NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

SPACE SHUTTLE MISSION STS-53

PRESS KIT
DECEMBER 1992

NINTH DEDICATED DEPARTMENT OF DEFENSE MISSION

STS-53 INSIGNIA

STS053-S-001 -- *Designed by the crewmembers, the STS-53 insignia shows the space shuttle Discovery rising to new achievements as it trails the symbol of the Astronaut Office against a backdrop of the American flag. The five stars and three stripes also serve to symbolize the mission designation (STS-53) and America's continuing commitment to world leadership in space. The pentagonal shape of the insignia represents the Department of Defense and its support of the space shuttle program. The band delineating the flag from space includes the four colors of the military services of the 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.

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PUBLIC AFFAIRS CONTACTS

NASA Headquarters

Office of Space Flight/Office of Space Systems Development
Mark Hess/Jim Cast/Ed Campion
(Phone: 202/453-8536)

Office of Space Science and Applications
Paula Cleggett-Haleim/Mike Braukus/Brian Dunbar
(Phone: 202/453-1547)

Office of Aeronautics and Space Technology
Drucella Andersen/Les Dorr
(Phone: 202/453-2754)

Office of Safety & Mission Quality/Office of Space Communications
Dwayne Brown
(Phone: 202/358-0547)

Department of Defense

Secretary of the Air Force Public Affairs
Maj. Dave Thurston
(Phone: 703/695-5766)

USAF Space and Missile Systems Center Public Affairs

Betty Ciotti	Dave Hess
(Phone: 310/363-6836)	(Phone: 310/363-6836

NASA Centers

Ames Research Center
Jane Hutchison
(Phone: 415/604-4968)

Ames-Dryden Flight Research Facility
Nancy Lovato
(Phone: 805/258-3448)

Goddard Space Flight Center
Dolores Beasley
(Phone: 301/286-2806)

Jet Propulsion Laboratory
James Wilson
(Phone: 818/354-5011)

Johnson Space Center
James Hartsfield
(Phone: 713/483-5111)

Langley Research Center
Jean Drummond Clough
(Phone: 804/864-6122)

Lewis Research Center
Mary Ann Peto
(Phone: 216/433-2899)

Marshall Space Flight Center
June Malone
(Phone: 205/544-0034)

Stennis Space Center
Myron Webb
(Phone: 601/688-3341)

Wallops Flight Center
Keith Koehler
(Phone: 804/824-1579)

Kennedy Space Center, FL
George Diller
(Phone: 407/867-2468)

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DISCOVERY TO FLY CLASSIFIED DEFENSE PAYLOAD

The newly-refurbished and modified Space Shuttle Discovery is scheduled to make its 15th orbital flight this month on a dedicated Department of Defense (DOD) mission. The STS-53 primary payload, designated DOD-1, is classified and represents the last major military payload currently planned for the Shuttle fleet.

"Nine DOD primary payloads have been carried into space by the Shuttle since 1985," said NASA Administrator Daniel S. Goldin. "The fact that complex mutual objectives have been achieved by two federal organizations, chartered with often-divergent goals, is a wonderful and remarkable demonstration of interagency cooperation at its best."

"STS-53 marks a milestone in our long and productive partnership with NASA. We have enjoyed outstanding support from the Shuttle program. Although this is the last dedicated Shuttle payload, we look forward to continued involvement with the program with DOD secondary payloads," added Martin C. Faga, Assistant Secretary of the Air Force (Space).

STS-53 Payloads

Although no public discussion of the identity and purpose of DOD-1 will take place due to national security concerns, a number of secondary experiments in the cargo bay and in Discovery's cabin will be openly conducted throughout the planned 7-day, 5-hour, 54- minute mission.

Among many secondary experiments will be medical studies of the effects of microgravity on cells from bone tissue, muscles and blood and the release of 2-, 4- and 6-inch metal spheres into space to test ground-based capabilities of detecting potentially dangerous debris in low-Earth orbit.

Military examination of a human's ability to observe ground- based phenomena from space will be carried out during the mission as will continuous measurements of the amount and types of radiation levels that accumulate in the crew cabin. Many of the STS-53 medical observations will apply directly to planning for human occupation of Space Station Freedom by the end of this decade.

Experienced Flight Crew

Four of Discovery's five crew members have flown in space before. Mission Commander David Walker will be making his third flight; Pilot Robert Cabana his second; Mission Specialists Guion Bluford and Jim Voss their fourth and second, respectively. Mission Specialist Michael Richard Clifford will be making his first flight. The Navy, Air Force, Marine Corps and Army (2) are represented by the all-military crew.

Discovery Face Lift

STS-53 will be Discovery's first mission since January 1992, when it successfully completed the International Microgravity Laboratory-1 flight, STS-42.

In the intervening months, the vehicle, like other members of the fleet, has undergone extensive structural inspections, modifications and equipment upgrades to insure its flight worthiness and ability to technologically perform on a level equal to that of its spaceborne peers.

(END OF GENERAL RELEASE; BACKGROUND INFORMATION FOLLOWS.)

MEDIA SERVICES INFORMATION

SPECIAL NOTICE: Department of Defense-1 (DOD-1), the primary payload on mission STS-53, is classified. As a result, NASA's normal Space Shuttle public affairs activities will be altered, slightly, to accommodate the national security interests of the DOD. In particular, the primary payload and activities associated with it will not be identified or discussed before, during or after the flight in any public forum or medium, including briefings, printed materials or interviews. NASA Select television and mission commentary also will be affected -- but, again, only slightly. Specific information concerning changes in STS-53 public affairs activities and practices will be released in a separate document no later than one week before launch.

NASA Select Television Transmission

NASA Select television is available on Satcom F-2R, Transponder 13, located at 72 degrees west longitude, frequency 3960.0 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; Ames-Dryden Flight Research Facility, Edwards, CA; Johnson Space Center, Houston 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 713/483-5817. COMSTOR is a computer database service requiring the use of a telephone modem. A voice recording of the television schedule is updated 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 news center.

Briefings

A mission press briefing schedule will be issued prior to launch. During the mission, change-of-shift briefings by a flight director will occur at least once per day. The updated NASA Select television schedule will indicate when mission briefings are planned.

STS-53 QUICK LOOK

Launch Date and Site:	Dec. 2, 1992, Kennedy Space Center, FL -- Pad 39A
Launch Window:	6:59 a.m. EST
Orbiter:	Discovery's 15th Flight
Orbit/Inclination:	200 x 200 n.m. at 57 degrees (DOD-1) 175 x 176 n.m. / 57 degrees (ODERACS deploy)
Landing Time/Date:	12:53 p.m. EST, Dec. 9
Primary Landing Site:	Kennedy Space Center, FL
Abort Landing Sites:	Return To Launch Site Abort: - Kennedy Space Center Transatlantic Abort -- Zaragoza, Spain -- Prime; Ben Guerir, Morocco -- Alternate Moron, Spain -- Alternate Abort-Once-Around: - Edwards AFB, Calif. -- Prime KSC/White Sands, NM -- Alternates
Crew:	David Walker - Commander Robert Cabana - Pilot Guion Bluford - MS1 Michael Clifford - MS2 James Voss - MS3
Cargo Bay Payloads:	Department of Defense-1 (DOD-1) Glow Experiment/Cryogenic Heat Pipe (GCP) Orbital Debris Radar Calibration Spheres (ODERACS)
Middeck Payloads:	Battlefield Laser Acquisition Sensor Test (BLAST) Clouds Logic to Optimize Use of Defense Systems (CLOUDS-1A) Cosmic Radiation Effects and Activation Monitor (CREAM) Fluid Acquisition and Resupply Experiment (FARE) Hand-held, Earth-oriented, Real-time Cooperative, User-friendly, Location-Targeting and Environmental System (HERCULES) Microcapsules in Space (MIS) Radiation Monitoring Equipment-III (RME-III) Space Tissue Loss (STL) Visual Function Tester-2 (VFT-2) Ultraviolet Plume Instrument

STS-53 SUMMARY TIMELINE

Flight Day One
Launch/Post Insertion
Primary payload activities

Flight Day Two
GCP operations
HERCULES operations
VFT-2 operations
FARE operations
OMS-3
OMS-4

Flight Day Three
ODERACS deploy
GCP operations
HERCULES operations
BLAST operations
FARE operations

Flight Day Four
HERCULES operations
BLAST operations
FARE operations

Flight Day Five
HERCULES operations
GCP operations
BLAST operations
FARE operations

Flight Day Six
GCP Operations
HERCULES operations
BLAST operations

Flight Day Seven
GCP Operations
Flight Control Systems checkout
Cabin Stow

Flight Day Eight
Deorbit Preparation
Deorbit Burn
Entry, Landing

STS-53 VEHICLE AND PAYLOAD WEIGHTS

	Pounds
Orbiter (Discovery) Empty and three SSMEs	173,596
Department of Defense-1 and Support Equipment (DOD-1)	23,215
Glow/Cryogenic Heat Pipe Experiment (GCP)	1,542
Orbital Debris Radar Calibration Spheres (ODERACS)	747
Battlefield Laser Acquisition Sensor (BLAST)	125
HERCULES	135
Fluid Acquisition and Resupply Experiment (FARE)	243
Microcapsules in Space Experiment MIS)	140
Total Vehicle at Solid Rocket Booster Ignition	4,506,246
Orbiter Landing Weight	193,045

