NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

SPACE SHUTTLE MISSION
STS-48

PRESS KIT
SEPTEMBER 1991

UPPER ATMOSPHERE RESEARCH SATELLITE (UARS)

STS-48 INSIGNIA

STS048-S-001 **--** *Designed by the astronaut crewmembers, the STS-48 insignia represents the space shuttle Discovery in orbit about the Earth after deploying the Upper Atmospheric Research Satellite (UARS) depicted in block letter style. The stars are those in the northern hemisphere as seen in the fall and winter when UARS will begin its study of Earth's atmosphere. The color bands on Earth's horizon, extending up to the UARS spacecraft, depict the study of Earth's atmosphere. The triangular shape represents the relationship among the three atmospheric processes that determine upper atmospheric structure and behavior: chemistry, dynamics, and energy. In the words of the crew members, "This continuous process brings life to our planet and makes our planet unique in the solar system."*

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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CONTENTS

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STS-48 DISCOVERY TO LOFT SATELLITE TO STUDY ATMOSPHERE, OZONE

Discovery will deploy the Upper Atmosphere Research Satellite (UARS) 350 statute miles above Earth to study mankind's effect on the planet's atmosphere and its shielding ozone layer as the highlight of Space Shuttle mission STS-48. Once deployed, UARS will have two opportunities to study winters in the northern hemisphere and one opportunity to study the Antarctic ozone hole during the satellite's planned 20-month life.

The Upper Atmosphere Research Satellite (UARS) is the first major flight element of NASA's Mission to Planet Earth, a multi-year global research program that will use ground-based, airborne and space-based instruments to study the Earth as a complete environmental system. Mission to Planet Earth is NASA's contribution to the U.S. Global Change Research Program, a multi-agency effort to better understand, analyze and predict the effect of human activity on the Earth's environment.

UARS is designed to help scientists learn more about the fragile mixture of gases protecting Earth from the harsh environment of space. UARS will provide scientists with their first complete data set on the upper atmosphere's chemistry, winds and energy inputs.

Discovery is planned to launch into a 57-degree inclination polar orbit at 6:57 p.m. EDT, Sept.. 12, from Kennedy Space Center's Launch Pad 39A on STS-48, Discovery's 13th flight and the 43rd Shuttle mission.

Secondary objectives on the flight include Protein Crystal Growth-7, the seventh flight of a middeck experiment in growing protein crystals in weightlessness; the Middeck 0-Gravity Dynamics Experiment, a study of how fluids and structures react in weightlessness; the Investigations into Polymer Membrane Processing-4, research into creating polymer membranes, used as filters in many industrial refining processes, in space; the Physiological and Anatomical Rodent Experiment, a study of the effects of weightlessness on rodents; the Shuttle Activation Monitor, a device that will measure the amounts of gamma rays in the Shuttle's crew cabin; the Cosmic Radiation Effects and Activation Monitor, a study of cosmic radiation in the orbiter environment; the Radiation Monitoring Experiment, an often flown device that monitors the amounts of radiation inside the Shuttle; and the Air Force Maui Optical System, a use of the Shuttle's visibility in orbit to calibrate Air Force optical instruments in Hawaii. Also, in the payload bay with UARS, the Ascent Particle Monitor will measure any contaminants that enter the cargo bay during launch.

Commanding Discovery will be Navy Capt. John Creighton. Navy Cmdr. Ken Reightler, making his first space flight, will serve as pilot. Mission Specialists will be Marine Corps Col. Jim Buchli, Army Lt. Col. Sam Gemar and Air Force Col. Mark Brown. The 5-day mission is scheduled to land at Kennedy's Shuttle Landing Facility at about 1:55 a.m. EDT Sept. 18, 1991.

(END OF GENERAL RELEASE; BACKGROUND INFORMATION FOLLOWS.)

MEDIA SERVICES

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 change-of-shift briefings from Johnson Space Center, Houston, will be available during the mission at Kennedy Space Center, Fla.; Marshall Space Flight Center, Huntsville, AL; Johnson Space Center; and NASA Headquarters, Washington, D.C. The television schedule will be updated to reflect changes dictated by mission operations.

Television schedules also may be obtained by calling the Johnson TV schedule bulletin board, 713/483-5817. The bulletin board is a computer data base service requiring the use of a telephone modem. A voice update of the television schedule may be obtained by dialing 202/755-1788. This service is updated daily at noon ET.

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

STS-48 QUICK LOOK

Launch Date	September 12, 1991
Launch Site	Kennedy Space Center, FL, Pad 39A
Launch Window	6:57 p.m.-7:41 p.m. EDT
Orbiter	Discovery (OV-103)
Orbit	351 x 351 statute miles, 57 degrees inclination
Landing Date/Time	Sept. 18, 1991, 1:55 a.m. EDT
Primary Landing Site	Kennedy Space Center, FL
Abort Landing Sites:	Return to Launch Site - Kennedy Space Center, FL Transoceanic Abort Landing - Zaragoza, Spain Alternate Transoceanic Abort Landing - Moron, Spain; Ben Guerir, Morocco Abort Once Around - Edwards Air Force Base, CA
Crew Members:	John Creighton, Commander Kenneth Reightler Jr., Pilot Charles D. Gemar, Mission Specialist 1 James F. Buchli, Mission Specialist 2 Mark N. Brown, Mission Specialist 3
Cargo Bay Payloads:	UARS (Upper Atmospheric Research Satellite) APM-03 (Atmospheric Particle Monitor-3)
Middeck Payloads:	RME-III-06 (Radiation Monitoring Experiment-III) PCG-07 (Protein Crystal Growth-7) MODE-01 (Middeck 0-Gravity Dynamics Experiment-1) IPMP-04 (Investigations into Polymer Membrane Processing-4) PARE-01 (Physiological and Anatomical Rodent Experiment-1) SAM-03 (Shuttle Activation Monitor-1) CREAM-01 (Cosmic Radiation Effects and Activation Monitor-1) AMOS (Air Force Maui Optical System-12) Electronic Still Photography Camera

SUMMARY OF MAJOR ACTIVITIES

Flight Day 1
Ascent
OMS 2
RCS-1
RCS-2
UARS on-orbit checkout
PCG activation

Flight Day 2
Middeck 0-Gravity Dynamics Experiment
Extravehicular Mobility Unit checkout
Depressurize cabin to 10.2 psi

Flight Day 3
UARS deploy
Repressurize cabin to 14.7 psi
Medical DSOs

Flight Day 4
Middeck 0-Gravity Dynamics Experiment
Shuttle Activation Monitor

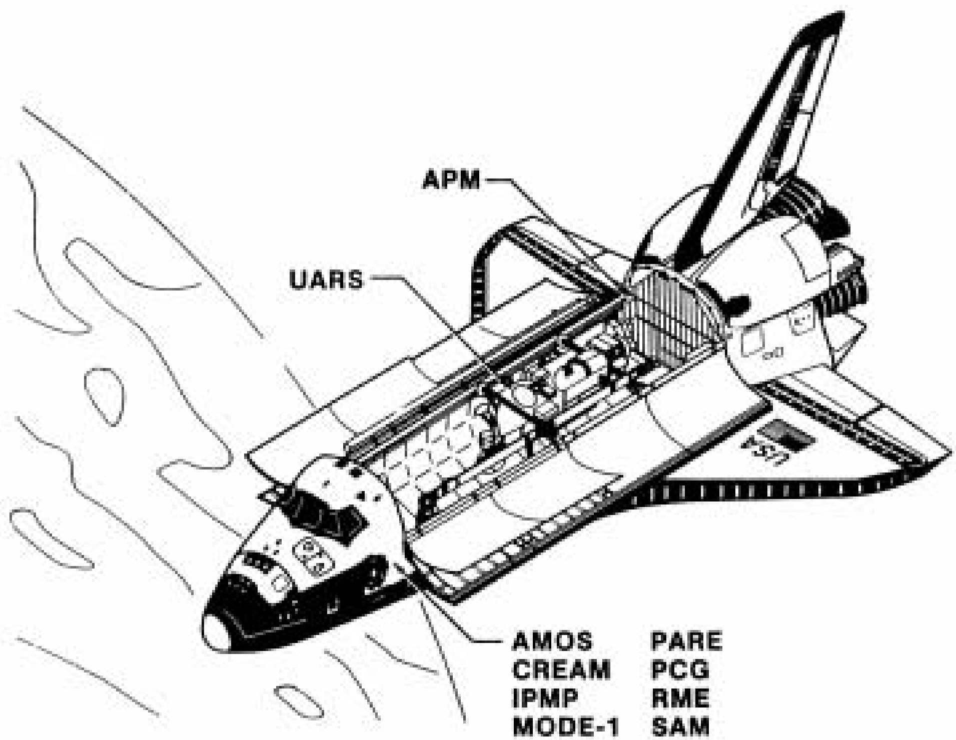
Flight Day 5
Protein Crystal Growth deactivation
Shuttle Activation Monitor stow
Flight Control Systems checkout
Reaction Control System hot-fire
Cabin stow

Flight Day 6
Deorbit preparation
Deorbit
Landing

VEHICLE AND PAYLOAD WEIGHTS

	Pounds
Orbiter (Discovery) empty and 3 SSMEs	172,651
Upper Atmospheric Research Satellite (UARS)	14,419
UARS Airborne Support Equipment	2,164
Ascent Particle Monitor	22
Cosmic Radiation Effects and Activation Monitor	48
Radiation Monitoring Experiment	7
Investigations into Polymer Membrane Processing	41
Protein Crystal Growth	89
Middeck 0-Gravity Dynamics Experiment	130
Shuttle Activation Monitor	90
Physiological and Anatomical Rodent Experiment	70
Detailed Supplementary Objectives (DSOs)	215
Detailed Test Objectives	45
Total Vehicle at SRB Ignition	4,507,348
Orbiter Landing Weight	192,507

STS-48 CARGO CONFIGURATION



SPACE SHUTTLE ABORT MODES

Space Shuttle launch abort philosophy aims for a 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 120 statute 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.; the Shuttle Landing Facility (SLF) at Kennedy Space Center, FL; or White Sands Space Harbor (Northrup Strip), NM.

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

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

STS-48 contingency landing sites are Edwards AFB, Kennedy Space Center, White Sands, Zaragoza, Moron and Ben Guerir.

