NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

SPACE SHUTTLE MISSION STS-85

PRESS KIT
AUGUST 1997

CRYOGENIC INFRARED SPECTROMETERS AND TELESCOPES FOR THE ATMOSPHERE-SHUTTLE PALLET SATELLITE-2 (CRISTA-SPAS-2)

STS-85 INSIGNIA

STS085-S-001 -- The mission patch for STS-85 is designed to reflect the broad range of science and engineering payloads on the flight. The primary objectives of the mission are to measure chemical constituents in earth's atmosphere with a free-flying satellite and to flight-test a new Japanese robotic arm designed for use on the International Space Station (ISS). STS-85 is the second flight of the satellite known as CRISTA-SPAS-02. CRISTA, depicted on the right side of the patch pointing its trio of infrared telescopes at Earth's atmosphere, stands for Cryogenic Infrared Spectrometers and Telescopes for the Atmosphere. The high inclination orbit is shown in a yellow band over earth's northern latitudes. In the space shuttle Discovery's open payload bay an enlarged version of the Japanese National Space Development Agency's (NASDA) Manipulator Flight Demonstration (MFD) robotic arm is shown. Also shown in the payload bay are the two sets of multi-science experiments: the International Extreme Ultraviolet Hitchhiker (IEH-02) nearest the tail and the Technology Applications and Science (TAS-01) payload. Jupiter and three stars are shown to represent sources of ultraviolet energy in the universe. Comet Hale-Bopp, which will be visible from earth during the mission, is depicted at upper right. The left side of the insignia symbolizes daytime operations over the Northern Hemisphere of Earth and the solar science objectives of several of the payloads.

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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EARTH OBSERVATIONS AND FUTURE SPACE STATION TECHNOLOGY HIGHLIGHT FLIGHT OF SHUTTLE DISCOVERY ON MISSION STS-85

The deployment and retrieval of a satellite designed to study Earth's middle atmosphere along with a test of potential International Space Station hardware will highlight NASA's sixth Shuttle mission of 1997 with the launch of Shuttle Discovery on Mission STS-85.

The prime payload for the flight, the Cryogenic Infrared Spectrometers and Telescopes for the Atmosphere-Shuttle Pallet Satellite-2 (CRISTA-SPAS-2) is making its second flight on the Space Shuttle and is the fourth mission in a cooperative venture between the German Space Agency (DARA) and NASA.

Following its deployment from Discovery using the Shuttle's mechanical arm, the CRISTA-SPAS system will free-fly for over 200 hours and will use three telescopes and four spectrometers to measure infrared radiation emitted by the Earth's middle atmosphere. Data gathered will help investigators from 15 countries to understand how small-scale tracer "filaments" in the stratosphere contribute to transport of ozone and chemical compounds that affect the distribution of ozone.

The STS-85 crew also will support tests of the Manipulator Flight Demonstration (MFD) investigation being sponsored by NASDA, the Japanese Space Agency. MFD consists of three separate experiments located on a support truss in the payload bay and is designed to demonstrate applications of a mechanical arm for possible use on the Japanese Experiment Module of the future International Space Station.

The STS-85 crew will be commanded by Curt Brown, who will be making his fourth Shuttle flight. The pilot, Kent Rominger, will be making his third flight. There are three mission specialists assigned to this flight. Jan Davis, serving as Payload Commander and Mission Specialist-1, is making her third flight. Mission Specialist-2 Robert Curbeam and Mission Specialist-3 Steve Robinson are both making their first flight. Bjarni Tryggvason from the Canadian Space Agency will serve as Payload Specialist-1 and is making his first spaceflight.

Discovery is targeted for launch on August 7, 1997 from NASA's Kennedy Space Center Launch Complex 39-A. The 1 hour 39 minute available launch window opens at 10:41 a.m. EDT. The STS-85 mission is scheduled to last 10 days, 20 hours, 24 minutes. An on-time launch on August 7 and nominal mission duration would have Discovery landing back at Kennedy Space Center on August 18 at about 7:05 a.m. EDT.

Two other payloads in Discovery's cargo bay will be the Technology Applications and Science-01 (TAS-01) and the International Extreme Ultraviolet Hitchhiker-02 (IEH-02). TAS holds seven separate experiments that will provide data on the Earth's topography and atmosphere, study the sun's energy and test new thermal control devices. The four experiments comprising the IEH payload will study ultraviolet radiation from the stars, the sun and other sources in the solar system.

Payload and experiments flying in the crew cabin area include the Southwest Ultraviolet Imaging System (SWUIS), a 7-inch imaging telescope that will be pointed out of the orbiter's windows by the crew primarily to observe the Hale-Bopp comet.

Also in the crew cabin will be the Bioreactor Demonstration System (BDS), a part of the Johnson Space Center's Medical Sciences Division Bioreactor program and the Biotechnology Specimen Temperature Controller (BSTC). The BSTC is a cell culture incubator that will ultimately lead to the use of microgravity to engineer tissues from individual cells. This investigation will confirm the procedures necessary to conduct cell biology experiments on orbit and investigate the assembly of cardiac and smooth muscle cells in microgravity.

STS-85 will be the 23rd flight of Discovery and the 86th mission flown since the start of the Space Shuttle program in April 1981.

(END OF GENERAL RELEASE; BACKGROUND INFORMATION FOLLOWS.)

MEDIA SERVICES INFORMATION

NASA Television Transmission

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

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

Status Reports

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

Briefings

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

Internet Information

Information on STS-85 is available through several sources on the Internet. The primary source for mission information is the NASA Shuttle Web, part of the World Wide Web. This site contains information on the crew and their mission and will be regularly updated with status reports, photos and video clips throughout the flight. The NASA Shuttle Web's address is:

http://shuttle.nasa.gov

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

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

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

http://www.nasa.gov

or

http://www.gsfc.nasa.gov/hqpao/hqpao_home.html

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

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

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

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

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

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

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

http://spacelink.msfc.nasa.gov

Detailed STS-85 payloads can be found via the Internet at the following URLs:

http://sspp.gsfc.nasa.gov/
http://sspp.gsfc.nasa.gov/ieh-2.html
http://radio.oma.be/solcon/solcon.htm
http://www.boulder.swri.edu/swuis/
http://uap-www.nrl.navy.mil/mahrsi/mahrsi.html
http://www.crista.uni-wuppertal.de/
http://denali.gsfc.nasa.gov/research/laser/

Access by CompuServe

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

STS-85 QUICK LOOK FACTS

Launch Date/Site:	August 7, 1997/KSC Launch Pad 39-A
Launch Time:	10:41 AM EDT
Launch Window:	1 hour, 39 minutes
Orbiter:	Discovery (OV-103), 23rd flight
Orbit Altitude/Inclination:	160 nautical miles, 57 degrees
Mission Duration:	10 days, 20 hours, 24 minutes
Landing Date:	August 18, 1997
Landing Time:	7:05 AM EDT
Primary Landing Site:	Kennedy Space Center, Florida
Abort Landing Sites:	Return to Launch Site - KSC
Transoceanic Abort Sites:	Zaragoza, Spain; Ben Guerir, Morocco; Moron, Spain
Abort-Once Around:	White Sands Space Harbor, NM
Crew:	Curt Brown, Commander (CDR), 4th flight Kent Rominger, Pilot (PLT), 3rd flight Jan Davis, Mission Specialist 1 (MS 1), 3rd flight Robert Curbeam, Mission Specialist 2 (MS 2), 1st flight Steve Robinson, Mission Specialist 3 (MS 3), 1st flight Bjarni Tryggvason (CSA), Payload Specialist 1 (PS 1), 1st flight
EVA Crewmembers	Robert Curbeam (EV 1), Steve Robinson (EV 2) (if needed, contingency)
Cargo Bay Payloads:	CRISTA-SPAS-02 MFD TAS-01 IEH-02
In-Cabin Payloads:	BDS-03 BRIC PCG-STES-05 ACIS MSX SIMPLEX SWUIS SSCE

CREW RESPONSIBILITIES

Payloads	Prime	Backup
CRISTA-SPAS	Robinson	Davis
Rendezvous	Brown	Rominger
RMS	Davis	Robinson
MFD	Davis	Robinson
TAS-01	Curbeam	Brown
IEH-02	Curbeam	Rominger
OSVS	Robinson	Davis
SWUIS	Robinson	Davis
PGC-STES	Davis	Rominger
SIMPLEX	Rominger	Brown
MSX	Rominger	Brown
BDS	Curbeam	Tryggvason
EVA	Curbeam (EV 1), Robinson (EV 2)	
Intravehicular Crew Member	Davis	----
Earth Observations	Robinson	Others
SSCE	Rominger	Tryggvason
BRIC	Brown	Davis
ACIS	Brown	Davis
MIM	Tryggvason	Curbeam