STS-53 TRAJECTORY SEQUENCE OF EVENTS

Event	Elapsed Time (d/h:m:s)	Velocity (fps)	Mach	Altitude (feet)
Launch	00/00:00:00			
Begin Roll Maneuver	00/00:00:10	188	0.17	799
End Roll Maneuver	00/00:00:19	428	0.38	3,653
SSME Throttle Down (67 Percent)	00/00:00:31	741	0.67	9,914
Max. Dynamic Pressure (Max Q)	00/00:00:53	1,210	1.16	28,605
SSME Throttle Up (104 Percent)	00/00:01:04	1,514	1.54	41,289
SRB Separation	00/00:02:04	4,151	3.79	154,703
Main Engine Cutoff (MECO)	00/00:08:36	25,032	22.0	373,332
Zero Thrust	00/00:08:42	25,057	21.55	377,730
Fuel Tank Separation	00/00:08:54			
OMS-2 Burn	00/00:36:57			
Deorbit Burn	07/04:51:00			
Landing at KSC	07/05:54:00			

Apogee, Perigee at MECO: 198 x 11 nautical miles
Apogee, Perigee after OMS-2: 201 x 200 nautical miles

SPACE SHUTTLE ABORT MODES

Space Shuttle launch abort philosophy aims toward safe and intact recovery of the flight crew, orbiter and its payload. Abort modes include:

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

- Abort-Once-Around (AOA) -- Earlier main engine shutdown with the capability to allow one orbit around before landing at either Edwards Air Force Base, Calif., White Sands Space Harbor, NM, or the Shuttle Landing Facility (SLF) at the Kennedy Space Center, FL.

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

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

STS-53 contingency landing sites are Edwards Air Force Base, the Kennedy Space Center, White Sands Space Harbor, Zaragoza, Ben Guerir and Moron.

STS-53 PRELAUNCH PROCESSING

The orbiter Discovery spent much of the past year in the Orbiter Processing Facility (OPF) undergoing extensive improvements and modifications.

Following its most recent mission, STS-42 in January 1992, Discovery was ferried from its landing site at Edwards Air Force Base to Kennedy Space Center on Feb. 16 and rolled into OPF bay 2.

After the International Microgravity Laboratory was removed from the orbiter's payload bay on Feb. 23, work began to remove other significant pieces of flight hardware such as the Forward Reaction Control System, both Orbital Maneuvering System (OMS) pods, the three main engines, and the body flap.

During its 6-month modification period, 78 modifications were conducted on the vehicle. The most significant included the addition of a drag chute, the capability for redundant nose wheel steering, improved auxiliary power units and making improvements to the vehicle's avionics packages. Also, wing strut inspections were conducted and the Freon service loop was reserviced.

In late July, the three main engines were installed on Discovery. Engine 2024 is in the number 1 position, engine 2012 is in the number 2 position and engine 2017 is in the number 3 position.

A standard 43-hour launch countdown is scheduled to begin 3 days prior to liftoff. About 9 hours before launch, the external tank will be filled with a half million gallons of liquid oxygen and liquid hydrogen propellants. Approximately 3 hours before launch, the crew will depart their quarters at KSC, be driven to the pad and take their assigned seats in the crew compartment.

Discovery's end-of-mission landing is planned at Kennedy Space Center's Shuttle Landing Facility.

Discovery's next mission, STS-56, is an 8-day flight featuring the ATLAS-2 payload. Launch is scheduled for early next year.

PRIMARY PAYLOAD

Department of Defense-1 (DOD-1) is the primary cargo bay payload for mission STS-53. The identity and purpose of DOD-1 are classified.

SECONDARY CARGO BAY PAYLOADS

Shuttle Glow/Cryogenic Heat Pipe Experiment (GCP)

Shuttle Glow (GLO)

The Shuttle Glow (GLO) experiment is sponsored by the Geophysics Directorate of the Air Force's Phillips Laboratory, Albuquerque, NM. GLO is being integrated and flown on STS-53 under the direction of the Department of Defense's Space Test Program. GLO will use the Arizona Imaging Spectrograph (AIS) to investigate Shuttle/environment interactions such as atomic oxygen surface glow on the orbiter's tail and other surfaces and wake phenomena. The AIS will observe the orbiter's orbital maneuvering system pods, OMS and reaction control system jet firings, waste water dumps and flash evaporative cooler system operations.

The AIS has cameras and spectrographs to record in the ultraviolet, visible and infrared bands. The AIS is almost identical to the Infrared Background Signature Survey instrument which flew on STS-39. The AIS is mounted in the cargo bay to a hitchhiker small plate.

In operation, the crew powers on the experiment. Johnson Space Center enables payload commanding from the "remote" payload operations control center (POCC) at Goddard Space Flight Center (GSFC), Greenbelt, MD. GSFC sends the "hitchhiker" configuration commands and enables the experimenters to send commands to configure the AIS (exposure time, number of detectors to use). The crew performs any required action (jet firing, water dump, etc.), and the observations are made. The data is downlinked to the POCC so viewing by the experimenters is near real-time.

Cryogenic Heat Pipe Experiment (CRYOHP)

The Cryogenic Heat Pipe (CRYOHP) experiment is a joint Department of Defense/NASA experiment to test advanced technology that will make it easier to reject excess heat from infrared sensors, instruments and space vehicles.

Electronics, mechanical systems and people all generate heat aboard a spacecraft. Unless the heat is rejected into space, sensors, instruments and systems will overheat and fail or return bad data.

A heat pipe is a simple, highly dependable way to reject heat. It is a closed vessel containing a fluid, with no moving mechanical parts. Instead, it uses the natural phenomena of liquids absorbing heat to evaporate and release that heat when they condense.

In a typical system, waste heat from the sensor or instrument evaporates the liquid at one end of the heat pipe and the vapor condenses and releases heat to space at the other end. Capillary action moves the fluid back to the evaporator end.

The prime goal of the Cryogenic Heat Pipe experiment is to prove that cryogenic (very low temperature) heat pipes can reliably start up and operate at -351 to minus 198 degrees F (minus 213 to minus 128 degrees C). Supercold liquid oxygen serves as the working fluid in CRYOHP instead of the water, ammonia or Freon used by most heat pipe concepts.

CRYOHP flies in a Hitchhiker canister mounted on the right side wall of Discovery's payload bay. The canister houses two heat pipe designs, one made by TRW, Torrance, CA, and the other by Hughes Aircraft Co. Electron Dynamics Division, Huntington Beach, CA. It also contains five Stirling cryogenic coolers to maintain cold temperatures, power and electronic control boxes and an upper end plate that lets heat escape to space.

Discovery's crew will turn CRYOHP on about 8.5 hours after liftoff. Eight sets of tests will be run alternating between the two heat pipes, starting with the TRW design. The runs will last from 7.5 and 27 hours for each concept. The Payload Operations Control Center at NASA's Goddard Space Flight Center will send all commands to CRYOHP and receive all telemetry during the STS-53 mission.

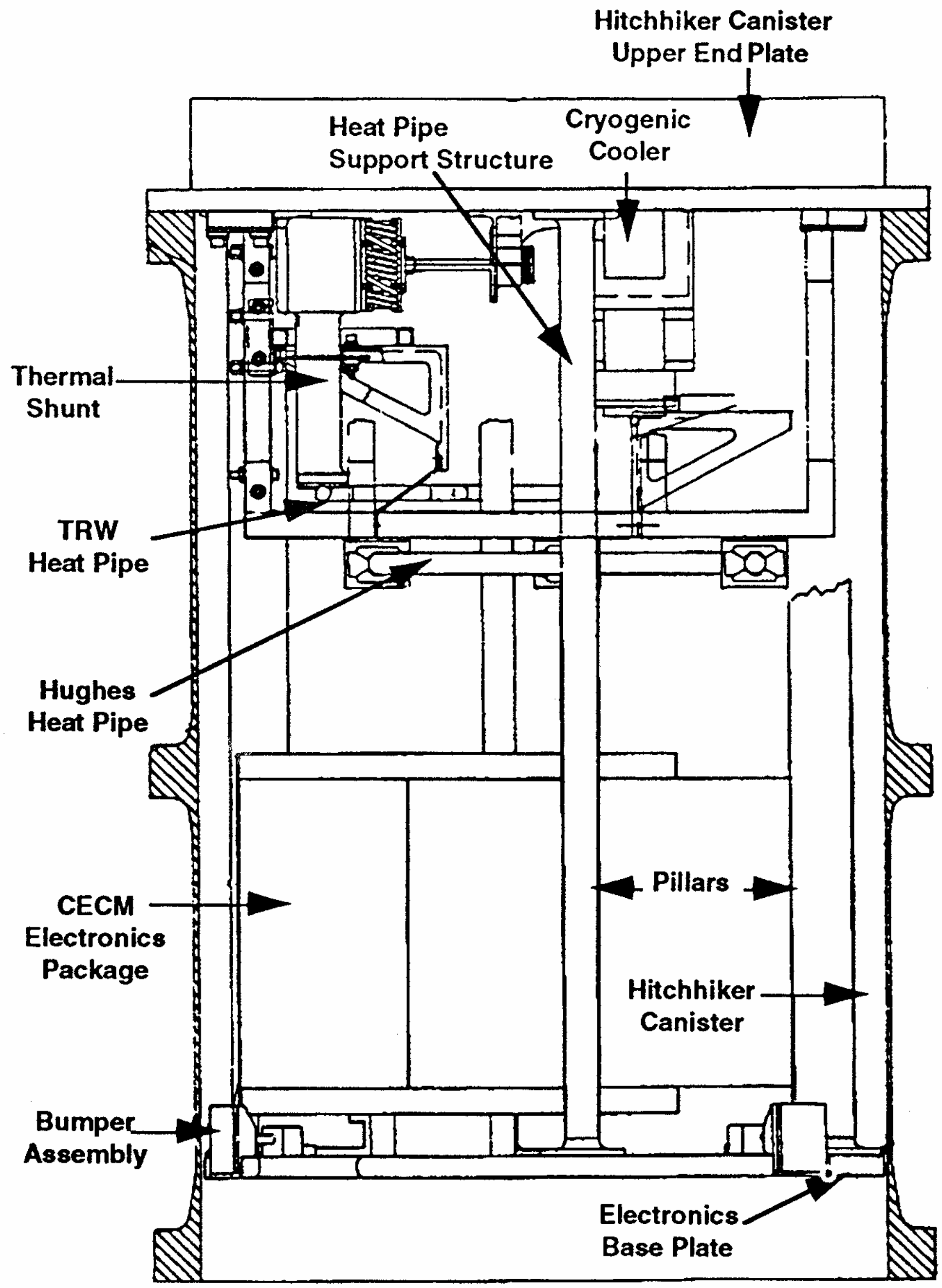
Co-investigators for the Cryogenic Heat Pipe experiment are Roy McIntosh of Goddard Space Flight Center and Jerry Beam of the U.S. Air Force Wright Aeronautical Laboratories, Dayton, Ohio.

