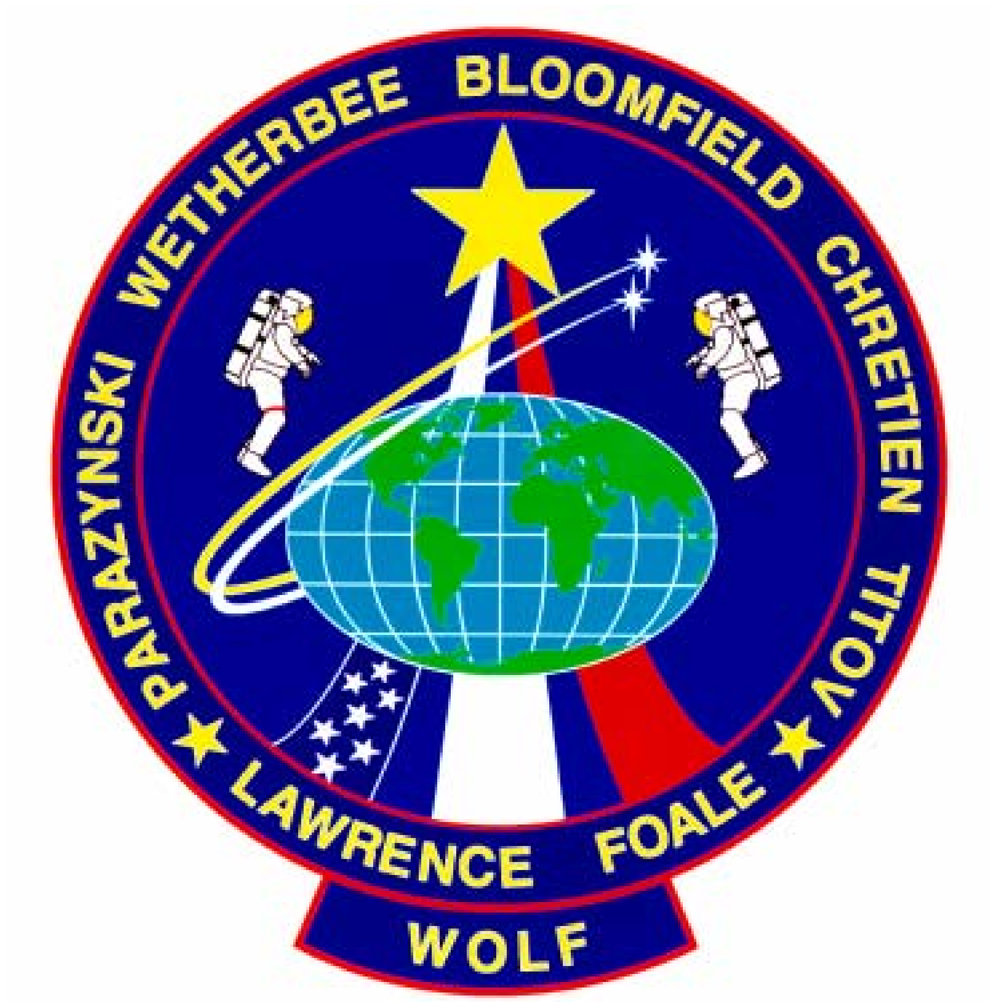
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

SPACE SHUTTLE MISSION STS-86

PRESS KIT
SEPTEMBER 1997



SHUTTLE MIR MISSION-07 (S/MM-07)

STS-86 INSIGNIA

STS086-S-001 -- The insignia for STS-86 symbolizes the seventh Shuttle-Mir docking mission with seven stars. The international crew includes astronauts from the United States, Russia and France. The flags of these nations are incorporated in the rays of the astronaut insignia. The rays of light streaking across the sky depict the orbital tracks of the two spacecraft as they prepare to dock. During the flight, an American astronaut and a Russian cosmonaut will perform an extravehicular Activity (EVA). The Mercator projection of earth illustrates the global cooperative nature of the flight.

The NASA insignia design for space shuttle flights is reserved for use by the astronauts and for other official use as the NASA Administrator may authorize. Public availability has been approved only in the form of illustrations by the various news media. When and if there is any change in this policy, which we do not anticipate, it will be publicly announced.

PHOTO CREDIT: NASA or National Aeronautics and Space Administration.

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RELEASE J97-27

ASTRONAUT WOLF CONTINUING AMERICAN PRESENCE ON MIR, JOINT U.S.-RUSSIAN SPACEWALK HIGHLIGHT STS-86 MISSION

The continuing cooperative effort in space exploration between the United States and Russia and a joint spacewalk will be the focus of NASA's seventh Shuttle mission of 1997 with the launch of Space Shuttle Atlantis on Mission STS-86.

This is the seventh of nine planned missions to Mir and the fourth one involving an exchange of U.S. astronauts. Astronaut Mike Foale, who has been on Mir since mid-May, will be replaced by astronaut David Wolf. Wolf will spend more than four months on the orbiting Russian facility. He will return to Earth on Space Shuttle Mission STS-89, scheduled for launch in January 1998.

The STS-86 crew will be commanded by Jim Wetherbee who will be making his fourth Shuttle flight. The pilot, Mike Bloomfield, will be making his first flight. There are five mission specialists assigned to this flight. Vladimir Titov, a Russian cosmonaut, serving as Mission Specialist-1, is making his fourth space flight and second flight on the Space Shuttle. Mission Specialist-2 Scott Parazynski is making his second flight. Jean-Loup Chrétien of the French Space Agency (CNES) is Mission Specialist-3 and is making his third flight and first on the Shuttle. Mission Specialist-4 Wendy Lawrence and Mission Specialist-5 David Wolf are making their second space flight. Shortly after docking, Wolf and Foale will conduct their handover with Wolf becoming a member of the Mir 24 crew and Foale becoming a STS-86 Mission Specialist through the end of the flight.

Atlantis is targeted for a late evening launch on September 25, 1997 from NASA's Kennedy Space Center Launch Complex 39-A. The current launch time of 10:34 p.m. EDT (0234 GMT Sept. 26) may vary slightly based on calculations of Mir's precise location in space at the time of liftoff due to Shuttle rendezvous phasing requirements. The STS-86 mission is scheduled to last 9 days, 20 hours, 24 minutes. An on-time launch on Sept. 25 and nominal mission duration would have Atlantis landing back at Kennedy Space Center on October 5 just before sunset at 6:58 p.m. EDT (2258 GMT).

Atlantis' rendezvous and docking with the Mir actually begin with the precisely timed launch setting the orbiter on a course for rendezvous with the orbiting Russian facility. Over the next two to three days, periodic firings of Atlantis' small thruster engines will gradually bring the Shuttle within close proximity to Mir.

The STS-86 mission is part of the NASA/Mir program which consists of nine Shuttle-Mir dockings and seven long duration flights of U.S. astronauts aboard the Russian space station. The U.S. astronauts will launch and land on a Shuttle and serve as Mir crew members while the Mir cosmonauts use their traditional Soyuz vehicle for launch and landing. This series of missions will expand U.S. research on Mir by providing resupply materials for experiments to be performed aboard the station as well as returning experiment samples and data to Earth.

Atlantis will again be carrying the SPACEHAB module in the payload bay of the orbiter. The double module configuration will house experiments to be performed by Atlantis' crew along with logistics equipment to be transferred to Mir.

Parazynski and Titov will conduct a five-hour spacewalk, or extravehicular activity (EVA), on the fourth day Atlantis is docked with the Mir. It will be the first U.S. spacewalk to include participation by a foreign astronaut. Parazynski and Titov will leave Atlantis' airlock to retrieve four suitcase-sized experiments called the Mir Environmental Effects Payload (MEEP) from the exterior of Mir's Docking Module. The experiments, which were attached to the Docking Module by astronauts during Shuttle mission STS-76 in March 1996, are studying the effects of exposure to the space environment on a variety of materials.

In addition to transferring the MEEP back to Atlantis, Parazynski and Titov will leave an item on the exterior of Mir. A solar array cap to be placed on the damaged Spektr module on a later Russian space walk will be brought out of the shuttle airlock and tethered to the exterior of the Docking Module. The solar array cap is too large to be transferred through Mir, and the cap is needed to seal off the base of the damaged array on Spektr if and when the array is jettisoned by cosmonauts.

Parazynski and Titov also will continue an evaluation of the Simplified Aid For EVA Rescue (SAFER), a small jet-backpack designed for use as a type of life jacket during station assembly. Parazynski and Titov also will evaluate equipment designed to be compatible for use by spacewalkers on the U.S. and Russian segments of the International Space Station.

The current Mir 24 mission began when cosmonauts Commander Anatoliy Solovyev and Flight Engineer Pavel Vinogradov were launched on August 5, in a Soyuz vehicle and docked with the Mir two days later. Mike Foale began his stay on the orbiting Russian facility with the Mir 23 crew in mid-May with the docking of STS-84. He became a member of the Mir 24 crew and continued his science investigations when the Mir 23 crew returned to Earth on August 13. Wolf is scheduled to be replaced by another NASA Astronaut when Endeavour docks with Mir in January 1998.

The STS-86 mission and the work performed by Wolf during his time on the Mir station will include investigations in the fields of advanced technology, Earth sciences, fundamental biology, human life sciences, International Space Station risk mitigation, microgravity sciences and space sciences. Because of his previous Space Shuttle extravehicular activity (EVA) spacewalk training along with Mir EVA training done at the Gagarin Cosmonaut Training Center in Star City, Russia, Wolf also may perform spacewalk activities during his tour of duty on the orbiting Russian facility.

When Atlantis undocks from Mir, the separation maneuvers performed will have two objectives. First, just after undocking, the Shuttle will continue to back away through a corridor similar to that used during approach with periodic stops to "stationkeep" in order to collect data for the European laser docking sensor. Atlantis will continue away from Mir until it reaches a distance of 600 feet below the Mir.

Following evaluations of the European sensor, Atlantis will then begin a re-approach to a distance of 240 feet while Mir maneuvers to an orientation that provides adequate viewing of the damaged areas of its Spektr module. After reaching the 240 foot range, Atlantis will begin a flyaround to photograph the damage from the Progress collision. Once the flyaround/photo survey activities are complete, Atlantis will perform a separation burn to move to an orbit below and ahead of Mir. Because of propellant constraints, this undocking profile may be modified during the mission.

STS-86 will be the 20th flight of Atlantis and the 87th mission flown since the start of the Space Shuttle program in April 1981.

(END OF GENERAL RELEASE; BACKGROUND INFORMATION FOLLOWS.)

MEDIA SERVICES INFORMATION

NASA Television Transmission

NASA Television is available through the GE2 satellite system which is located on Transponder 9C, at 85 degrees west longitude, frequency 3880.0 MHz, audio 6.8 MHz.