DEVELOPMENTAL TEST OBJECTIVES/ DETAILED SUPPLEMENTARY OBJECTIVES/ RISK MITIGATION EXPERIMENTS

DTO 255	Wraparound DAP Flight Test Verification
DTO 312	External Tank TPS Performance
DTO 700-10	Orbiter Space Vision System Videotaping
DTO 700-12	Global Positioning System/Inertial Navigation System
DTO 700-14	Single String Global Positioning System
DTO 805	Crosswind Landing Performance
DTO 842	AutoTRAC Computer Vision System
DTO 843	V-Bar Proximity Operations Demonstration for ISS
DTO 844	RMS Situational Awareness Displays
DSO 331	Integration of the Space Shuttle Launch and Entry Suit
DSO 484C	Assessment of Sleep Quality and Circadian Rhythms in Astronauts
DSO 485	Intermars Tissue Equivalent Proportional Counter
DSO 493	Monitoring Latent Virus Reaction and Shedding in Astronauts
DSO 802	Educational Activities
RME 1328	Microgravity Vibration Isolation Mount System Performance

PAYLOAD AND VEHICLE WEIGHTS

	Pounds
Orbiter (Discovery) empty and 3 SSMEs	153,819
Shuttle System at SRB Ignition	4,513,280
Orbiter Weight at Landing with Cargo	217,910
CRISTA-SPAS	7,724
IEH-02	3,220
MFD	3,632
TAS-01	5,548
SWUIS	138

STS-85 ORBITAL EVENTS SUMMARY

Event	**MET**	**Time of Day (EDT)**
Launch	0/00:00	10:41 AM, August 7
CRISTA-SPAS Deploy	0/07:16	5:57 PM, August 7
Crew News Conference	7/18:15	4:56 AM, August 15
CRISTA-SPAS Retrieval	9/00:35	11:16 AM, August 16
KSC Landing	10/20:24	7:05 AM, August 18

(Note: Above dates/times based on an August 7, 1997 launch)

MISSION SUMMARY TIMELINE

Flight Day 1
Launch/Ascent
OMS-2 Burn
Payload Bay Door Opening
RMS Checkout
CRISTA-SPAS Deployment
MIM Activation and Experiment Operations

Flight Day 2
MFD Operations
MIM Operations

Flight Day 3
SWUIS Operations
SSCE Operations
SVS Checkout and Operations
MIM Operations

Flight Day 4
MFD Operations
MIM Operations

Flight Day 5
MFD Operations
Educational Video Recording
MIM Operations

Flight Day 6
SWUIS Operations
MFD Operations
MIM Operations

Flight Day 7
MFD Operations
MIM Operations

Flight Day 8
SWUIS Operations
MIM Operations
Off-Duty Time

Flight Day 9
Crew News Conference
SWUIS Operations
MFD Operations
MIM Operations
Educational Video Recording

Flight Day 10
CRISTA-SPAS Rendezvous and Retrieval
MIM Operations

Flight Day 11
Flight Control System Checkout
Reaction Control System Hot-Fire
SVS RMS Tests with SPAS Satellite
MIM Operations
Cabin Stowage

Flight Day 12
Payload Bay Door Closing
Deorbit Burn
KSC Landing

SHUTTLE ABORT MODES

Space Shuttle launch abort philosophy aims toward safe and intact recovery of the flight crew, Orbiter and its payload. Abort modes for STS-85 include:

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

- Abort-Once-Around (AOA) -- Earlier main engine shutdown with the capability to allow one orbit of the Earth before landing at the White Sands Space Harbor, NM

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

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

CARGO BAY PAYLOADS

MISSION TO PLANET EARTH ENTERPRISE PAYLOADS

This August, STS-85 will continue NASA's ongoing study of natural and human-induced changes in Earth's environment under the agency's Mission to Planet Earth enterprise. The overall aim of the STS-85 mission is the study of several Mission to Planet Earth research interests, including atmospheric dynamics, atmospheric chemistry, long-term climate change and land cover/land use change around the world. During the eleven-day mission, Space Shuttle Discovery will deploy the fourth flight of the German-built Shuttle Pallet Satellite (SPAS), which will carry the Cryogenic Infrared Spectrometers and Telescopes for the Atmosphere (CRISTA) and the Middle Atmosphere High Resolution Spectrograph Investigation (MAHRSI) into space for the second time.

Mission to Planet Earth program investigations also will be performed by three experiments - Solar Constant Experiment (SOLCON), Infrared Spectral Imaging Radiometer (ISIR) and Shuttle Laser Altimeter (SLA) that are a part of the Technology Applications and Science-1 (TAS-1) payload.

CRYOGENIC INFRARED SPECTROMETERS AND TELESCOPES FOR THE ATMOSPHERE - SHUTTLE PALLET SATELLITE (CRISTA-SPAS)

The SPAS carrier is a battery-powered freeflyer that will store data onto tapes for post-flight analysis. During this flight CRISTA's three telescopes will make atmospheric observations along parallel tracks of trace constituents and temperature distributions. The scientific emphasis will be on the study of small-scale tracer "filaments" (long, thin regions of differing atmospheric composition, including temperatures) in the stratosphere. By examining the atmospheric flow patterns of these elements, based on data collected during the previous STS-66 mission in November 1994 and new data collected during STS-85, researchers from 15 countries hope to better understand how these filaments contribute to transport of ozone and chemical compounds that affect the distribution of ozone.

STS-85 offers researchers an opportunity for increased latitudinal coverage of the atmosphere beyond that of data gathered during STS-66, providing data about summer conditions at high northern latitudes and the polar night at high southern latitudes. CRISTA's detailed high horizontal resolution information is very complementary to the less well resolved, but longer duration data from other free flyers, such as the Upper Atmospheric Research Satellite (UARS). During Discovery's flight, ground-based researchers will be conducting extensive balloon, aircraft and sounding rocket campaigns to gather data to be compared with data collected by the three telescopes aboard CRISTA. Balloons and aircraft will take data over Europe, while sounding rockets will be flown out of NASA's Wallops Flight Facility, Wallops Island, VA, and the White Sands Missile Range, NM.

During STS-66, CRISTA found several examples of tracer filaments in the atmosphere. CRISTA's unique viewing capabilities of the stratosphere, combined with new hardware upgrades since its last flight, will provide atmospheric scientists and researchers with valuable data upon which to build more accurate models on the transport and chemistry of ozone in the atmosphere. In the long term, this research may provide data on which to test the computer models about the transport processes that operate in the stratosphere. During recent years there has been significant theoretical development concerning atmospheric transport processes, especially relatively small-scale features, though opportunities to test these theories (and computational models) have been limited, especially above the levels of the stratosphere accessible to high-altitude research aircraft such as the ER-2. CRISTA also obtains measurements of the mesosphere and thermosphere and which may be helpful to shed new light on the interactions between the stratosphere and the overlying regions of the atmosphere. CRISTA is sponsored by the German Space Agency DARA and is managed by the University of Wuppertal, Germany.

MIDDLE ATMOSPHERE HIGH RESOLUTION SPECTROGRAPH INVESTIGATION (MAHRSI)

During STS-85 the Middle Atmosphere High Resolution Spectrograph Investigation (MAHRSI) will focus on obtaining new vertical profile data on the distribution of hydroxyl (OH) in the mesosphere and upper stratosphere under very different conditions (both seasonal and diurnal) from its previous flight on STS-66. A goal of MAHRSI's flight will be to provide global maps of the vertical distribution of OH and measurements of nitric oxide in the middle atmosphere. A major finding during MAHRSI's STS-66 flight was that the observed OH profiles differed significantly from those expected based on knowledge of distributions of water vapor and the measured rates of photochemical processes involved in production and destruction of OH. By using data from the Upper Atmospheric Research Satellite (UARS), as well as new data from the second flight of CRISTA/MAHRSI, researchers hope to gain a better understanding of how hydroxyl behaves during different seasons around the globe and how it interacts with the behavior of ozone and other trace chemicals. The Space Shuttle provides exceptional opportunities for gathering OH data -- since the location of OH for this research is between 25 and 75 miles in altitude, the study's target area is too high for balloon research, and tends to be too quickly traversed by sounding rockets for the gathering of meaningful data. Currently, data for computer models of OH and its interaction with other atmospheric chemicals in this region of the atmosphere is scarce -- MAHRSI and its unique spaceborne viewing of this area will provide for better understanding of OH and, therefore, ozone levels in the upper atmosphere, allowing for better models of Earth's atmosphere.

