NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

SPACE SHUTTLE MISSION
STS-81

PRESS KIT
JANUARY 1997

Fifth Shuttle-Mir Docking Mission

STS-81 INSIGNIA

STS081-S-001 -- The insignia for STS-81, the fifth Shuttle-Mir docking mission, is shaped to represent the Roman numeral V. The space shuttle Atlantis, OV-104, is launching toward a rendezvous with Russia's Mir space station, silhouetted in the background. Atlantis and the STS-81 crew will spend several days docked to Mir during which time astronaut Jerry M. Linenger (NASA-Mir 4) will replace astronaut John E. Blaha (NASA-Mir 3) as the United States crew member onboard Mir. Scientific experiments and logistics will also be transferred between Atlantis and Mir. The United States and Russian flags are depicted along with the names of the Shuttle crewmembers.

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.

NEWS MEDIA CONTACTS

For Information on the Space Shuttle and STS-81 Mission Operations

Debbie Rahn NASA Headquarters Washington, DC	International Cooperation	202/358-1639
Ed Campion Johnson Space Center Houston, TX	Mission Operations, Astronauts	713/483-5111
Bruce Buckingham Kennedy Space Center, FL	Launch Processing, KSC Landing Information	407/867-2468
June Malone Marshall Space Flight Center Huntsville, AL	External Tank/SRBs/SSMEs	205/544-0034
Cam Martin Dryden Flight Research Center, Edwards, CA	DFRC Landing Information	805/258-3448

For Information on STS-81 Science Experiments

Mike Braukus NASA Headquarters Washington, DC	202/358-1979
Steve Roy Marshall Space Flight Center Huntsville, AL	205/544-6535

CONTENTS

RELEASE: 97-2

FIFTH SHUTTLE-MIR DOCKING FLIGHT HIGHLIGHTS STS-81 MISSION

The continuing cooperative effort in space exploration between the United States and Russia will be the focus of NASA's first Shuttle mission of 1997 with the launch of Space Shuttle Atlantis on Mission STS-81.

This is the fifth of nine planned missions to Mir and the second one involving an exchange of U.S. astronauts. Astronaut John Blaha, who has been on Mir since September 19, 1996, will be replaced by astronaut Jerry Linenger. Linenger will spend more than four months on Mir. He will return to Earth on Space Shuttle Mission STS-84, scheduled for launch in May 1997.

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.

The STS-81 crew will be commanded by Michael A. Baker who will be making his fourth Shuttle flight. The pilot, Brent W. Jett, Jr., will be making his second flight. There are four mission specialists assigned to this flight. Peter J. K. "Jeff" Wisoff, serving as Mission Specialist-1, is making his third flight. Mission Specialist-2 John M. Grunsfeld is making his second space flight. Marsha S. Ivins serving as Mission Specialist-3 is making her fourth space flight. Jerry M. Linenger will be Mission Specialist-4 for launch through docking with Mir. Shortly after docking, Linenger and Blaha will conduct their handover with Linenger becoming a member of the Mir crew and Blaha becoming Mission Specialist-4 through the end of the flight.

Atlantis is targeted for an early morning launch on or about January 12, 1997 from NASA's Kennedy Space Center Launch Complex 39-B. The current launch time of 4:27 a.m. EST may vary by a few minutes based on calculations of Mir's precise location in space at the time of liftoff due to Shuttle rendezvous phasing requirements. The STS-81 mission is scheduled to last 10 days, 3 hours, 30 minutes. An on-time launch on January 12 and nominal mission duration would have Atlantis landing back at Kennedy Space Center on January 22 at about 8 a.m. EST.

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 closer proximity to Mir.

The STS-81 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.