The schedule for television transmissions from the orbiter and for mission briefings will be available during the mission at Kennedy Space Center, FL; Marshall Space Flight Center, Huntsville, AL; Dryden Flight Research Center, Edwards, CA; Johnson Space Center, Houston, TX; and NASA Headquarters, Washington, DC. The television schedule will be updated to reflect changes dictated by mission operations.

Status Reports

Status reports on countdown and mission progress, on-orbit activities and landing operations will be produced by the appropriate NASA newscenter.

Briefings

A mission press briefing schedule will be issued before launch. During the mission, status briefings by a flight director or mission operations representative and when appropriate, representatives from the payload team, will occur at least once each day. The updated NASA television schedule will indicate when mission briefings are planned.

Internet Information

Information on STS-86 is available through several sources on the Internet. The primary source for mission information is the NASA Shuttle Web, part of the World Wide Web. This site contains information on the crew and its mission and will be regularly updated with status reports, photos and video clips throughout the flight. The NASA Shuttle Web's address is:

http://shuttle.nasa.gov

If that address is busy or unavailable, Shuttle information is available through the Office of Space Flight Home Page:

http://www.osf.hq.nasa.gov/

General information on NASA and its programs is available through the NASA Home Page and the NASA Public Affairs Home Page:

http://www.nasa.gov or http://www.nasa.gov/newsinfo/index.html

Information on other current NASA activities is available through the Today@NASA page:

http://www.nasa.gov/today.html

The NASA TV schedule is available from the NTV Home Page:

http://www.nasa.gov/ntv

Status reports, TV schedules and other information also are available from the NASA Headquarters FTP (File Transfer Protocol) server, ftp.hq.nasa.gov. Log in as anonymous and go to the directory /pub/pao. Users should log on with the user name “anonymous” (no quotes), then enter their E-mail address as the password. Within the /pub/pao directory there will be a “readme.txt” file explaining the directory structure:

- Pre-launch status reports (KSC): ftp.hq.nasa.gov/pub/pao/statrpt/ksc
- Mission status reports(JSC): ftp.hq.nasa.gov/pub/pao/statrpt/jsc
- Daily TV schedules: ftp.hq.nasa.gov/pub/pao/statrpt/jsc/tvsked.

NASA Spacelink, a resource for educators, also provides mission information via the Internet. Spacelink may be accessed at the following address:

http://spacelink.nasa.gov

Access by CompuServe

Users with CompuServe accounts can access NASA press releases by typing "GO NASA" (no quotes) and making a selection from the categories offered.

STS-86 QUICK LOOK

Launch Date/Site:	September 25, 1997/KSC Launch Pad 39-A
Launch Time:	10:34 PM EDT
Launch Window:	Approximately 7 minutes
Orbiter:	Atlantis (OV-104), 20th flight
Orbit Altitude/Inclination:	160 nautical miles, 51.6 degrees (213 n.m. for docking)
Mission Duration:	9 days, 20 hours, 24 minutes
Landing Date:	October 5, 1997
Landing Time:	6:58 PM EDT
Primary Landing Site:	Kennedy Space Center, Florida
Abort Landing Sites:	Return to Launch Site - KSC
Transoceanic Abort Sites:	Zaragoza, Spain; Ben Guerir, Morocco; Moron, Spain
Abort-Once Around:	KSC
Crew:	Jim Wetherbee, Commander (CDR), 4th flight Mike Bloomfield, Pilot (PLT), 1st flight Vladimir Titov, Mission Specialist 1 (MS 1), 4th flight Scott Parazynski, Mission Specialist 2 (MS 2), 2nd flight Jean-Loup Chrétien, Mission Specialist 3 (MS 3), 3rd flight Wendy Lawrence, Mission Specialist 4 (MS 4), 2nd flight David Wolf, Mission Specialist 5 up, (MS 5), 2nd flight Mike Foale, Mission Specialist 5 down, (MS 5), 4th flight
EVA Crew:	Scott Parazynski (EV 1), Vladimir Titov (EV 2)
Cargo Bay Payloads:	Spacehab Double Module Orbiter Docking System European Proximity Sensor MEEP Carriers SEEDS-II
In-Cabin Payloads:	RMEs KidSat CPCG CREAM CCM-A MSX SIMPLEX

CREW RESPONSIBILITIES

Payloads	Prime	Backup
Rendezvous and Docking	Wetherbee	Bloomfield
Undocking and Flyaround	Bloomfield	Wetherbee
Rendezvous Tools	Parazynski	Titov
Orbiter Docking System	Parazynski	Chrétien
Russian Language	Chrétien	Titov
Spacehab	Chrétien	Titov
Logistics Transfers	Titov	Chrétien
Water Bag Fills	Titov	Others
EVA	Parazynski	Titov
Intravehicular Crewmember	Bloomfield	------
CPCG	Bloomfield	------
CCM-A	Wetherbee	------
SIMPLEX	Bloomfield	Wetherbee
MSX	Bloomfield	Wetherbee
KidSat	Bloomfield	------
SEEDS-II	Chrétien	------
Earth Observations	Parazynski	Others
Ascent Seat on Flight Deck	Titov	------
Entry Seat on Flight Deck	Chrétien	------
Recumbent Seat Setup	Titov	Foale

STS-86 ORBITAL EVENTS SUMMARY

(based on a September 25, 1997 launch)

Event	MET	Time of Day (EDT)	GMT
Launch	0/00:00	10:34 PM, Sept. 25	0234, Sept. 26
Mir Docking	1/18:56	5:30 PM, Sept. 27	2130, Sept. 27
Mir Undocking	7/13:12	11:46 AM, Oct. 3	1546, Oct. 3
KSC Landing	9/20:24	6:58 PM, Oct. 5	2258, Oct. 5

DEVELOPMENTAL TEST OBJECTIVES, DETAILED SUPPLEMENTARY OBJECTIVES, RISK MITIGATION EXPERIMENTS

DTO 259:	Tuned Notch Filter Test
DTO 312:	External Tank TPS Performance
DTO 671:	EVA Hardware for Future Scheduled EVA Missions
DTO 700-9A:	Orbiter Evaluation of TDRS Acquisition in Despreader Bypass Mode
DTO 700-10:	Orbiter Space Vision System Videotaping
DTO 700-12:	Global Positioning System/Inertial Navigation System
DTO 700-13A:	Signal Attenuation Effects of ET During Ascent
DTO 700-15:	Space Integrated GPS/Inertial Navigation System
DTO 700-16:	S-Band Sequential Still Video Demonstration
DTO 805:	Crosswind Landing Performance
DTO 1118:	Photographic and Video Survey of Mir Space Station
DTO 1125:	Measurements of Dose as a Function of Shielding Thickness
DTO 1213:	Station Docking Target Evaluation
DSO 207:	Adaptation to Linear Acceleration after Space Flight
RME 1303-1:	Shuttle/Mir Experiment Kit Transport, Enhanced Dynamic Loads
RME 1303-2:	Shuttle /Mir Experiment Kit Transport, Mir Auxiliary Sensor Unit
RME 1303-3:	Shuttle/Mir Experiment Kit Transport, Water Experiment Kit
RME 1303-5:	Space Portable SpectroReflectometer
RME 1304:	Mir Environmental Effects Payload
RME 1314:	ESA Proximity Operations Sensor
RME 1317:	Mir Structural Dynamics Experiment
RME 1320:	Radiation Monitoring Equipment-III
RME 1324:	Volatile Organics Analyzer
RME 1332:	Space Station - Test of PCS Hardware

PAYLOAD AND VEHICLE WEIGHTS

	Pounds
Orbiter (Atlantis) empty and 3 SSMEs	152,174
Shuttle System at SRB Ignition	4,514,873
Orbiter Weight at Landing with Cargo	251,730
Spacehab	14,447
Orbiter Docking System	4,016

MISSION SUMMARY TIMELINE

Flight Day 1
Launch/Ascent
OMS-2 Burn
Payload Bay Door Opening
Spacehab Activation

Flight Day 2
EMU Checkout
SAFER Checkout
Rendezvous Tool Checkout
Centerline Camera Installation
Orbiter Docking System Ring Extension

Flight Day 3
Rendezvous and Docking
Hatch Opening and Welcoming Ceremony

Flight Day 4
Soyuz Seat Transfer and Installation
Logistics Transfer Operations

Flight Day 5
Greenhouse Operations
Logistics Transfer Operations

Flight Day 6
Logistics Transfer Operations
Hatch Closure for EVA
EVA Tool Preparation

Flight Day 7
EVA (5 hours, Parazynski and Titov)
Hatch Opening

Flight Day 8
Final Logistics Transfer Operations and Inventory
Joint Crew News Conference
Farewell Ceremony
Final Hatch Closure

Flight Day 9
Undocking and Flyaround Inspection of Spektr Module
Separation Maneuver
Off Duty Time

Flight Day 10
Flight Control System Checkout
Reaction Control System Hot-Fire
Cabin Stowage
Recumbent Seat Setup

Flight Day 11
Payload Bay Door Closing
Deorbit Burn
KSC Landing

SHUTTLE ABORT MODES

Space Shuttle launch abort philosophy aims toward safe and intact recovery of the flight crew, Orbiter and its payload. Abort modes for STS-86 include:

- Abort-To-Orbit (ATO) -- Partial loss of main engine thrust late enough to permit reaching a minimal 105-nautical mile orbit with the orbital maneuvering system engines.

- Abort-Once-Around (AOA) -- Earlier main engine shutdown with the capability to allow one orbit of the Earth before landing at Kennedy Space Center, Fla.

- Transoceanic Abort Landing (TAL) -- Loss of one or more main engines midway through powered flight would force a landing at either Zaragoza or Moron in Spain or Ben Guerir in Morocco.

- Return-To-Launch-Site (RTLS) -- Early shutdown of one or more engines, and without enough energy to reach a TAL site, would result in a pitch around and thrust back toward Kennedy until within gliding distance.

STS-86 MIR RENDEZVOUS, DOCKING & UNDOCKING

Atlantis' rendezvous and docking with the Russian Space Station Mir actually begins with the precisely timed launch of the shuttle on a course for the Mir, and, over the next two days, periodic small engine firings that will gradually bring Atlantis to a point eight nautical miles behind Mir on docking day, the starting point for a final approach to the station.

Mir Rendezvous & Docking-- Flight Day 3.

About two hours before the scheduled docking time on Flight Day Three of the mission, Atlantis will reach a point about eight nautical miles behind the Mir Space Station and conduct a Terminal Phase Initiation (TI) burn, beginning the final phase of the rendezvous. Atlantis will close the final eight nautical miles to Mir during the next orbit. As Atlantis approaches, the shuttle's rendezvous radar system will begin tracking Mir and providing range and closing rate information to Atlantis. Atlantis' crew also will begin air-to-air communications with the Mir crew using a VHF radio.