During STS-85 MAHRSI also will examine more closely the measurements of nitric oxide within the atmosphere. These measurements will not only provide a full global picture of nitric oxide in the mesosphere and thermosphere, but also will be able to provide information on the spatial and temporal variability of nitric oxide. Information on variability of nitric oxide will be obtained by taking advantage of the unique pointing capability of the SPAS platform to look at the same geographical location during several successive orbits. There are 38 working groups of researchers associated with the CRISTA/MAHRSI science team.

TECHNOLOGY APPLICATIONS AND SCIENCE (TAS-1)

TAS-01 is a diverse Hitchhiker payload flying on STS-85. TAS-01 will carry more experiments (eight) and weigh more than any previous Hitchhiker payload. The individual objectives of each experiment are described below, but the overall objective of the Hitchhiker payload is to fly more science experiments using better, faster, cheaper avionics and processes. The payload uses standardized Hitchhiker avionics to provide power and enables command and transmission of experiment data to and from the payload. The Hitchhiker program is managed by the Shuttle Small Payloads Project at Goddard Space Flight Center (GSFC) in Greenbelt, Md.

There are eight experiments that make up the TAS payload. Three of the experiments - the Solar Constant Experiment (SOLCON), Infrared Spectral Imaging Radiometer (ISIR) and Shuttle Laser Altimeter (SLA) are part of NASA's Mission to Planet Earth program. The other five experiments on TAS are the Critical Viscosity of Xenon (CVX), Space Experiment Module (SEM), Two Phase Flow (TPF), Cryogenic Flight Experiment (CFE) and Stand Alone Acceleration Measurement Device and the Wide Band Stand Alone Acceleration Measurement Device (SAAMD/WBSAAMD).

Solar Constant Experiment (SOLCON)

The Belgian SOLCON is a unique instrument designed to examine the effects of the total solar irradiance (TSI), or the Sun's total energy input into the Earth/atmosphere system, by using spaceborne radiometers to try and pinpoint within 0.01 percent the absolute value of the TSI. Solar energy is the only external source of energy for Earth, thus a primary natural driver for climate change. The measurement of TSI is important for researchers studying the effects of global warming. By making data observations from the Shuttle and the ability to return the instrument to Earth and recalibrate it, SOLCON provides an opportunity to measure the TSI without the potential spacecraft degradation from solar radiation that other orbiting instruments may suffer. Ultimately, SOLCON provides researchers with a "quality control" capability for checking continuously orbiting TSI measuring instruments. On STS-85 SOLCON researchers will compare measurements of TSI with the DIARAD/VIRGO instrument aboard the SOHO spacecraft, and make comparisons to the ACRIM instrument aboard UARS. SOLCON flight operations will work in conjunction with the Belgian Space Remote Operations Center installed at the Royal Meteorological Institute of Belgium and perform experiments in preparation for experiment operations aboard the International Space Station.

Infrared Spectral Imaging Radiometer (ISIR)

The Infrared Spectral Imaging Radiometer (ISIR) is a Space Shuttle Hitchhiker instrument that will test new technology and techniques for cloud observations from space. Clouds have a direct effect on heating of the Earth's surface, interacting with other aspects of the atmosphere in the control of ground temperatures. ISIR's new technology is infrared imaging with an uncooled detector array. A major limitation of infrared imagers in the past has been the bulky and difficult to use passive radiative coolers, or unreliable and expensive mechanical coolers, that are needed for research. Cooling systems for detector arrays also can require costly refurbishment, causing for instrument maintenance down-time. The new technology of the microbolometer focal plane arrays of ISIR will allow infrared imaging without external cooling. ISIR has three narrow band radiometers and one broad band radiometer. The uncooled microbolometer array aboard ISIR has 80,000 pixels with a swath width of 80 km and a spatial resolution of 250 miles. ISIR will test the potential of this new technology for much more compact, lower cost and more reliable spaceborne infrared imagers. The ultimate purpose of this study is to pave the way toward the next generation of operational Low Earth Orbiting observing satellites. ISIR incorporates NASA's philosophy of "faster, better, cheaper" technology development for spacecraft and scientific instruments.

Shuttle Laser Altimeter (SLA)

The Shuttle Laser Altimeter (SLA) is a pathfinder for future operational space-based laser remote sensing devices and lidar. Similar to ISIR, SLA-2 is a Space Shuttle Hitchhiker payload.

During the first flight of the instrument, SLA-01, flew in space successfully on STS-72 in January 1996 at a 28 degree inclination. That instrument demonstrated the viability of surface lidar sensing from Earth orbit, obtained a high-quality (meter-level accuracy) data set on ocean and land topography, and was a major factor in selection of the Vegetation Canopy Lidar for the first Earth Systems Science Pathfinder Mission. Tree height data sets obtained on SLA-01 were the first measurements from space that can be tied directly to remote sensing of above ground biomass and forest canopy architecture. This also will be the first flight on the SLA instrument of a variable gain amplifier to extend the dynamic range for detection of faint laser echoes by over one order of magnitude.

The Space Laser Altimeter-2 instrument will give direct measurements of the height of clouds, as well as acquire profiles of land and surface vegetation canopies over continental and island targets with a 1-10 meter rms surface elevation accuracy and sub-kilometer spatial resolution. The SLA instrument measures the distance from the Space Shuttle to the Earth's surface by timing the two-way propagation of short laser pulses. The SLA data system makes the pulse time interval measurement to a precision of about five nsec and also records the temporal shape of the laser echo from the Earth's surface for interpretation of surface height distribution within the 100 meter diameter sensor footprint. For example, tree height can be determined by measuring the characteristic double-pulse signature that results from a separation in time of laser backscatter from tree canopies and the underlying ground.

SLA-2 also will measure the complex shape of laser pulse echoes from land and vegetation with sub-meter vertical resolution and obtain grids of altimetry data for major topography study regions, including the continental United States. Other primary targets for SLA-2 surface research include: the Amazon Basin in Brazil; the Canadian Boreal Forest; the Kamchatka Peninsula; the Patagonian ice fields; West Africa Tropical Forests; high latitude steppe deserts in China; large inland seas including the Caspian and Aral Seas; large oceanic islands, including Tasmania, the Falklands, and Madagascar; the Northern Sahara Sand Seas (Grand Ergs) and the Mississippi Delta region of the U.S. In addition to providing first ever observations of northern deciduous biomes, mountainous regions, and high plateaus, the SLA-2 data set should provide measurement of calibration and validation sites in the United States that are essential for understanding not only the SLA-2 observations but for scientific pathfinding and algorithm development for upcoming free-flyer surface lidar sensors.

The combination of ISIR and SLA will allow techniques for cloud observations based on the combination of passive infrared and active laser sensing to be applied from space. SLA and ISIR will complement each other in their data gathering -- SLA will use active laser research to provide data that then can be compared with ISIR's passive data observations. This mission marks the first simultaneous application of active and passive remote sensing for cloud studies.

CVX - Critical Viscosity of Xenon

The Critical Viscosity of Xenon (CVX) experiment measures the viscosity of xenon under a set of conditions that cannot be achieved on Earth. A near-critical state of the fluid, xenon, has been chosen because many fluid properties (such as viscosity) exhibit remarkable changes near the critical point (a unique combination of temperature and density).

The critical temperature, Tc = 16.7 degree centigrade for xenon, is the highest temperature at which gas and liquid can coexist for the chosen fluid. Viscosity increases significantly near critical temperature and precise measurement of the viscosity very near critical temperature will enable an improved understanding of the microscopic dynamics that underlie the viscosity increase. The measurement requires a test sample uniform in composition, temperature, and density. The CVX experiment employs: a precisely prepared sample of pure xenon; a unique viscometer (designed especially for this experiment); and a custom thermostat (providing temperature control to a few millionths of a degree).

By conducting the experiment in the low-gravity environment of near-Earth orbit, more uniform sample density can be attained. The experiment will operate for the full duration of the mission and will make viscosity measurements approximately once per minute as the temperature is scanned towards critical temperature at rates as slow as two millionths of a degree per minute to maintain the uniformity of sample density and temperature. This combination of science and space will permit more precise measurements of viscosity than possible on Earth and, therein, a better test of current theoretical models which try to predict such phenomena.

The experiment explores the vapor/liquid critical point, a second-order phase change at which the fluid properties are dominated by fluctuations in bulk properties rather than the details of atomic or molecular parameters. Theories which describe such phenomena are believed to be 'universal' and can be used to describe other interesting second-order phase changes such as the transition to superconductivity in mercury, the transition to ferromagnetization in iron, and the transition to superfluidity in cryogenic helium. Thus, by testing the detail of existing, universal theories, the precise measurements the CVX experiment will make in xenon will support improved understanding in other interesting and diverse fields.