The current Mir 22 mission began when cosmonauts Valeri Korzun and Aleksandr Kaleri were launched on August 17, 1996, in a Soyuz vehicle and docked with the Mir two days later. John Blaha joined the Mir 22 crew with the September 19, 1996, docking of STS-79. Blaha will complete his stay on Mir and return with the STS-81 crew. Linenger will work with the Mir 22 crew until the arrival of Mir 23 cosmonauts Vasili Tsibliyev, Aleksandr Lazutkin and German researcher Reinhold Ewald in early February 1997. After the Mir 22 crew and Ewald return to Earth in a Soyuz, Linenger will complete his tour with the Mir 23 crew. Linenger will be replaced by NASA Astronaut Mike Foale when Atlantis again docks with Mir in May.

The STS-81 mission also will include several experiments in the fields of advanced technology, Earth sciences, fundamental biology, human life sciences, microgravity, and space sciences. Data also 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.

STS-81 will involve the transfer of 5,975 pounds of logistics to and from the Mir, the largest transfer of items to date. During the docked phase, 1,400 pounds of water, 1,137.7 pounds of U.S. science equipment, 2,206.1 pounds of Russian logistics along with 268.2 pounds of miscellaneous material will be transferred to Mir. Returning to Earth aboard Atlantis will be 1,256.6 pounds of U.S. science material, 891.8 pounds of Russian logistics and 214.6 pounds of miscellaneous material.

STS-81 will be the 18th flight of Atlantis and the 81st 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 Spacenet-2 satellite system. Spacenet-2 is located on Transponder 5, channel 9, C- Band, at 69 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.

Television schedules also may be obtained by calling COMSTOR at 713/483-5817. COMSTOR is a computer data base service requiring the use of a telephone modem. A voice update of the television schedule is provided daily at noon Eastern time.

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-80 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 their 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.gsfc.nasa.gov/hqpao/hqpao_home.html

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

http://www.hq.nasa.gov/office/pao/NewsRoom/today.html

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

http://www.hq.nasa.gov/office/pao/ntv.html

Status reports, TV schedules and other information are also 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's Spacelink, a resource for educators, also provides mission information via the Internet. The system fully supports the following Internet services:

- World Wide Web: http://spacelink.msfc.nasa.gov
- Gopher: spacelink.msfc.nasa.gov
- Anonymous FTP: spacelink.msfc.nasa.gov
- Telnet : spacelink.msfc.nasa.gov

- Spacelink's dial-up modem line is 205/895-0028.

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-81 QUICK LOOK FACTS

Launch Date/Site:	January 12, 1997/KSC Launch Pad 39-B
Launch Time:	4:27 a.m. EST
Launch Window:	7-10 minutes (for a Flight Day 3 rendezvous)
Orbiter:	Atlantis (OV-104), 18th flight
Orbit Altitude	160 nautical miles, 213 n.m. for docking
Inclination:	51.6 degrees
Mission Duration:	10 days, 3 hours, 30 minutes
Landing Date:	January 22, 1997
Landing Time:	7:57 a.m. EST
Primary Landing Site:	Kennedy Space Center, FL
Abort Landing Sites:	Return to Launch Site - KSC Transoceanic Abort Sites - Zaragoza, Spain Ben Guerir, Morocco Moron, Spain Abort-Once Around - KSC
Crew:	Mike Baker, Commander (CDR), 4th flight Brent Jett, Pilot (PLT), 2nd flight Jeff Wisoff, Mission Specialist 1 (MS 1), 3rd flight John Grunsfeld, Mission Specialist 2 (MS 2), 2nd flight Marsha Ivins, Mission Specialist 3 (MS 3), 4th flight Jerry Linenger, Mission Specialist 4 (MS 4-up), 2nd flight John Blaha, Mission Specialist 4, (MS 4-down), 5th flight
Mir 22 Crew:	Valery Korzun, Commander, (CDR) Alexander Kaleri, Flight Engineer, (FE) John Blaha, Flight Engineer 2, (FE 2)
EVA Crew (if required):	Jeff Wisoff (EV 1), John Grunsfeld (EV 2)
Cargo Bay Payloads:	SPACEHAB-Double Module
In-Cabin Payloads:	TVIS Biorack KidSat CREAM Orbiter Space Vision System MSX