STS-48 TRAJECTORY SEQUENCE OF EVENTS

Event	MET (d/h:m:s)	Relative Velocity (fps)	Mach	Altitude (ft)
Launch	00/00:00:00			
Begin Roll Maneuver	00/00:00:10	191	0.17	813
End Roll Maneuver	00/00:00:19	434	0.39	3,710
SSME Throttle Down to 89%	00/00:00:22	517	0.46	4,999
SSME Throttle Down to 67%	00/00:00:30	719	0.65	9,362
SSME Throttle Up to 104%	00/00:01:02	1,470	1.49	39,013
Max. Dyn. Pressure (Max Q)	00/00:01:05	1,573	1.63	42,512
SRB Staging	00/00:02:04	4,162	3.86	153,823
Main Engine Cutoff (MECO)	00/00:08:37	25,241	22.14	373,714
Zero Thrust	00/00:08:43	25,255	N/A	377,239
ET Separation	00/00:08:55			
OMS-2 Burn	00/00:43:41			
Landing (orbit 81)	05/08:31:00			

Apogee, Perigee at MECO: 287 x 35 nautical miles
Apogee, Perigee post-OMS 2: 291 x 293 nautical miles

ON-ORBIT EVENTS

Event	MET (d/h:m:s)	Apogee/ Perigee (n. mi.)	Orbit	Delta Velocity (fps)
OMS-2	00/00:48:00	291x293	1	448.1
RCS-1 (forward)	00/06:42:00	292x305	5	23.5
RCS-2 (aft)	00/07:29:00	305x306	5	22.4
UARS Deploy	02/04:35:00	305x306	33	n/a
RCS-3 (separation 1)	02/04:36:00	306x308	33	2
RCS-4 (separation 2)	02/04:53:00	303x306	34	5.5
Deorbit	05/07:18:00	n/a	80	501

STS-48 PRELAUNCH PROCESSING

Flight preparations on Discovery for the STS-48 mission began May 7 following its last mission, STS-39, which ended with a landing at KSC's Shuttle Landing Facility. Discovery was towed from the runway to the Orbiter Processing Facility (OPF) to start operations for its 13th flight. Discovery's systems were fully tested while in the OPF including the orbital maneuvering system pods and the forward reaction control system.

Space Shuttle main engine locations for this flight are as follows: engine 2019 in the No. 1 position, engine 2031 in the No. 2 position and engine 2107 in the No. 3 position. These engines were installed in June.

The Upper Atmosphere Research Satellite arrived at the Kennedy Space Center by barge on May 13 and was taken to the Payload Hazardous Servicing Facility for final installation of the flight components and spacecraft checkout. On July 27 it was transferred to the Vertical Processing Facility for testing to verify its compatibility and readiness to be integrated with the Space Shuttle.

UARS was moved to Pad 39-A on Aug. 10 and installed into the payload bay of Discovery on Aug. 14. Integrated testing, communications checks and a Launch Readiness Test were scheduled to verify that UARS was ready for the pending deployment and its mission.

Booster stacking operations on mobile launcher platform 3 began June 27 with the right aft booster. Stacking of all booster segments was completed by July 20. The external tank was mated to the boosters on July 24 and the Orbiter Discovery was transferred to the Vehicle Assembly Building on July 25. The orbiter was mated to the external tank and solid rocket boosters on Aug. 2.

The STS-48 vehicle was rolled out to Launch Pad 39-A on Aug. 12. A dress rehearsal launch countdown was held Aug. 19-20 at KSC. A standard 43-hour launch countdown is scheduled to begin 3 days prior to launch. During the countdown, the orbiter's onboard fuel and oxidizer storage tanks will be loaded and all orbiter systems will be prepared for flight.

About 9 hours before launch the external tank will be filled with its flight load of a half a million gallons of liquid oxygen and liquid hydrogen propellants. About 2 and one-half hours before liftoff, the flight crew will begin taking their assigned seats in the crew cabin.

The first night landing is planned at the Shuttle Landing Facility at the conclusion of this 5-day mission. KSC's landing convoy teams will safe the vehicle on the runway and tow it into the new Orbiter Processing Facility. This will mark the first use of OPF bay 3 where Discovery will be prepared for its 14th space flight, Mission STS-42 with the International Microgravity Laboratory.

UPPER ATMOSPHERE RESEARCH SATELLITE

The Upper Atmosphere Research Satellite (UARS) is the first major flight element of NASA's Mission to Planet Earth, a multi-year global research program that will use ground-based, airborne and space-based instruments to study the Earth as a complete environmental system. Mission to Planet Earth is NASA's contribution to the U.S. Global Change Research Program, a multi-agency effort to better understand, analyze and predict the effect of human activity on the Earth's environment.

UARS is designed to help scientists learn more about the fragile mixture of gases protecting Earth from the harsh environment of space. UARS will provide scientists with their first complete data set on the upper atmosphere's chemistry, winds and energy inputs.

One of UARS' focuses will be an area in which humanity's technological advancement is changing the Earth on a global scale -- depletion of ozone in the stratosphere, or upper atmosphere. The stratosphere ranges from approximately 9 to 30 miles above the Earth's surface. Ozone, a molecule made up of three oxygen atoms, blocks ultraviolet light that can cause skin cancer and damage food crops.

Although there are some natural causes of stratospheric ozone depletion, such as volcanic eruptions, the "ozone hole" that forms over Antarctica in the Southern Hemisphere's spring season and the 5 percent depletion observed over northern mid-latitudes in the last decade are a direct consequence of human activity. These long-term ozone trends are caused by chlorine compounds released into the atmosphere as by-products of industry, including refrigeration and the making of plastic foam.

To study ozone depletion more completely and to better understand other aspects of Earth's fragile atmosphere, scientists need the global perspective available from an orbiting satellite, one that makes simultaneous measurements of all the factors of ozone depletion with state-of-the-art instruments. To that end, the UARS science program has been designed as a single experiment with nine component instruments that will study the upper atmosphere's chemical, dynamic and energy systems. In addition to the UARS instrument science teams, 10 other teams will use the data to improve theoretical models of the upper atmosphere and consequently, scientists' ability to predict the effects of change in the atmosphere.

An extensive program of correlative investigations using ground-based, aircraft and balloon-carried instruments is also planned. As a whole, the UARS program is designed to give scientists the data they need to address the challenge of Mission to Planet Earth -- to understand and predict the effect of human activity on the environment.

UARS's nine complementary scientific instruments each provide measurements critical to a more complete understanding of the upper atmosphere, concentrating their observations in chemistry, dynamics and energy input.

UARS carries a 10th instrument, the Active Cavity Radiometer II (ACRIM II), that is not technically part of the UARS mission. ACRIM II will take advantage of a flight opportunity aboard UARS to study the Sun's energy output, an important variable in the study of the Earth's climate.

Chemistry Studies

Four of UARS' instruments will measure the concentrations and distribution of gases important to ozone depletion, climate change and other atmospheric phenomena.

Cryogenic Limb Array Etalon Spectrometer

Like all spectrometers, the Cryogenic Limb Array Etalon Spectrometer (CLAES) will search for the tell-tale spectra that indicate the presence of certain chemicals. In particular, CLAES will determine concentrations and distributions by altitude of nitrogen and chlorine compounds, ozone, water vapor and methane, all of which take part in the chemistry of ozone depletion. Principal Investigator for CLAES is Dr. Aidan E. Roche, Lockheed Palo Alto Research Laboratory, Palo Alto, Calif. Dr. John Gille of the National Center for Atmospheric Research, Boulder, Colo., is a collaborative investigator.

Improved Stratospheric and Mesospheric Sounder

The Improved Stratospheric and Mesospheric Sounder (ISAMS) will study atmospheric water vapor, carbon dioxide, nitrous oxide, nitric acid, ozone, methane and carbon monoxide. Like CLAES, ISAMS detects infrared radiation from the atmosphere and uses it to derive information on atmospheric temperature and composition. Principal Investigator for ISAMS is Dr. Fred W. Taylor, University of Oxford, Department of Atmospheric Physics, Oxford, United Kingdom. Dr. James M. Russell III of NASA's Langley Research Center, Hampton, VA, is a collaborative investigator.

Microwave Limb Sounder

The Microwave Limb Sounder (MLS) will provide, for the first time, a global data set on chlorine monoxide, the key intermediate compound in the ozone destruction cycle. MLS data also will be used to generate three-dimensional maps of ozone distribution and to detect water vapor in the microwave spectral range. Principal Investigator for MLS is Dr. Joseph W. Waters, NASA's Jet Propulsion Laboratory, Pasadena, Calif.

Halogen Occultation Experiment

The Halogen Occultation Experiment (HALOE) will observe the vertical distribution of hydrofluoric acid, hydrochloric acid, methane, carbon dioxide, ozone, water vapor and members of the nitrogen family. Each day, HALOE will observe 28 solar occultations, that is, it will look through Earth's atmosphere toward the sun to measure the energy absorption of the Sun's rays by these gases. Principal Investigator for HALOE is Dr. James M. Russell III, NASA's Langley Research Center, Hampton, VA.

Dynamics

Two instruments, the High Resolution Doppler Imager and the Wind Imaging Interferometer, will provide scientists with the first directly measured, global picture of the horizontal winds that disperse chemicals and aerosols through the upper atmosphere.

High Resolution Doppler Imager

By measuring the Doppler shifts of atmospheric chemicals, the High Resolution Doppler Imager (HRDI) will measure atmospheric winds between 6.2 and 28 miles and above 34 miles. These data are important to understanding the essential role of atmospheric motion on the distribution of chemicals in the upper atmosphere. Principal Investigator for HRDI is Dr. Paul B. Hays, University of Michigan, Space Physics Research Laboratory, Ann Arbor.

Wind Imaging Interferometer

The Wind Imaging Interferometer (WINDII) also will use the Doppler shift measurement technique to develop altitude profiles of horizontal winds in the upper atmosphere. WINDII's measurements will tell scientists about the winds at and above 49 miles. Principal Investigator for WINDII is Dr. Gordon G. Shepherd, York University, Ontario, Canada. The investigation is provided by a partnership between Canada and France, with the latter making important contributions to the data analysis software.

Energy Inputs

Three instruments, the Solar Ultraviolet Spectral Irradiance Monitor, the Solar Stellar Irradiance Comparison Experiment, and the Partial Environment Monitor, will measure solar energy that reaches the Earth and study its effect on the atmosphere.

Solar Ultraviolet Spectral Irradiance Monitor

Ultraviolet light from the Sun is the driver of the ozone cycle, dissociating chlorine compounds into reactive chlorine atoms that in turn break up ozone molecules . The Solar Ultraviolet Spectral Irradiance Monitor (SUSIM) will measure solar ultraviolet energy, the most important spectral range in ozone chemistry. Principal Investigator for SUSIM is Dr. Guenter E. Brueckner, Naval Research Laboratory, Washington, D.C.

Solar Stellar Irradiance Comparison Experiment

Like SUSIM, the Solar Stellar Irradiance Comparison Experiment (SOLSTICE) will conduct in-depth ultraviolet studies of the Sun. SUSIM will compare the Sun's ultraviolet energy to the UV radiation of bright blue stars, providing a standard against which the solar energy level can be measured in future long-term monitoring of the Sun. Principal Investigator for SOLSTICE is Dr. Gary J. Rottman, University of Colorado, Boulder.

Particle Environment Monitor

The Particle Environment Monitor (PEM) will help to answer questions about the effect of energetic particles from the Sun on the upper atmosphere, detecting and measuring the particles as they enter the atmosphere. PEM uses four primary instrument subunits to take detailed particle measurements in different energy ranges. Principal Investigator for PEM is Dr. J. David Winningham, Southwest Research Institute, San Antonio, Texas.

Solar Constant

Active Cavity Radiometer Irradiance Monitor

The Active Cavity Radiometer Irradiance Monitor (ACRIM II) will provide accurate monitoring of total solar activity for long-term climate studies. ACRIM II is an instrument of opportunity, added to the UARS spacecraft after the engineering team determined that the spacecraft could fly a 10th instrument. Though not a part of the UARS program, ACRIM II data is important to other studies within Mission to Planet Earth. Principal Investigator for ACRIM II is Dr. Richard D. Willson, NASA's Jet Propulsion Laboratory, Pasadena, Calif.