The experiment is supported by the NASA Microgravity Research Program and will be operated by the CVX team composed of scientists from the National Institute for Science and Technology and engineers from the NASA Lewis Research Center, Cleveland, Ohio.

Space Experiment Module (SEM)

The Space Experiment Module (SEM) Program is an education initiative sponsored by NASA's Shuttle Small Payloads Project. The program provides nationwide educational access to space for kindergarten through university level students. Within the program, NASA provides small containers or modules to students to fly zero-gravity and micro-gravity experiments on the Space Shuttle. The experiments are created, designed, built, and implemented by students with teacher and/or mentor guidance. Student experiment modules are flown in a "carrier" which resides in the cargo bay of the Shuttle. The carrier supplies power to, and the means to control and collect data from each experiment, greatly simplifying the engineering process for students so that they can focus on creating science experiments. Here are the SEM experiments that are scheduled to fly on STS-85:

- Boy Scouts of America, Pack 727, Arnold, Md. are sponsoring a variety of passive experiments including colored sand layers, yeast, seeds, crystal growth medium.

- CAN-DO, Charleston, SC is sponsoring several active experiments, including one that measures the radiation, sound acquisition, and dispersion of paint.

- CAN-DO, Charleston, SC also is sponsoring a variety of passive experiments including: brine shrimp, "silly putty", antibiotic, cartilage, dye, film, hair, rice, graphite, seeds, soap, vinegar.

- Chesterfield County (Virginia) Math and Science High School,. has variety of passive experiments, including radiation effects on software, black and white, and x-ray film.

- William E. Fanning Elementary School, Orange, Calif. is sponsoring an active experiment on acceleration measurement and seeds.

- Glenbrook North High School, Northbrook, Ill. is sponsoring experiments on surface tension of immiscible and non-immiscible fluids, crystal growth, and mosquito development. Glenbrook also is sponsoring a variety of passive experiments, including baking soda, gravel, rubber, brine shrimp eggs, yeast, seeds, beans, and salt water.

- Charles R. Spain Career Enrichment Center, Albuquerque, NM is sponsoring an experiment on particle stratification.

Two Phase Flow (TPF)

The Two Phase Flow (TPF) experiment will characterize micro-gravity operations and demonstrate reliability of a capillary pumped loop (CPL) containing multiple evaporators. CPL's are being developed at NASA's Goddard Space Flight Center and are the next major thermal control innovation since heat pipes. CPL's are two-phase heat transfer systems that use capillary wicks to move the ammonia working fluid from the instrument cooling interface to the spacecraft radiator for heat rejection to space. The CPL system contains no moving parts and requires only a small amount of heater power to control the operating temperature. The capillary forces that move the fluid are very small when compared to Earth gravity, so a capillary system's operation on the ground can be very different from micro-gravity operation. These spaceflight experiments are required to demonstrate technology and provide data for computer models that predict future performance.

Previous flight experiments have proven the feasibility of the technology, but have raised questions concerning the reliability of current CPL designs and the ability to scale up or down for different sized systems. The TPF experiment is designed to address these issues. TPF is sponsored by the Advanced Technology and Mission Studies Division in NASA's Office of Space Science with additional support from the Earth Observing System-PM (EOS-PM) project. The Thermal Engineering Branch at NASA Goddard manages the experiment. The CPL system was designed and built by TRW.

Cryogenic Flight Experiment (CFE)

Long term cryogenic cooling is an enabling technology for future space missions. It can be used to cool superconducting computers and sensors or to extend the capabilities of life support systems. The COOLLAR Flight Experiment (CFE) will test a Joule-Thomson (J-T) Cycle cryocooler designed to provide two stages of cooling.

The objective of the COOLLAR Flight Experiment is to demonstrate the operation of a J-T cycle cryocooler designed for space applications. Of particular interest is demonstrating the collection and distribution of oil used to lubricate the long-life J-T compressor, and the collection, storage, and application of liquid nitrogen to provide uniform and precise temperature control of components with varying heat loads.

Stand Alone Acceleration Measurement Device and the Wide Band Stand Alone Acceleration Measurement Device (SAAMD/WBSAAMD)

SAAMD is a self-contained autonomous data acquisition system designed to measure low frequency acceleration in the Space Shuttle during launch and landing. The device is triggered by an inertia switch that is closed by the vibration of starting the main engines prior to launch and is triggered again by an inertia switch closed upon reentry. WBSAAMD measures acceleration at a higher frequency range.

MANIPULATOR FLIGHT DEMONSTRATION PAYLOAD

Manipulator Flight Demonstration (MFD)

The Manipulator Flight Demonstration (MFD) on STS-85 will evaluate the use of the Small Fine Arm that is planned to be part of the future Japanese Experiment Module's Remote Manipulator System on the International Space Station. The MFD is sponsored by the National Space Development Agency of Japan (NASDA).

The investigation consists of the Small Fine Arm (SFA), located on a payload support structure in Discovery's payload bay; rotational and translational hand controllers in Discovery's aft cockpit; and displays that will be available via a laptop computer in the aft cockpit. The arm itself is about five feet in length and has a shoulder roll and pitch joint, elbow pitch joint and wrist pitch and yaw joint. During launch and landing, the arm is secured in a Arm Hold and Release Mechanism (AHRM). Television cameras and lights for operation of the arm also are mounted on the cargo bay support structure.

The SFA evaluation will provide Japanese designers insight on the in-flight operation of the arm and its controls. Aboard the International Space Station, the Japanese Experiment Module's arm will be used to tend experiments on an unpressurized "back porch" of the laboratory designed to allow experiments to be exposed to space.

Mission Specialist Jan Davis will be the primary operator of the MFD, using the aft cockpit controls to maneuver the arm in a variety of tasks, including grasping a simulated Orbital Replacement Unit (ORU) experiment box and opening a hinged experiment door. Mission Specialist Stephen Robinson also will evaluate the arm. Following onboard evaluations of the arm by the crew, controllers on the ground will remotely conduct evaluations of the arm, testing a possible remote operation capability planned for the station.

Two additional although unrelated NASDA experiments are mounted near the arm in the payload bay, the Two-Phase Fluid Loop Experiment (TPFLEX) and the Evaluation of Space Environment and Effects on Materials (ESEM).

Two-Phase Fluid Loop Experiment (TPFLEX)

The TPFLEX studies how cooling systems operate in weightlessness, with the experimental cooling unit circulating water from an evaporator to a condenser. The study is hoped to provide NASDA with information that will be helpful in designing active cooling systems for future spacecraft.

Evaluation of Space Environment and Effects on Materials (ESEM).

The ESEM experiment is a holder for several sample materials that will be exposed to the environment in low Earth orbit and collect cosmic dusts. Among the samples that will be studied on ESEM is solar cell glass.

INTERNATIONAL EXTREME ULTRAVIOLET HITCHHIKER

The International Extreme Ultraviolet Hitchhiker will fly a second time when it is lifted into space aboard STS-85. IEH-2 consists of four experiments: Solar Extreme Ultraviolet Hitchhiker (SEH) -2, Ultraviolet Spectrograph Telescope for Astronomical Research (UVSTAR), Distribution and Automation Technology Advancement - Colorado Hitchhiker and Student Experiment of Solar Radiation (DATA-CHASER), and Shuttle Glow Experiments (GLO)-5 and 6, all with the common objective of investigate the uncertainty and long term variation in the absolute solar extreme ultraviolet (EUV) flux and the EUV emissions of the Jupiter Io plasma torus system.

The IEH-2 set of experiments is an engineering achievement that contains the most moving parts of any Hitchhiker assembly. IEH-02 is managed by the Shuttle Small Project at Goddard Space Flight Center. The Hitchhiker avionics provide power to the payload and commanding capabilities from Goddard Payload Operations Control Center. The crew will support the IEH-2 payload by activating it and performing attitude maneuvers in support of UVSTAR, SEH, GLO-5, GLO-6 and DATA-CHASER observations.

UVSTAR

UVSTAR is an international payload sponsored by NASA and ASI, the Italian Space Agency. The experiment is a joint collaboration between the Universities of Arizona and Trieste. The goal is to study extended sources in the EUV bands. Key targets are planetary, such as the high temperature plasma confined in a toroidal ring around Io's orbit at Jupiter, remnants of supernovae with their expanding envelopes, the hot blue star content of the globular clusters, i.e. very dense stellar aggregates that give clue to our understanding of stellar evolution, and other, including targets of opportunity such as comets or special sudden events occurring in the sky.