CREW RESPONSIBILITIES

Payloads	Prime	Backup
Orbiter Docking System	Wisoff	Grunsfeld, Jett
Orbiter Space Vision System	Grunsfeld	Baker
EVA (if needed)	Wisoff (EV 1)	Grunsfeld (EV 2)
Intravehicular Crewmember	Ivins	Jett
Rendezvous	Baker	Jett, Wisoff
Logistics and Science Transfers	Ivins	Jett
SPACEHAB Science and Systems	Wisoff	Ivins, Grunsfeld
Russian Language	Baker	-----
Earth Observations	Grunsfeld	Ivins
Risk Mitigation Experiments	Wisoff	Ivins
KidSat	Ivins	Wisoff
Joint U.S.-Russian Science	Blaha, Linenger	-----
BRIC	Baker	Jett
CREAM	Wisoff	Grunsfeld

DEVELOPMENTAL TEST OBJECTIVES/DETAILED SUPPLEMENTARY OBJECTIVES/RISK MITIGATION EXPERIMENTS

DTO 255:	Wraparound DAP Flight Test Verification
DTO 256	Alt PRCS Flight Test
DTO 312:	ET TPS Performance
DTO 700-10:	Orbiter Space Vision System Flight Video Taping
DTO 700-12:	GPS/Inertial Navigation System Test
DTO 700-14:	Single String Global Positioning System Test
DTO 805:	Crosswind Landing Performance
DTO 840:	Hand Held Lidar Procedures
DTO 1118:	Photographic and Video Survey of Mir Space Station
DTO 1125:	Measurements of Dose as a Function of Shielding Thickness
DSO 487:	Immunological Assessment of Crewmembers
RME 1302:	Electric Fields High Inclination for the Mir
RME 1303:	Shuttle/Mir Experiment Kit Transportation
RME 1307:	Optical Properties Monitor
RME 1317:	Mir Structural Dynamics Experiment Joint Operations
RME 1318:	Treadmill Vibration Isolation and Stabilization System (TVIS)
RME 1319:	Inventory Management System Test for the SPACEHAB

PAYLOAD AND VEHICLE WEIGHTS

	Pounds
Orbiter (Atlantis) empty and 3 SSMEs	180,713
Shuttle System at SRB Ignition	4,510,780
Orbiter Weight at Landing with Cargo	249,936
Spacehab-Double Module	10,525
Orbiter Docking System	4,016

MISSION SUMMARY TIMELINE

(Assumes Jan. 12, 1997 launch)

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

Flight Day 2
Completion of Spacehab Activation
Biorack Operations
KidSat Activation
Centerline Camera Mount
Rendezvous Tool Checkout
Orbiter Docking System Ring Extension
Mir Rendezvous Burns

Flight Day 3
Mir Rendezvous Burns
TVIS Assembly and Operation

Flight Day 4
Mir Rendezvous Burns
Atlantis/Mir Docking
Hatch Opening/Welcoming Ceremony
Transfer Activities
Soyuz Seatliner Installation
Blaha/Linenger Transfer

Flight Day 5
Biorack Operations
Dosimeter Exchange
Transfer Activities

Flight Day 6
Transfer Activities
Greenhouse Harvest and Stowage
Biorack Operations

Flight Day 7
Transfer Activities
Biorack Operations
Mir Water Sample Collection

Flight Day 8
Transfer Activities
ALIS Installation
Crew News Conference
Farewell Ceremony
Hatch Closure

Flight Day 9
Undocking and Flyaround
Atlantis Separation from Mir
Biorack Operations
Transfer Item Stowage
Off Duty Time

Flight Day 10
Flight Control System Checkout
Reaction Control System Hot-Fire
Biorack Operations
Cabin Stow
Spacehab Module Stowage

Flight Day 11
Spacehab Deactivation
Recumbent Seat Setup
Deorbit Preparation Briefing
Deorbit Preparation
Deorbit Burn
KSC Landing

NOTE: Exact times for major events on STS-81 and other Phase 1 Shuttle-Mir docking missions will not be determined until after launch because of the rendezvous requirements needed for Atlantis to reach the Mir Space Station.