Propulsion

The UARS observatory consists of a standard design Multi-mission Modular Spacecraft (MMS), coupled to a module that includes the 10 instruments. The MMS Hydrazine Propulsion Module will power orbit adjustment maneuvers for the initial boost to orbit and maintain the required altitude. The system consists of four 5-pound thrusters and 12 small 0.2-pound attitude control thrusters. The MMS was built by Fairchild, Inc., Germantown, MD.

Modular Attitude Control System

For UARS to make the minute changes in its orientation toward the Earth needed for the long-duration measurements of the atmosphere, the spacecraft must know at all times where it is pointed. To do this, UARS uses a system known as the Modular Attitude Control System (MACS). The MACS subsystem is a three-axis system made up of many flight-proven NASA components contained within the MMS. The system contains sensors that tell UARS where it's pointed and actuators that can point the spacecraft as required. The MACS module originally flew aboard the Solar Maximum Mission (SMM). It was returned to Earth as part of the 1984 SMM repair mission and refurbished for flight aboard UARS.

Communications and Data Handling

The Communications and Data Handling (CADH) system uses software based on proven modular technology that flew on the Solar Maximum Mission and Landsat 4 and 5. The modular programming allows sections of the software to be rewritten or repaired without requiring end-to-end verification of an entire new program. The CADH system consists of the CADH module, a high-gain antenna and two omni-directional low-gain antennas.

The CADH also has a Tracking and Data Relay Satellite System (TDRSS) transponder for communications between UARS and TDRSS. UARS uses a NASA standard spacecraft computer which provides for some autonomous operation of the spacecraft. It will perform such tasks as command processing, attitude determination computations and power management.

Payload Operation and Control Center

Instructions to UARS during its space voyage begin with the controllers at computer terminals located in the UARS Payload Operations Control Center (POCC) at the Goddard Space Flight Center, Greenbelt, MD. The POCC is the focal point for all UARS pre-mission preparations and on-orbit operations. For the UARS mission, the POCC is part of the Multi-satellite Operations Control Center (MSOCC) at Goddard that provides mission scheduling, tracking, telemetry data acquisition, command and processing required for down linked data.

UARS Ground Data System

A dedicated Central Data Handling Facility (CDHF), located at the Goddard Space Flight Center, will process the UARS scientific data. The CDHF is linked to 20 Remote Analysis Computers at the instrument and theoretical principal investigator's home institutions via an electronic communications system. This will make all UARS data available to all investigators. The CDHF also is designed to encourage frequent interactions between the different investigation groups and facilitate quick response to unusual events, such as solar flares and volcanic eruptions.

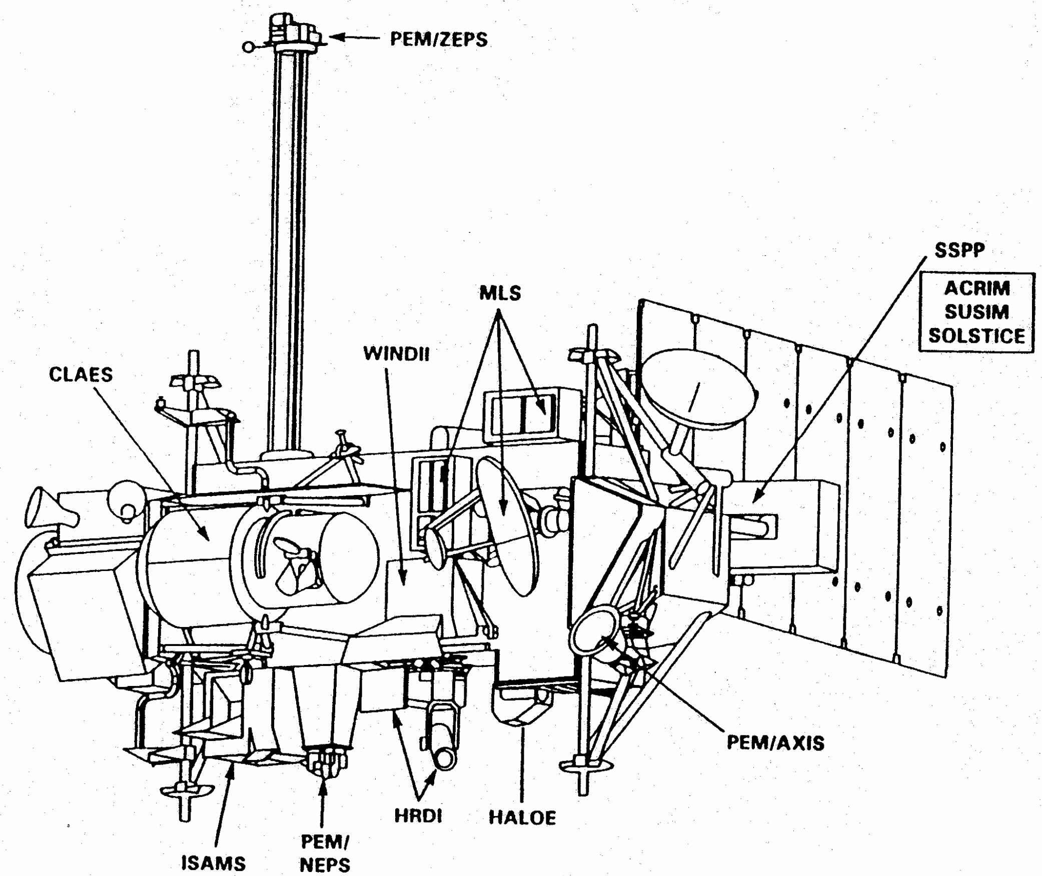
UARS scientific data will be continuously recorded on two alternating onboard tape recorders at the rate of 32 kilobits per second. Upon acquiring contact with the Tracking and Data Relay Satellite, the UARS data will be transmitted via the NASA Communications Network to the Data Capture Facility (DCF), located at Goddard. The DCF will perform telemetry preprocessing, which includes time-ordering, merging, editing and sorting of the data stream. The output will be transferred to the UARS CDHF.

Thermal Subsystems

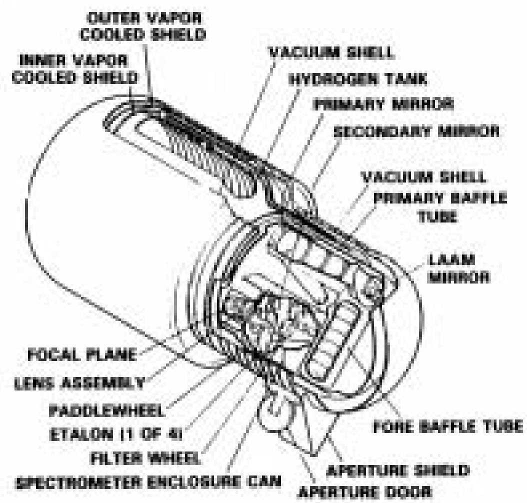
Thermal control of UARS during launch and orbital operation will be largely through passive means -- paint, blankets, coatings and temperature sensors augmented by electrical heaters. The CLAES and ISAMS instruments have special cooling requirements met by subsystems within the instruments.

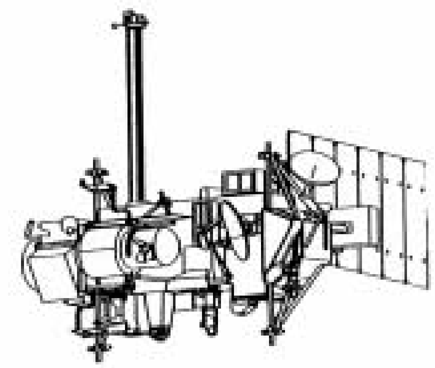
UARS was built and integrated by General Electric Astro-Space Division, Valley Forge, Penn., and East Windsor, NJ. The UARS project is managed by the Goddard Space Flight Center, Greenbelt, MD, for NASA's Office of Space Science and Applications.

UARS EXPERIMENTS



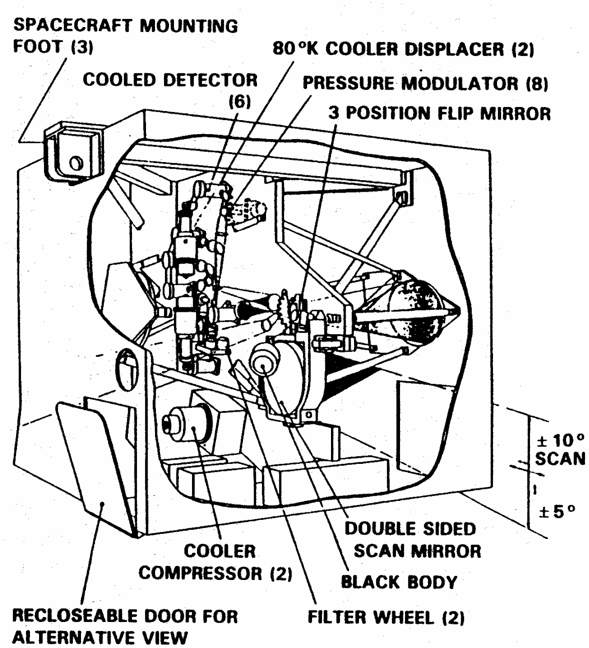
CRYOGENIC LIMB ARRAY ETALON SPECTROMETER (CLAES)

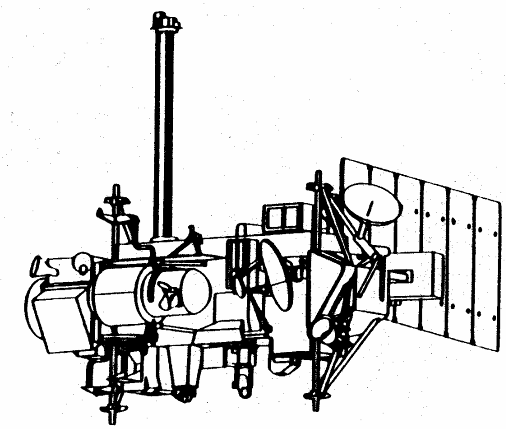




INSTRUMENT WT.:	1358 lb.
AVERAGE POWER:	29 WATTS.
DATA RATE:	3 kbps.