NASA's Hitchhiker project was created in early 1984 to provide a quick reaction and low cost capability for flying small payloads in the Shuttle payload bay. This is done with a short turn-around time -- from manifest to flight takes an average of 18 months. Hitchhikers are intended for customers whose space activity requires power, data or command services.

Hitchhiker payloads are entitled to special "handling" in the orbiter that other small payloads, like the Get Away Specials, do not receive. This special handling includes tapping into the Shuttle for power and astronaut services such as requiring specific Shuttle attitudes or maneuvers. The orbiter crew moves the Shuttle when necessary to the position needed for the Hitchhiker experiment, provided it does not interfere with the needs of the primary payloads.

Hitchhikers are manifested to fly with primary payloads that either have similar requirements or that will not be affected by the changes in Shuttle position necessary to the Hitchhiker experiments.

CRYOGENIC HEAT PIPE EXPERIMENT



Orbital Debris Radar Calibration System (ODERACS)

The Orbital Debris Radar Calibration System (ODERACS) experiment will release six calibration spheres from Discovery. The spheres -- two 6-inches in diameter, two 4-inches in diameter and two 2-inches in diameter -- will be placed in a 175 nautical- mile-high (377 kilometer) orbit when they are ejected from the Shuttle's cargo bay.

The primary objective of the ODERACS experiment is to provide a source for fine-tuning of the Haystack Radar, located in Tyngsboro, MA, and operated by the Lincoln Laboratory at the Massachusetts Institute of Technology for the Air Force. NASA uses information from the radar as part of the inputs gathered to measure the amount of debris in Earth orbit. The Haystack radar can observe objects as small as 1 centimeter in diameter at ranges greater than 620 nautical miles (1,000 kilometers).

The six spheres are planned to be ejected from Discovery on its 31st orbit and will be tracked by a number of radar facilities, including the Haystack Radar as well as several telescopes. Facilities around the world that will track the spheres include Millstone Radar, Kwajalein Radar, the Eglin Radar in Florida and the FGAN radar in Germany. Optical facilities that will track the spheres include the worldwide GEODDS telescope network, the NASA/Johnson Space Center telescope in Houston and the Super-RADOT telescope facility in the South Pacific.

The spheres will help these facilities and others to better characterize their instruments by allowing them to home in on objects whose size, composition, reflectivity and electromagnetic scattering properties are well known.

The four-inch spheres' useful life is about 70 days and they will reenter the atmosphere after approximately 120 days. The 2- inch and 6-inch spheres have a useful life of about 45 days and will reenter after approximately 65 days. When they reenter the atmosphere, the spheres will be destroyed before they reach the ground.

STS-53 Mission Specialist Michael Clifford will control the operation of the ODERACS Ejection System using a hand-held encoder to send commands to the Shuttle's Autonomous Payload Control System. Clifford will verify the ejection of all six spheres. Video and radar coverage will determine the actual ejection time and velocity. The velocity data will be used to update the computers that will calculate the spheres' locations to assist the telescope and radar systems in initially locating them.

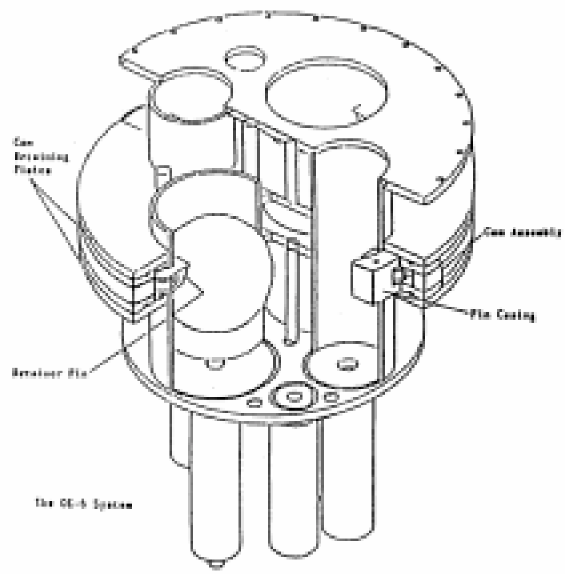
ODERACS Hardware

The ODERACS Ejection System is contained in a standard 5- cubic-foot cylindrical canister, called a Get-Away Special container. The ejection system has four subsystem elements consisting of release pins, ejection springs, electrical batteries and motor and structural support.

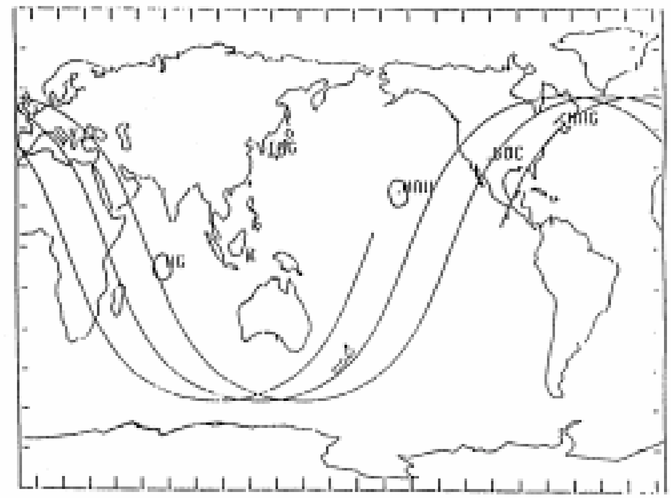
The calibration spheres themselves are made to precise specifications. The 2-inch spheres are made of solid stainless steel and weigh 1.17 lbs. (0.532 kg); the 4-inch spheres, also solid stainless steel, weigh 9.36 lbs. (4.256 kg); and the 6-inch spheres, made of solid aluminum, weigh 11 lbs. (5 kg).

ODERACS

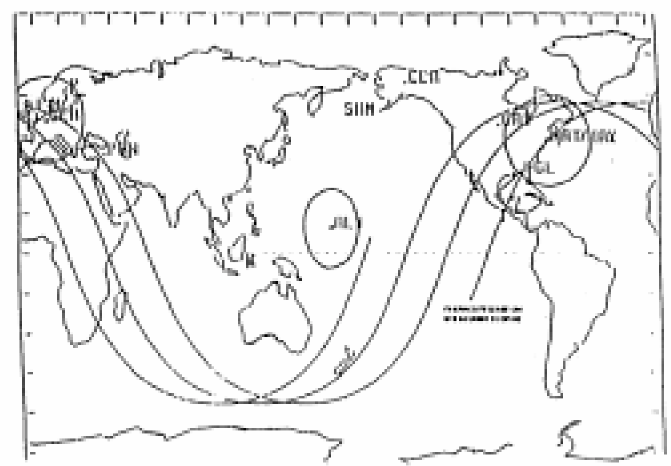
ODERACS EJECTION SYSTEM



OPTICAL SITES, FIELDS OF VIEW



RADAR SITES, FIELDS OF VIEW



SECONDARY IN-CABIN PAYLOADS, EXPERIMENTS

Battlefield Laser Acquisition Sensor Test (BLAST)

The Battlefield Laser Acquisition Sensor Test (BLAST) is an Army space project jointly sponsored by the Army Space Command, Colorado Springs, the Army Space Technology Research Office, Adelphi, MD, and the Night Vision Electro Optics Directorate, Ft. Belvoir, VA.