UVSTAR, which flew previously in 1995, consists of several sets of hardware components: a twin telescope (which includes a spectrograph system operating in two ultraviolet (UV) bands, a two axis platform which gives azimuth and elevation motion, a finder and tracker system for the pointing and tracking the targets, and several electronic boxes for running the instrument and acquiring the data. The two groups establish a modern and updated astronomical instrumentation at low cost continuously upgrade the hardware, software and operational system, including a newly developed code that determines autonomously the pointing direction of the telescope.

SEH

The SEH experiment is designed to accurately measure the solar flux (flux is the amount of light for a given area per second) in the extreme ultraviolet region of the solar spectrum. The EUV spectrum contains high energy, short wavelength light that does not penetrate the Earth's atmosphere. Because the atmosphere blocks these wavelengths, scientists must use instruments above the atmosphere, at an altitude of at least 125 miles (200 kilometers), to study this portion of the solar spectrum.

Models of the Earth's atmosphere and other planetary atmospheres require accurate knowledge of the Sun's total energy output. The EUV radiation is especially important in atmospheric studies since these wavelengths interact directly with atmosphere components, and form the planetary ionosphere. It is widely recognized that long term, accurate, solar measurements are urgently needed. Furthermore, the solar spectrum in the EUV region is highly variable and changes from one solar rotation to the next, and more dramatically over the 11 year solar cycle.

The SEH instrumentation was most recently flown successfully on the Space Shuttle as part of the International Extreme ultraviolet Hitchhiker-1 (IEH-1) bridge, on Mission STS-69. On IEH-2, the solar system response to the solar input will be observed by a complementary set of instruments, UVSTAR and SEH. Both SEH and UVSTAR are international cooperative experiments. On this mission, the UVSTAR instrumentation will provide Jovian system extreme ultraviolet/far ultraviolet data, and SEH will provide the required solar flux data for proper interpretation. Through such missions scientists will continue to provide the planetary community with the highest quality solar EUV data available. The SEH experiment was developed and built at the University of Southern California. Professor Darrell Judge is the principal investigator and Donald McMullin is the payload manager.

Distribution and Automation Technology Advancement - Colorado Hitchhiker and Student Experiment of Solar Radiation (DATA-CHASER)

The Distribution and Automation Technology Advancement - Colorado Hitchhiker and Student Experiment of Solar Radiation consists of two synergetic projects, DATA and CHASER, whose respective objectives complement each other. The DATA canister represents the advanced technology goals, and the CHASER canister represents the scientific goals. The experiment is designed and built by the students at the Colorado Space Grant College of the University of Colorado. Their plans are to demonstrate distributed, interactive and intelligent control approaches that enable space payloads to be operated by scientists from their home institutions.

DATA seeks to advance human support technology. By integrating advanced data system tools and technologies, DATA will help improve space payload operations. Specifically, DATA will: establish interactive payload control for the payload engineers and scientists; distribute control to separate and remote users; create robust on-board and ground automation; and establish a cooperative control by people and automated systems. To meet these objectives, DATA will interface with CHASER.

CHASER will measure the full-disk solar ultraviolet and soft X-ray irradiance as well as image the Sun in its Lyman-Alpha wavelength. CHASER consists of three instruments: LASIT, SXEE (pronounced "sexy"), and FARUS. With these data, the designers of CHASER hope to help correlate solar activity with radiation flux and associate Lyman-Alpha fluxes with individual active regions.

Glow Experiments (GLO)

The GLO-5 and GLO-6 experiments consist of two separate scan platforms designed to measure Earth's atmospheric emissions, day and night glow, and aurora. The platforms will allow stereoscopic measurements of the size and range of structures. The GLO experiments also will be used to study the Shuttle glow phenomena in the 115 to 1,150 nautical miles range. In addition, the co-manifesting of the GLO experiments with the Shuttle Laser Altimeter-02 on the TAS-01 payload will allow GLO to measure the interaction of lasers in the Shuttle environment. The experiment's name is derived from another of its objectives: to observe the orbiter interaction with the atmosphere for 'Shuttle' glow phenomena.

IN-CABIN PAYLOADS

BIOREACTOR DEMONSTRATION SYSTEM-3 (BDS-3)

Just as gravity affects the manner in which crystals grow and materials are processed, Earth's pull also can alter the development of cells and tissues. Microgravity, however, can provide researchers with the opportunity to grow cells into three-dimensional tissue pieces that are not achievable using conventional tissue culture methods on Earth.

The BDS is designed to perform cell biology experiments under controlled conditions on small samples of material. Experiment applications include mammalian cell cultures, plant cell growth, microbial growth, and radiation biology.

The BDS is comprised of an experiment control computer (ECC) and an engineering development unit (EDU)-1R. The EDU uses a rotating cylinder to suspend cells and tissues in a growth medium, simulating some aspects of microgravity.

A series of shuttle flights will test the four BDS configurations (A, B, C, and D). Results will be used in the development of the bioreactor, a cell culture growth device, at NASA's Johnson Space Center. BDS previously flew on STS-62 and STS-70.

Configuration B will be flown on this mission. This configuration will verify the operation of the biotechnology specimen temperature controller (BSTC), a cell culture incubator that enables the performance of cell biology experiments in space that could lead ultimately to the use of microgravity to engineer tissues from individual cells. This mission will confirm the procedures necessary to conduct cell biology experiments on orbit and investigate the assembly of cardiac and smooth muscle cells in microgravity.

The muscle cells will be placed in culture modules that fit into the BSTC, which will be installed in two and one-half middeck lockers. The cells will be maintained at 4 degrees Celsius through the launch. On orbit, the temperature will be raised to 37 degrees Celsius, and the crew will take growth media samples; measure the pH, carbon dioxide, oxygen, glucose, and other metabolites; visually inspect the media; log measurements; and report results.

During the last two days of on-orbit activities, colored beads of different sizes and densities will be added to the EDU-1R for a fluid dynamics study. The EDU-1R will be operated at different combinations of inner and outer wall rotation rates and perfusion rates, while a video of the bead path is automatically recorded.

PROTEIN CRYSTAL GROWTH/SINGLE-LOCKER THERMAL ENCLOSURE SYSTEM (PCG-STES)

Experiment: Protein Crystallization Apparatus for Microgravity/Single-locker Thermal Enclosure System

Principal Investigator: Dr. Dan Carter of New Century Pharmaceuticals, Huntsville, Ala.

Facility: The Protein Crystallization Apparatus for Microgravity is one of several devices developed to grow large numbers of protein crystals in space for later evaluation on Earth. Protein crystals are used in basic biological research, pharmacology and drug development.

The crystallization apparatus uses vapor diffusion to grow crystals, relying on water vapor pressure differences within a chamber to create optimum growth conditions. Little crew involvement is required with the apparatus.

The apparatus consists of small plastic trays, each with seven sample wells surrounded by donut-shaped reservoirs. Each well holds a drop of protein solution and precipitant mixed together. Nine trays, accommodating 63 specimens, are housed in a cylinder.

On STS-85, a total of 630 specimens will be transported to orbit using 10 cylinders -- four in a cabin-temperature locker, and six within a Single-locker Thermal Enclosure System -- a commercially derived refrigerator incubator module.

After the mission, the trays will be returned to the Marshall Space Flight Center in Huntsville, Ala., and then to the principal investigator for study.

MIDCOURSE SPACE EXPERIMENT (MSX)

The Midcourse Space Experiment contains no flight hardware. The objectives of the MSX activity is to obtain ultraviolet, infrared, and visible data from sensors on the MSX satellite of orbiter thruster firings (OMS/PRCS) under controlled conditions and to determine instrumentation capabilities of the MSX by observing the orbiter hardbody. The space-based MSX sensors may collect data during any encounter opportunity when the orbiter support activities can be planned to meet the defined criteria.

Prior to STS-85, the MSX satellite was placed in a 99 degree inclination orbit with an altitude of approximately 485 nautical miles. MSX is sponsored by the United States Air Force Missile Systems Center and NASA.

SHUTTLE IONOSPHERIC MODIFICATION WITH PULSED LOCAL EXHAUST (SIMPLEX)

The Shuttle Ionospheric Modification with Pulsed Local Exhaust (SIMPLEX) experiment will use Orbital Maneuvering System (OMS) thruster firings to create ionospheric disturbances for observation by the three SIMPLEX radar sites in Arecibo, Kwajalein, and Jicamarca.

The SIMPLEX experiment contains no flight hardware. The objective is to determine the source of Very High Frequency (VHF) radar echoes caused by the Orbiter and its OMS engine firings. The Principal Investigator (PI) will use the collected data to examine the effects of orbital kinetic energy on ionospheric irregularities and to understand the processes that take place with the venting of exhaust materials.