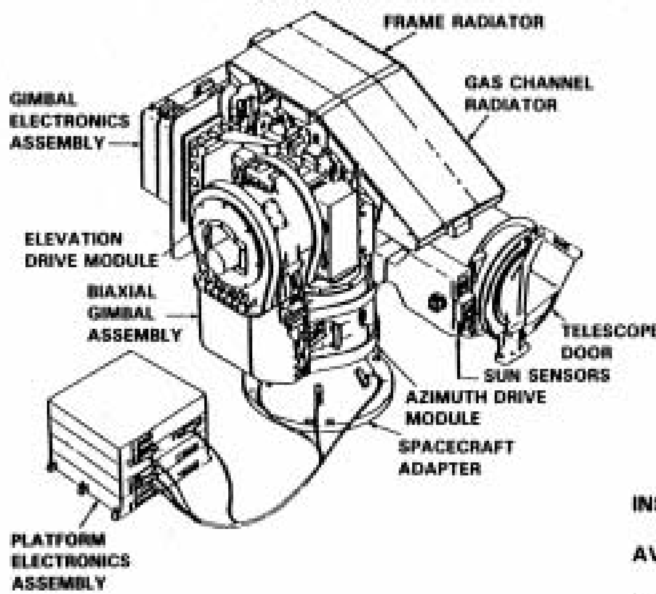
IMPROVED STRATOSPHERIC AND MESOSPHERIC SOUNDER (ISAMS)

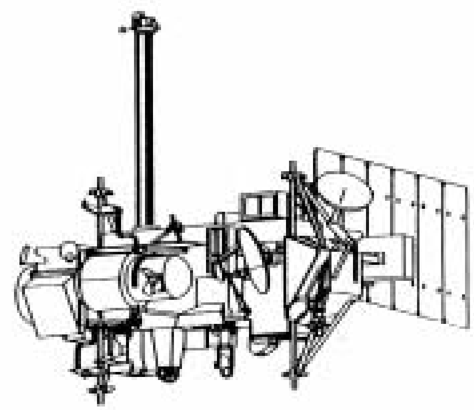




INSTRUMENT WT.:	**392 lb.**
AVERAGE POWER:	**149 WATTS.**
DATA RATE:	**1250 bps.**

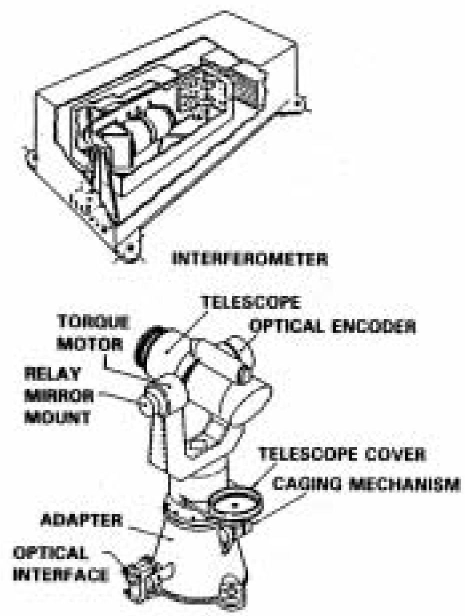
HALOGEN OCCULTATION EXPERIMENT (HALOE)

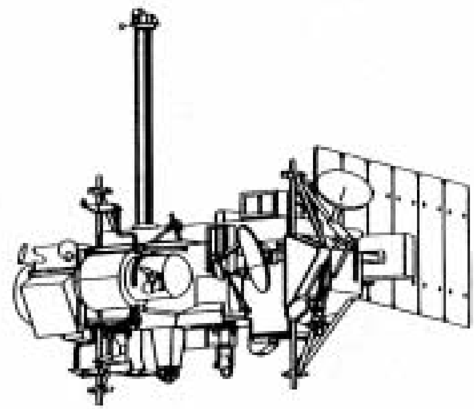




INSTRUMENT WT.:	204 lb.
AVERAGE POWER:	132 WATTS.
DATA RATE:	4000 bps.

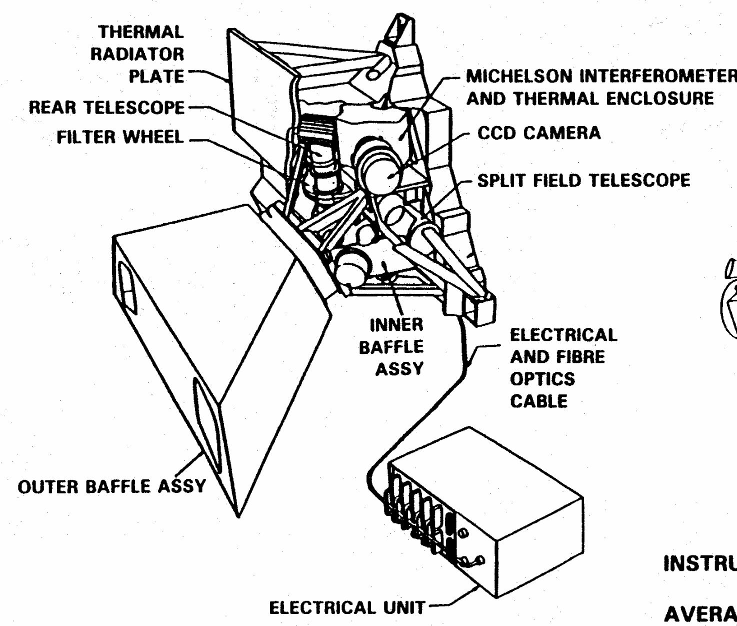
HIGH RESOLUTION DOPPLER IMAGER (HRDI)

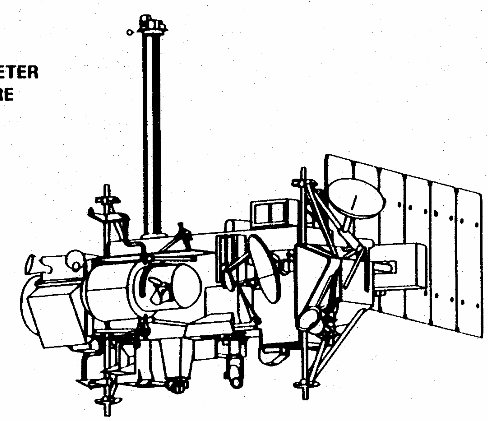




INSTRUMENT WT.:	348 lb.
AVERAGE POWER:	91 WATTS.
DATA RATE:	4750 bps.

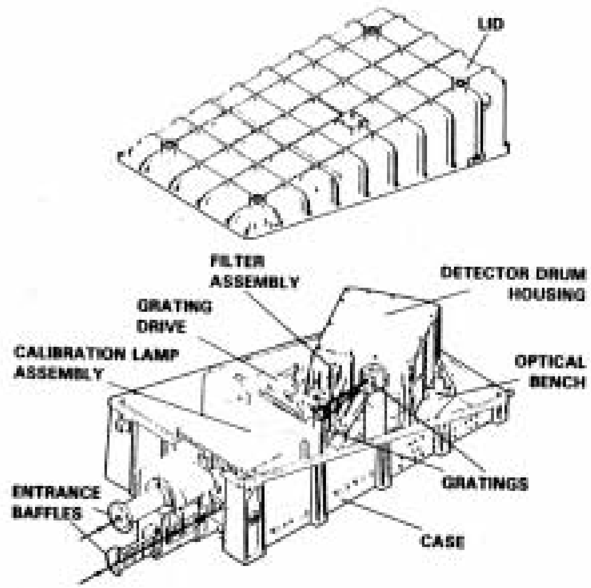
WIND IMAGING INTERFEROMETER (WINDII)

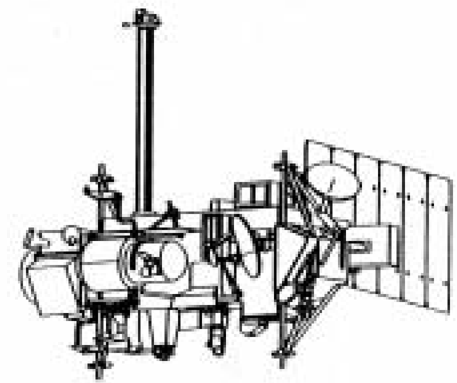




INSTRUMENT WT.:	269 lb.
AVERAGE POWER:	73 WATTS.
DATA RATE:	2000 bps.

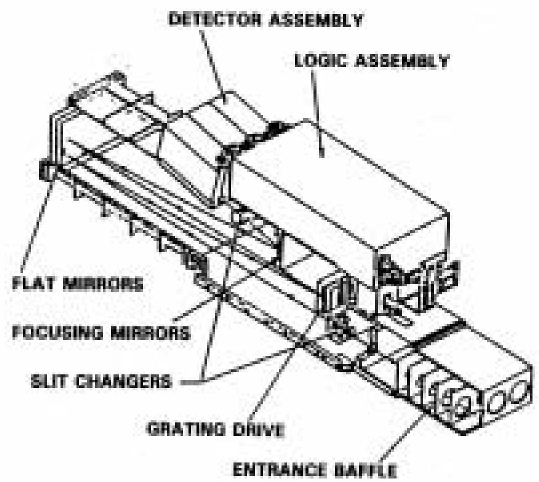
SOLAR ULTRAVIOLET SPECTRAL IRRADIANCE MONITOR (SUSIM)

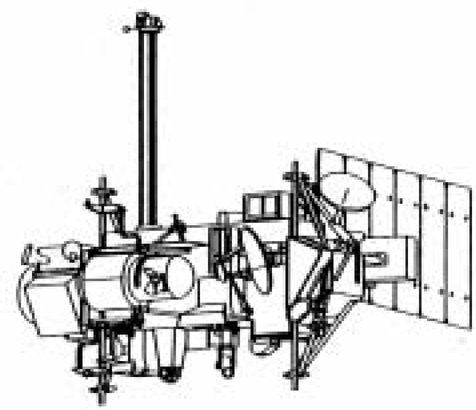




INSTRUMENT WT.:	241 lb.
AVERAGE POWER:	20 WATTS.
DATA RATE:	2 kbps.

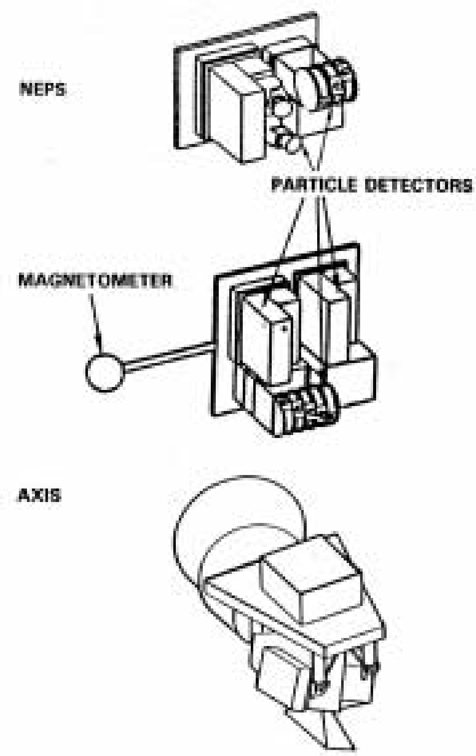
SOLAR STELLAR IRRADIANCE COMPARISON EXPERIMENT (SOLSTICE)





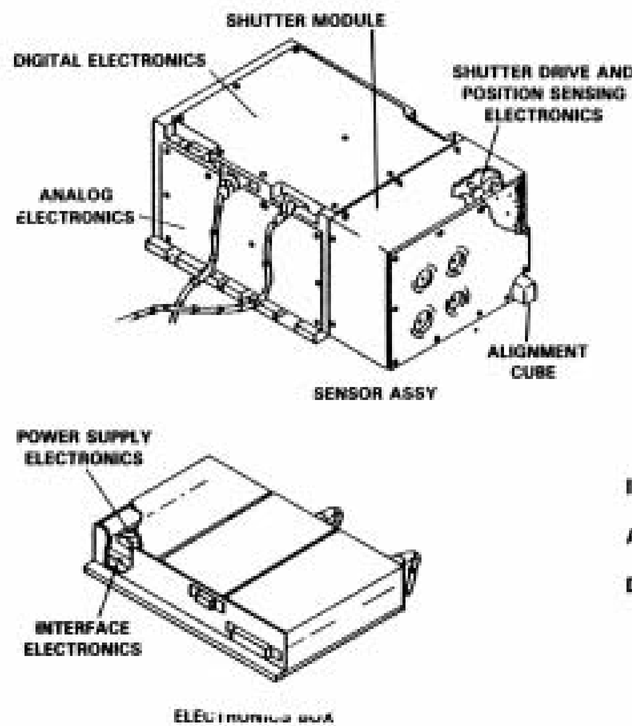
INSTRUMENT WT.:	42 lb.
AVERAGE POWER:	8 WATTS.
DATA RATE:	250 bps.