As Atlantis reaches close proximity to Mir, the Trajectory Control Sensor, a laser ranging device mounted in the payload bay, will supplement the shuttle's onboard navigation information by supplying additional data on the range and closing rate. As Atlantis closes in on the Mir, the shuttle will have the opportunity for four small successive engine firings to fine-tune its approach using its onboard navigation information. Flying a slightly modified rendezvous profile for improved efficiency, Atlantis will aim for a point directly below Mir, along the Earth radius vector (R-Bar), an imaginary line drawn between the Mir center of gravity and the center of Earth. Approaching along the R-Bar, from directly underneath the Mir, allows natural forces to assist in braking Atlantis' approach. During this approach, the crew will begin using a hand-held laser ranging device to supplement distance and closing rate measurements made by other shuttle navigational equipment.

Atlantis will intercept the R-Bar at a point 600 ft below Mir. Commander Jim Wetherbee will fly the shuttle using the aft flight deck controls as Atlantis begins moving up toward Mir. Because of the approach from underneath Mir, Wetherbee will have to perform very few braking firings. However, if such firings are required, the shuttle's jets will be used in a mode called "Low-Z," a technique that uses slightly offset jets on Atlantis' nose and tail to slow the spacecraft rather than firing jets pointed directly at Mir. This technique avoids contamination of the space station and its solar arrays by exhaust from the shuttle steering jets.

Using the centerline camera fixed in the center of Atlantis' docking mechanism, Wetherbee will center Atlantis' docking mechanism with the Docking Module mechanism on Mir, continually refining this alignment as he approaches within 300 feet of the station.

At a distance of about 30 feet from docking, Wetherbee will stop Atlantis and stationkeep momentarily to adjust the docking mechanism alignment, if necessary. At that time, a final go or no- go decision to proceed with the docking will be made by flight control teams in both Houston and Moscow.

When Atlantis proceeds with docking, the shuttle crew will use ship-to-ship communications with Mir to inform the Mir crew of the shuttle's status and to keep them informed of major events, including confirmation of contact, capture and the conclusion of damping. Damping, the halt of any relative motion between the two spacecraft after docking, is performed by shock absorber-type springs within the docking device. Mission Specialist Scott Parazynski will oversee the operation of the Orbiter Docking System from onboard Atlantis.

Undocking and Separation

Once Atlantis is ready to undock from Mir, the initial separation will be performed by springs that will gently push the shuttle away from the docking module. Both the Mir and Atlantis will be in a mode called "free drift" during the undocking, a mode that has the steering jets of each spacecraft shut off to avoid any inadvertent firings.

Once the docking mechanism's springs have pushed Atlantis away to a distance of about two feet from Mir, where the docking devices will be clear of one another, Atlantis' steering jets will be turned back on and fired in the Low-Z mode to begin slowly moving away from Mir.

The shuttle will continue to back away through a corridor similar to that used during approach with periodic stops to "stationkeep" in order to collect data for the European laser docking sensor. Atlantis will continue away from Mir until it reaches a distance of 600 feet below the Mir. At this point, Atlantis will begin a re-approach to a distance of 240 feet while Mir maneuvers to an orientation that provides adequate viewing of the damaged areas of its Spektr module. After reaching the 240 foot range, Atlantis will begin a flyaround to photograph the damage from the Progress collision. Once the flyaround/photo survey activities are complete, Atlantis will perform a separation burn to move to an orbit below and ahead of Mir. Because of propellant constraints, this undocking profile may be modified during the mission.

SHUTTLE-MIR ACTIVITIES & SCIENCE

EVA Development Flight Test (EDFT)

Mission Specialists Scott Parazynski and Vladimir Titov will conduct a five-hour spacewalk, or extravehicular activity (EVA), on the fourth day Atlantis is docked with the Mir. It will be the first U.S. spacewalk to include the participation of a foreign astronaut.

Parazynski is designated Extravehicular crewmember-1 (EV-1) and will be identified by red bands around each leg of his spacesuit. Titov is designated EV-2. Parazynski and Titov will leave Atlantis' airlock to retrieve four suitcase-sized experiments called the Mir Environmental Effects Payload (MEEP) from the exterior of Mir's Docking Module. The experiments were attached to the Docking Module by astronauts Linda Godwin and Rich Clifford during Shuttle mission STS-76 in March 1996.

Parazynski and Titov will exit the upward-facing hatch in the tunnel between Atlantis' crew cabin and the Spacehab module and move up the Docking Module to release the MEEP packages. The retrieved packages will be folded and stowed in sidewall carriers in Atlantis' cargo bay, two carriers located in front of the Orbiter Docking System (ODS) and two located aft of the ODS. Within the MEEP packages, investigators are studying the effects of exposure to the space environment on a variety of materials.

In addition to transferring the MEEP back to Atlantis, Parazynski and Titov will leave an item on the exterior of Mir. A solar array cap to be placed on the damaged Spektr module on a later Russian space walk will be brought out of the shuttle airlock and tethered to the exterior of the Docking Module. The solar array cap is too large to be transferred through Mir, and is needed to seal off the base of the damaged array on Spektr if and when the array is jettisoned by cosmonauts.

The spacewalk will continue a series of EVA Development Flight Test (EDFT) spacewalks that have been conducted on six past Space Shuttle missions. The tests are designed to evaluate equipment and techniques and build experience among astronauts and ground controllers in preparation for assembly of the International Space Station. Past EDFT spacewalks have evaluated equipment ranging from the labeling to be used on the exterior of the station to the nuts and bolts to be used as connectors.

In addition to retrieving the MEEP, Parazynski and Titov will continue an evaluation of the Simplified Aid For EVA Rescue (SAFER), a small jet-backpack designed for use as a type of life jacket during station assembly. Originally evaluated on Shuttle mission STS-64, the SAFER is designed to be worn by astronauts during station spacewalks to allow them to fly back to the station under their own power in the event they become untethered. The SAFER unit to be tested on STS-86 is the first flight production model. Parazynski and Titov will be wearing the devices, and, while remaining tethered and in a foot restraint, they will evaluate the deployment of the hand controller and the firing of the automatic attitude hold feature. Firing the automatic attitude hold feature while the astronauts are in a foot restraint will test the firing mechanisms in the device, such as the valves and gas thrusters. The astronauts will not perform any free-flight testing of the SAFER as was performed on STS-64.

Parazynski and Titov also will evaluate equipment designed to be compatible for use by spacewalkers on the U.S. and Russian segments of the International Space Station. The evaluations will include a Universal Foot Restraint designed to hold the boots of both U.S. and Russian spacesuits; common safety, equipment and body restraint tethers; and a common tool carrier.

MIR Environmental Effects Payload (MEEP)

The Mir Environmental Effects Payload (MEEP) is managed by NASA's Langley Research Center, Hampton, VA, and has been studying the frequency and effects of space debris striking the Mir space station. MEEP has been gathering data on human-made and natural space debris, capturing some debris for later study. It was attached to Mir's Docking Module during a spacewalk by two Shuttle astronauts during the STS-76 mission in March 1996.

The MEEP payload has also exposed selected and proposed International Space Station materials to the effects of space and orbital debris to determine the reactions of the materials to the space environment. Because the International Space Station will be placed in approximately the same Earth orbit as Mir, flying MEEP aboard Mir is giving researchers an opportunity to test materials for the International Space Station in a comparable orbital position.

MEEP consists of four separate experiments. The Polished Plate Micrometeoroid and Debris experiment is designed to study how often space debris hit the station, the sizes of these debris, the source of the debris, and the damage the debris would do if it hit the station. The Orbital Debris Collector experiment is designed to capture orbital debris and return them to Earth to determine what the debris are made of and their possible origins.

The Passive Optical Sample Assembly I and II experiments consist of various materials that are intended for use on the International Space Station. These materials include paint samples, glass coatings, multi-layer insulation and a variety of metallic samples.

The four MEEP experiments have been attached to Mir for more than a year. The data will be studied to determine what kind of debris hit the space station and how those contaminants can actually collect on some of the different surfaces of a space station, affecting its surfaces and long-term performance.

The four MEEP experiments will be carried back in Atlantis' cargo bay. They will be contained in four Passive Experiment Carriers (PEC) - two in front of, and two behind the Orbiter Docking System.

PHASE 1 RESEARCH PROGRAM

The Phase 1 Program consists of nine Shuttle-Mir dockings and seven long-duration flights of U.S. astronauts aboard the Russian space station between early 1995 and mid 1998. The U.S. astronauts will launch and land on a Shuttle and serve as Mir crewmembers for flight durations ranging from 127 to 187 days, while the Mir cosmonauts stay approximately 180 days and use their traditional Soyuz vehicle for launch and landing. This series of missions will expand U.S. research on Mir by providing resupply materials for experiments to be performed aboard Mir, as well as returning experimental samples and data to Earth.

The Mir 24 mission began when the cosmonaut crew launched on August 5, 1997, in a Soyuz vehicle and docked with the Mir two days later. Michael Foale joined the Mir 23 crew with the May 17, 1997, docking of Atlantis during Mission STS-84. The return of Atlantis on STS-86 will conclude some experiments, continue others and commence still others. Data gained from the mission will supply insight for the planning and development of the International Space Station, Earth-based sciences of human and biological processes and the advancement of commercial technology.

Science Overview

As scientists learn more about the effects of the space environment, they continue to develop questions from the fields of human life sciences, fundamental biology, biotechnology, material sciences, and spacecraft structural and environmental dynamics. Valuable scientific information regarding these subjects will be returned from the NASA/Mir Program disciplines of advanced technology, Earth sciences, fundamental biology, human life sciences, International Space Station risk mitigation, microgravity sciences and space sciences. This knowledge will assist researchers in developing future space stations, science programs and procedures for those facilities, and advance the knowledge base of these areas to the benefit of all people on Earth.

The advanced technology discipline will evaluate new technologies and techniques using Mir as a test bed. Self-contained experiments in biotechnology, as well as pioneering work in space based metallurgy, will be conducted.

Earth sciences research in ocean biochemistry, land surface hydrology and meteorology will be performed. Observation and documentation of transient natural and human-induced changes will be accomplished with the use of hand-held photography. Residence in Earth orbit will allow for documentation of atmospheric conditions, unpredictable events, and ecological and seasonal changes over long time periods.

Fundamental biology research continues investigations to study the radiation environment of Mir, particularly in the area of charged particles.

Human life sciences research consists of investigations that focus on the crewmembers' adaptation to weightlessness in terms of skeletal muscle and bone changes, the cardiovascular system, psychological interactions and metabolism. In the Space Medicine Program, environmental factors such as water quality, air quality, surface assessment for microbes, and crew microbiology will be assessed. These ambitious investigations will continue the characterization of the integrated human responses to a prolonged presence in space.