The experiment is designed to demonstrate the technology associated with using a spaceborne laser receiver to detect laser energy from ground-based test locations. BLAST is being integrated and flown on the Space Shuttle under the direction of the Department of Defense's Space Test Program.

BLAST is making its first flight. It will demonstrate the Army's ability to uplink Global Positioning System data through a laser medium. The test primarily will involve the use of two fixed optical tracking facilities located at the Air Force Maui Optical Site in Hawaii and the Air Force Malabar Test Facility in Palm Bay, FL. Additionally, portable tracking sites will be set up at various DOD field locations.

A low power visible laser mounted on a gimbaled tracking system will track the Shuttle, based on the most recent NASA orbiter location information. The optical signal from the tracking facilities is captured by an on-board laser receiver mounted in the Shuttle flight deck overhead window. The optical signal is processed and displayed to the flight crew real-time and recorded for post mission analysis. Data obtained will be used to develop DOD sensor technology.

Cloud Logic to Optimize Use of Defense Systems (CLOUDS)

The objective of CLOUDS, a Military-Man-In-Space experiment, is to quantify the variation in apparent cloud cover as a function of the angle at which clouds are viewed from orbit.

The equipment used is a standard Nikon 35 mm camera. A crew member simply points the camera at scenes of interest and continually photographs the scene as the orbiter passes over and away from the scene. The scenes of interest are identified by meteorologists on the ground and relayed to the Shuttle crew. Each mission has a specific meteorological or cloud feature of interest which will be emphasized. This mission will emphasize severe weather, to include thunderstorms and tropical storms.

Data from the CLOUDS experiment will be stored in a high resolution data base for use by the meteorological community and various Defense Meteorological Satellite Program (DMSP) initiatives. The DMSP system program office will use the data in the development and evaluation of future electro-optical sensors through the generation of standard scenes for model evaluation and the study of high incidence angle effects.

CLOUDS has flown on various Shuttle missions since 1984 and is being integrated and flown on the Space Shuttle under the direction of the Department of Defense's Space Test Program.

Cosmic Radiation Effects and Activation Monitor (CREAM)

The CREAM experiment is designed to collect data on cosmic ray energy loss spectra, neutron fluxes and induced radioactivity.

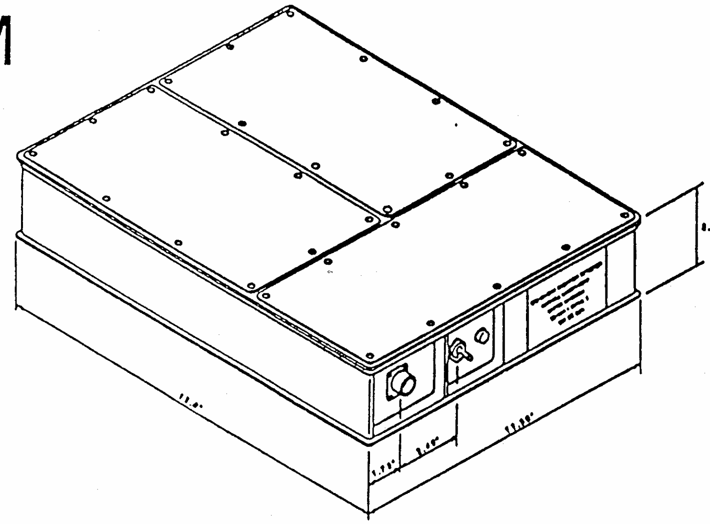
The data will be collected by active and passive monitors placed at specific locations throughout the Orbiter's cabin. CREAM data will be obtained from the same locations used to gather data for the Radiation Monitoring Equipment-III experiment in an attempt to correlate data between the two.
The active monitor to obtain real-time spectral data, while the passive monitors will obtain data during the entire mission to be analyzed after the flight.

The flight hardware has the active cosmic ray monitor, a passive sodium iodide detector and up to five passive detector packages. All hardware fits in one locker on Discovery's middeck.

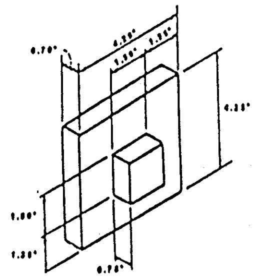
Once in orbit, the payload will be unstowed and operated by the crew. A crew member will be available at regular intervals to monitor the experiment and to relocate the active detector. The CREAM flight is sponsored by the Department of Defense, and the experiment is provided by the United Kingdom Defense Research Agency at Farnborough, England. CREAM is being integrated and flown on the Space Shuttle under the direction of the DOD's Space Test Program.

The experiment has already flown successfully on Missions 44 and 48 and has given important results on the buildup of secondary radiation with increased shielding as well as identifying a new region of trapped radiation over the South Atlantic.

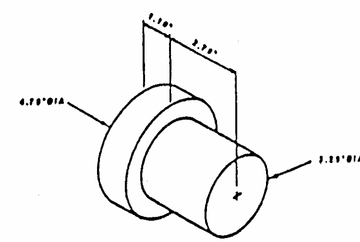
CREAM



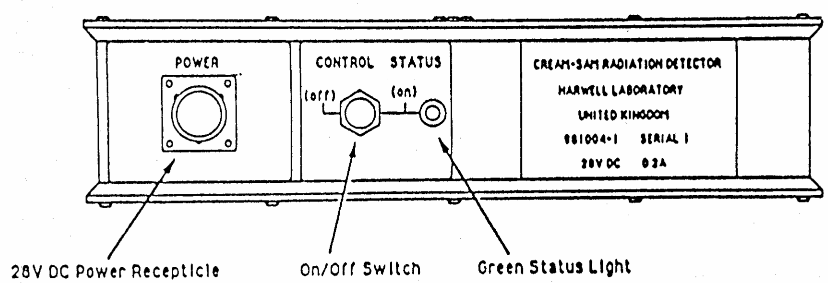
Cosmic Radiation Effects and Activation
Monitor (CREAM) - Active Monitor



Passive Dosimetry Package



Sodium Iodide Crystal
Passive Detector



Detail of CREAM Active Monitor Front Panel

Fluid Acquisition and Resupply Equipment (FARE)

The Fluid Acquisition and Resupply Experiment (FARE) will investigate the dynamics of fluid transfer in microgravity.

In space, fluid in a container does not readily settle on the bottom or leave a pocket of gas on top as it does on Earth. The orientation of liquids in weightlessness is highly unpredictable because the fluid may locate in any area within the container and may encapsulate large bubbles of gas. To replenish on-board fluids and prolong the life of space vehicles such as Space Station Freedom, satellites and extended duration orbiters, methods for transferring vapor-free propellants and other liquids must be developed.

Housed in four middeck lockers, FARE is designed to demonstrate the effectiveness of a device to alleviate the problems associated with vapor-free liquid transfer. The device exploits the surface tension of the liquid to control its position within the tank.

The basic flight hardware consists of a 12.5 inches (30.48 cm) spherical supply tank and a 12.5 inches (30.48 cm) spherical receiver tank made of transparent acrylic. Additional items include liquid transfer lines, two pressurized air bottles, a calibrated cylinder and associated valves, lines, fittings, pressure gauges and a flowmeter display unit.

The experiment is essentially self-contained, with the exception of a water-fill port, air-fill port and an overboard vent connected to the orbiter waste management system.

Mission specialists will conduct this experiment eight times during the flight, using a sequence of manual valve operations. Air from the pressurized bottles will force fluid from the supply tank to the receiver tank and back to the supply tank eight times during the 8-hour operation. The receiver tank contains baffles to control fluid motions during the transfer and a fine mesh screen to filter vapor out of the liquid. An overboard vent will remove the vapor from the receiver tank as the fluid level rises.

The FARE control panel, containing four pressure gauges and one temperature control gauge, will be used by the crew to monitor and control the experiment. Camcorder video tapes and 35 mm photographs will be made during the transfer process. The crew also will have the option of using air-to-ground communication to consult with the principal investigator.