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-81 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 the Kennedy Space Center, FL.

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

- 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.

MIR RENDEZVOUS AND DOCKING

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 -- 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. Identical to prior Mir dockings, 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 handheld laser ranging device to supplement distance and closing rate measurements made by other shuttle navigational equipment.

The manual phase of the rendezvous will begin just as Atlantis reaches a point about a half-mile below Mir. Commander Mike Baker will fly the shuttle using the aft flight deck controls as Atlantis begins moving up toward Mir. Because of the approach from underneath Mir, Baker 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, Baker 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, Baker 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 Jeff Wisoff will oversee the operation of the Orbiter Docking System from onboard Atlantis.

Undocking, Separation and Mir Fly-Around

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.

Atlantis will continue away from Mir to a distance of about 600 feet, where Pilot Brent Jett will begin a flyaround of the station. Atlantis will circle Mir twice before firing its jets again to depart the vicinity of the station.

SHUTTLE-MIR SCIENCE

The NASA/Mir program is now into the Phase 1B portion, which consists of nine Shuttle-Mir dockings and seven long-duration flights of U.S. astronauts aboard the Russian space station between early 1996 and late 1998. The U.S. astronauts will launch and land on a Shuttle and serve as a Mir crewmember for flight durations ranging from 127 to 158 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 22 mission began when the crew launched on August 17, 1996, in a Soyuz vehicle and docked with the Mir two days later. John Blaha joined the Mir 22 crew with the September 19, 1996, docking of STS-79. The return of STS-81 will conclude a mission of experiments in the fields of advanced technology, Earth sciences, fundamental biology, human life sciences, microgravity, and space sciences, as well as send up new research experiments in these areas. 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, behavioral sciences, fundamental biology, biotechnology, material sciences, and spacecraft structural and environmental dynamics. Valuable scientific information regarding these subjects will be returned from the Shuttle Mir Science Program disciplines of advanced technology, Earth sciences, fundamental biology, human life sciences, International Space Station, microgravity and space sciences. These investigations will provide valuable information about space flight and long term exposure to the microgravity environment. This knowledge will assist researchers in developing future space stations, science programs, procedures for those facilities, and advance the knowledge base of these areas to the benefit of all people on Earth.

The commercial initiated research and technology from the advanced technology discipline will evaluate new technologies and techniques using the Mir space station as a test bed. An increased understanding of the characteristics of superconductors, protein crystal growth, and the development of biological and chemical systems through fluid processing in reduced gravity can lead to an enhanced technological base for implementation on the International Space Station and commercial processing here on Earth.

Earth sciences research in ocean biochemistry, land surface hydrology, meteorology, and atmospheric physics and chemistry also will be performed. Observation and documentation of transient natural and human-induced changes will be accomplished with the use of passive microwave radiometers, a visible region spectrometer, a side-looking radar, and hand-held photography. Earth orbit will allow for documentation of atmospheric conditions, ecological and unpredictable events, and seasonal changes over long time periods.

Fundamental biology research continues developmental investigations that study the effects of the space environment on the biological systems of plants. Prolonged exposure to microgravity provides an ideal opportunity to determine the role gravity has on cell regulation and how this affects development and growth. Investigations under this discipline will also characterize the internal radiation environment of the Mir space station.

Human life sciences research consists of investigations that focus on the crewmember's adaptation to weightlessness in terms of skeletal muscle and bone changes, psychological interactions, immune system function, and metabolism. In addition, 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, crew force impacts to structures, particle impact on the station, docked configuration stability, water microbiological monitoring and inventory management.

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

Space science research continues with the externally mounted Mir Sample Return Experiment (MSRE) and Particle Impact Experiment (PIE) payloads. These experiments continue to collect interstellar and interplanetary space particles to further our understanding of the origin and evolution of planetary systems and life on Earth.

