during launch and landing. When asked why he thought he had been assigned to the role five times he put it down to experience, and needing less in-depth training each time he was assigned because of the skills gained over many years.

"One of the tricks to being a good MS-2, I thought, was firstly you had to know your stuff, but you also had go know how to work with the pilot and the commander. Sometimes a commander may want to hear from you more often, another commander less. Sometimes, we had a commander who would only say something if it was really important, other times people wanted to know [everything that] was going on." It was not only a case of getting to know the personalities of the commander and the pilot, but also "how fast can the three of you work together to be as efficient as possible, so it's just a question of finding the right mix of tasks, in my view, whatever the commander wants." Hawley also thought that the skill of becoming a good MS-2 was all about finding a suitable balance between the requests of the pilots and the skills of the flight engineer. [**26**]

Fig. 12.6: The end of an era. Steve Hawley, the last of the TFNG to fly in space, stands under the nose of *Columbia* with the rest of the crew at the end of their mission. [l-r] MS Cady Coleman, TFNG MS Steve Hawley, PLT Jeff Ashby, CDR Eileen Collins and CNES French MS Michel Tognini.

THE FINAL YEARS IN THE OFFICE

As the new millennium dawned, so the era of the TFNG waned. In 2000, there were still a few flights on the manifest which were not related to assembling and supplying the space station, mainly the Hubble Servicing Missions and a few science-based missions. There was talk of retiring *Columbia*, of returning Hubble to be put on display in a museum, and of a new vehicle to replace the Orbiter fleet, but for now the Space Shuttle remained the only American vehicle to put astronauts into space. Through agreements with the Russians, space station crewmembers would rotate (in teams of three) on either Shuttle assembly or Soyuz ferry missions. The Soyuz would act as a stand-by crew rescue vehicle while the station was being built and each would be exchanged by short, visiting missions at the end of its orbital life expectancy. With Mir being decommissioned, to some regret within Russia, by early 2001 the sole operations in Earth orbit for the Americans, the Russians and their international partners in the first decade of the new millennium centered upon

bringing the ISS up to full habitation standard. Waiting in the wings, however, was a new player: China. By 2001, the permanent occupancy of the ISS had begun and most of the TFNG had departed. Less than two years later, the completion of the ISS was paramount, as was deciding the future direction of U.S. human space flight following the recovery from another tragedy, the loss of *Columbia* and her crew of seven which signaled the eventual end of the Shuttle program. The first few years of the new century had become as frustrating, difficult and dark as the middle of the 1980s had been, but early in the second decade of the new millennium the station had been completed, the Shuttle retired and new goals were put forward, though a qualified replacement for the Space Shuttle remained a long way off.

But what of the remaining TFNG still with NASA at the millennium, over 20 years after their selection? Of the 35 chosen, only five were employed by NASA (although another would soon return to the agency for a few years), but none remained active for selection to a flight crew. They were all in various managerial roles, working their last assignments before finally departing the agency and leaving it to new generations of managers and astronauts.

The now-veteran 'New Guys' remaining were:

Mike Coats: After leaving NASA in 1991, Mike Coats worked in the private sector until he became the tenth Director of JSC in November 2005, a position he held until December 31, 2012, when he once again retired from NASA, just over a year after the retirement of the Space Shuttle fleet (see Chapter 13).

Anna Fisher: From January 2011 until August 2017, Fisher served as an ISS Capcom in Mission Control and became Lead Capcom for Expedition 33. In 2011, she explained her preparations for the role and how different it was from being a Capcom on an early Shuttle flight (STS-9) almost two decades earlier: "When I was a Capcom for STS-9, you just went over there and you sat with another astronaut who was there before you, and when they thought you were ready, you were ready. There was no training flow. Being a Capcom was training. That was because you didn't get in a flow until you were a crew. So getting to be a Capcom or working at SAIL [Shuttle Avionics Integration Laboratory] or any of those things was your training. Now it's the other way around. Now you have to have all this other training before you can do that. It's just kind of interesting." Towards the end of the Shuttle program she also worked Shuttle FDF and training issues, "which obviously is trailing down, and I just didn't figure it was worth giving that to someone else. I know all the people. I've been working with them for years and years, and it doesn't take that much of my time to follow that." [**83**] From 2013 until she left NASA in 2017, in addition to serving as ISS Capcom, Fisher held a concurrent assignment as a Management Astronaut working on crew display development for Orion, NASA's replacement spacecraft for the Space Shuttle that is intended to take astronauts deeper into the solar system.