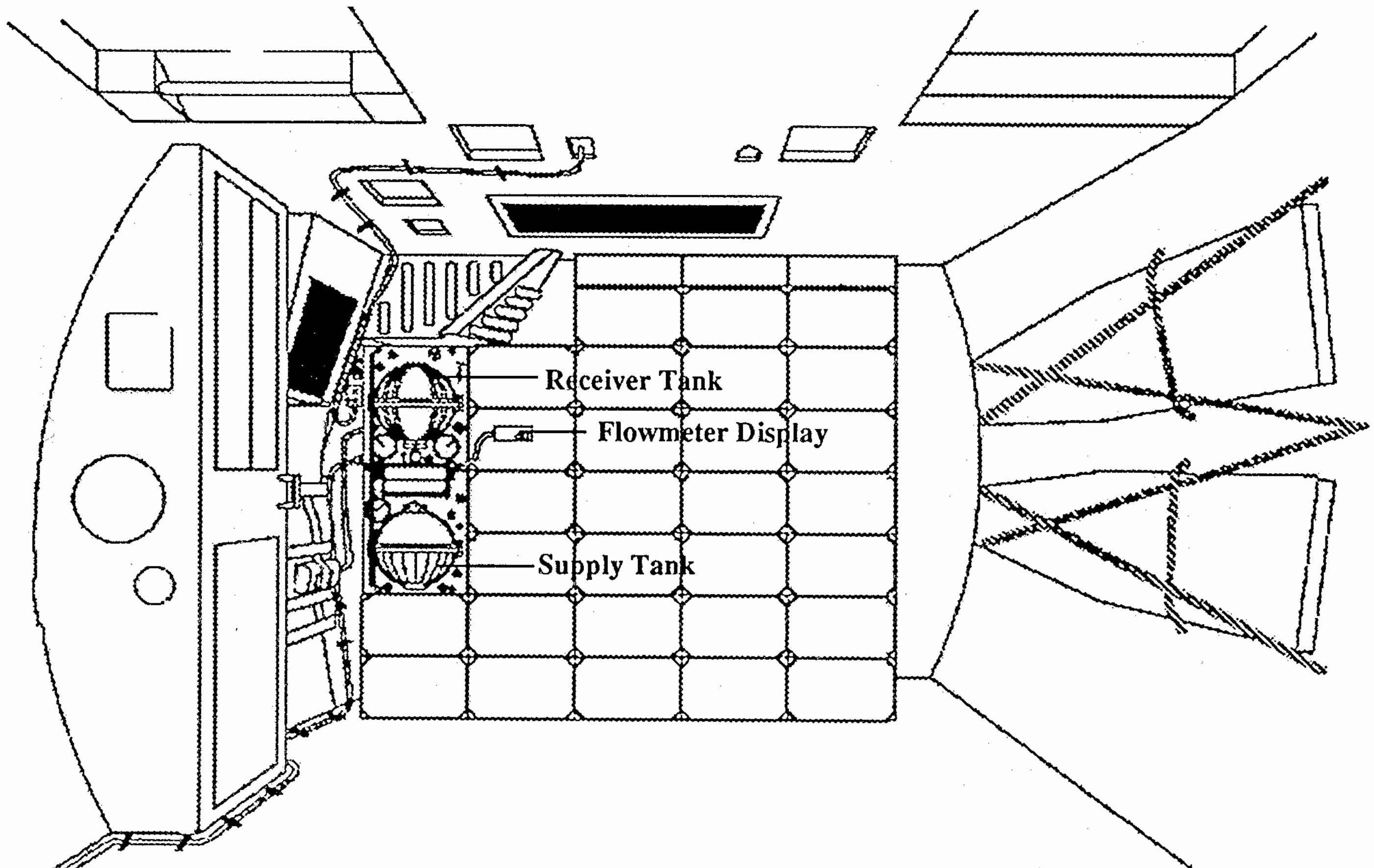
The test fluid used for this experiment is water with iodine used as a disinfectant; blue food coloring allowing better visibility of the liquid movement; a wetting solution, known as Triton X-100, to give the fluid the consistency of a propellant and an anti-foaming emulsion agent to prevent bubbles from forming in the receiver tank.

Post-mission analysis of FARE will include evaluation of the experiment equipment, as well as review of camcorder video tapes and 35 mm photographs. Because there will be no real-time data downlink during this experiment, study and analysis of test data will not be conducted until after the mission.

Historically, problems dealing with fluid transfer have been dealt with by using collapsible supply tanks to move liquid without any pressurant gas or vapor surface. These systems are heavier, more complex, more expensive and more prone to leakage during the transfer process than conventional methods of liquid containment, such as the FARE equipment.

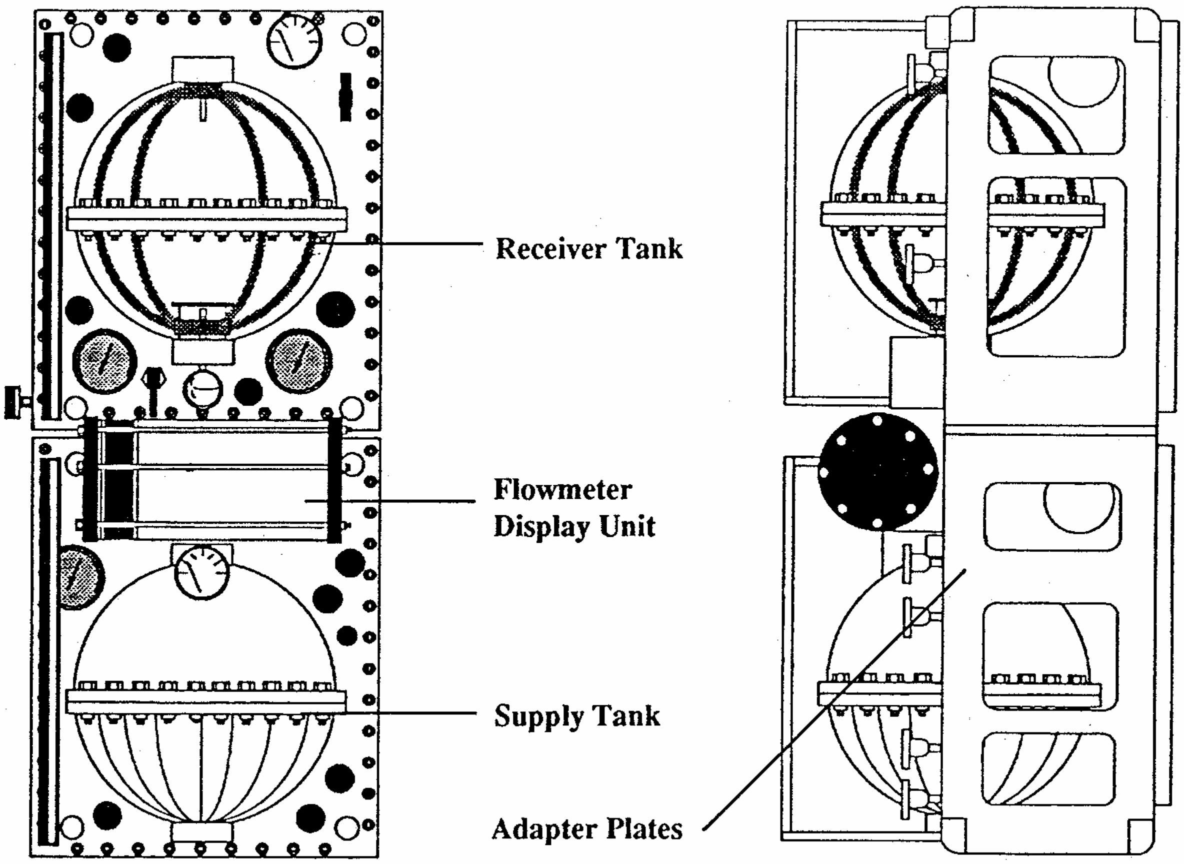
During this mission, FARE, managed by NASA's Marshall Space Flight Center, Huntsville, AL, will use basic equipment developed by Martin Marietta for a previous experiment called the Storable Fluid Management Demonstration (SFMD), which flew on STS-51C in 1985. SFMD tested a different configuration of the fluid management device in the receiver tank than what is being tested on FARE. At Marshall, Susan L. Driscoll is Principal Investigator for FARE.

FARE Middeck Installation



Orbiter Middeck, Looking Forward

FARE Configuration



*Envelope: 45" X 22" X 19" (114.3 cm X 55.88 cm X 48.26 cm)

*Tanks:
*Material: Acrylic
*Diameter: 12.5" (30.48 cm)
*Volume: 1022 cubic inches (16,748 cu. cm)

*Test Fluid:
*Water & Additives
*Amount: 5.4 gallons (20.52 liters)

Hand-held, Earth-oriented, Real-time, Cooperative, User- friendly, Location-targeting and Environmental System (HERCULES)

Naval Research Laboratory (NRL), Wash., DC, scientists have developed a new system that will allow a Shuttle astronaut in space to point a camera at an interesting feature on Earth, record the image and determine the latitude and longitude of the feature.

Called HERCULES, the system is attached to a modified Nikon camera and employs a geolocation process which determines in real- time the latitude and longitude of points on Earth within 2 nautical miles.

HERCULES will provide a valuable Earth observation system for military, environmental, oceanographic and meteorological applications. STS-53 is the first flight of HERCULES. It is scheduled to fly again aboard STS-56 in April 1993. HERCULES is being integrated and flown on the Space Shuttle under the direction of the Department of Defense's Space Test Program.

The project is a joint Navy, Army and NASA effort. Scientists at NRL's Naval Center for Space Technology developed the HERCULES Attitude Processor (HAP) and the alignment, geolocation and human interface software to perform the geolocation. The other components in the system are a NASA-built Electronic Still Camera (ESC), a modified Nikon F-4 and Honeywell ring-laser gyro.

On board the Shuttle, the astronaut will start the system by pointing the camera, with the attached gyro, at two known stars to obtain a bearing. The astronaut then "shoots" images by pointing the camera at the Earth and snapping the shutter.

The camera communicates with HAP, which processes the data from the gyro and determines its absolute orientation in space. Then, the HAP passes this pointing information to the NRL software running on a NASA-modified GRID portable computer. The computer then determines the longitude and latitude of the image.