Most of the Mir 22/NASA research will be conducted on the Mir; however, Shuttle-based experiments are conducted in the middeck and modules of STS-81.

Fundamental Biology

The microgravity environment on a long duration mission provides an ideal opportunity to determine the role gravity plays in molecular mechanisms at a cellular level and in regulatory and sensory mechanisms, and how this affects development and fundamental biological growth. Fundamental biology is also responsible for characterizing the radiation of the Mir environment and determining how it may impact station-based science.

Environmental Radiation Measurements: Exposure of crew, equipment, and experiments to the ambient space radiation environment in low Earth orbit poses one of the most significant problems to long term space habitation. As part of the collaborative NASA/Mir Science program, a series of measurements is being compiled of the ionizing radiation levels aboard Mir. During the mission, radiation will be measured in six separate locations throughout the Mir using a variety of passive radiation detectors. This experiment will continue on later missions, where measurements will be used to map the ionizing radiation environment of Mir. These measurements will yield detailed information on spacecraft shielding in the 51.6-degree-orbit of the Mir. Comparisons will be made with predictions from space environment and radiation transport models.

Greenhouse-Integrated Plant Experiments: The microgravity environment of the Mir space station provides researchers an outstanding opportunity to study the effects of gravity on plants, specifically dwarf wheat. The greenhouse experiment determines the effects of space flight on plant growth, reproduction, metabolism, and production. By studying the chemical, biochemical, and structural changes in plant tissues, researchers hope to understand how processes such as photosynthesis, respiration, transpiration, stomatal conductance, and water use are affected by the space station environment. This study is an important area of research, due to the fact that plants could eventually be a major contributor to life support systems for space flight. Plants produce oxygen and food, while eliminating carbon dioxide and excess humidity from the environment. These functions are vital for sustaining life in a closed environment such as the Mir or the International Space Station.

Wheat is planted and grown in the "Svet," a Russian/Slovakian developed plant growth facility, where photosynthesis, transpiration, and the physiological state of the plants are monitored. The plants are observed daily, and photographs and video images are taken. Samples are also collected at certain developmental stages, fixed or dried, and returned to Earth for analysis.

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 space flight factors on the ways humans live and work. The Human Life Sciences (HLS) project has a set of investigations planned for the Mir 23/NASA 4 mission to determine how the body adapts to weightlessness and other space flight factors, including the psychological and microbiological 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.

Assessment of Humoral Immune Function During Long Duration Space Flight: Experiments concerned with the effects of space flight on the human immune system are important to protect the health of long duration crews. The human immune system involves both humoral (blood-borne) and cell-mediated responses to foreign substances known as antigens. Humoral responses include the production of antibodies, which can be measured in samples of saliva and serum (blood component). The cell-mediated response, which involves specialized white blood cells, appears to be suppressed during long duration space missions. Preflight, baseline saliva and blood sample are collected. While on Mir, the crew is administered a subcutaneous antigen injection. In flight and postflight, follow-up blood and saliva samples are collected to measure the white blood cell activation response to the antigen.

Diffusion-Controlled Crystallization Apparatus for Microgravity --Protein crystals are used in basic biological research, pharmacology and drug development. Earth's gravity affects the purity and structural integrity of crystals. The low gravity environment in space allows for the growth of larger, purer crystals of greater structural integrity. Therefore, the analyses of some protein crystals grown in space have revealed more about a protein's molecular structure than crystals grown on Earth. During STS-81, astronauts will retrieve protein samples that have been growing on Mir since the STS-79 docking on September 19 and replace them with new samples.