The International Space Station risk mitigation discipline consists of several technology demonstrations associated with human factors and maintenance of crew health and safety aboard the space station. In order to improve the design and operation of the International Space Station, information is gathered to fully evaluate the Mir interior and exterior environments. This discipline includes investigations of radio interference, particle impact on the station, docked configuration stability, water microbiological monitoring and radiation monitoring.

Microgravity research will advance scientific understanding through research in biotechnology, crystal growth and materials science. The ambient acceleration and vibration environment of Mir will be characterized to support future research programs.

Most of the Mir 24/NASA research will be conducted on the Mir; however, Shuttle-based experiments will be conducted in the middeck or Spacehab modules of STS-86.

Human Life Sciences

The task of safely keeping men and women in space for long durations, whether they are doing research in Earth orbit or exploring other planets in our solar system, requires continued improvement in our understanding of the effects of spaceflight factors on the ways humans live and work. The Human Life Sciences (HLS) project has a set of investigations planned for the Mir 24/NASA 6 mission to determine how the body adapts to weightlessness and other space flight factors, including the psychological aspects of a confined environment and how they readapt to Earth's gravitational forces. The results of these investigations will guide the development of ways to minimize any negative effects so that crewmembers can remain healthy and efficient during long flights, as well as after their return to Earth.

International Space Station Risk Mitigation

The Space Portable Spectroreflectometer (SPSR) is a new tool designed to measure the effects of the space environment on spacecraft materials. This is the first hand-held, battery-powered device of its kind, allowing astronauts to measure actual spacecraft devices, rather than relying on information gathered from samples. During Extravehicular Activity (EVA) operations scheduled later this year, cosmonauts and astronauts will use this device to measure how much energy is being absorbed by the thermal control coatings, or radiator surfaces, of the Mir space station. Radiators, which are used to shed excess heat from the spacecraft, play a vital role as part of the station's cooling system.

Measurements will be used to determine the deterioration of radiator surfaces caused by the space environment. The radiator surfaces of Mir are very similar to those being manufactured for the International Space Station. Based on ground testing, researchers have constructed models of expected deterioration for the Space Station. The SPSR will provide valuable data for determining how materials degrade when exposed to the space environment.

The Space Portable Spectroreflectometer was built for the Space Environments and Effects program at NASA's Marshall Space Flight Center in Huntsville, AL by AZ Technology, In. of Huntsville.

Microgravity

The Interferometer to study Protein Crystal Growth (IPCG)- flying for the first time on STS-86 and the NASA 6 mission-- is an instrument designed to yield valuable preliminary data on how protein crystal growth differs in the microgravity environment of space. Researchers also hope to develop technologies and methods to improve the protein crystal growth process, which may help unlock future answers to the molecular structure of targeted proteins, leading to the development of new, disease-fighting drugs.

The IPCG hardware will be transported to the Mir on STS-86 and installed in the microgravity glovebox for experiment operations. Once installed, the interferometer, an instrument for measuring wavelengths of light, collects and stores optical information on a growing crystal in the facility, showing growth in form and structure, as well as in change in concentration of the protein solution surrounding the crystal. A total of three experiments will be conducted on six fluid systems. The IPCG hardware will be removed from the glovebox and returned to stowage at the completion of the experiments and returned on STS-89.

Dr. Alexander McPherson, University of California, Irvine, is the principal investigator of the IPCG experiment.

The Canadian Protein Crystallization Experiment (CAPE) is a biotechnology flight experiment developed by Canadian Space Agency scientists that could help lead to advanced treatment and possible cures for some debilitating diseases as well as bacterial and viral infections. Some of the diseases targeted include cancer, meningitis, cystic fibrosis, emphysema, diabetes, Alzheimer's, breast cancer and hypertension.

CAPE consists of wells, or small test tubes, which will be processed over a period of several months aboard the Mir. Of the 700 wells available for the project, the majority will contain samples of 32 different proteins from 15 Canadian universities and research institutions. Forty-four wells will contain student experiments.

Because protein crystals are fragile, it is difficult to grow adequately large or perfect protein crystals in Earth-based laboratories. However, the microgravity environment of space does not present gravity-induced effects such as sedimentation and convection to disrupt the growth of these fragile crystals. The chance of growing larger, more perfect crystals is greatly improved. and may significantly accelerate drug development research.

Coordination and integration of the experiment with the Shuttle/Mir Flight Program is managed by NASA's Microgravity Research Program at Marshall Space Flight Center in Huntsville, AL.

ESA ACTIVITIES ON STS-86

The European Space Agency (ESA) is again sponsoring a test of a European laser docking system that will be tested for the second time during the Shuttle's approach and departure from Mir. A GPS receiver and an optical rendezvous sensor on the Shuttle, together with equipment already installed on Mir, will be operated in an enactment of how ESA's unmanned Automated Transfer Vehicle (ATV) will approach and depart the International Space Station when it delivers supplies to it early in the next century.

During the long-range approach to Mir (starting 3 hours before docking), ESA's receivers on Atlantis and Mir will receive data from Navstar Global Positioning Satellites on the position of the other craft. The accuracy of that relative navigational data will later be compared with true data from the Shuttle's rendezvous radar.

When the Shuttle is 170 feet from Mir, the short-range experiment will begin. Navigation will be handed over to the optical rendezvous sensor. Data will later be compared with "true" figures, this time supplied by the NASA Trajectory Control System (TCS), a laser ranging device in the payload bay.

The experiments will be repeated during Atlantis' departure from Mir. As the Shuttle backs away from Mir through a corridor similar to that used during approach, periodic stops will be made to "stationkeep" in order to collect data for the European laser docking sensor. Atlantis will continue backing away from Mir until it reaches a distance of 600 feet below the Mir.

This test is last in a series of three flight demonstrations. The GPS elements of the system were tested on STS-80 in November 1996 and the first full flight test was done on the sixth Shuttle-Mir docking mission in May 1997.

STS-86 EDUCATIONAL ACTIVITIES.

SEEDS-II

The Seeds in Space-II experiment will passively expose a group of tomato seeds, in hand-sewn Dacron bags, to the vacuum of space. Seeds flown in the SEEDS-II payload will be compared with a control group of seeds and an experimental group of seeds located in an underwater habitat in Key Largo, Florida. Upon completion of the mission, all of the seeds will be distributed to schools for education and outreach purposes. The students will compare the experimental seeds with the control group seeds. The experiment is designed to increase student awareness of the similarities and complexities involved in the hostile ocean and space environments.

The SEEDS-II is a passive payload and does not require any power or crew interaction. The payload will be self-contained within a standard, unsealed 2.5 ft GAS canister that will be exposed to space for the duration of the mission.

KIDSAT

The STS-86 mission will support the third and final flight of KidSat, NASA's pilot education program that uses an electronic still camera aboard the Shuttle to bring the frontiers of space exploration to a growing number of U.S. middle school classrooms via the Internet.
KidSat is a NASA-sponsored research and development project that links middle school, high school and university students to Space Shuttle missions. The mission of KidSat is to understand and demonstrate how middle school students can actively make observations of the Earth by using mounted cameras onboard the Space Shuttle to conduct scientific inquiry in support of their middle school curricula. Students engage in a process to select and analyze images of the Earth during Shuttle flights and use the tools of modern science (computers, data analysis tools and the Internet) to widely disseminate the images and results. A team environment, modeling scientific research and space operations and promoting student growth, discovery and achievement, while helping students participate in solving real-world problems, is implemented.

These students remotely operate a Kodak electronic still camera, mounted in the right overhead window on the flight-deck of the Space Shuttle, to take digital photographs of the Earth. Middle school students are responsible for planning the photo requests, which involves calculating the longitude and latitude of a region, as well as the exact time the Shuttle flies over it. High school and university students then compile the requests into a single control file that is forwarded by KidSat representatives at the Johnson Space Center (JSC) in Houston to the IBM ThinkPad connected to the camera. Using special flight software, the ThinkPad automatically commands the camera to snap the pictures requested by the middle schools. These pictures then retrace their path back down to Earth where they reach their final destination -- a computer archive. Students then can access their pictures from this archive, using the Internet.

KidSat has flown on two previous Shuttle missions: the first was in March 1996 (STS-76) and the second in January 1997 (STS-81). STS-86 marks the third and final mission of this pilot program. Three U.S. middle schools participated in the first flight. Since then, KidSat has been growing; there were 15 schools participating during the STS-81 mission, and 52 schools will participate during the STS-86 flight.

Over 300 photos were taken during STS-76, and another 500 were taken during STS-81. These can be accessed at the following URL:

http://www.jpl.nasa.gov/kidsat/

The three-year pilot program is a partnership between NASA's Jet Propulsion Laboratory (JPL), the University of California at San Diego (UCSD), and the Johns Hopkins University Institute for the Academic Advancement of Youth (JHU-IAAY).

During the Shuttle mission, the KidSat mission operations center at UCSD is staffed by undergraduate and high school students. The center is modeled after Mission Control at JSC. The students receive telemetry from the Shuttle on their computer monitors and can listen to and receive instructions from NASA's flight controllers over direct channels to JSC.

The KidSat mission operations team monitors the Shuttle's progress around the clock and continually provides up-to-date information to the middle schools, which are using the Internet to send instructions to photograph specific regions of the Earth. Since any change in the Shuttle's orbit can affect students' selections, UCSD constantly updates this information so that the middle schools may re-plan their photographic requests if necessary. This is done through a sophisticated World Wide Web site that allows students access to interactive maps of orbit ground tracks to aid in photo selection.

When the image requests have been verified by KidSat mission operations, they are compiled into a single camera control file and forwarded electronically to the KidSat representatives at JSC. They pass this file on to flight controllers who uplink it to an IBM ThinkPad connected to the KidSat camera. Software on the ThinkPad, developed by students working at JPL, uses these commands to control the camera. These same students trained the astronauts on the use of the software and the installation of the KidSat camera in the Shuttle's overhead window.

After the photographs are taken, they are sent back down to the KidSat data system at JPL, staffed by high school students during the mission and posted on the World Wide Web for the students to study and analyze. The curriculum used by the middle school students and teachers is being developed by the JHU-IAAY and UCSD.

Some of the topics the students explored during the previous KidSat missions were weather, biomes, the relationship between history and geography and the patterns of rivers on the landscape. Additional interests for these missions included searching for impact craters and studying the relationships of center pivot irrigation fields to available water supply.

The KidSat pilot program is sponsored by NASA's Office of Human Resources and Education, with support from the Offices of Space Flight, Mission to Planet Earth, and Space Science.

COMMERCIAL PROTEIN CRYSTAL GROWTH (CPCG)

The Commercial Protein Crystal Growth (CPCG) payload is comprised of a Commercial Refrigerator/Incubator Module (CRIM) designed as a generic carrier, and the Commercial Vapor Diffusion Apparatus (CVDA) experiment. The primary objective of the CVDA experiment is to produce large, high-quality crystals of selected proteins under controlled conditions in microgravity. Crystals of sufficient size and suitable quality are essential for protein crystallographic analysis of molecular structures via X-ray diffraction and computer modeling.