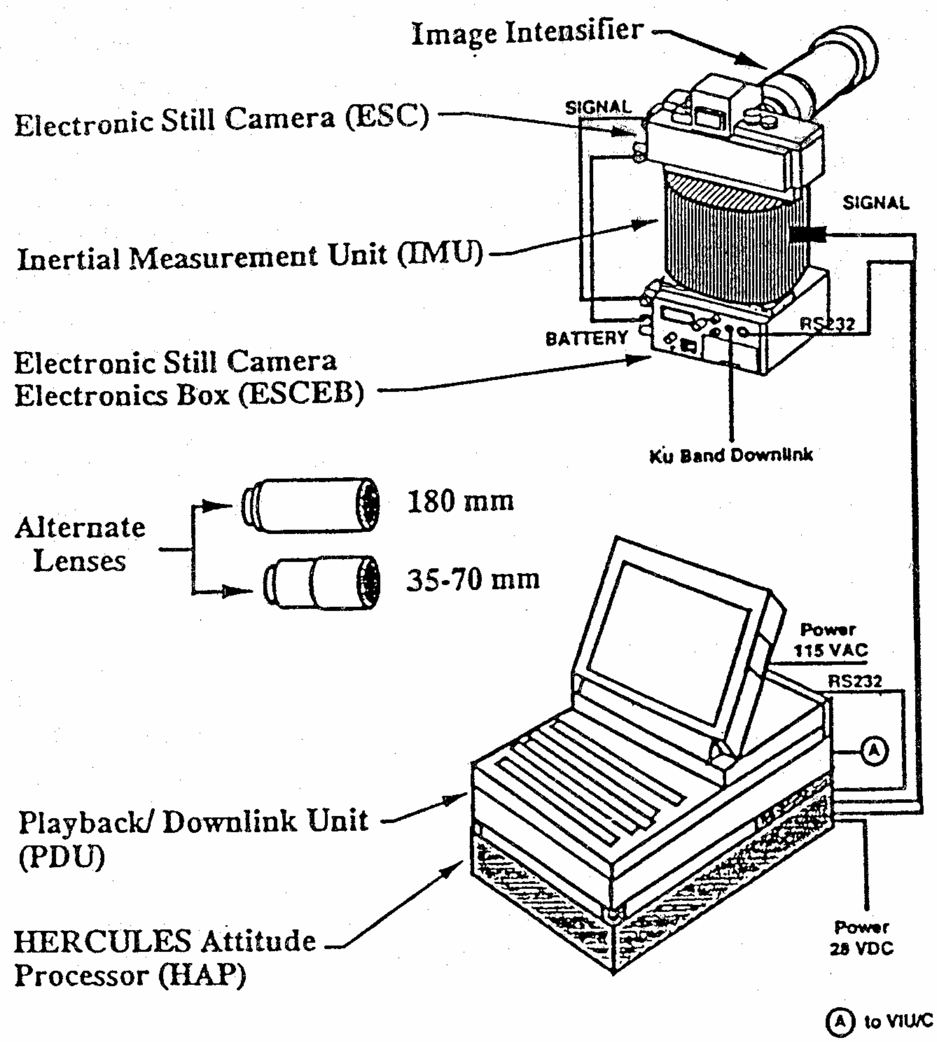
The geolocation information is sent back to the camera by the HAP, where it is appended to the image data. The astronaut can view the image on the Shuttle and downlink it to Earth. The image and geolocation data also are stored in the ESC system for post- mission analysis.

The system is a significant improvement over its predecessor called L-cubed. Under the L-cubed system, the astronauts had to take multiple images of the same target while simultaneously keeping the edge of the Earth in view, which limited image magnification.

With HERCULES, the astronaut only needs to look at the point of interest, allowing the use of many different camera lenses. In the daytime, the system uses any Nikon-compatible lens. At night, it operates with an image intensifier developed by the Army's Night Vision Laboratory. At any magnification, images with no distinguishing demographic features can be captured and geolocated. HERCULES captures images digitally, which allows computer analysis and data dissemination, an improvement over the film-based L-cubed system.

NRL scientists already are exploring enhancements to HERCULES. Incorporating Global Positioning System (GPS) hardware into HERCULES would provide a geolocation accuracy better than 1 nautical mile, and adding a gimbal system would allow the system to automatically track points on Earth.

HERCULES



HERCULES Configuration B

Microencapsulation In Space (MIS)

Microencapsulation in Space (MIS) will make its maiden flight on board Space Shuttle Discovery. Recently completed by the Controlled Release Division at Southern Research Institute, it is the objective of this Army project to increase the knowledge of microencapsulated drug technology. Sponsored by the U.S. Army Institute of Dental Research (USAIDR), U.S. Army Medical Research and Development Command and partially funded by the U.S. Army Laboratory Command, the experiment will fly several times over the next few years.

MIS is being integrated and flown on the Space Shuttle under the direction of the Department of Defense's Space Test Program. In the first flight, Shuttle astronauts will perform two experiments incorporated in MIS to produce time-release antibiotic microcapsules. The antibiotic, ampicillin, will be microencapsulated with a biodegradable polymer. Scientists at Southern Research Institute and the U.S. Army have reason to believe that microcapsules made in weightlessness will have properties vastly superior to microcapsules made on Earth.

Southern Research Institute scientists Dr. Thomas R. Tice, Principal Investigator, and Dr. Richard J. Holl, Program Manager, were responsible for the conception, design and construction of MIS. Dr. Jean A. Setterstrom of USAIDR, who obtained sponsorship and funding by first proposing the experiment to the Army, is the technical representative/coordinator.

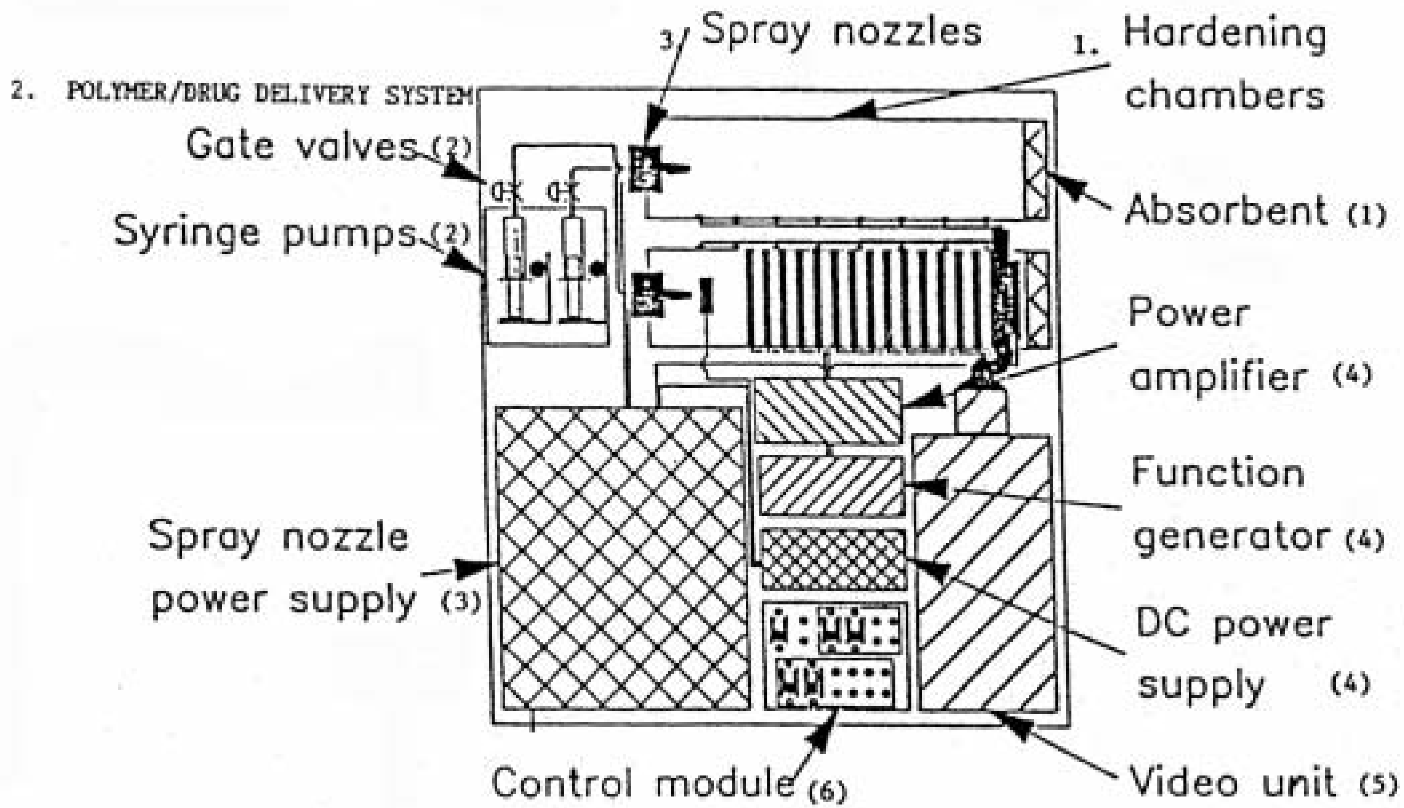
Microcapsules are tiny spheres typically 50 to 100 micrometers in diameter. For comparison, human hair is about 100 micrometers thick, and human blood cells are about 7 micrometers in diameter.