In the experiment chamber called the Diffusion-controlled Crystallization Apparatus for Microgravity (DCAM), crew members will remove the "growing" samples and replace them with 162 new samples. The DCAM is designed to grow protein crystals in a microgravity environment. It uses the liquid/liquid and dialysis methods in which a precipitant solution diffuses into a bulk solution. In the DCAM, a "button" covered by a semi-permeable membrane holds a small protein sample but allows the precipitant solution to pass into the protein solution to initiate the crystallization process. The DCAM is a method to passively control the crystallization process over extended periods of time. The Principal Investigator is Dr. Daniel Carter of Marshall Space Flight Center in Huntsville, AL.

Gaseous Nitrogen Dewar -- Frozen protein samples will be transported to the Russian Mir space station in a gaseous nitrogen Dewar (GN2 Dewar) on STS-81, and the existing protein crystals on board Mir from the STS-79 mission will be returned to Earth for laboratory analysis. The Dewar is a vacuum jacketed container with an absorbent inner liner saturated with liquid nitrogen. The protein samples will remain frozen for approximately two weeks, until the liquid nitrogen has completely boiled off. This provides ample time to transport and transfer the Dewar to the Mir station. After the liquid nitrogen is completely discharged, the samples will thaw to ambient temperature and protein crystals will nucleate and start growing over the four-month duration of the mission. The Principal Investigator is Alex McPherson of the University of California - Riverside.

Liquid Metal Diffusion (LMD) using MIM--The LMD experiment will measure the diffusion rate of molten indium at approximately 392 F. Diffusion is the process by which individual atoms or molecules move as a result of random collisions with neighboring atoms and molecules. Diffusion is difficult to study on Earth because gravity masks the effect of the collisions, that is, hot pockets of liquid rise while the more dense, cooler areas sink. Radiation detectors in the LMD hardware will measure the diffusive motions of a radioactive tracer in non-radioactive indium. The Microgravity Isolation Mount (MIM) will be used to isolate the experiment from vibrations which could disturb the liquid indium during the experiment and induce motions which are not diffusive. The MIM will also be used to provide measured vibrations for some samples to determine how easily diffusion can be affected by these forces. A total of five samples will be processed. The information obtained from diffusion measurements can be used to determine the rate at which material travels between two bodies of fluids separated by a stagnant layer which the material must diffuse through. This is a common occurrence for some types of crystal growth and alloy processing on Earth. The Principal Investigator is Dr. Franz Rosenberger of the University of Alabama - Huntsville.

Optical Properties Monitor (OPM)-- OPM is the first experiment capable of relaying on-orbit data which will measure the effect of the space environment on optical properties, such as those of mirrors used in telescopes, and structural elements, such as the coatings used on space hardware. OPM instruments will measure various optical properties of the, overall showing to what extent the samples deteriorate over the course of the experiment.

Once aboard Mir, American astronauts and Russian cosmonauts will mount the monitor to the outside of the space station. This marks the first experiment deployed jointly by the U.S. and Russia, setting the stage for how the astronauts and cosmonauts will work together on the International Space Station.

During its scheduled nine months on Mir, the experiment will measure the environment's effect on nearly 100 sample materials. The monitor will be the first externally powered experiment in space, using a power-data line to receive power from and transmit information to the Mir. The monitor will collect and store measurements to be transferred weekly to a Mir computer, then to scientists on Earth.

Information gathered will be used to improve designs of optical and structural elements of spacecraft, particularly the International Space Station. It will also be used to plan maintenance schedules for in-orbit satellites, based on measured rates of degradation.

OPM was developed by NASA's Marshall Space Flight Center and AZ Technology of Huntsville, AL. It is scheduled to be retrieved from Mir in February 1998 during the STS-89 mission. The Principal Investigator is Donald Wilkes of AZ Technology in Huntsville, AL.

KIDSAT TO FLY AGAIN ON SPACE SHUTTLE

The electric still cameras aboard the Space Shuttle Atlantis will support the second flight of KidSat, as part of NASA's three- year pilot education program designed to bring the frontiers of space exploration to 15 U.S. middle school classrooms via the Internet during the STS-81 mission.