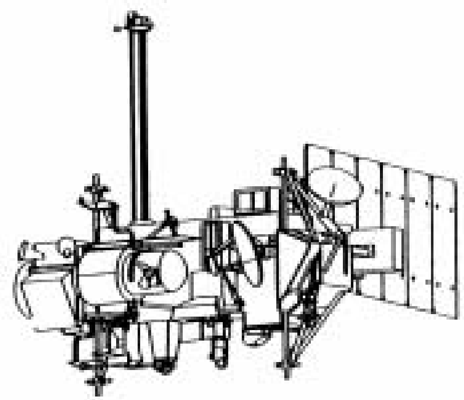
PARTICLE ENVIRONMENT MONITOR (PEM)



INSTRUMENT WT.:	200 lb.
AVERAGE POWER:	82 WATTS.
DATA RATE:	3.5 kbps.

ACTIVE CAVITY RADIOMETER IRRADIANCE MONITOR (ACRIM II)





INSTRUMENT WT.:	52 lb.
AVERAGE POWER:	7 WATTS.
DATA RATE:	500 bps.

PROTEIN CRYSTAL GROWTH (PCG)

In collaboration with a medical researcher at the University of Alabama at Birmingham, NASA is continuing a series of experiments in protein crystal growth that may prove a major benefit to medical technology.

These experiments could improve food production and lead to innovative new pharmaceutical agents to combat cancer, immune system disorders, rheumatoid arthritis, emphysema and many other diseases.

Background

In a protein crystal, individual protein molecules occupy locations in a repeating array. With a good crystal roughly the size of a grain of table salt, scientists are able to determine, using a technique known as X-ray diffraction, the structure of protein molecules.

Determining a protein crystal's molecular shape is an essential step in several phases of medical research. Once the three-dimensional structure of a protein is known, it may be possible to design drugs that will either block or enhance the protein's normal function within the body. Though crystallographic techniques can be used to determine a protein's structure, this powerful technique has been limited by problems encountered in obtaining high-quality crystals well ordered and large enough to yield precise structural information. Protein crystals grown on Earth are often small and flawed.

One hypothesis for the problems associated with growing these crystals can be understood by imagining the process of filling a sports stadium with fans who all have reserved seats. Once the gate opens, people flock to their seats and, in the confusion, often sit in someone else's place. On Earth, gravity-driven convection keeps the molecules crowded around the "seats" as they attempt to order themselves. Unfortunately, protein molecules are not as particular as many of the smaller molecules and are often content to take the wrong places in the structure.

As would happen if you let the fans into the stands slowly, microgravity allows the scientist to slow the rate at which molecules arrive at their seats. Since the molecules have more time to find their spot, fewer mistakes are made, creating better and larger crystals.

During STS-48, 60 different protein crystal growth experiments will be conducted simultaneously. Though there are four processes used to grow crystals on Earth -- vapor diffusion, batch process, liquid diffusion and dialysis -- only vapor diffusion will be used in this set of experiments.

Shortly after achieving orbit, either Mission Specialist Kenneth Reightler or Charles D. Gemar will combine each of the protein solutions with other solutions containing a precipitation agent to form small droplets on the ends of double-barreled syringes positioned in small chambers. Water vapor will diffuse from each droplet to a solution absorbed in a porous reservoir that lines each chamber. The loss of water by this vapor diffusion process will produce conditions that cause protein crystals to grow in the droplets.

Protein crystal growth experiments were first carried out by the investigating team during STS 51-D in April 1985. These experiments have flown a total of 10 times. The first four flights of hand-held protein crystal growth were primarily designed to develop space crystal growing techniques and hardware. The next four flights were scientific attempts to grow useful crystals by vapor diffusion in microgravity, and on the last two flights (STS-37 and STS-43), crystals of bovine insulin were grown using the batch method. The six most recent flight experiments have had temperature control. The results from these experiments show that microgravity-grown crystals have higher internal molecular order than their Earth-grown counterparts.

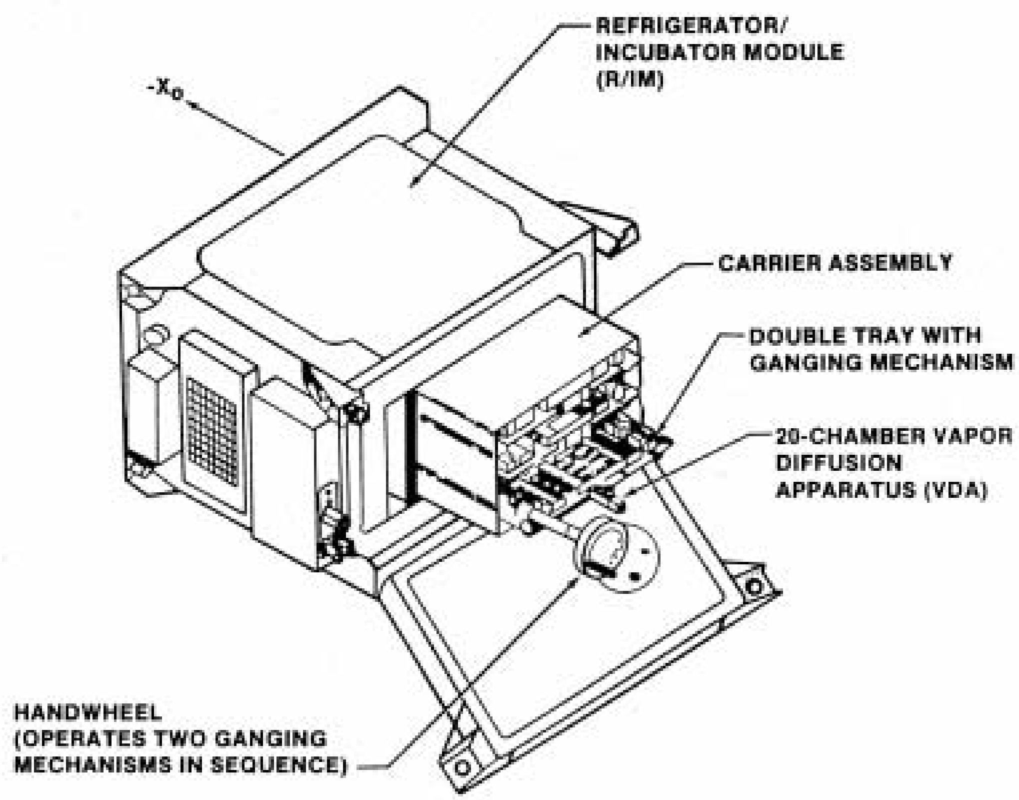
In the three 20-chambered, 15" x 10" x 1.5" trays of the STS-48 experiment, crystals will be grown at room temperature (22 degrees Celsius). After experiment activation and just before deactivation, the mission specialist will videotape with a camcorder the droplets in the chambers. Then all the droplets and any protein crystals grown will be drawn back into the syringes. The syringes will then be resealed for reentry. Upon landing, the hardware will be turned over to the investigating team for analysis.

The protein crystal growth experiments are sponsored by NASA's Office of Space Science and Applications Microgravity Science and Applications Division and the Office of Commercial Programs. The principal investigator is Dr. Charles Bugg of the University of Alabama at Birmingham. The Marshall Space Flight Center, Huntsville, AL, is managing the flight of the experiments. Blair Herren is the experiment manager and Richard E. Valentine is the mission manager for the PCG experiment at the center. Julia Goldberg is the integration engineer, and Dr. Daniel Carter is the project scientist for the PCG experiment at Marshall.

PROTEINS SELECTED TO FLY ON STS-48

Protein	Investigator
Fc fragment of mouse immunoglobin A	Dr. George Birnbaum
Fab YST9-1	Dr. George Birnbaum
Anti-HPr Fab fragment	Dr. Louis Delbaere
2 domain CD4 (1-183)	Dr. Howard Einspahr
Beta-Lactamase (Entero-c-P99)	Dr. James Knox
Canavalin Satellite	Dr. Alex McPherson
Satellite Tobacco Mosaic Virus	Dr. Alex McPherson
Interleukin-4	Dr. T. L. Nagabhushan
Bovine Proline Isomerase	Dr. Manuel Navia
Thermolysin	Dr. Manuel Navia
Recombinant Bacterial Luciferase	Dr. Keith Ward
Apostreptavidin	Dr. Pat Weber

PCG BLOCK I CONFIGURATION



MIDDECK 0-GRAVITY DYNAMICS EXPERIMENT

Discovery's STS-48 mission carries one of the more complex experiments ever to be tested in the orbiter's middeck cabin area. MODE -- for Middeck 0-gravity Dynamics Experiment -- will study mechanical and fluid behavior of components for Space Station Freedom and other future spacecraft.

MODE, developed by Massachusetts Institute of Technology, is the first university experiment to fly in the NASA Office of Aeronautics, Exploration and Technology's In-Space Technology Experiment and Technology program. IN-STEP, an outreach effort that began in 1987, allows universities, industry and the government to develop small, inexpensive technology flight experiments.

Testing space structures in the normal 1g environment of Earth poses problems because gravity significantly influences their dynamic response. Also, the suspension systems needed for tests in 1g further complicate the gravity effects. Models of space structures intended for use in microgravity can be tested more realistically in the weightlessness of space.

The MODE experiment consists of special electronically-instrumented hardware that Discovery's astronauts will test in the craft's pressurized middeck section. MODE will study the sloshing of fluids in partially-filled containers and the vibration characteristics of jointed truss structures.

MODE occupies 3 1/2 standard Shuttle middeck lockers. One locker contains an experiment support module that controls the experiment. The module contains a special purpose computer, high speed input/output data and control lines to the test articles, a power conditioning system, signal generator, signal conditioning amplifiers and a high capacity optical disk data recording system.

The other middeck lockers accommodate fluid test articles (FTA), a partially-assembled structural test article (STA), optical data storage disks and a shaker that mounts to the experiment support module. The FTAs and shaker attach to the support module for testing. The STA floats free in the weightlessness of the middeck, but connects to the support module with an umbilical through which excitation and sensor signals travel.

In orbit, the astronauts command the computer via a keypad to execute test routines stored on the optical recorder before launch. Once a test routine begins, the computer and associated control circuits energize the containers or the truss with precisely controlled forces and then measure the response. The Shuttle crew members use an alpha-numeric display to monitor the status and progress of each test.

The four fluid test articles are Lexan cylinders -- two containing silicon oil and two containing water. Silicon oil has dynamic properties that approximate those of typical spacecraft fluid propellants. Water is more likely than the silicon oil to stay together at one end of the cylinder, an important test condition. The same basic dynamic information will be obtained for both fluids.