The vapor diffusion method of protein crystal growth is a technique by which protein crystallization is initiated through change in protein/precipitant concentrations. Water vapor is transported from a droplet protein/precipitant solution at a given pH to a reservoir containing a relatively high concentration of precipitating agent. The process is driven by drop-reservoir vapor pressure difference in a closed volume. Typical precipitating agents are ammonium sulfate, sodium chloride, polyethylene glycol, and methyl pentane diol.

The CVDA design provides a better thermal environment for samples as well as providing a larger number of experiments per CRIM, 128 as compared with 60 per old VDA configuration. Each CVDA Chamber Block consists of four experiment chambers per row. The assembly will have eight rows of experiment chambers, thus 128 per assembly.

COSMIC RADIATION EFFECTS AND ACTIVATION MONITOR (CREAM)

The Cosmic Radiation Effects and Activation Monitor will be used to collect data on cosmic ray energy loss spectra, neutron fluxes and induced radioactivity as a function of geomagnetic coordinates and detector location within the orbiter. Payload hardware consists of the active cosmic ray monitor, a passive scintillation crystal canister, two neutron spectrometers and 10 passive detector packages. The active monitor will be used to obtain real-time spectral data, while the passive monitors will obtain data integrated over the mission duration. An additional control passive detector package will be used for obtaining background data prior to launch.

The CREAM active monitor is a box containing sensors and associated electronics and solid-state memory. The active monitor will be rotated between two passive package locations throughout the mission. CREAM uses three different types of passive detectors. The first is a set of scintillation crystals packaged in an aluminum canister that will remain in a central location within Mir throughout the mission.

There are also passive detector packages, which contain nickel and gold activation foils, neutron bubble dosimeters and thermoluminescent dosimeters. Eight of these packages will be placed in four specific locations within Mir, while the remaining two will remain in the central location within Mir. The third type of passive detector is the neutron spectrometer, which consists of three identical sets of six gel-filled test tubes. The "test tubes," or neutron bubble detectors, are designed to measure specific energy thresholds of the neutron environment within Mir.

CELL CULTURE MODULE-A (CCM-A)

The Cell Culture Module-A payload was formerly known as the Space Tissue Loss / National Institutes of Health-Cells Configuration A. The payload objectives are to validate models for muscle, bone and endothelial cell biochemical and functional loss induced by microgravity stress; to evaluate cytoskeleton, metabolism, membrane integrity and protease activity in target cells; and to test tissue loss pharmaceuticals for efficacy. The experiment unit fits into a single standard middeck locker that has a modified locker door with its panels removed. The unit takes in and vents air to the cabin via the front panel. The experiment is powered and functions continuously from pre-launch through post-landing.

The analysis module includes the sealed fluid path assembly containing the cells under study, all media for sustained growth, automated drug delivery provisions for testing of candidate pharmaceuticals, inline vital activity and physical environment monitors, integral fraction collection capabilities and cell fixation facilities.

Experiment activities can be performed without any crew intervention other than initiation of the experiment at the beginning of on-orbit payload operations and termination of the experiment prior to deorbit preparation.

SHUTTLE IONOSPHERIC MODIFICATION WITH PULSED LOCAL EXHAUST (SIMPLEX)

The Shuttle Ionospheric Modification with Pulsed Local Exhaust payload of opportunity has no flight hardware; orbiter OMS thruster firings will be used to create ionospheric disturbances for observation by the SIMPLEX radars. SIMPLEX has three different radar sites used for collecting data: 1) Arecibo, 2) Kwajalein, and 3) Jicamarca. One of the radar sites (Arecibo) will also use a low-level laser to observe the effects on the ionosphere resulting from the thruster firing.

The objective of the SIMPLEX activity is to determine the source of Very High Frequency (VHF) radar echoes caused by the Orbiter and its OMS engine firings. The principal investigator (PI) will use the collected data to examine the effects of orbital kinetic energy on ionospheric irregularities and to understand the processes that take place with the venting of exhaust materials. SIMPLEX sensors may collect data during any encounter opportunity when the orbiter support activities meet the criteria defined.

STS-86 CREWMEMBERS

STS086-S-002 -- These eight astronauts have been assigned as the crew members for the STS-86 mission, scheduled for a September 1997 launch and visit to Russia's Mir space station. Wearing the partial pressure launch and entry suits are, from the left, Jean-Loup J. M. Chrétien and David A. Wolf, mission specialists; Michael J. Bloomfield, pilot; James D. Wetherbee, mission commander; and Wendy B. Lawrence, and C. Michael Foale, both mission specialists. Wearing the Extravehicular Mobility Unit (EMU) space suits are Scott F. Parazynski (left) and Vladimir G. Titov, both mission specialists. Chrétien and Titov are international mission specialists, representing the French Space Agency (CNES) and the Russian Space Agency (RSA), respectively. When the STS-86 crew arrives at Mir, Wolf is scheduled to replace Foale a cosmonaut guest researcher aboard Mir.

PHOTO CREDIT: NASA or National Aeronautics and Space Administration.

BIOGRAPHICAL DATA

NAME: James D. Wetherbee (Commander, USN)
STS-86 Mission Commander

PERSONAL DATA: Born November 27, 1952, in Flushing, New York. Considers Huntington Station, New York, his hometown. Married to the former Robin DeVore Platt of Jacksonville, Florida. They have two children. He enjoys tennis, skiing, softball, running, and music. His parents, Mr. and Mrs. Dana A. Wetherbee, reside in Huntington Station, New York. Her parents, Mr. and Mrs. Harry T. Platt, Jr., reside in Jacksonville, Florida.

EDUCATION: Graduated from Holy Family Diocesan High School, South Huntington, New York, in 1970; received a bachelor of science degree in aerospace engineering from the University of Notre Dame in 1974.

ORGANIZATIONS: Member of the Society of Experimental Test Pilots.

SPECIAL HONORS: Awarded the Distinguished Flying Cross, the Navy Achievement Medal, and two Meritorious Unit Commendations.

EXPERIENCE: Wetherbee received his commission in the United States Navy in 1975 and was designated a naval aviator in December 1976. After training in the A-7E, he was assigned to Attack Squadron 72 (VA-72) from August 1977 to November 1980 aboard the USS John F. Kennedy and logged 125 night carrier landings. After attending the U.S. Naval Test Pilot School, Patuxent River, Maryland, in 1981 he was assigned to the Systems Engineering Test Directorate. He was a project officer and test pilot for the weapons delivery system and avionics integration for the F/A-18 aircraft. Subsequently assigned to Strike Fighter Squadron 132 (VFA-132), Wetherbee flew operationally in the F/A-18 from January 1984 until his selection for the astronaut candidate program. He has logged over 4,200 hours flying time and 345 carrier landings in 20 different types of aircraft.

NASA EXPERIENCE: Selected by NASA in May 1984, Wetherbee became an astronaut in June 1985. A veteran of three space flights, Wetherbee has logged over 695 hours in space. He was the pilot on STS-32 in 1990), and was the mission commander on STS-52 in 1992 and STS-63 in 1995). From February to December 1996, Wetherbee served as Deputy Director of the Johnson Space Center. Wetherbee will command an international crew on STS-86, NASA's seventh Shuttle mission to rendezvous and dock with the Russian Space Station Mir. Launch is scheduled for September 1997.

STS-32 Columbia (January 9-20, 1990) saw the successful deployment of the Syncom IV-F5 satellite, and retrieval of the 21,400-pound Long Duration Exposure Facility (LDEF) using the remote manipulator system (RMS). The crew also operated a variety of middeck experiments and conducted numerous medical test objectives, including in-flight aerobic exercise and muscle performance to evaluate human adaptation to extended duration missions. Mission duration was 261 hours, 01 minute, 38 seconds.

STS-52 Columbia (October 22 to November 1, 1992) successfully deployed the Laser Geodynamic Satellite (LAGEOS), a joint Italian-American project. The crew also operated the first U.S. Microgravity Payload (USMP) with French and American experiments, and successfully completed initial flight tests of the Canadian-built Space Vision System (SVS). Mission duration was 236 hours, 56 minutes, 13 seconds.

STS-63 Discovery (February 2-11, 1995), was the first flight of the new joint Russian-American Space Program. Mission highlights included the rendezvous with the Russian Space Station, Mir, operation of Spacehab, and the deployment and retrieval of Spartan 204. The mission was accomplished in 129 orbits, traveling over 2.9 million miles in 198 hours, 29 minutes.

BIOGRAPHICAL DATA

NAME: Michael J. Bloomfield (Major, USAF)
NASA Astronaut

PERSONAL DATA: Born March 16, 1959, in Flint, Michigan. Considers Lake Fenton, Michigan, to be his hometown. Married to the former Lori Ann Miller. They have two children He enjoys reading, gardening, all sporting activities including running, softball, skiing, and any activity with his children His parents, Rodger and Maxine Bloomfield, reside in Linden, Michigan. Her parents, Dave and Donna Miller, reside in Albuquerque, New Mexico.

EDUCATION: Graduated from Lake Fenton High School, Fenton, Michigan, in 1977. Bachelor of science degree in engineering mechanics from the U.S. Air Force Academy, 1981. Master of science degree in engineering management from Old Dominion University, 1993.

ORGANIZATIONS: Member of the United States Air Force Academy Association of Graduates, the Air Force Association, and the Society of Experimental Test Pilots.

SPECIAL HONORS: Captain, 1980 United States Air Force Academy Falcon Football Team. Voted to the 1980 WAC All-Academic Football Team. Commanders Trophy winner as top graduate from Air Force Undergraduate Pilot Training (1983). Distinguished Graduate of USAF Test Pilot School Class 92A. Awarded the Air Force Meritorious Service Medal, the Air Force Commendation Medal, and the Air Force Aerial Achievement Medal.

EXPERIENCE: Bloomfield graduated from the USAF Academy in 1981. He completed Undergraduate Pilot Training at Vance Air Force Base (AFB), Oklahoma, in 1983, and was selected to fly the F-15. From 1983 until 1986, he served as a combat ready pilot and instructor pilot in the F-15 at Holloman AFB, New Mexico. In 1987, Bloomfield was re- assigned to Bitburg Air Base, Germany, where he served as an F-15 instructor pilot and completed the United States Fighter Weapons Instructor Course. In 1989 he was subsequently assigned to the 48th Fighter Interceptor Squadron at Langley AFB, Virginia. serving as an F-15 squadron weapons officer until 1992, when he was selected for the USAF Test Pilot School. Honored as a distinguished graduate in 1992, Bloomfield remained at Edwards AFB, California, where he conducted tests in all models of the F-16. While a member of the 416th Flight Test Squadron, Bloomfield served as squadron safety officer and as squadron flight commander. In March 1995, he was assigned to NASA as an astronaut candidate.