SOUTHWEST ULTRAVIOLET IMAGING SYSTEM (SWUIS)

The Southwest Ultraviolet Imaging System (SWUIS) consists of a baffled Ultraviolet (UV) 7 inch imaging telescope with A1/MgF2 (UV-reflective) optics, a manual filter changeout assembly, a UV-sensitive Intensified Charge Coupled Device (ICCD) Xybion camera, a telescope-to-camera coupling assembly, imaging filters and a SSP-provided Video Interface Unit (VIU).

The SWUIS is stored in the orbiter middeck lockers during launch and entry and is assembled for on-orbit operations where it will be mounted in either the orbiter side hatch window, Aft Flight Deck (AFD) overhead windows, or the pilot-side forward window via SSP-provided standard mounts/brackets and a customer-provided mount adapter.

The SWUIS telescope will be used primarily to view the Hale-Bopp comet. However, it can also be used to perform ultraviolet astronomy, planetary and cometary imaging, terrestrial airglow and atmospheric background imaging, auroral imaging, or studies of Shuttle Glow and vehicle plume evaluations.

GET AWAY SPECIALS (GAS) PAYLOADS

The Shuttle Small Payloads Project at Goddard Space Flight Center has two Get Away Special (GAS) payloads onboard Discovery: G-572 and G-745.

Hearts in Space, GAS payload G-572, will attempt to answer why astronauts' hearts get smaller while in space. Researchers at Bellarmine College, (Louisville, KY), the University of Utah (Salt Lake City, UT), and Utah State University (Logan, UT) have constructed G-572 to investigate the effect of weightlessness on the physical factors that contribute to cardiac function.

The GAS payload G-745 was constructed by students and teachers at Mayo High School in Rochester, MN. The experiment will investigate root growth during a shuttle mission. Six growing chambers will each contain bean seeds embedded in vermiculite. After launch, the seeds will be watered and allowed to germinate in a temperature controlled environment.

BIOLOGICAL RESEARCH IN CANISTERS-10 (BRIC-10)

NASA's Office of Life and Microgravity Sciences and Applications is sponsoring Biological Research in Canisters (BRIC) 10, the latest in a series of life sciences experiments designed to examine the effects of microgravity on a wide range of physiological processes in higher order plants and arthropod animals (e.g., insects, spiders, centipedes, crustaceans).

One of four BRIC payload hardware configurations is chosen for each flight to meet scientific requirements:

Block I: five 82-mm-diameter dual-chamber BRIC-60 canisters in a single middeck locker

Block II: two 82-mm-diameter dual-chamber BRIC-60 canisters, one pair of cryogenic gloves, and one gaseous-nitrogen freezer in a single middeck locker

Block III: three 114-mm-diameter single-chamber BRIC-100 canisters in a single middeck locker

Block IV: nine 114-mm-diameter single-chamber BRIC-VC canisters in a single middeck locker

The canisters are self-contained aluminum holders for the specimen support hardware and require no orbiter power. The canisters and freezer are housed in a standard middeck locker. The BRIC Block I, Block III, and Block IV experiment configurations require no crew interaction. The Block II configuration requires a crew member to put on a pair of insulating gloves, remove a canister from the locker, and replace it in the freezer. The Block II configuration will be flown on STS-85.

BRIC-01 examined how microgravity affects the developing gypsy moth's diapause cycle-the period of time when the moth is in a dormant state undergoing development-with the aim of creating sterile moths. BRIC-02 focused on how plant tissue culture develops in microgravity. BRIC-03 studied the development and differentiation of soybeans as well as the effects of microgravity on the plants' carbohydrate metabolism, which provides plants the energy they need to grow. BRIC-04 examined how the hormone system and muscle formation processes of the tobacco hornworm (Manduca sexta) are affected by an altered gravitational field. BRIC-05 tested whether the cell division changes observed in the daylily (Hemerocallis cultivar, Autumn Blaze) are caused by the direct effects of microgravity or indirect effects like water availability.

BRIC-06 studied how gravity is sensed within mammalian cells. The processing of outside signals by mammalian cells is complex. Gravity is one signal that is received by these cells, but the gravity-sensing mechanism in mammalian cells has not been identified. To study this intracellular signal transmission, BRIC-06 flew a unicellular eucaryote cell culture of slime mold (Physarum polycephalum) as a model system. The investigator examined the cultures for specific chemical concentrations that are signs of the signal transduction process.

BRIC-07 helped investigators discover the mechanisms behind one endocrine system in insects, which may aid in research on endocrine systems in general, including human systems. This research is important to the space program because space flight is known to affect astronauts' endocrine systems. The experiment began after the pupae, placed in the BRIC canisters before launch, started to develop. After the flight, the pupae were examined morphologically. Half to two thirds of the insects were sacrificed so investigators could collect and study their hemolymph, the circulatory fluid of invertebrates that is similar to the blood and lymph of vertebrates, and ecdysone, a hormone produced by insects that triggers molting and metamorphosis. The rest of the insects were allowed to develop to adulthood. During the 24 hours before the adult insects emerged, investigators removed their dorsolongitudinal flight muscles and analyzed their protein content and concentration.

BRIC-08 investigated the somatic embryogenesis of day lily plant cells.

BRIC-09 studied the influence of microgravity on genetically altered tomato and tobacco seedlings that had been modified to contain elements of soybean genes. The study provided information about plants' molecular biology and insight into understanding the transport and distribution mechanisms for hormones within plants. The research could provide crucial information on how to improve growth rates and biomass production of space-grown plants as well as information on how to enhance crop productivity on Earth.

BRIC-10 will study gravitational effects on growth, development, and metabolic processes in Arabidopsis thaliana and tobacco seeds. The investigation will use the specimens to identify and clone genes whose expression is altered when grown in the microgravity environment. For STS-85, both canisters will be flown assembled. One of the canisters will be frozen on orbit.

SOLID SURFACE COMBUSTION EXPERIMENT (SSCE)

The Solid Surface Combustion Experiment (SSCE) is designed to be flown in the Space Shuttle middeck and consists of a camera module assembly and an experiment sample chamber assembly.

The camera module assembly consists of one 16 mm camera (using a 50 mm lens), a camera mount, an electrical box, a battery, and an R.F. filter.

The chamber assembly consists of one Polymethyl Methacrylate (PMMA) fuel sample internally mounted in the center of a pressurized chamber. Two windows orthogonal to one another in the chamber wall allow camera viewing of the side edge and top of the PMMA sample. The sample will be ignited by a hot filament wire. Instrumentation will consist of six thermocouples on or about the PMMA samples, a silicon temperature sensor and pressure transducer to measure the internal chamber temperature and pressure. The electrical leads for the igniter wire, the thermocouples, the silicon temperature sensor, and the pressure transducer will be brought through a connector on the chamber to the electrical box on the camera module assembly. A power/control line has been added for the extinguisher solenoids.

A light has been added inside the chamber due to the low visible light intensity witnessed in the paper fuel combustion experiments and which is also expected in the PMMA fuel combustion experiments. The light will consist of an aluminum mast, three 1 watt bulbs, blinking light printed circuit card and aluminum enclosure. The light is activated once every second to provide two artificially illuminated frames out of 24 frames being recorded in a second.

Externally, a 32-pin hermetic connector will be used on the cable harness connecting the camera module assembly to the chamber assembly. The magazine holders accommodate 200-foot magazines. Two holders, one on the chamber assembly and one on the camera module assembly mast, house two magazines each.

On-orbit activities consist of the flight crew activating the SSCE payload and burning one PMMA sample in the chamber.

DEVELOPMENT TEST OBJECTIVES

Wraparound digital autopilot (DAP) flight test verification (DTO 255).

The purpose of this DTO is to verify in flight the stability and control of the DAP. The first four flights used the programmed test inputs (PTI) capability to execute flight test maneuvers. The next two flights actually enabled the wraparound DAP while flying a nominal end-of-mission (NEOM) trajectory. Once operational, this will provide an estimated 200 to 400 lb. RCS propellant savings during entry. This is the seventh flight of DTO 255.

External tank thermal protection system performance, method 3 (DTO 312).

Photographs will be taken of the external tank and solid rocket boosters after separation to determine TPS charring patterns, identify regions of TPS material spallation, evaluate overall TPS performance, and identify TPS or other problems that may pose a debris hazard to the orbiter. The camera is located on the flight deck (hand-held 300 mm Nikon). This DTO is required on each flight of each vehicle. This DTO has previously been manifested on 60 flights.

Orbiter space vision system flight video taping (DTO 700-10).

The OSVS uses existing shuttle payload bay cameras and other payload bay hardware to provide precise relative position, attitude, and rate cues in a concise graphical and digital format. The orbiter crew uses these cues to perform remote manipulator system (RMS) operations and/or proximity operations.