The cylinders mount one at a time to a force balance that connects to a shaker on the support module. The balance will measure the forces arising from the motion of the fluid inside the tanks. These forces, with other data such as test article accelerations and the ambient acceleration levels of the entire assembly, will be recorded in digital form on an optical disk.

The structural test article is a truss model of part of a large space structure. It includes 4 strain gauges and 11 accelerometers and is vibrated by an actuator. When deployed in the Shuttle orbiter's middeck, the test device is about 72 inches long with an 8-inch square cross section.

There are two types of trusses, deployable and erectable. The deployable structures are stored folded and are unhinged and snapped into place for the tests. The erectable structure is a collection of individual truss elements that screw into round joints or "nodes."

Four different truss configurations are slated for testing. First, the basic truss will be evaluated. It is an in-line combination of truss sections, with an erectable module flanked by deployable modules mounted on either end. Next, a rotary joint, similar to the Space Station Freedom "alpha joint" that will govern the orientation of the station's solar arrays, will replace the erectable section.

The third configuration will be L-shaped combination of a deployable truss, rotary joint and erectable module (all mounted in-line) and another deployable section mounted at a 90-degree angle to the end of the erectable truss. The final arrangement will mount a flexible appendage simulating a solar panel or a solar dynamic module to the elbow of the L-shaped third configuration.

Both test articles will be tested using vibrations over a specified frequency range. On-orbit experiment operations with both devices will include assembly, calibration, performance of test routines and stowage.

MODE requires two 8-hour test periods in orbit. Researchers expect to obtain more than 4 million bits of digital data, about 4 hours of video tape and more than 100 photographs. The space-based data will be analyzed and detailed comparisons made with pre-and post-flight measurements done on the flight hardware using laboratory suspension systems. The results also will refine numerical models used to predict the dynamic behavior of the test articles.

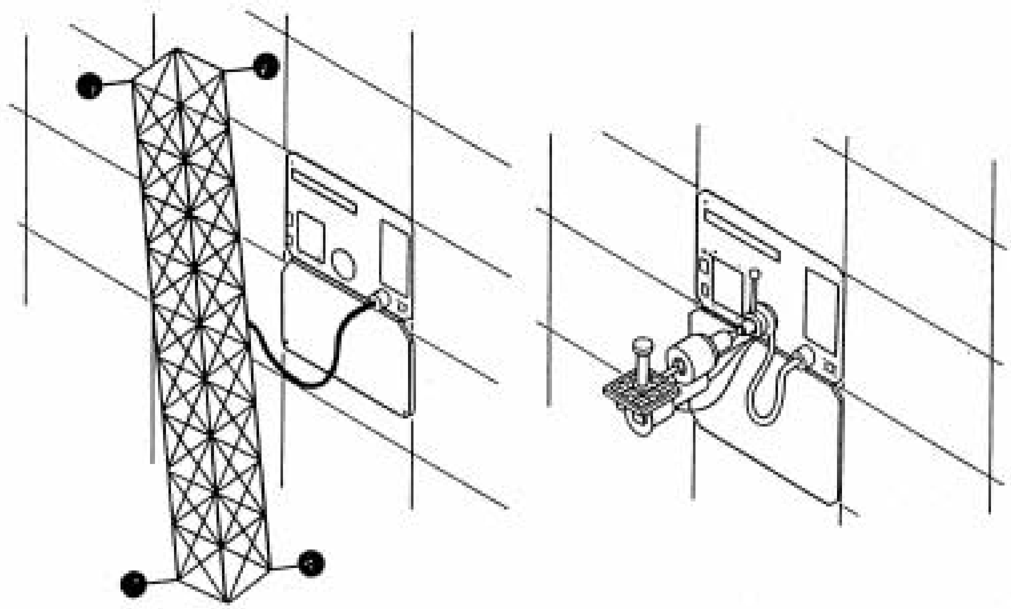
This low-cost experiment will provide better understanding of the capabilities and limitations of ground-based suspension systems used to measure the dynamic response of complex structures. It should lead to more sophisticated computer models that more accurately predict the performance of future large space structures and the impact of moving liquids in future spacecraft.

In response to the 1987 IN-STEP program solicitation, the Massachusetts Institute of Technology (MIT) Space Engineering Research Center developed MODE and received a NASA contract in 1987. MIT selected Payload Systems Inc., Cambridge, Mass., as the prime subcontractor responsible for hardware fabrication, certification and mission support. McDonnell Douglas Space Systems Co., Huntington Beach, Calif., joined the program in 1989 using its own funds to support design and construction of part of the structural test article.

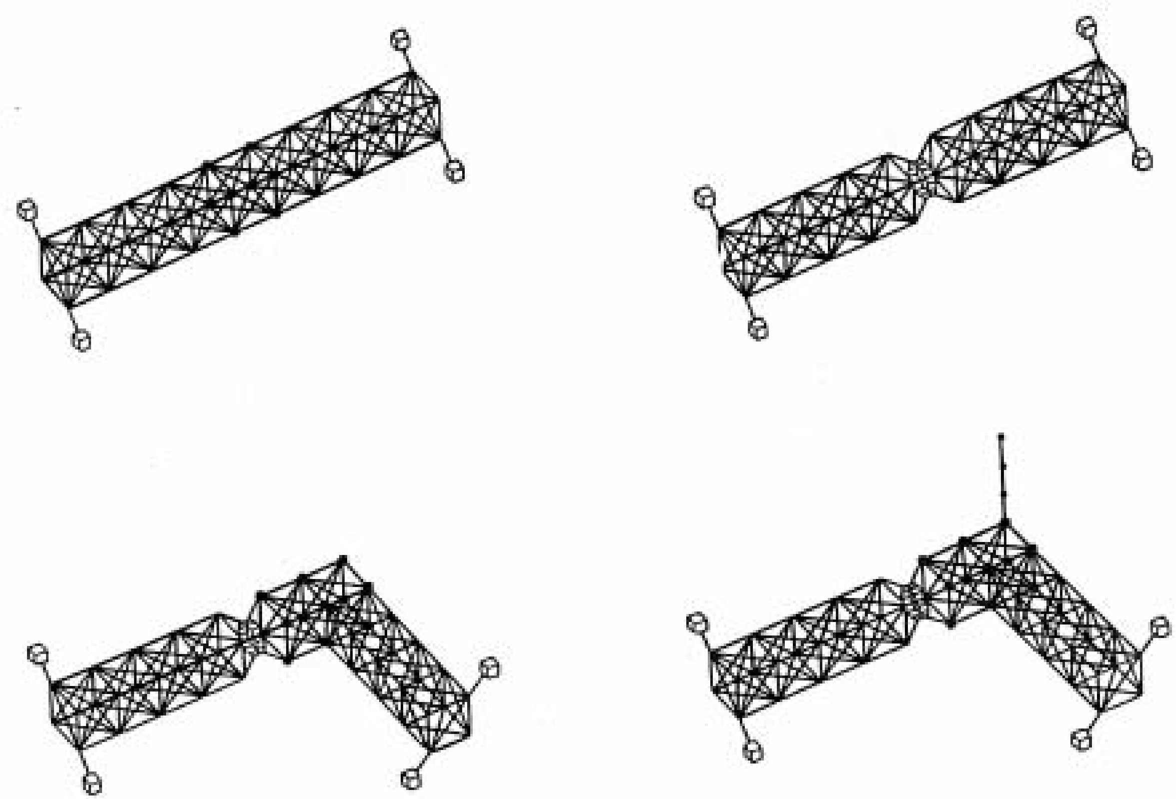
NASA's Langley Research Center, Hampton, VA, manages the contract. With NASA Headquarters, Langley also provides technical and administrative assistance to integrate the payload into Discovery for STS-48.

Sherwin M. Beck is the NASA MODE Project Manager at Langley. MIT Professor Edward F. Crawley is the experiment's Principal Investigator. Edward Bokhour is Hardware Development Manager at Payload Systems, Inc., and Dr. Andrew S. Bicos is the Project Scientist at McDonnell Douglas Space Systems Company.

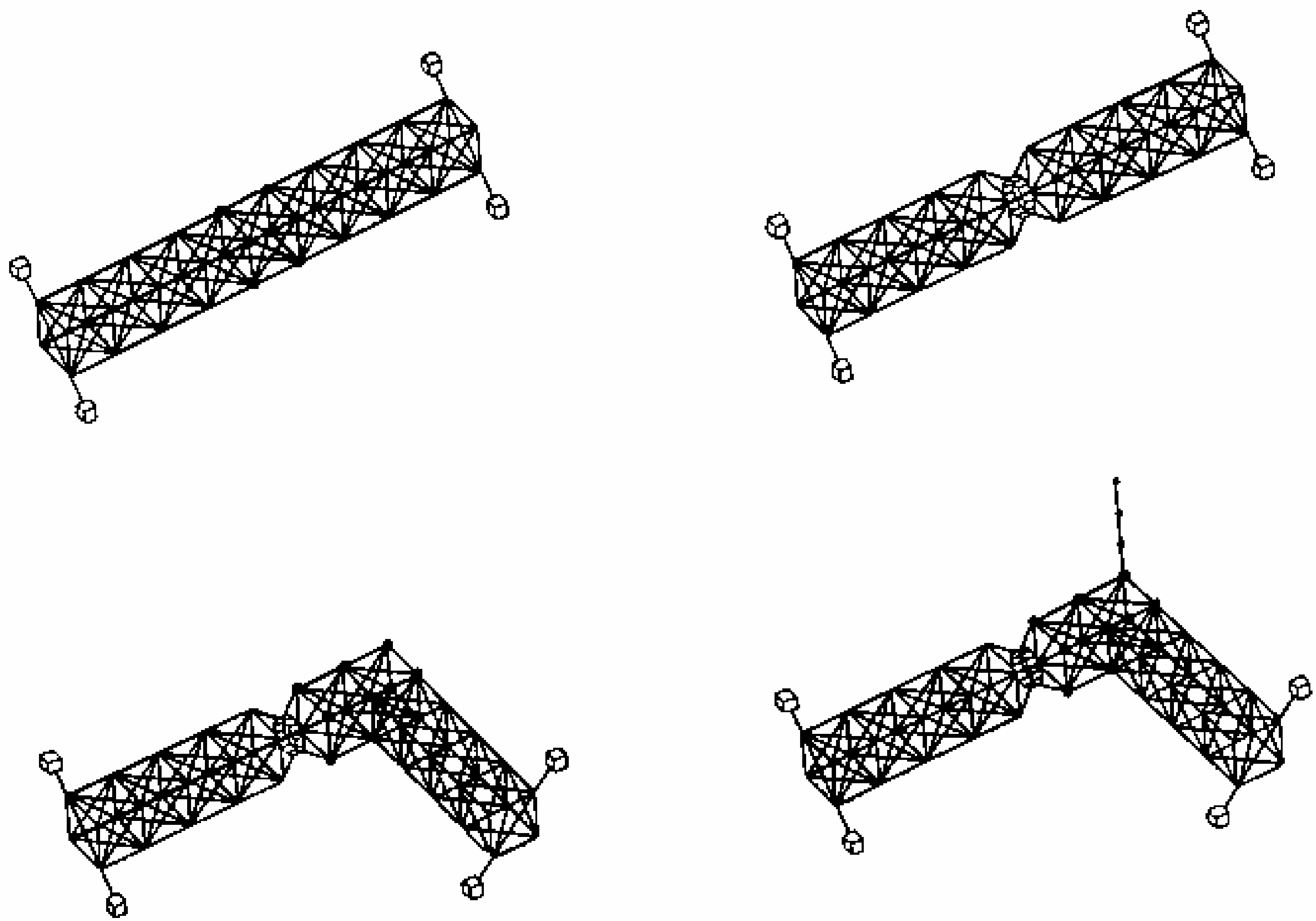
MODE PAYLOAD CONFIGURATION



MODE STRUCTURAL TEST ARTICLE CONFIGURATIONS



MODE STRUCTURAL TEST ARTICLE CONFIGURATIONS



COSMIC RADIATION EFFECTS AND ACTIVATION MONITOR

The Cosmic Radiation Effects and Activation Monitor (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 that will be used to gather data for the Shuttle Activation Monitor experiment in an attempt to correlate data between the two.