NASA EXPERIENCE: Selected by NASA in December 1994, Bloomfield reported to the Johnson Space Center in March 1995, has completed a year of training and evaluation, and is currently qualified for assignment as a shuttle pilot. He was initially assigned to work technical issues for the Operations Planning Branch of the Astronaut Office. He is currently assigned to serve as pilot on STS-86, NASA's seventh Shuttle mission to rendezvous and dock with the Russian Space Station Mir. Launch is scheduled for September 1997.

BIOGRAPHICAL DATA

Vladimir Georgievich Titov (Colonel, Russian Air Force)
Russian Cosmonaut/STS-86 Mission Specialist

PERSONAL DATA: Born January 1, 1947, in Sretensk, in the Chita Region of Russia. Married to the former Alexandra Kozlova of Ivanovo Region, Russia. They have two children. He enjoys tennis, hunting, and spending time with his family. His mother, Vera Titova, resides in Star City, Russia. His father, Georgi Titov, died in 1961. Her parents, Ruric and Alevtina Kozlov, reside in Ivanovo Region.

EDUCATION: Graduated from secondary school in 1965, from the Higher Air Force College in Chernigov in Ukraine in 1970, and the Yuri Gagarin Air Force Academy in 1987.

SPECIAL HONORS: Awarded the title of Hero of the Soviet Union, and recipient of the Order of Lenin (1983, 1988). In 1988, the French awarded him the title of Commandeur de la Legion d'Honneur, and in 1990 he and Manarov were awarded the U.S. Harmon Prize-the first Soviet citizens to win the award-in recognition of their world endurance record.

EXPERIENCE: In 1966, Vladimir Titov enrolled at the Higher Air Force College in Chernigov in Ukraine, graduating in 1970. Until 1974, he served at the College as a pilot-instructor and was responsible for the graduation of twelve student pilots. He later served as a flight commander with the air regiment where the cosmonauts carry out flying practice. He has flown 10 different types of aircraft, has logged more than 1,400 hours flying time, and holds the qualifications of Military Pilot, 1st Class, and Test Pilot, 3rd Class.

Vladimir Titov was selected to join the cosmonaut team in 1976, and in September 1981 was paired with Gennadiy Strekalov. The two men served as the back-up crew for Soyuz T-5 in 1982 and Soyuz T-9 in 1983. A veteran of five space flights, Titov served as commander on Soyuz T-8 and Soyuz T-10 in 1983 and Soyuz TM-4 in 1987, and flew on the crew of STS-63 in 1995 and STS-86 in 1997. He has logged a total of 18 hours, 48 minutes of EVA, and has spent a total of 387 days, 52 minutes, 18 seconds in space (including the Soyuz T-10 launch abort).

Titov made his first space flight on April 20, 1983, as commander of Soyuz T-8. He and Strekalov had been specifically trained to repair the faulty Salyut 7 solar array. He was supposed to dock with Salyut 7, but once in orbit the Soyuz rendezvous radar antenna failed to deploy properly. Several attitude control maneuvers at high rates were made but failed to swing the boom out. (The postflight inquiry later discovered that the antenna had been torn off when the Soyuz payload shroud separated.) With FCC permission, the crew attempted a rendezvous using only an optical sight and ground radar inputs for guidance. During the final approach, which was made in darkness, Titov believed that the closing speed was too great. He therefore attempted a braking maneuver, but felt that the two spacecrafts were still closing too fast. He aborted the rendezvous to avoid a crash, and no further attempts were made before the three men returned to Earth after a flight lasting just 2 days, 17 minutes, 48 seconds.

Titov and Strekalov were then scheduled for launch on board what should have been Soyuz T-10 on September 27, 1983. However, a valve in the propellant line failed to close at T-90 seconds, causing a large fire to start at the base of the launch vehicle only one minute before launch. The fire quickly engulfed the rocket, and the automatic abort sequence failed as the wires involved burned through. Two launch controllers manually aborted the mission by sending radio commands from the launch blockhouse. This was accomplished 12 seconds after the fire began. The Soyuz descent module was pulled clear by the launch escape system, and after being subjected to 15-17 G's, the crew landed safely some 2.5 miles (4 km) from the launch vehicle, which apparently exploded seconds after the Soyuz separated. The two men were given a medical check-up, but had sustained no injuries during their brief flight which lasted 5 minutes, 30 seconds.

Titov was next assigned to command Soyuz TM-2. He and his flight engineer, Alexander Serebrov, were scheduled for a long-duration flight on board Mir 1. Six-days prior to launch, due to doubts about Serebrov's health, they were replaced by the back-up crew. Titov continued training for a long-duration mission, and in April 1987 was paired with Musa Manarov. Later that year, he graduated from the Yuri Gagarin Air Force Academy while continuing his work at the Yuri Gagarin Cosmonaut Training Center.

His next assignment came as the commander of Soyuz TM-4, which launched on December 21, 1987. Together with Musa Manarov and Anatoliy Levchenko, he linked up with the orbiting Mir 1 space station and her crew. After a short period of joint work, Romanenko, Alexandrov, and Levchenko returned to Earth handing over the space station to Titov and Manarov. The two men settled down to a long program of scientific experiments and observations, and played host to the visiting Soyuz TM-5 and TM-6 missions. At the end of the Soyuz TM-6 visit, one of its crew, Dr. Valeriy Polyakov, remained on board with Titov and Manarov.

On February 26, 1988, the two cosmonauts carried out an EVA lasting 4 hours and 25 minutes, during which they removed one of the sections of the solar panel and installed a new one. They also installed some new scientific experiments and removed samples of material that had been left exposed to open space, and inspected the Progress 34 spacecraft.

On June 30, 1988, they attempted a repair on the Roentgen X-ray telescope. The telescope had not been designed for repair or replacement so the EVA was a difficult one. As they sliced through the 20-layer thick thermal blanket to expose the telescope's faulty X-ray detector unit, the two men had to stop and rest several times, as they had nowhere to anchor themselves, and had to take turns holding each other steady. Their bulky gloves made removing the small bolts very difficult, and it took 90 minutes instead of the 20 allocated. When a special wrench they were using suddenly snapped, the EVA had to be aborted, and the two men returned inside the Mir, having spent 5 hours, 10 minutes in open space.

On October 20, 1988, repairs were successfully completed, and the X-ray telescope recommenced operations. The cosmonauts also installed some anchor points for the EVA scheduled for the joint Soviet-French mission, installed a new short-wave aerial, and took samples of a film which had formed over one of the portholes, before returning inside the Mir after 4 hours and 12 minutes. They then settled down to their program of experiments and observations. In November 1988, they played host to the joint Soviet-French mission. After three weeks of joint work, Titov and Manarov returned to Earth together with the French cosmonaut Jean-Loup Chrétien. Titov and Manarov returned to Earth after a mission lasting 365 days, 22 hours, 39 minutes, setting a new record, and exceeding one year in space for the first time.

On October 28, 1992, NASA announced that an experienced cosmonaut would fly aboard the STS-60 Space Shuttle mission. Titov was one of two candidates named by the Russian Space Agency for mission specialist training at the Johnson Space Center. In April 1993, he was assigned as back-up mission specialist for Sergei Krikalev, who flew on STS-60 the first joint U.S./Russian Space Shuttle Mission (February 3-11, 1994). In September 1993, Titov was selected to fly on STS-63 with Krikalev training as his back-up.

From February 2-11, 1995, Titov was a mission specialist aboard the Orbiter Discovery, on STS-63, the first flight of the new joint Russian-American Space Program. Mission highlights included the rendezvous with the Russian Space Station, Mir, operation of Spacehab, and the deployment and retrieval of Spartan 204. In completing this mission, he logged an additional 198 hours and 29 minutes in space.

CURRENT EXPERIENCE - Colonel Titov will serve as a mission specialist on STS-86, NASA's seventh scheduled Shuttle mission to rendezvous and dock with the Russian Space Station Mir. Launch is scheduled for September 1997.

BIOGRAPHICAL DATA

Scott E. Parazynski (M.D.)
NASA Astronaut

PERSONAL DATA: Born July 28, 1961, in Little Rock, Arkansas. Considers Palo Alto, California, and Evergreen, Colorado, to be his hometowns. Married to the former Gail Marie Vozzella. They have one son. He enjoys mountaineering, rock climbing, flying, scuba diving, skiing, travel, and nature photography.

EDUCATION: Attended junior high school in Dakar, Senegal, and Beirut, Lebanon. Attended high school at the Tehran American School, Iran, and the American Community School, Athens, Greece, graduating in 1979. He received a bachelor of science degree in biology from Stanford University in 1983, continuing on to graduate with honors from Stanford Medical School in 1989. He served his medical internship at the Brigham and Women's Hospital of Harvard Medical School (1990). He then completed 22 months of a residency in emergency medicine in Denver, Colorado, when selected to the astronaut program.

ORGANIZATIONS: Member of the Aerospace Medical Association, the American Society for Gravitational and Space Biology, the Wilderness Medical Society, the American Alpine Club, and the Association of Space Explorers.

SPECIAL HONORS: National Institutes of Health Predoctoral Training Award in Cancer Biology (1983). Rhodes Scholarship finalist (1984). NASA Graduate Student Researcher's Award (1988). Stanford Medical Scholars Program (1988). Research Honors Award from Stanford Medical School (1989). NASA-Ames Certificate of Recognition (1990). Wilderness Medical Society Research Award (1991). NASA Space Flight Medal (1994).

While in medical school he competed on the United States Development Luge Team and was ranked in the top 10 in the nation during the 1988 Olympic Trials. He also served as an Olympic Team Coach for the Philippines during the 1988 Olympic Winter Games in Calgary, Canada.

EXPERIENCE: While an undergraduate at Stanford University, Dr. Parazynski studied antigenic variation in African Sleeping Sickness, using sophisticated molecular biological techniques. While in medical school, he was awarded a NASA Graduate Student Fellowship and conducted research on fluid shifts that occur during human space flight. Additionally, he has been involved in the design of several exercise devices that are being developed for long-duration space flight, and has conducted research on high-altitude acclimatization. Dr. Parazynski has numerous publications in the field of space physiology, and has a particular expertise in human adaptation to stressful environments.

NASA EXPERIENCE: Selected by NASA in March 1992, Dr. Parazynski reported to the Johnson Space Center in August 1992. He completed one year of training and evaluation, and qualified for assignment as a mission specialist on future Space Shuttle flight crews. Dr. Parazynski initially served as one of the crew representatives for extravehicular activity in the Astronaut Office Mission Development Branch. He first flew in 1994 on STS-66 and has logged over 262 hours in space. He was then assigned as a backup for the third American long-duration stay aboard Russia's Space Station Mir, and was expected to serve as a prime crew member on a subsequent mission. He spent 5 months in training at the Gagarin Cosmonaut Training Center, Star City, Russia. In October 1995, when sitting-height parameters raised concerns about his fitting safely in the Soyuz vehicle in the event of an emergency on-board the Mir station, he was deemed too tall for the mission and was withdrawn from Mir training. He presently serves as the Astronaut Office Operations Planning Branch crew representative for Space Shuttle, Space Station and Soyuz training, and is assigned to the crew of STS-86.