Although microencapsulation was initially used to develop products such as carbonless copy paper and scratch and sniff products, it is now used for innovative pharmaceutical products and high-performance chemical products (smart materials). The use of micro-encapsulated pharmaceutical products has touched us all, ranging from taste-masked pediatric formulations, once- or twice- a-day oral formulations and once-a-month injectable formulations.

These microcapsule products greatly improve therapeutic success. There is no doubt that time-release, drug-delivery technology will provide new approaches for innovative pharmaceutical products of the future.

Scientists expect that the basic and applied knowledge gained from MIS will lead to better pharmaceutical products made on Earth as well as in space. The results of the MIS experiment could lead to new and exciting pharmaceutical manufacturing opportunities on Space Station Freedom.

MIS MICROCAPSULES IN SPACE



MIS component configuration

Radiation Monitoring Equipment-III (RME-III)

RME-III is an instrument which measures the exposure to ionizing radiation on the Space Shuttle. It displays the dose rate and total accumulated radiation dose to the astronaut operator. Simultaneously the device registers the number of radiation interactions and dose accumulated at 10 second intervals and stores the data in an internal memory for follow-up analysis upon return to Earth.

The radiation detector used in the instrument is a spatial ionization chamber called a tissue equivalent proportional counter (TEPC). The device effectively simulates a target size of a few microns of tissue, the dimensions of a typical human cell. For this reason, TEPC-based instruments such as the RME-III are called micro-dosimeter instruments.

RME stands for Radiation Monitoring Equipment, the name given to prototype dosimeter instruments flown on the Space Shuttle prior to STS-26. The RME-III has successfully flown on 12 Space Shuttle missions since STS-26.

RME is being integrated and flown on this mission under the direction of the Defense Department's Space Test Program. It has been flown in conjunction with other radiation experiments, such as the CREAM (Cosmic Radiation Effects and Activation Monitor) and SAM (Shuttle Activation Monitor). It is anticipated that RME will be flown on several future Space Shuttle missions.

The data obtained from the RME-III is archived and is being used to update and refine models of the space radiation environment in low Earth orbit. This will assist space mission planners to more accurately assess risk and safety factors in future long- term space missions, such as Space Station Freedom.

Next generation instruments similar to the RME-III will be flown on Space Station Freedom and on future manned and unmanned missions to the Moon, Mars and beyond. RME-III also is being used to measure radiation exposure in high altitude aircraft such as the Concorde.

Space Tissue Loss (STL)

The Department of Space Biosciences at the Walter Reed Army Institute of Research (WRAIR) in Washington, DC, will see the second flight of its Space Tissue Loss (STL) model hardware aboard Space Shuttle Discovery. STL is being integrated and flown on the Shuttle under the direction of the Defense Department's Space Test Program.

The STL module was developed to help scientists and Army medical practitioners understand more about the effects of space flight on fragile life systems, including the immune system, muscle and bone. When gravity is removed or reduced as in space travel, life systems degrade at a remarkable rate, very much like a rapid aging process or what occurs after severe trauma or infection.

WRAIR and NASA's Life Sciences Division have entered into a joint project to study these effects in space. As part of the project, researchers will place a cell culture device, designed by Army scientists at WRAIR in a middeck payload locker on the Shuttle. The device will allow Walter Reed and NASA researchers to study cells from bone tissue, skeletal muscle, cardiac muscle, endothelial and white blood cells under various conditions. Testing will include the effect of different stimulants, hormones and drugs on cells in the microgravity environment.

The STL study will help scientists understand more about how white cells respond to antigens from infectious agents and tumors. It also will show how space flight can cause the tremendous loss of calcium and minerals from bones and find ways to prevent or minimize bone failure in space and on Earth.

Findings from tests of muscle disintegration could yield more information about similar muscle failure that occurs in forms of Muscular Dystrophy, the loss of muscle mass after severe injury, prolonged bed rest and aging.

Dr. George Kearney, research scientist at Walter Reed Army Institute of Research is the Principal Investigator. Colonel Bill Wiesmann, MD, Director of the Division of Surgery, WRAIR, is the Program Manager. Tom Cannon, Department of Space Biosciences, WRAIR, is the Project Manager. They are supported by collaborative partners at WRAIR, the Armed Forces Institute of Pathology, NASA's Ames Research Center, University of Louisville Medical School, and a Defense Department's Space Test Program team of personnel from the Air Force, The Aerospace Corporation and Rockwell International.

Visual Function Tester - Model II (VFT-2)

Since 1984, Air Force scientists of the Armstrong Laboratory at Wright- Patterson AFB, Ohio, have been conducting a series of vision performance experiments on the Space Shuttle to assess the effect of microgravity on visual function.

The second test device now being used is the Visual Function Tester - Model II (VFT-2), which measures the sensitivity of the eye to image contrast at threshold. The device is small, hand- held, battery-powered and presents three types of image patterns to the eye. This is the sixth in a series of flights with this tester.

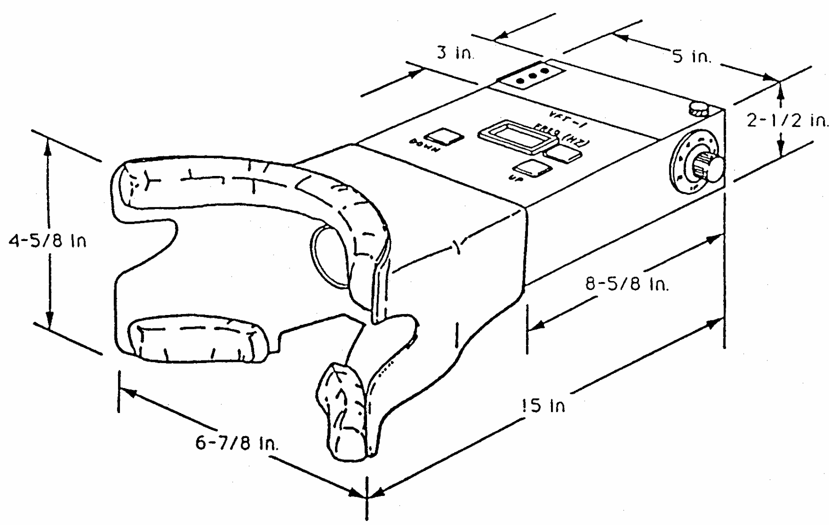
Two of the astronauts on STS-53 will participate in the experiment. They receive training in the use of VFT-2 and will take the test twice prior to space flight to establish their baseline performance, use VFT-2 daily while in orbit, at landing and two times post-flight. The primary purpose of these vision experiments is to determine if any change in vision occurs while in space and if so, are the changes clinically significant and how quickly the individual recovers.

Dr. Lee Task, research physicist, and Dr. (Lt. Col.) Mel O'Neal, research optometrist, of the Human Engineering Division, are the principal investigators for the VFT-2. They are assisted by personnel from the Air Force and Rockwell International located at the Johnson Space Center, Houston. This payload is a Department of Defense Space Test Program secondary experiment.

VFT-2

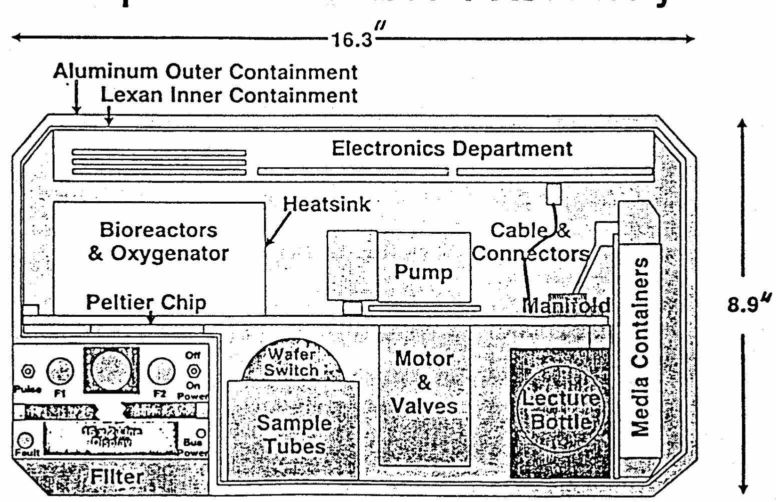
Visual Funtion Tester

Configuration No. 1



STL

Space Tissue Loss 1 Assembly



STS-53 CREWMEMBERS

STS053-S-001 **--** *STS-53 Discovery, Orbiter Vehicle (OV) 103, crewmembers, wearing launch and entry suits (LESs), pose for official crew portrait in front of a display and space shuttle orbiter model at the Space Center Houston (SCH) facility. Pictured are, left to right (front) mission specialists Guion S. Bluford and James S. Voss and (back row) mission commander David M. Walker, pilot Robert D. Cabana, and mission specialist Michael R. U. Clifford. Portrait made by NASA JSC contract photographer Jack Jacob.*

BIOGRAPHICAL DATA

DAVID M. WALKER, 48, Capt., USN, will command STS-53. Selected as an astronaut in January 1978, Walker considers Eustis, FL, his hometown and will be making his third space flight.

Walker graduated from Eustis High School in 1962 and received a bachelor's degree from the Naval Academy in 1966. After being designated a naval aviator in 1967, he was assigned to the aircraft carriers USS Enterprise and USS America flying F-4 Phantom aircraft. In 1971, he graduated from the Air Force Aerospace Research Pilot school and was assigned as a test pilot at the Naval Air Test Center. Walker has logged more than 5,500 flying hours.