The active monitor will be used 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 payload/experiment. CREAM is sponsored by the Department of Defense.

RADIATION MONITORING EQUIPMENT-III

The Radiation Monitoring Equipment-III measures ionizing radiation exposure to the crew within the orbiter cabin. RME-III measures gamma ray, electron, neutron and proton radiation and calculates, in real time, exposure in RADS-tissue equivalent. The information is stored in memory modules for post-flight analysis.

The hand-held instrument will be stored in a middeck locker during flight except for activation and memory module replacement every 2 days. RME-III will be activated by the crew as soon as possible after reaching orbit and operated throughout the mission. A crew member will enter the correct mission elapsed time upon activation.

RME-III is the current configuration, replacing the earlier RME-I and RME-II units. RME-III last flew on STS-31. The experiment has four zinc-air batteries and five AA batteries in each replaceable memory module. RME-III is sponsored by the Department of Defense in cooperation with NASA.

AIR FORCE MAUI OPTICAL SYSTEM

The Air Force Maui Optical System (AMOS) is an electrical-optical facility located on the Hawaiian island of Maui. The facility tracks the orbiter as it flies over the area and records signatures from thruster firings, water dumps or the phenomena of shuttle glow, a well-documented glowing effect around the Shuttle caused by the interaction of atomic oxygen with the spacecraft. The information obtained is used to calibrate the infrared and optical sensors at the facility. No hardware onboard the Shuttle is needed for the system.

SHUTTLE ACTIVATION MONITOR

The Shuttle Activation Monitor (SAM) is designed to measure gamma ray data within the orbiter as a function of time and location. Located in the middeck, the crew will install a foil packet at four locations onboard. A tape recorder and two detector assemblies will record the information. Each activation of the experiment will last about 12 hours and will record information from a different location of the cabin. SAM is sponsored by the Air Force Space Systems Division, Los Angeles, Calif.

INVESTIGATIONS INTO POLYMER MEMBRANE PROCESSING

The Investigations into Polymer Membrane Processing (IPMP), a middeck payload, will make its fourth Space Shuttle flight for the Columbus, Ohio-based Battelle Advanced Materials Center, a NASA Center for the Commercial Development of Space (CCDS), sponsored in part by the Office of Commercial Programs.

The objective of the IPMP is to investigate the physical and chemical processes that occur during the formation of polymer membranes in microgravity such that the improved knowledge base can be applied to commercial membrane processing techniques. Supporting the overall program objective, the STS-48 mission will provide additional data on the polymer precipitation process.

Polymer membranes have been used by industry in separation processes for many years. Typical applications include enriching the oxygen content of air, desalination of water and kidney dialysis.

Polymer membranes frequently are made using a two-step process. A sample mixture of polymer and solvents is applied to a casting surface. The first step involves the evaporation of solvents from the mixture. In the second step, the remaining sample is immersed in a fluid (typically water) bath to precipitate the membrane from the solution and complete the process.

On the STS-48 mission, Commander John Creighton will operate the IPMP experiment. He will begin by removing the units from their stowage location in a middeck locker. By turning the unit's valve to the first stop, the evaporation process is initiated. After a specified period consisting of several minutes, a quench procedure will be initiated. The quench consists of introducing a humid atmosphere which will allow the polymer membrane to precipitate out. Ground-based research indicates that the precipitation process should be complete after approximately 10 minutes, and the entire procedure is at that point effectively quenched. The two units remain stowed in the locker for the flight's duration.

Following the flight, the samples will be retrieved and returned to Battelle for testing. Portions of the samples will be sent to the CCDS's industry partners for quantitative evaluation consisting of comparisons of the membranes' permeability and selectivity characteristics with those of laboratory-produced membranes.

Lisa A. McCauley, Associate Director of the Battelle CCDS, is program manager for IPMP. Dr. Vince McGinness of Battelle is principal investigator.

ELECTRONIC STILL PHOTOGRAPHY TEST

Electronic still photography is a new technology that enables a camera to electronically capture and digitize an image with resolution approaching film quality. The digital image is stored on removable hard disks or small optical disks, and can be converted to a format suitable for downlink transmission or enhanced using image processing software. The ability to enhance and annotate high-resolution images on orbit and downlink them in real-time is expected to greatly improve photo-documentation capabilities in Earth observations and on-board activity on the Space Shuttle as well as future long-duration flights such as Space Station Freedom or a human mission to Mars.

During the STS-48 mission, NASA will evaluate the on-orbit and downlinking performance and capabilities of the Electronic Still Camera (ESC), a handheld, self-contained digital camera developed by the Man-Systems Division at Johnson Space Center. The ESC is the first model in a planned evolutionary development leading to a family of high-resolution digital imaging devices.

Additionally, through a Technical Exchange Agreement with NASA's Office of Commercial Programs, Autometric, Inc., Alexandria, VA, will assess the utility of the camera for commercial applications in close range photogrammetry, terrestrial monitoring and near real-time capabilities.

The basic photographic platform is a Nikon F4 35 mm film camera converted to a digital image storing device by placement of a 1 million picture element (pixel) charge coupled device (CCD) at the film plane. The battery-operated ESC retains all the available features of the F4 and will accept any lens or optics with a Nikon mount. Lenses used on STS-48 will include 20 mm AF Nikkor, 35-70 mm zoom AF Nikkor, 50 mm f/1.2 AF Nikkor and 180 mm AF Nikkor.

Images obtained during the STS-48 mission will be monochrome with 8 bits of digital information per pixel (256 gray levels) and stored on a removable computer hard disk. The images may be viewed and enhanced on board using a modified lap-top computer before being transmitted to the ground via the orbiter digital downlinks.

During STS-48, the ESC will be used to image areas of interest to commercial remote sensing users. Scenes of Earth, such as major cities and geological formations will be used to compare the ESC to other Earth-looking sensors. Images of Shuttle crew member tasks in the middeck and payload bay will be taken to test the camera's use for documentation and support to missions. Attempts will be made to collect stereo pairs at close and far ranges to test the camera's photogrammetric capabilities.

In addition to imagery collection by the Shuttle crew, three ground-based tasks will be employed to demonstrate the advantages of a digital system. The first will provide hard-copy prints of the downlinked images during the mission. Upon receipt at the Mission Control Center, the images will be processed on a workstation and stored on disks for transfer to JSC's Electronic Still Camera Laboratory.

There, the images will be processed by Autometric and printed with the 3M Color Laser Imager, an advanced 300 dpi color output device capable of printing over 170 photographic quality originals an hour. The goal is to have hard-copy images within 1 hour after the image is received in Mission Control.

The second demonstration will be performed in conjunction with the Virginia Institute of Marine Sciences (VIMS). To provide additional imagery to compare with the ESC data, VIMS will conduct a simultaneous collection of imagery with an airborne sensor of the Colonial National Historic Park and the Middle Peninsula of Virginia.

The third task will test the ability to respond to ad hoc imaging requirements which could provide critical support to management of natural disasters and other crises. After the mission commences, an area of interest will be named, it's location precisely defined and collection times identified. The imagery then will be downlinked to and printed at JSC.

H. Don Yeates, Man-Systems Division, Johnson Space Center, is program manager for the Electronic Still Camera. Jennifer Visick is the program manager for Autometric, Inc.

PHYSIOLOGICAL AND ANATOMICAL RODENT EXPERIMENT

The Physiological and Anatomical Rodent Experiment (PARE-01) is the first in a series of planned experiments that focuses on physiological and developmental adaptation to microgravity.

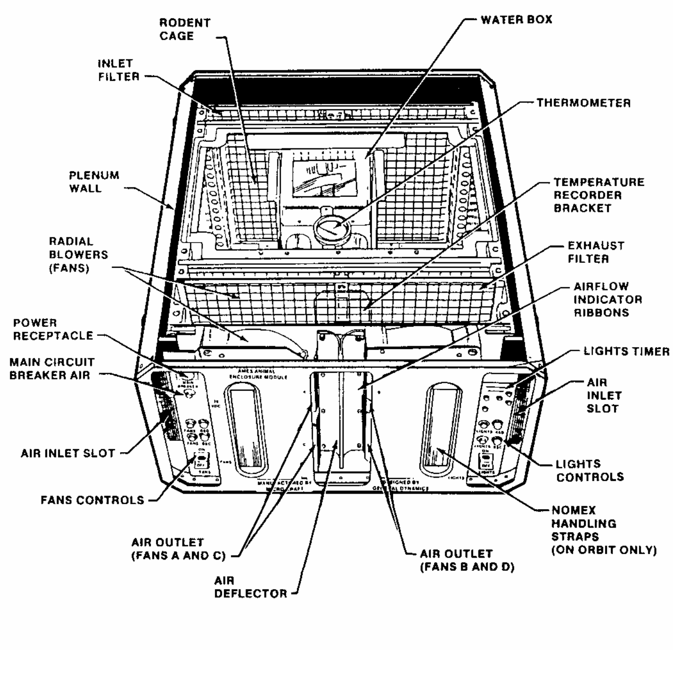
The PARE-01 experiment will examine changes caused by exposure to microgravity in anti-gravity muscles (those used for movement) and in tissues not involved in movement. Previous experience has indicated that muscle atrophy resulting from exposure to the weightlessness of space is a serious consideration, particularly for missions of extended duration. This and similar research may ultimately lead to a better understanding of muscle wasting, which could lead to development of treatments for muscle atrophy in patients confined to bed for long periods of time, as well as for astronauts.

Through previous ground-based research, the principal investigator has identified glucose transport as one important factor in muscle atrophy and the breakdown of muscle proteins. The objectives of this flight experiment are to determine whether microgravity affects insulin control of glucose transport in an anti-gravity muscle (the soleus); to confirm that in microgravity, non-load-bearing tissues (the heart, liver and adipose tissue) store additional amounts of glycogen as a result of altered regulation of glucose metabolism; and to provide the first data regarding changes in muscle mass and protein content in developing mammals exposed to microgravity.