CURRENT ASSIGNMENT: Dr. Parazynski will serve as Mission Specialist-2 (Flight Engineer) on STS-86, NASA's seventh scheduled Shuttle mission to rendezvous and dock with the Russian Space Station Mir. While docked, he and Russian cosmonaut Vladimir Titov will perform a 5-1/2 hour EVA to retrieve experiments first deployed on Mir during the STS-76 docking mission. Launch is scheduled for September 1997.

BIOGRAPHICAL DATA

Jean-Loup J. M. Chrétien (Brigadier-General, French Air Force)
CNES Astronaut - STS-86 Mission Specialist

PERSONAL DATA: Born August 20, 1938, in the town of La Rochelle, France. Married to Amy Kristine Jensen of New Canaan, Connecticut. Five children (one deceased). Hobbies include skiing in Winter and sailing in Summer. He also enjoys golf, wind-surfing, car-rallying and woodworking. In addition, he plays the church organ, and took an electric one with him during his first stay in Star City, Russia. His father, Jacques, was a Navy sailor, and his mother, the former Marie-Blanche Coudurier, was a housewife. Her parents, Nels and Betty Jensen, reside in Tarpon Springs, Florida.

EDUCATION: Chrétien was educated at l'Ecole Communale a Ploujean, the College Saint-Charles a Saint-Brieuc, and the Lycee de Morlaix. He entered l'Ecole de l'Air (the French Air Force Academy) at Salon de Provence in 1959, and graduated in 1961, receiving a master's degree in aeronautical engineering.

ORGANIZATIONS: Member of the board of the Academie de l'Air et de l'Espace, and the French Air and Space Museum. Counselor for Space Activities (Manned) to the President of Dassault Aviation. Counselor to the President of Air France. Member of the American Institute of Aeronautics and Astronautics, the International Academy of Astronautics, and the Association of Space Explorers.

SPECIAL HONORS: Awarded the title of Hero of the Soviet Union. Recipient of the Order of Lenin; the Order of the Red Banner of Labor; Commandeur de la Légion d'Honneur (Commander of the Order of the Legion of Honor); Chevalier de l'Ordre National du Mérite (Knight of the National Order of Merit); Titulaire de la Médaille de l'Aéronautique (Holder of the Aeronautics Medal), and honorary citizenship of Arkalyk.

EXPERIENCE: Chrétien received his fighter pilot/pilot-engineer wings in 1962, after one year of training on Mystere- 4's. He was promoted to Lieutenant, and joined the 5th Fighter Squadron in Orange, in the Southeast of France, where he served for seven years as a fighter-pilot in an operational squadron flying Super-Mystere B2's and then Mirage III interceptors. In 1970, he was assigned to the French test pilots school, EPNER (Ecole du Personnel Navigant d'Essais et de Réception), then served as a test-pilot at the Istres Flight Test Center for seven years. During that time he was responsible for supervising the flight test program for the Mirage F-1 fighter. In 1977-78, he was appointed Deputy Commander of the South Air Defense Division in Aix en Provence, and he served in this position until his selection as a cosmonaut in June 1980. Chrétien remained a French Air Force officer but was placed on detachment to CNES for his space flight activities ensuring his availability for future flights with the Shuttle (NASA), Mir (Soviet Union) or Spacelab (ESA). He has accumulated over 6,000 hours of flying time in various aircraft, including Russia's Tupolev 154, MIG 25, and Sukoi 26 and 27. A veteran of two space flights, Chrétien was the 10th Intercosmos cosmonaut, and has spent a total of 32 days 15 hours 57 minutes and 52 seconds in space.

In April 1979, the Soviet Union offered France the opportunity to fly a cosmonaut on board a joint Soviet-French space flight, along the same lines as the agreement to fly non-Soviet cosmonauts from member countries of the Intercosmos program. The offer was accepted, and France began a cosmonaut selection program in September 1979. Chrétien was one of two finalists named on June 12, 1980. He started training at the Yuri Gagarin Cosmonaut Training Center in September 1980. The following year he was named as the research-cosmonaut for the prime crew of the Soyuz T-6 mission.

Soyuz T-6 was launched on June 24, 1982, and Chrétien, Dzhanibekov and Ivanchenko linked up with Salyut 7 and joined the crew of Berezovoy and Lebedev already on board. They spent nearly seven days carrying out a program of joint Soviet-French experiments, including a series of French echography cardiovascular monitoring system experiments, before returning to Earth after a flight lasting 7 days 21 hours 50 minutes and 42 seconds.

Following the mission he was appointed Chief, CNES Astronaut Office.

Chrétien was selected as the back-up payload specialist for STS-51G. During 1984-85, he participated in mission training at the Johnson Space Center.

Chrétien made his second space flight as a research-cosmonaut on board Soyuz TM-7, which launched on November 26, 1988. Together with Volkov and Krikalev, he linked up with Mir 1 and joined the crew of Titov Manarov and Polyakov already on board. They spent 22 days carrying out a program of joint Soviet-French experiments, including a 5 hour 57 minute EVA by Volkov and Chrétien during which the two men installed the French ERA experimental deployable structure and a panel of material samples. In making the EVA, he became the first non-American and non- Soviet cosmonaut to walk in space. In addition, he was the first non-Soviet cosmonaut to make a second space flight aboard a Soviet spacecraft. The mission lasted 24 days 18 hours and 7 minutes.

During 1990-93, Chrétien participated in Buran spacecraft pilot training at the Moscow Joukovski Institute. He has also flown the Tupolev 154 and MIG 25 aircraft, flying simulators equivalent to the Shuttle Training Aircraft (STA).

Chrétien is fluent in English and Russian.

NASA EXPERIENCE: Chrétien attended ASCAN Training at the Johnson Space Center during 1995. He was initially assigned to work technical issues for the Operations Planning Branch of the Astronaut Office. He is currently assigned as a mission specialist on STS-86, NASA's seventh Shuttle mission to rendezvous and dock with the Russian Space Station Mir. Launch is scheduled for September 1997.

BIOGRAPHICAL DATA

Wendy B. Lawrence (Commander, USN)
STS-86 Mission Specialist

PERSONAL DATA: Born July 2, 1959, in Jacksonville, Florida. She enjoys running, rowing, triathlons and gardening. Her father, Vice Admiral William P. Lawrence (USN, retired), resides in Crownsville, Maryland. Her mother, Anne Haynes, resides in Alvadore, Oregon.

EDUCATION: Graduated from Fort Hunt High School, Alexandria, Virginia, in 1977; received a bachelor of science degree in ocean engineering from U.S. Naval Academy in 1981; a master of science degree in ocean engineering from Massachusetts Institute of Technology (MIT) and the Woods Hole Oceanographic Institution (WHOI) in 1988.

ORGANIZATIONS: Phi Kappa Phi; Association of Naval Aviation; Women Military Aviators; Naval Helicopter Association.

SPECIAL HONORS: Awarded the Defense Superior Service Medal, the NASA Space Flight Medal, the Navy Commendation Medal and the Navy Achievement Medal. Recipient of the National Navy League's Captain Winifred Collins Award for inspirational leadership (1986).

EXPERIENCE: Lawrence graduated from the United States Naval Academy in 1981. A distinguished flight school graduate, she was designated as a naval aviator in July 1982. Lawrence has more than 1,500 hours flight time in six different types of helicopters and has made more than 800 shipboard landings. While stationed at Helicopter Combat Support Squadron SIX (HC-6), she was one of the first two female helicopter pilots to make a long deployment to the Indian Ocean as part of a carrier battle group. After completion of a master's degree program at MIT and WHOI in 1988, she was assigned to Helicopter Anti-Submarine Squadron Light THIRTY (HSL-30) as officer-in-charge of Detachment ALFA. In October 1990, Lawrence reported to the U.S. Naval Academy where she served as a physics instructor and the novice women's crew coach.

NASA EXPERIENCE: Selected by NASA in March 1992, Lawrence reported to the Johnson Space Center in August 1992. She completed one year of training and is qualified for assignment as a mission specialist on future Space Shuttle missions. Her technical assignments within the Astronaut Office have included: flight software verification in the Shuttle Avionics Integration Laboratory (SAIL); Astronaut Office Assistant Training Officer. She flew on STS-67 in March 1995. She served as Director of Operations for NASA at the Gagarin Cosmonaut Training Center in Star City, Russia, with responsibility for the coordination and implementation of mission operations activities in the Moscow region for the joint U.S./Russian Shuttle/Mir program. In September 1996 she began training for a 4-month mission on the Russian Space Station Mir, but in July 1997 NASA decided to replace Lawrence with her back-up, Dr. David Wolf. This decision enables Wolf to act as a backup crew member for spacewalks planned over the next several months to repair the damaged Spektr module on the Russian outpost. Lawrence will also fly with the STS-86 crew because of her knowledge and experience with Mir systems and with crew transfer logistics for the Mir.

Lawrence flew as the ascent/entry flight engineer and blue shift orbit pilot on STS-67 in March 1995. This mission was the second flight of the ASTRO observatory, a unique complement of three telescopes. During this record-setting 16-day mission, the crew conducted observations around the clock to study the far ultraviolet spectra of faint astronomical objects and the polarization of ultraviolet light coming from hot stars and distant galaxies. Mission duration was 399 hours and 9 minutes.

BIOGRAPHICAL DATA

David A. Wolf (M.D.)
STS-86 / Mir 24 / STS-89

PERSONAL DATA: Born August 23, 1956, in Indianapolis, Indiana. Single. He enjoys sport aerobatic flying, scuba diving, handball, running, and water skiing. His parents, Dr. and Mrs. Harry Wolf, reside in Indianapolis.

EDUCATION: Graduated from North Central High School, Indianapolis, Indiana, in 1974; received a bachelor of science degree in electrical engineering from Purdue University in 1978, and a doctorate of medicine from Indiana University in 1982. He completed his medical internship (1983) at Methodist Hospital in Indianapolis, Indiana, and USAF flight surgeon primary training at Brooks Air Force Base in San Antonio, Texas.

ORGANIZATIONS: Member of the Institute of Electrical and Electronics Engineers; the Aerospace Medical Association; the Experimental Aircraft Association; the International Aerobatic Club; and the Air National Guard.