Fred Gregory: After leaving the Astronaut Office in May 1992, Fred Gregory had relocated to Washington D.C. where he served in a number of senior management positions at NASA Headquarters (see Chapter 13) until his retirement from the agency in November 2005.

Steve Hawley: Following STS-93 in 1999, there were the usual debriefings and press conferences but there were no large formal post-flight activities. Shortly after completing his commitments, Steve Hawley returned to his role as Deputy Director at the Flight Crew Operations Directorate at JSC until he was asked by Roy S. Estess (JSC Acting Director February 2001–March 2002) to become Director of FCOD. From October 2001 to November 2002, Hawley served as Director, Flight Crew Operations, and from 2003 to 2004 he served as the first Chief Astronaut for the NASA Engineering and Safety Center. Up to late 2002, he was therefore still *technically* available for crew assignment, though he stated when he was Director FCOD that "I wouldn't have assigned myself…[though] I would have enjoyed going to the [ISS], I don't know that I would have wanted to take on the burden of all the training that it would have taken to have been a long duration crewmember… [perhaps on an assembly crew], that would have been more fun, I didn't really want to go to Russia to train." [**26**]. He then became Director of Astromaterials Research and Exploration Science Directorate between 2002 and 2008. In this role, he was responsible for directing a scientific organization conducting research in planetary and space science. The primary functions of the organization included astromaterials acquisition and curation, astromaterials research, and human exploration science. On February 27, 2008, it was announced that Steve Hawley had accepted an appointment with the faculty of the University of Kansas and would leave NASA that May.

Table 12.2: SHANNON LUCID MCC HOUSTON CAPCOM ASSIGNMENTS 2005–2012

Dates	STS Flt	MCC 'flight' name
Jul 26–Aug 9, 2005	114	Topaz
Dec 9–Dec 22, 2006	116	Pegasus
Aug 8–Aug 21, 2007	118[a]	Apex/Iron
Oct 23–Nov 7, 2007	120[a]	Kodiak/Intrepid
Feb 7–Feb 20, 2008	122	Iron
May 31–Jun 14, 2008	124[a]	Iron/Intrepid
Nov 14–Nov 30, 2008	126[a]	Iron/Defiant
Mar 15–Mar 28, 2009	119[a]	Amethyst/Onyx
Jul 15–Jul 31, 2009	127	Kodiak
Aug 28–Sep 12, 2009	128	Viper
Feb 8–Feb 21, 2010	130	Venture
May 14–May 26, 2010	132	Vega
May 16–Jun 1, 2011	134[a]	Pegasus/Defiant
Jul 8–Jul 21, 2011	135[a]	Iron/Intrepid

[a]During the STS-118, 120, 124, 126, 119, 134 and 135 missions, the 'Flight' position during Planning Shifts was split between different Flight Directors, hence the two Flight names

Fig. 12.7: (top) Between 2005 and 2011, Shannon Lucid served as shift Capcom on the Planning team for at least 14 Shuttle missions. Here, she is seen on the console for STS-126 in 2008. (bottom) Lucid on duty as Capcom during STS-135 in July 2011, ending an era begun 30 years earlier by Dan Brandenstein as launch Capcom for STS-1 in April 1981.