The 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 flight, the KidSat mission operations center at UCSD will be staffed by undergraduate and high school students. The center has capabilities similar to those of Mission Control at NASA's Johnson Space Center (JSC) in Houston. 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, who 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 photograph requests if necessary. This is done through a sophisticated web site that allows middle school students access to interactive maps of orbit ground tracks and other resources 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 middle school students to study and analyze. The curriculum used by the middle school students and teachers was developed by the JHU-IAAY and UCSD. Teachers participating in the mission learn to use the curriculum during summer training workshops.

Some of the topics the students were interested in exploring during the first KidSat mission were weather, biomes, the relationship between history and geography and the patterns of rivers on the landscape. Additional interests for this mission include searching for impact craters and studying the relationships of center pivot irrigation fields to available water supply.

Images and student results will be posted on the KidSat home page. Interested public school districts, teachers, and students may view the images and information provided by students during the mission via this World Wide Web site: http://www.jpl.nasa.gov/kidsat

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.

STS-81 CREWMEMBERS

STS081-S-002 -- These seven NASA astronauts are the crew of STS-81. From the left are astronauts John M. Grunsfeld, Brent W. Jett, John E. Blaha, Peter J.K. Wisoff, Jerry M. Linenger, Michael A. Baker and Marsha S. Ivins.

PHOTO CREDIT: NASA or National Aeronautics and Space Administration.

BIOGRAPHICAL DATA

Michael A. Baker (Captain, USN), will serve as Commander (CDR) for STS-81. He was born October 27, 1953, in Memphis, TN, but considers Lemoore, CA, to be his hometown. He graduated from Lemoore Union High School in 1971 and received a bachelor of science degree in aerospace engineering from the University of Texas in 1975. Baker completed flight training and earned his Wings of Gold at Naval Air Station Chase Field, Beeville, TX, in 1977.

Baker was selected for the astronaut program in June 1985. He is a veteran of three space flights, STS-43 in 1991, STS-52 in 1992, and STS-68 in 1994, and has logged over 720 hours in space. From March to October 1995, Baker was the Director of Operations for NASA at the Gagarin Cosmonaut Training Center in Star City, Russia, responsible for the coordination and implementation of mission operations activities in the Moscow region for the Shuttle-Mir program.

Brent Jett (Commander, USN), will serve as Pilot (PLT) for STS-81. He was born October 5, 1958 in Pontiac, MI, but considers Ft. Lauderdale, FL, to be his hometown. Jett graduated from Northeast High School in Oakland Park, FL, in 1976. He received a bachelor of science degree in aerospace engineering from the U.S. Naval Academy in 1981 and a master of science degree in aeronautical engineering from the U.S. Naval Postgraduate School in 1989. Jett received his commission from the Naval Academy in May 1981 and was designated a Naval Aviator in March 1993.

He was selected for the astronaut program in March 1992. He is a veteran of STS-72 and has logged 214 hours in space.

Peter J. K. "Jeff" Wisoff (Ph.D.), will serve as Mission Specialist-1 (MS-1) on STS-81. He was born August 16, 1958 in Norfolk, VA. He graduated from Norfolk Academy in 1976. He received a bachelor of science degree in physics (with highest distinction) from the University of Virginia in 1980, a master of science degree and a doctorate in applied physics from Stanford University in 1982 and 1986, respectively.

In his research career before joining NASA, Wisoff focused on the development of new vacuum ultraviolet and high intensity laser sources, and also collaborated on research on the applications of lasers to the reconstruction of damaged nerves.

He was selected for the astronaut program in January 1990. Wisoff served as a mission specialist on STS-57 in 1993 and STS-68 in 1994 and has logged over 509 hours in space.

John M. Grunsfeld (Ph.D.), will serve as Mission Specialist-2 (MS- 2) on STS-81. He was born October 10, 1958 in Chicago, IL. He graduated from Highland Park High School, Highland Park, IL, in 1976. He received a bachelor of science degree in physics from the Massachusetts Institute of Technology in 1980, and a master of science degree and a doctorate in physics from the University of Chicago in 1984 and 1988, respectively.