His first Shuttle flight was as Pilot of STS-51A in November 1984. He next flew as Commander of STS-30 in May 1989. He has logged a total of 289 hours in space.

ROBERT D. CABANA, 43, Col., USMC, will be Pilot. Selected as an astronaut in June 1985, Cabana considers Minneapolis his hometown and will be making his second space flight.

Cabana graduated from Washburn High School in Minneapolis in 1967 and received a bachelor's degree in mathematics from the Naval Academy in 1971. He completed Naval Flight Officer training in 1972 and served as an A-6 bombardier/navigator with the Marine Air Wings in Cherry Point, NC, and Iwakuni, Japan. In 1976, he was designated a naval aviator and was assigned as an A-6 Intruder pilot at Cherry Point. He graduated from the Naval Test Pilot School in 1981 and was assigned to the Naval Air Test Center. Cabana has logged more than 4,100 hours in 32 different aircraft.

Cabana's first Shuttle flight was as Pilot of STS-41 in October 1990. He has logged 98 hours in space.

GUION S. BLUFORD Jr., 50, Col., USAF, will be Mission Specialist 1 (MS1). Selected as an astronaut in August 1979, Bluford considers Philadelphia his hometown and will be making his fourth space flight.

Bluford graduated from Overbrook Senior High School in Philadelphia in 1960; received a bachelor's degree in aerospace engineering from Penn State in 1964; received a master's in aerospace engineering from the Air Force Institute of Technology in 1974; received a doctorate in aerospace engineering with a minor in laser physics from the Air Force Institute of Technology in 1978 and received a master in business administration from the University of Houston in Clear Lake in 1987.

Bluford first flew as a mission specialist on STS-8 in September 1983. His next flight was as a mission specialist on STS-61A in November 1985. His third flight was as a mission specialist on STS-39 in April 1991. He has logged more than 513 hours in space.

JAMES S. VOSS, 43, Lt. Col., USA, will be Mission Specialist 2 (MS2). Selected as an astronaut in June 1987, Voss considers Opelika, AL, his hometown and will be making his second space flight.

Voss graduated from Opelika High School; received a bachelor's degree in aerospace engineering from Auburn University in 1972 and received a master's in aerospace engineering from the University of Colorado in 1974.

Voss began working at the Johnson Space Center in 1984, supporting Shuttle and payload testing at the Kennedy Space Center as a Vehicle Integration Test Engineer until his selection as an astronaut. His first Shuttle flight was STS-44 in November 1991. Voss has logged 166 hours in space.

BIOGRAPHICAL DATA

MICHAEL RICHARD URAM CLIFFORD, 40, Lt. Col., USA, will be Mission Specialist 3 (MS3). Selected as an astronaut in January 1990, Clifford considers Ogden, Utah, his hometown and will be making his first space flight.

Clifford graduated from Ben Lomond High School in Ogden in 1970; received a bachelor's degree from U.S. Military Academy at West Point in 1974 and received a master's degree in aerospace engineering from the Georgia Institute of Technology in 1982.

After graduation from West Point, Clifford was commissioned in the U.S. Army and assigned with the 10th Calvary in Fort Carson, CO, for 2 years before entering the Army Aviation School in 1976. He was designated an Army aviator in 1976 and assigned with the Attack Troop, 2nd Armored Calvary in Nuremberg, West Germany. After completing his master's, he was assigned as an instructor and assistant professor at West Point in 1982. In 1986, he graduated from the Naval Test Pilot School. Clifford has logged more than 2,700 flying hours in fixed and rotary-wing aircraft.

He was assigned to NASA by the military in 1987 and worked at the Johnson Space Center as a Shuttle vehicle integration engineer until his selection as an astronaut.

MISSION MANAGEMENT FOR STS-53

NASA HEADQUARTERS, WASHINGTON, DC

Office of Space Flight

Jeremiah W. Pearson III	Associate Administrator
Bryan O'Connor	Deputy Associate Administrator
Tom Utsman	Space Shuttle Program Director
Leonard Nicholson	Space Shuttle Program Manager (located at JSC)
Brewster Shaw	Deputy Space Shuttle Program Manager (Located at KSC)

Office of Space Science and Applications

Dr. Lennard Fisk	Associate Administrator
Al Diaz	Deputy Associate Administrator

Office of Aeronautics and Space Technology

Richard H. Petersen	Associate Administrator
Gregory M. Reck	Director for Space Technology
Jack Levine	Manager, Space Experiments Office
Arthur R. Lee	Program Manager, Cryogenic Heat Pipe

Office of Safety and Mission Quality

Col. Frederick Gregory	Associate Administrator
Dr. Charles Pellerin Jr.	Deputy Associate Administrator
Richard Perry	Director, Programs Assurance

DEPARTMENT OF DEFENSE PAYLOAD MANAGEMENT

Key Management Participants

Brigadier General Donald R. Walker, USAF Director, Office of Space Systems Office of the Secretary of the Air Force	Mission Director
Colonel Robert Ballard, USAF Program Manager, Space Test and Transportation Systems HQ, Space and Missile Systems Center Los Angeles AFB, CA	Deputy Mission Director
Lt. Colonel James McLeroy, USAF Executive Director, Operating Location AW HQ Space and Missile Systems Center Johnson Space Center, Houston, TX	Assistant Deputy Mission Director
Major Butch Domino, USAF	Mission Director Action Officer (JSC/OL-AW)
Captain John Hennessey, USAF Captain Richard Martinez, USAF Captain Reid Maier, USAF Captain David Goldstein, USAF	Secondary Payload Managers (JSC/OL-AW)

KENNEDY SPACE CENTER, FL

Robert L. Crippen	Director
James A. "Gene" Thomas	Deputy Director
Jay F. Honeycutt	Director, Shuttle Management and Operations
Robert B. Sieck	Launch Director
David A. King	Discovery Flow Director
J. Robert Lang	Director, Vehicle Engineering
Al J. Parrish	Director of Safety Reliability and Quality Assurance
John T. Conway	Director, Payload Management and Operations
P. Thomas Breakfield	Director, Shuttle Payload Operations
Joanne H. Morgan	Director, Payload Project Management
Ralph Schuiling	STS-53 Payload Processing Manager

MARSHALL SPACE FLIGHT CENTER, HUNTSVILLE, AL

Thomas J. Lee	Director
Dr. J. Wayne Littles	Deputy Director
Harry G. Craft	Manager, Payload Projects Office
Alexander A. McCool	Manager, Shuttle Projects Office
Dr. George McDonough	Director, Science and Engineering
James H. Ehl	Director, Safety and Mission Assurance
Otto Goetz	Manager, Space Shuttle Main Engine Project
Victor Keith Henson	Manager, Redesigned Solid Rocket Motor Project
Cary H. Rutland	Manager, Solid Rocket Booster Project
Parker Counts	Manager, External Tank Project

JOHNSON SPACE CENTER, HOUSTON, TX

Aaron Cohen	Director
Paul J. Weitz	Acting Director
Daniel Germany	Manager, Orbiter and GFE Projects
Dr. Steven Hawley	Acting Director, Flight Crew Operations
Eugene F. Kranz	Director, Mission Operations
Henry O. Pohl	Director, Engineering
Charles S. Harlan	Director, Safety, Reliability and Quality Assurance

STENNIS SPACE CENTER, BAY ST. LOUIS, MS

Roy S. Estess	Director
Gerald Smith	Deputy Director
J. Harry Guin	Director, Propulsion Test Operations

AMES RESEARCH CENTER, MOUNTAIN VIEW, CA

Dr. Dale L. Compton	Director
Victor L. Peterson	Deputy Director
Dr. Joseph C. Sharp	Director, Space Research

AMES-DRYDEN FLIGHT RESEARCH FACILITY, EDWARDS, CA

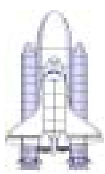
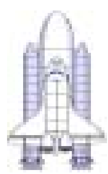
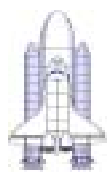
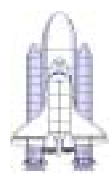
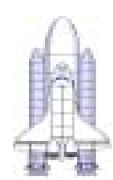
Kenneth J. Szalai	Director
T. G. Ayers	Deputy Director
James R. Phelps	Chief, Shuttle Support Office

GODDARD SPACE FLIGHT CENTER, GREENBELT, MD

Dr. John M. Klineberg	Director
Peter T. Burr	Deputy Director
Vernon J. Weyers	Director, Flight Projects Directorate

SHUTTLE FLIGHTS AS OF DECEMBER 1992

51 TOTAL FLIGHTS OF THE SHUTTLE SYSTEM -- 26 SINCE RETURN TO FLIGHT

OV-102 Columbia (13 flights)	**OV-099 Challenger (10 flights)**	**OV-103 Discovery (14 flights)**	**OV-104 Atlantis (12 flights)**	**OV-105 Endeavour (2 flights)**
		STS-42 01/22/92 - 01/30/92		
STS-52 10/22/92 - 11/01/92		STS-48 09/12/91 - 09/18/91		
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-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-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-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-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-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-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-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-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-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