SPECIAL HONORS: Recipient of the NASA Exceptional Engineering Achievement Medal (1990); NASA Inventor of the Year, 1992. Dr. Wolf graduated "with distinction" from the honors curriculum in electrical engineering at Purdue University and received an Academic Achievement Award upon graduation from medical school. He received the Carl R. Ruddell scholarship award for research in medical ultrasonic signal and image processing. He is a member of Eta Kappa Knu and Phi Eta Sigma honorary societies. Dr. Wolf has received 11 U.S. Patents and over 20 Space Act Awards for 3-dimensional tissue engineering technologies earning the Texas State Bar Patent of the Year in 1994. He has published over 40 technical papers.

EXPERIENCE: As a research scientist at the Indianapolis Center for Advanced Research from 1980 to 1983, he developed digital signal and image processing techniques utilizing matched filter detection of high time-bandwidth product transmissions producing "state of the art" high resolution medical ultrasonic images to the 100 micron level. He also developed new Doppler demodulation techniques extending the range velocity product limitation of conventional pulsed Doppler systems. He is a USAF senior flight surgeon in the Air National Guard (1982 to present) and is a member of the Board of Directors of the National Inventors Hall of Fame. He has logged over 2000 hours of flight time including air combat training as a weapons systems officer (F4 Phantom jet), T-38 Talon, and competition aerobatics (PITTS Special and Christen Eagle).

NASA EXPERIENCE: In 1983, Dr. Wolf joined the Medical Sciences Division, Johnson Space Center, Houston, Texas. He was responsible for development of the American Flight Echocardiograph for investigating cardiovascular physiology in microgravity. Upon completion he was assigned as chief engineer for design of the Space Station medical facility. In 1986 he was assigned to direct development of the Space Bioreactor and associated tissue engineering and cancer research applications utilizing controlled gravitational conditions. This resulted in the state of the art NASA rotating tissue culture systems. He has particular expertise in the design of real time computer process control systems, communications, bioprocessing, physiology, fluid dynamics, and aerospace medicine. Dr. Wolf is an active public speaker.

Selected as a NASA astronaut in January 1990, Dr. Wolf became qualified for space flight in July 1991. His technical assignments have included Orbiter vehicle processing and test at Kennedy Space Center (1991-1992), STS-58 mission specialist (1993), and spacecraft communications (CAPCOM) (1994-1995). He is qualified for Extravehicular Activity (Spacewalk), Remote Manipulator System (Robot Arm), and Rendezvous. He was the CAPCOM for the first and third Shuttle-Mir rendezvous. He recently completed training at the Gagarin Cosmonaut Training Center in Star City, Russia, in preparation for a 4-month stay on the Russian Space Station Mir in September 1997. He will launch aboard Space Shuttle Atlantis as part of the STS-86 crew.

Dr. Wolf served as a mission specialist astronaut aboard Space Shuttle Columbia (STS-58), a 14-day dedicated Spacelab life sciences research mission 910/16/93-11/1/93). During this record length shuttle mission the crew conducted neurovestibular, cardiovascular, cardiopulmonary, metabolic, and musculoskeletal research utilizing microgravity to reveal fundamental physiology normally masked by earth gravity. They accomplished 225 orbits in 336 hours, 13 minute, 01 seconds.

BIOGRAPHICAL DATA

C. Michael Foale (Ph.D.)
STS-84 / Mir 23 & 24 / STS-86

PERSONAL DATA: Born January 6, 1957, in Louth, England, but considers Cambridge, England, to be his hometown. Married to the former Rhonda R. Butler of Louisville, Kentucky. They have two children. He enjoys many outdoor activities, particularly wind surfing. Private flying, soaring, and project scuba diving have been his other major sporting interests. He also enjoys exploring theoretical physics and writing children's software on a personal computer. His parents, Colin and Mary Foale, reside in Cambridge. Her parents, Reed & Dorothy Butler, reside in Louisville.

EDUCATION: Graduated from Kings School, Canterbury, in 1975. He attended the University of Cambridge, Queens' College, receiving a bachelor of arts degree in Physics, National Sciences Tripos, with 1st class honors, in 1978. While at Queens' College, he completed his doctorate in Laboratory Astrophysics at Cambridge University in 1982.

ORGANIZATIONS: Member of the Cambridge Philosophical Society, England, and Aircraft Owners & Pilots Association.

EXPERIENCE: While a postgraduate at Cambridge University, Foale participated in the organization and execution of scientific scuba diving projects. With the cooperation of the Greek government, he participated as both a member of one expedition and the leader of another, surveying underwater antiquities in Greece. In the fall of 1981, he dove on the 1543 ocean galleon, "The Mary Rose," as a volunteer diver, learning excavation and survey techniques in very low visibility conditions. Pursuing a career in the U.S. Space Program, Foale moved to Houston, Texas, to work on Space Shuttle navigation problems at McDonnell Douglas Aircraft Corporation. In June 1983, Foale joined NASA Johnson Space Center in the payload operations area of the Mission Operations Directorate. In his capacity as payload officer in the Mission Control Center, he was responsible for payload operations on Space Shuttle missions STS-51G, 51-I, 61-B and 61-C.

NASA EXPERIENCE: Selected as an astronaut candidate by NASA in June 1987, Foale completed a one-year training and evaluation program in August 1988. Before his first flight he flew the Shuttle Avionics Integration Laboratory (SAIL) simulator to provide verification and testing of the Shuttle flight software, and later developed crew rescue and integrated operations for International Space Station Alpha. He has served as Deputy Chief of the Mission Development Branch in the Astronaut Office, and Head of the Astronaut Office Science Support Group. He trained at the Cosmonaut Training Center, Star City, Russia, in preparation for a long duration flight on the Russian Space Station Mir. He launched aboard Space Shuttle Atlantis on May 15, 1997. He is scheduled to return from Mir on STS-86 in September 1997.

A veteran of three space flights, Foale has logged more than 634 hours in space. He flew as a mission specialist on STS-45 (March 24 to April 2, 1992) the first of the ATLAS series of missions to address the atmosphere and its interaction with the Sun, and again as a mission specialist on STS-56, carrying ATLAS-2, and the SPARTAN retrievable satellite which made observations of the solar corona. Most recently, he served as a mission specialist on STS-63 (February 2-11, 1995), the first rendezvous with the Russian Space Station, Mir. During the flight he made a space walk (extravehicular activity) for 4 hours, 39 minutes, evaluating the effects of extremely cold conditions on his spacesuit, as well as moving the 2800-pound Spartan satellite as part of a mass handling experiment.

SHUTTLE FLIGHTS AS OF SEPTEMBER 1997

86 TOTAL FLIGHTS OF THE SHUTTLE SYSTEM -- 61 SINCE RETURN TO FLIGHT

STS-94 07/01/97 - 07/17/97		STS-85 08/07/97 - 08/19/97		
STS-83 04/04/97 - 04/08/97		STS-82 02/11//97 - 02/21/97		
STS-80 11/19/96 - 12/07/96		STS-70 07/13/95 - 07/22/95		
STS-78 06/20/96 - 07/07/96		STS-63 02/03/95 - 02/11/95		
STS-75 02/22/96 - 03/09/96		STS-64 09/09/94 - 09/20/94	STS-84 05/15/97 - 05/24/97	
STS-73 10/20/95 - 11/05/95		STS-60 02/03/94 - 02/11/94	STS-81 01/12/97 - 01/22/97	
STS-65 07/08/94 - 07/23/94		STS-51 09/12/93 - 09/22/93	STS-79 09/16/96 - 09/26/96	
STS-62 03/04/94 - 03/18/94		STS-56 04/08/83 - 04/17/93	STS-76 03/22/96 - 03/31/96	
STS-58 10/18/93 - 11/01/93		STS-53 12/02/92 - 12/09/92	STS-74 11/12/95 - 11/20/95	
STS-55 04/26/93 - 05/06/93		STS-42 01/22/92 - 01/30/92	STS-71 06/27/95 - 07/07/95	
STS-52 10/22/92 - 11/01/92		STS-48 09/12/91 - 09/18/91	STS-66 11/03/94 - 11/14/94	
STS-50 06/25/92 - 07/09/92		STS-39 04/28/91 - 05/06/91	STS-46 07/31/92 - 08/08/92	
STS-40 06/05/91 - 06/14/91		STS-41 10/06/90 - 10/10/90	STS-45 03/24/92 - 04/02/92	STS-77 05/19/96 - 05/29/96
STS-35 12/02/90 - 12/10/90	STS-51L 01/28/86	STS-31 04/24/90 - 04/29/90	STS-44 11/24/91 - 12/01/91	STS-72 01/11/96 - 11/20/96
STS-32 01/09/90 - 01/20/90	STS-61A 10/30/85 - 11/06/85	STS-33 11/22/89 - 11/27/89	STS-43 08/02/91 - 08/11/91	STS-69 09/07/95 - 09/18/95
STS-28 08/08/89 - 08/13/89	STS-51F 07/29/85 - 08/06/85	STS-29 03/13/89 - 03/18/89	STS-37 04/05/91 - 04/11/91	STS-67 03/02/95 - 03/18/95
STS-61C 01/12/86 - 01/18/86	STS-51B 04/29/85 - 05/06/85	STS-26 09/29/88 - 10/03/88	STS-38 11/15/90 - 11/20/90	STS-68 09/30/94 - 10/11/94
STS-9 11/28/83 - 12/08/83	STS-41G 10/05/84 - 10/13/84	STS-51-I 08/27/85 - 09/03/85	STS-36 02/28/90 - 03/04/90	STS-59 04/09/94 – 04/20/94
STS-5 11/11/82 - 11/16/82	STS-41C 04/06/84 - 04/13/84	STS-51G 06/17/85 - 06/24/85	STS-34 10/18/89 - 10/23/89	STS-61 12/02/93 - 12/13/93
STS-4 06/27/82 - 07/04/82	STS-41B 02/03/84 - 02/11/84	STS-51D 04/12/85 - 04/19/85	STS-30 05/04/89 - 05/08/89	STS-57 06/21/93 - 07/01/93
STS-3 03/22/82 - 03/30/82	STS-8 08/30/83 - 09/05/83	STS-51C 01/24/85 - 01/27/85	STS-27 12/02/88 - 12/06/88	STS-54 01/13/93 - 01/19/93
STS-2 11/12/81 - 11/14/81	STS-7 06/18/83 - 06/24/83	STS-51A 11/08/84 - 11/16/84	STS-61B 11/26/85 - 12/03/85	STS-47 09/12/92 - 09/20/92
STS-1 04/12/81 - 04/14/81	STS-6 04/04/83 - 04/09/83	STS-41D 08/30/84 - 09/05/84	STS-51J 10/03/85 - 10/07/85	STS-49 05/07/92 - 05/16/92
OV-102 Columbia (23 flights)	**OV-099 Challenger (10 flights)**	**OV-103 Discovery (23 flights)**	**OV-104 Atlantis (19 flights)**	**OV-105 Endeavour (11 flights)**