Dr. Grunsfeld's research has covered x-ray and gamma-ray astronomy, high energy cosmic ray studies, and the development of new detectors and instrumentation. He was selected for the astronaut program in March 1992. He served as mission specialist on STS-67/Astro-2 in 1995 and has logged 399 hours in space.

Marsha S. Ivins will serve as Mission Specialist-3 (MS-3) on STS- 81. She was born April 15, 1951 in Baltimore, MD. She graduated from Nether Providence High School, Wallingford, PA, in 1969. She received a bachelor of science degree in aerospace engineering from the University of Colorado in 1973.

Ivins was employed as an engineer and pilot at Johnson Space Center for several years prior to her selection for the astronaut program in 1984. A veteran of three space flights, Ivins was mission specialist on STS-32 in 1990, STS-46 in 1992 and STS-62 in 1994. She has logged over 764 hours in space.

BIOGRAPHICAL DATA

Jerry Linenger (Captain, Medical Corps, USN), will serve as Mission Specialist-4 (MS-4) from launch through docking on STS-81. After docking and a crew exchange, Linenger will replace John Blaha aboard Mir and officially become a member of the Mir crew. During his five-month stay aboard the station, he will conduct material, fluid and life science research before being replaced by U.S. astronaut Mike Foale in May 1997.

Linenger was born January 16, 1955, in Eastpointe, MI. He graduated from East Detroit High School in 1973. He received a bachelor of science degree in bioscience from the U.S. Naval Academy in 1977. He holds four advanced degrees: a doctorate in medicine from Wayne State University in 1981, a master of science in systems management from the University of Southern California in 1988, a master of public health degree in health policy from the University of North Carolina in 1989, and a doctor of philosophy degree in epidemiology, also from the University of North Carolina, in 1989.

Linenger was selected for the astronaut program in August 1992. He served as a mission specialist on STS-64 in September 1994 and has logged more than 262 hours in space.

John E. Blaha (Colonel, USAF, Ret.) is the third NASA astronaut to serve as a researcher aboard the Mir Space Station. He has been aboard the orbiting facility as a member of the Mir 22 crew since September when Atlantis docked to retrieve Shannon Lucid and deliver supplies.

Blaha was born August 26, 1942, in San Antonio, TX. He graduated from Granby High School in Norfolk, VA, in 1960. Blaha received a bachelor of science in engineering science from the United States Air Force Academy in 1965 and a master of science in astronomical engineering from Purdue University in 1966. He graduated in 1971 from the U.S. Air Force Aerospace Research Pilot School.

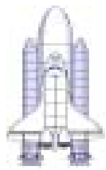
Blaha was selected as an astronaut in May 1980. Prior to STS-79, he had logged 33 days in space on four space missions. He served as commander on two flights - STS-58 in 1993 and STS-43 in 1991 and as Pilot on two flights - STS-33 and STS-29, both in 1989.

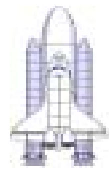
Additional biographical information on the STS-81 crew members and other NASA astronauts is available on the World Wide Web at:

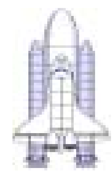
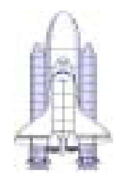
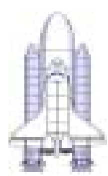
http://www.jsc.nasa.gov/Bios/astrobio.html

SHUTTLE FLIGHTS AS OF JANUARY 1997

80 TOTAL FLIGHTS OF THE SHUTTLE SYSTEM -- 55 SINCE RETURN TO FLIGHT





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-73 10/20/95 - 11/05/95		STS-60 02/03/94 - 02/11/94		
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 (21 flights)	**OV-099 Challenger (10 flights)**	**OV-103 Discovery (21 flights)**	**OV-104 Atlantis (17 flights)**	**OV-105 Endeavour (11 flights)**