Use of the OSVS could reduce or eliminate the need for dedicated keel and boresight payload bay cameras for RMS operations. In addition, it could reduce orbiter propellant usage and plume impingement effects during payload proximity operations and rendezvous and docking operations. This system also could increase the probability of meeting required docking conditions.

A minimum of three flights of good data are required. This is the ninth flight of DTO 700-10.

Orbiter space vision system (SVS) flight unit testing (DTO 700-11).

SVS photogrammetry technology uses existing payload bay hardware to provide precise relative position, attitude, and rate cue in a concise graphical and digital format. The orbiter crew uses the cues to perform RMS operations and/or proximity operations (prox ops) piloting.

The SVS flew as part of Canex-II on STS-52. It provided the RMS operators with precision position and attitude cues to support Canadian target assembly (CTA) unberthing, maneuvering, and berthing operations. It was also used in support of CTA deployment and free-flying proximity operations.

The orbiter SVS (OSVS), which flew on STS-80, is an advanced version of the SVS that is smaller and lighter, has a much simpler user interface, and has significantly upgraded operational capabilities. The OSVS has the potential to reduce or eliminate the need for dedicated keel and boresight cargo bay cameras required for RMS operations. For prox ops applications, it has the potential to decrease orbiter propellant usage and plume impingement effects, and it could increase the chance for meeting the docking conditions for approaches to the Mir space station and the International Space Station. It is also anticipated that it will reduce both training and on-orbit operations timelines.

The purpose of this DTO is to evaluate the operation and performance of OSVS in conjunction with the orbiter closed-circuit television (CCTV) system and crew operations in the on-orbit environment.

The OSVS is planned for critical path operations early in the Space Station assembly sequence. The OSVS will be the only source of precision data with which the shuttle RMS operator will perform station assembly operations that include androgynous peripheral attachment system (APAS) and common berthing mechanism (CBM) mating tasks. The goal of the DTO is to develop a high level of confidence that OSVS can be relied on for Space Station assembly.

The OSVS will be flown on one demo flight and at least one flight of opportunity. The demo flight will include dedicated robotic operations designed to provide a thorough evaluation of system performance and capabilities. For the flights of opportunity, the OSVS will be used in parallel to nominally planned operations; it will serve as an additional source of payload position and attitude information to aid RMS operators and/or pilots in performing robotic and free-flying operations. It is also planned to support rendezvous/docking on Mir-7 and solar dynamics installation on Mir-7.

On-board video recording of camera views used by OSVS for on-board photogrammetric processing and the results of the photosolution (i.e., either the synthetic display or encoded data added to the raw video signals) is required for postflight analysis. In addition, real-time downlink of camera video used by OSVS is desired for real-time processing and recording on the ground. Where keel or boresight cameras are used in parallel with OSVS, simultaneous on-board recording of these views is desired for postflight comparison to OSVS performance.

A minimum of four flights of good data is required. This is the third flight of DTO 700-11.

Single-string Global Positioning System (GPS) (DTO 700-14).

The purpose of this DTO is to demonstrate the performance and operation of the GPS during orbiter ascent, on-orbit, entry, and landing phases. A modified military GPS receiver processor and the existing orbiter GPS antennas are used. GPS data are downlinked during backup flight system operation, ascent, and entry only. A PGSC hard drive is used to record GPS data during extended on-orbit time. This is the fourth flight of DTO 700-14.

Crosswind landing performance (DTO 805).

This DTO will continue to gather data to demonstrate the capability to perform a manually controlled landing with a 90-degree, 10- to 15-knot steady-state crosswind. This DTO can be performed regardless of landing site or vehicle mass properties. Following a crosswind landing, the drag chute will be deployed after nose gear touchdown when the vehicle is stable and tracking the centerline. This DTO has previously been manifested on 50 flights.

AutoTRAC computer vision system (ACVS) (DTO 842).

The purpose of this DTO is to demonstrate a space vision system concept that can be used to support cargo element berthing and proximity operations for Space Station assembly flights 2A through 6A. The ACVS DTO has three objectives.

The first objective is to unberth/berth a payload using a redundant mini-keel camera and mirror target with retroflectors as a crew visual (relative orientation) aid.

The second objective is to assess the video quality of a new wireless camera system, mounted on the solid rocket motors, in conjunction with its use as a crew visual (relative orientation) aid. In addition, it will be determined whether the system can successfully receive and process video signals via multiple radio frequency paths by using the wireless camera transceiver, as well as the extravehicular mobility unit television receiver, simultaneously.

The third objective is to assess the ability of the color TV camera and intensified TV camera to track a free-flying payload, with cooperative targets, out to 30 to 500 feet during payload deployment and retrieval operations. This is the first flight of DTO 842.

V-bar proximity operations demonstration for International Space Station (DTO 843).

The purpose of this DTO is to demonstrate piloting techniques and shuttle performance during a V-bar approach to a small payload target, using a single-nose x-jet for x-axis translation control.

Shuttle flights to the International Space Station on flights 6A and subsequent will use a V-bar docking attitude approach procedure. Shuttle flights 6A through 13A will use V-bar docking with a single-nose x-axis translation jet. This is the first flight of DTO 843.

Remote manipulator system (RMS) situational awareness displays (RSAD) (DTO 844).

The objective of this DTO is to demonstrate the use of RSAD before it is used operationally on International Space Station assembly flights. RSAD will integrate information pertaining to RMS from various sources, such as PCMMU, the Canadian Space Vision System; the Johnson Space Center Vision System; and any other system that may be developed to determine the position and attitude of a payload. This is the first flight of DTO 844.

RISK MITIGATION EXPERIMENT

Microgravity vibration isolation mount (MIM) system performance evaluation and characterization (RME 1328). The primary objective of this RME is to thoroughly characterize the performance of the MIM using advanced control techniques and to determine what level of microgravity quality is obtainable with the MIM. This knowledge will be used to assist in determining what microgravity environment is achievable on the International Space Station using locker-level motion-isolation systems. This is the first Space Shuttle flight of RME 1328.

DETAILED SUPPLEMENTARY OBJECTIVES

Interaction of the space shuttle launch and entry suit (LES) and sustained weightlessness on egress locomotion (DSO 331)

Previous flight experience has shown that astronauts' energy expenditure increases when they move around while wearing the LES. The purpose of this DSO is to investigate the effect of the LES/advanced crew escape suit on egress locomotion and to directly assess the emergency egress capacity of crew members at wheel stop. Before beginning deorbit preparations, the crew members will instrument themselves with the egress monitor assembly, which measures oxygen consumption, body temperatures, heart rate, and ventilatory equivalent.

Assessment of sleep quality and circadian rhythms in astronauts by bright light (DSO 484C).

This DSO will assess the efficacy of bright light in facilitating preflight circadian shifting in astronauts who must undergo atypical work-rest cycles during space flight. Circadian shift will be monitored by examining physical activity and physiological properties such as melatonin and cortisol. A total of 12 crew members from varying flights are required for the study. The activity is entirely scheduled for pre- and postflight periods. There is no in-flight activity.

Inter-Mars tissue-equivalent proportional counter (ITEPC) (DSO 485)

The purpose of this DSO is to demonstrate the ability of hardware to withstand the radiation environment of space flight and to demonstrate the expanded capability of experiment software over the previously flown middeck TEPC. In addition, the experiment will gather key data on the radiation environment for future extravehicular activities and on single-event upsets that affect the orbiter's hardware. This experiment will be flown on an adaptive payload carrier mounted on the starboard side in the cargo bay. It consists of two units, each with a spectrometer, radiation detector, data storage board, computer clock, multi-channel analyzer, discriminators, amplifiers, and power supply. The equipment is activated by the crew after orbital insertion and is deactivated during deorbit preparation.

Monitoring latent virus reactivation and shedding in astronauts (DSO 493)

The objective of DSO 493 is to determine the frequency of induced reactivation of herpes viruses, herpes virus shedding, and clinical disease after exposure to physical stresses associated with space flight. Saliva will be collected once per flight day, immediately after the sleep cycle.

Educational activities (DSO 802)

This DSO has two objectives. The first is to produce educational products that will capture the interest of students and motivate them toward careers in science, engineering, and mathematics. These products will include video lessons with scenes recorded both on orbit and on the ground of educational activities performed by the flight crew. The second objective is to support the live television downlink of educational activities performed by the flight crew.