Shannon Lucid: On February 12, 2002, Shannon Lucid was named as NASA's Chief Scientist, replacing Dr. Kathie Olsen. In this role, Lucid would be responsible for the scientific merit of the agency's programs. She would report for that duty after

completing her responsibilities in March 2002 as a Shift Capcom for STS-109 (Hubble Service Mission 3B). NASA Administrator Sean O'Keefe, who announced the appointment, said "The Chief Scientist has tremendous responsibility to develop and communicate the agency's science and research objectives to the outside world. What better selection than a NASA scientist and astronaut with extensive experience [of] living and working in the harsh environment of space." [**87**]

Following that assignment, Lucid returned to JSC in the fall of 2003 to resume technical assignments in the Astronaut Office, serving as Capcom in the Mission Control Center (MCC) for numerous Shuttle and station crews. Representing the flight crew office, she provided a familiar (and experienced) voice for dozens of her friends and colleagues in space. Starting with the Return-to-Flight Mission (STS-114) in July 2005, Lucid was at console in MCC as a shift Capcom (Planning Shift) over the next seven years (see Table 12.2). Her record of 223 days for the most days in space logged in a career by a female, set in September 1996, was surpassed in June 2007 by Sunita Williams, but Lucid's position as a pioneer in female space endurance and experience remains. On January 31, 2012, six months after the final Shuttle mission (STS-135), NASA announced that Shannon Lucid had retired from NASA after more than three decades of service to the agency. [**88**]

Loren Shriver: In June 1993, Loren Shriver became Space Shuttle Program Manager, Launch Integration, at KSC. In this position, he was responsible for final Shuttle preparation, mission execution, and the return of the Orbiter to KSC following landings at Edwards AFB in California. From 1997, he served as the Deputy Director for Launch and Payload Processing at KSC until he retired from NASA in 2000.

The last of the TFNG leaves NASA

On April 28, 2017, NASA announced that Anna Fisher had retired after nearly four decades of service to NASA. [**89**] "Flying the Shuttle was so much fun, but, boy, you work. You work very hard. Every minute you're conscious you've got a job to do and you've got to perform it, so it's not like going on vacation and kicking back and relaxing. It would be so much fun to go [back] into space and be able to do that too. I would love it…to be able to just go into space to just have fun and not have to work." [**83**]. Fisher had remained with NASA for almost 40 years but in that time flew in space just once for one week.

Since their selection on January 16, 1978, and working for the agency as an active group until Fisher departed, they had represented NASA at several field centers (JSC, KSC, HQ, Ames) for 39 years, 3 months, 12 days. Of course, their time spent actually flying in space, even including Thagard and Lucid on Mir, was just a small percentage of that total, as Steve Hawley pointed out. "Flying [in space] was almost incidental, I was there for 30 years and I flew [five missions] cumulative for about a month." [**26**].

SUMMARY

Across 30 years and 135 missions, members of NASA's Group 8 supported most of the missions either on the ground, as Capcom at Mission Control, on the flight crews, or in managerial roles. A remarkable record. They supported the program from before STS-1 and one of them was at MCC working the Capcom console for the final flight.

In April 1981, Dan Brandenstein had been launch Capcom on the very first Shuttle mission. Then Rick Hauck, John Fabian, Sally Ride, and Norman Thagard became the first members of their group to fly in space in June 1983. Two years later, all 35 had flown at least one mission into space and many would get the chance to do so again, some several times. Over the years there was inevitable attrition, and sadly losses too, and though Steve Hawley flew into space in July 1999, the final member of the group to do so, their work continued in new roles in the space program, either within or outside of NASA. It was fitting that in July 2011, one of the final Capcom shifts on the last flight day of STS-135, which ended the program, was TFNG Shannon Lucid, prior to her retirement six months later. She was followed by JSC Director Mike Coats at the end of 2012. The closure of the story of the TFNG within NASA occurred in April 2017, when Anna Fisher, one of the first six women astronauts in the Office, became the 35th and last member of the group to leave the agency.

It was over.

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