In this experiment, eight young, healthy rats will fly on the Space Shuttle. After flight, full ground studies housing an identical group of animals under identical conditions (except for the presence of gravity) will be conducted. Both groups will be housed in self-contained animal enclosure modules that provide food, water and environmental control throughout the flight. The experiment's design and intent have received the review and approval of the animal care and use committees at both NASA and the University of Arizona. Laboratory animal veterinarians will oversee the selection, care and handling of the rats.

Following the flight, the rat tissues will be thoroughly evaluated by Dr. Marc Tischler of the College of Medicine, University of Arizona, Tucson, the principal investigator. Payload and mission integration support is provided by NASA's Ames Research Center, Mountain View, Calif.

PARE PAYLOAD CONFIGURATION



STS-48 CREWMEMBERS

STS048-S-002 -- These five astronauts, wearing launch and entry suits (LESs), have been assigned to NASA's STS-48 mission aboard Discovery, Orbiter Vehicle (OV) 103. Seated left to right are mission specialist Mark N. Brown, mission commander John O. Creighton, and pilot Kenneth S. Reightler Jr. Standing behind them are mission specialists Charles D. Gemar (left) and James F. Buchli. The United States flag and the mission insignia are displayed in the background. Portrait was made by NASA JSC contract photographer Jack Jacob.

BIOGRAPHICAL DATA

JOHN O. CREIGHTON, 48, Capt., USN, will serve as Commander of STS-48 and will be making his third space flight. Creighton, from Seattle, Wash., was selected as an astronaut in January 1978.

Creighton graduated from Ballard High School in Seattle in 1961; received a bachelor of science from the United States Naval Academy in 1966 and a masters of science in administration of science and technology from George Washington University in 1978.

Creighton received his wings in October 1967. From July 1968 to May 1970, he flew F-4Js and made two combat deployments to Vietnam aboard the USS Ranger. In June 1970, he attended the Naval Test Pilot School. After graduation, he served as the F-14 engine development project officer with the Service Test Division at the Naval Air Station in Patuxent River, MD. He later became a member of the first F-14 operational squadron. At the time of his selection by NASA, he was assigned as an operations officer and an F-14 program manager in the Naval Air Test Center's Strike Directorate.

Creighton first flew as pilot aboard Shuttle mission STS-51G in June 1985, a mission that deployed communications satellites for Mexico, the Arab League, and the U.S. Creighton next flew as Commander of STS-36, a March 1990 Department of Defense-dedicated Shuttle flight. He has logged 276 hours in space.

KENNETH S. REIGHTLER Jr., 40, Cmdr., USN, will serve as pilot. Selected as an astronaut in June 1987, Reightler considers Virginia Beach, VA, his hometown and will be making his first space flight.

He graduated from Bayside High School in Virginia Beach in 1969; received a bachelor of science in aerospace engineering from the Naval Academy in 1973; and received a masters of science in aeronautical engineering from the Naval Postgraduate School and a masters in systems management from the University of Southern California in 1984.

Reightler was designated a naval aviator at Corpus Christi, Texas., in 1973, and then served as Mission Commander and Patrol Plane Commander to Patrol Squadron 16 in Jacksonville, FL. Reightler graduated from the Naval Test Pilot School in 1978, and he served as a senior airborne systems instructor pilot and later as a chief flight instructor there until his selection by NASA.

CHARLES D. (SAM) GEMAR, 36, Major, USA, will be Mission Specialist 1. Selected as an astronaut in June 1985, Gemar will be making his second space flight and considers Scotland, S. D., his hometown.

Gemar graduated from Scotland Public High School in 1973 and received a bachelor of science in engineering from the U.S. Military Academy in 1979.

Gemar was assigned to the 18th Airborne Corps at Ft. Bragg, N. C., in November 1973. After attending the Military Academy, he studied entry rotary wing aviation and fixed-wing, multi-engine aviation. Until his selection by NASA, he was assigned with the 24th Infantry Division, where he served as Wright Army Airfield Commander, among other duties.

Gemar served as a mission specialist on STS-38, a Department of Defense-dedicated flight in November 1990. Gemar has logged 117 hours in space.

BIOGRAPHICAL DATA

JAMES F. BUCHLI, 46, Col., USMC, will be Mission Specialist 2. Selected as an astronaut in August 1979, Buchli considers New Rockford, ND, his hometown and will be making his fourth space flight.

Buchli graduated from Fargo Central High School, Fargo, ND, in 1963; received a bachelor of science in aeronautical engineering from the Naval Academy in 1967; and received a masters of science in aeronautical engineering systems from the University of West Florida in 1975.

Buchli served as Platoon Commander of the 9th Marine Regiment and later as a Company Commander and Executive Officer of "B" Company, 3rd Reconnaissance Battalion, in Vietnam. In 1969, he went through naval flight officer training at Pensacola, FL. After graduation, he was assigned to various fighter attack squadrons in Hawaii, Japan and South Carolina.

Buchli first flew as a mission specialist on STS-51C, the first Department of Defense-dedicated Shuttle mission in January 1985. He next flew on STS-61A, a German Spacelab flight, as a mission specialist in November 1985. His third flight was mission STS-29 in March 1989, a flight that deployed the third Tracking and Data Relay Satellite. Buchli has logged 362 hours in space.

MARK N. BROWN, 40, Col., USAF, will be Mission Specialist 3. Selected as an astronaut in May 1984, Brown considers Valparaiso, Ind., his hometown and will be making his second space flight.

Brown graduated from Valparaiso High School in 1969; received a bachelor of science in aeronautical and astronautical engineering from Purdue University in 1973; and received a masters of science in astronautical engineering from the Air Force Institute of Technology in 1980.

Brown received his pilot wings at Laughlin Air Force Base, Texas, in 1974, and was assigned to the 87th Fighter Interceptor Squadron at K. I. Sawyer Air Force Base, Mich. In 1979, Brown was transferred to the Air Force Institute of Technology at Wright-Patterson Air Force Base, Ohio. Brown was employed by NASA's Johnson Space Center at the time of his selection as an astronaut, with duties that included a Flight Activities Officer in Mission Control and development of many contingency procedures for the Shuttle.

Brown first flew on STS-28, a Department of Defense-dedicated flight in August 1989. He has logged a total of 121 hours in space.

STS-48 MISSION MANAGEMENT

NASA HEADQUARTERS, WASHINGTON, DC

Richard H. Truly	NASA Administrator
J. R. Thompson	Deputy Administrator

Office of Space Flight

Dr. William Lenoir	Associate Administrator, Office of Space Flight
Robert L. Crippen	Director, Space Shuttle
Leonard S. Nicholson	Deputy Director, Space Shuttle (Program)
Brewster H. Shaw	Deputy Director, Space Shuttle (Operations)

Office of Space Science

Dr. L. A. Fisk	Associate Administrator, Space Science and Applications
Alphonso V. Diaz	Deputy Associate Administrator, Space Science and Applications
Dr. Shelby G. Tilford	Director, Earth Science and Applications Division
Michael R. Luther	Program Manager
Dr. Robert J. McNeal	Program Scientist

Office of Aeronautics Exploration and Technology

Arnold D. Aldrich	Associate Administrator for Aeronautics, Exploration and Technology
Gregory S. Reck	Director for Space Technology
Jack Levine	Director, Flight Projects Division
Jon S. Pyle	Manager, IN-STEP
Lelia Vann	MODE Program Manager

Office of Commercial Programs

James T. Rose	Assistant Administrator for Commercial Programs
J. Michael Smith	Deputy Assistant Administrator for Commercial Programs (Program Development)
Richard H. Ott	Director, Commercial Development Division
Garland C. Misener	Chief, Flight Requirements and Accommodations
Ana M. Villamil	Program Manager, Centers for the Commercial Development of Space
John L. Emond	Agreements Coordinator

Office of Safety and Mission Quality

George A. Rodney	Associate Administrator for Safety and Mission Quality
James H. Ehl	Deputy Associate Administrator for Safety and Mission Quality
Richard U. Perry	Director, Programs Assurance Division

GODDARD SPACE FLIGHT CENTER, GREENBELT, MD

Dr. John M. Klineberg	Director
Charles E. Trevathan	Project Manager
Dr. Carl A. Reber	Project Scientist
John L. Donley	Deputy Project Manager
Richard F. Baker	Deputy Project Manager/Resources
John Pandelides	Ground and Mission Systems Manager

KENNEDY SPACE CENTER, FL

Forrest S. McCartney	Director
Jay Honeycutt	Director, Shuttle Management and Operations
Robert B. Sieck	Launch Director
John T. Conway	Director, Payload Management and Operations
Joanne H. Morgan	Director, Payload Project Management
Roelof Schuiling	STS-48 Payload Manager

MARSHALL SPACE FLIGHT CENTER, HUNTSVILLE, AL

Thomas J. Lee	Director
Dr. J. Wayne Littles	Deputy Director
G. Porter Bridwell	Manager, Shuttle Projects Office
Dr. George F. McDonough	Director, Science and Engineering
Alexander A. McCool	Director, Safety and Mission Assurance
Victor Keith Henson	Manager, Solid Rocket Motor Project
Cary H. Rutland	Manager, Solid Rocket Booster Project
Jerry W. Smelser	Manager, Space Shuttle Main Engine Project
Gerald C. Ladner	Manager, External Tank Project

JOHNSON SPACE CENTER, HOUSTON, TX

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Paul J. Weitz	Deputy Director
Daniel Germany	Manager, Orbiter and GFE Projects
Donald Puddy	Director, Flight Crew Operations
Eugene F. Kranz	Director, Mission Operations
Henry O. Pohl	Director, Engineering
Charles S. Harlan	Director, Safety, Reliability and Quality Assurance
Robert Stuckey	MODE Payload Integration Manager

STENNIS SPACE CENTER, BAY ST. LOUIS, MS

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Gerald W. Smith	Deputy Director
J. Harry Guin	Director, Propulsion Test Operations

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

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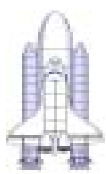
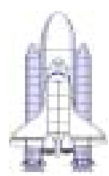
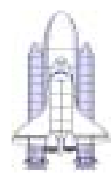
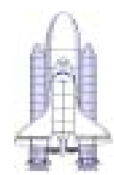
Victor L. Peterson	Deputy Director
Dr. Steven A. Hawley	Associate Director
Dr. Joseph C. Sharp	Director, Space Research

LANGLEY RESEARCH CENTER, HAMPTON, VA

Richard H. Petersen	Director
W. Ray Hook	Director for Space
Joseph B. Talbot	Manager, Space Station Freedom Office
Lenwood G. Clark	Manager, Experiments Office
Robert W. Buchan	NASA MODE Experiment Manager
Sherwin M. Beck	NASA MODE Project Manager

SHUTTLE FLIGHTS AS OF SEPTEMBER 1991

42 TOTAL FLIGHTS OF THE SHUTTLE SYSTEM -- 17 SINCE RETURN TO FLIGHT

		STS-39 04/28/91 - 05/06/91	
STS-40 06/05/91 - 06/14/91		STS-41 10/06/90 - 10/10/90	
STS-35 12/02/90 - 12/10/90	STS-51L 01/28/86	STS-31 04/24/90 - 04/29/90	
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-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
OV-102 **Columbia** **(11 flights)**	**OV-099** **Challenger** **(10 flights)**	**OV-103** **Discovery** **(12 flights)**	**OV-104** **Atlantis** **(9 flights)**