STS-85 CREWMEMBERS

STS085-S-002 -- *Five NASA astronauts and a Canadian payload specialist pause from their training schedule to pose for the traditional crew portrait for their mission. In front are astronauts Curtis L. Brown Jr. (right), mission commander, and Kent V. Rominger, pilot. On the back row, from the left, are astronauts Robert L. Curbeam Jr., Stephen K. Robinson and N. Jan Davis, all mission specialists, along with the Canadian Space Agency's (CSA) payload specialist Bjarni Tryggvason.*

PHOTO CREDIT: NASA or National Aeronautics and Space Administration.

BIOGRAPHICAL DATA

CURTIS L. BROWN Jr. (LIEUTENANT COLONEL, USAF)
STS-85 COMMANDER

PERSONAL DATA - Born March 11, 1956, in Elizabethtown, North Carolina. Unmarried. One son. He enjoys water and snow skiing, scuba diving, remote control model aircraft, restoring old cars, woodworking, sailing, aerobatic flying. His mother, Mrs. Rachel H. Brown, resides in Elizabethtown. His father, Mr. Curtis L. Brown, Sr., is deceased.

EDUCATION - Graduated from East Bladen High School, Elizabethtown, North Carolina, in 1974; received a bachelor of science degree in electrical engineering from the Air Force Academy in 1978.

ORGANIZATIONS - Member, United States Air Force Association, and United States Air Force Academy Association of Graduates.

SPECIAL HONORS - Defense Superior Service Medal, Air Force Meritorious Service Medal, Air Force Commendation Medal, NASA Space Flight Medals.

EXPERIENCE - Brown was commissioned a second lieutenant at the United States Air Force Academy, Colorado Springs, in 1978, and completed undergraduate pilot training at Laughlin Air Force Base, Del Rio, Texas. He graduated in July 1979 and was assigned to fly A-10 aircraft at Myrtle Beach Air Force Base, South Carolina, arriving there in January 1980 after completing A-10 training at Davis-Monthan Air Force Base, Arizona. In March 1982, he was reassigned to Davis-Monthan Air Force Base as an instructor pilot in the A-10. In January 1983, he attended USAF Fighter Weapons School at Nellis Air Force Base and returned to Davis-Monthan Air Force Base as an instructor in A-10 weapons and tactics.

In June 1985, he attended USAF Test Pilot School at Edwards Air Force Base, California. Upon graduation in June 1986, Brown was assigned to Eglin Air Force Base, Florida, where he served as a test pilot in the A-10 and F-16 aircraft until his selection for the astronaut program.

He has logged over 3,700 hours flight time in jet aircraft.

NASA EXPERIENCE - Selected as an astronaut candidate by NASA in June 1987, Brown completed a one-year training and evaluation program in August 1988, and qualified for assignment as a pilot on future Space Shuttle flight crews. His technical assignments have included: involvement in the upgrade of the Shuttle Mission Simulator (SMS); development of the Flight Data File FDF); he served as lead of the astronaut launch support team responsible for crew ingress/strap-in prior to launch and crew egress after landing; monitored the refurbishment of OV-102 and OV-103 during ground turnaround processing; lead spacecraft communicator (CAPCOM). A veteran of three space flights, Brown has logged over 693 hours in space. He was the pilot on STS-47 in 1992, STS-66 in 1994 and STS-77 in 1996.

STS-47 Spacelab-J (September 12-20, 1992) was an eight-day cooperative mission between the United States and Japan focused on life science and materials processing experiments in space. After completing 126 orbits of the Earth, the mission ended with Space Shuttle Endeavour landing at Kennedy Space Center, Florida. Mission duration was 190 hours, 30 minutes, 23 seconds.

STS-66 (November 3-14, 1994) was the Atmospheric Laboratory for Applications and Science-3 (ATLAS-3) mission. ATLAS-3 was part of an ongoing program to determine the Earth's energy balance and atmospheric change over an 11-year solar cycle. Following 175 orbits of the Earth, the 11-day mission ended with the Shuttle Atlantis landing at Edwards Air Force Base, California. Mission duration was 262 hours and 34 minutes.

STS-77 (May 19-29, 1996) was a ten-day mission aboard Space Shuttle Endeavour. The crew performed a record number of rendezvous sequences (one with a SPARTAN satellite and three with a deployed Satellite Test Unit) and approximately 21 hours of formation flying in close proximity of the satellites. During the flight the crew also conducted 12 materials processing, fluid physics and biotechnology experiments in a Spacehab Module. STS-77 deployed and retrieved a SPARTAN satellite, which carried the Inflatable Antenna Experiment designed to test the concept of large, inflatable space structures. A small Satellite Test Unit was also deployed to test the concept of self-stabilization by using aerodynamic forces and magnetic damping. The mission was concluded in 160 Earth orbits, traveling 4.1 million miles in 240 hours and 39 minutes.

CURRENT ASSIGNMENT - Brown is assigned to command the crew of STS-85 during Discovery's 11-day mission to study changes in the Earth's atmosphere. STS-85 is targeted for an August 1997 launch.

BIOGRAPHICAL DATA

KENT V. ROMINGER (COMMANDER, USN)
STS-85 PILOT

PERSONAL DATA - Born August 7, 1956, in Del Norte, Colorado. Married to the former Mary Sue Rule. One child. He enjoys snow skiing, water skiing, horseback riding, and running. His parents, Mr. & Mrs. R. Vernon Rominger, reside in Del Norte, Colorado. Her parents, Mr. & Mrs. Delbert Rule, of Durango, Colorado, are deceased.

EDUCATION - Graduated from Del Norte High School, Del Norte, Colorado, in 1974; received a bachelor of science degree in civil engineering from Colorado State University in 1978; a master of science degree in aeronautical engineering from the U.S. Naval Postgraduate School in 1987.

ORGANIZATIONS - Member, Society of Experimental Test Pilots, American Institute of Aeronautics and Astronautics, Association of Naval Aviation, and Chi Epsilon Civil Engineering Society.

SPECIAL HONORS - Recipient of Navy Commendation Medal, National Defense Medal, Southwest Asia Service Medal, Expert Rifle and Pistol Medals, and various unit and service awards. Distinguished graduate, U.S. Naval Test Pilot School. NATC Test Pilot of the Year (1988).Ray E. Tenhoff Award for most outstanding presentation at 34th Annual Society of Experimental Test Pilots Symposium (1990). Top-Ten Carrier Landing Distinction in Airwings Two and Nine. West Coast Tomcat Fighter Pilot of the Year (1992).

EXPERIENCE - Rominger received his commission through the Aviation Reserve Officer Candidate (AVROC) Program in 1979, and was designated a Naval Aviator in September 1980. Following training in the F-14 Tomcat, he was assigned to Fighter Squadron Two (VF-2) from October 1981 to January 1985 aboard the USS Ranger and USS Kitty Hawk. While assigned to VF-2 Rominger attended the Navy Fighter Weapons School (Topgun). In 1987 he completed the Naval Postgraduate School/Test Pilot School Cooperative Program, and was assigned as F-14 Project Officer to the Carrier Suitability Branch of the Strike Aircraft Test Directorate at Patuxent River, Maryland. During his tour of duty Rominger completed the initial carrier suitability sea trials of the F-14B, logging the first aircraft carrier arrestment and catapult launch in the upgraded Tomcat. In September 1990 he reported to Fighter Squadron Two Hundred Eleven (VF-211) where he served as Operations Officer and completed a Desert Storm Deployment to the Arabian Gulf aboard USS Nimitz.

He has logged over 4,500 flying hours in over 35 types of aircraft and 685 carrier landings.

NASA EXPERIENCE - Selected by NASA in March 1992, Rominger reported to the Johnson Space Center in August 1992. He completed one year of training and is qualified for assignment as a pilot on future Space Shuttle flight crews. Rominger was initially assigned to work technical issues for the Astronaut Office Operations Development Branch. A veteran of two space flights, STS-73 in 1995 and STS-80 in 1996, Rominger has logged 33 days, 13 hours, 45 minutes and 21 seconds in space. He will serve as pilot on the crew of STS-85 during Discovery's 11-day mission to study changes in the Earth's atmosphere. STS-85 is targeted for an August 1997 launch.

From October 20 to November 5, 1995, Rominger served as pilot aboard Space Shuttle Columbia on STS-73, the second United States Microgravity Laboratory mission. The mission focused on materials science, biotechnology, combustion science, the physics of fluids, and numerous scientific experiments housed in the pressurized Spacelab module. In completing his first space flight, Rominger orbited the earth 256 times, traveled over 6 million miles, and logged a total of 15 days, 21 hours, 52 minutes and 21 seconds in space.

From November 19 to December 7, 1996, Rominger served as pilot aboard Space Shuttle Columbia on STS-80. During the flight, the crew deployed and retrieved the Wake Shield Facility (WSF) and the Orbiting Retrievable Far and Extreme Ultraviolet Spectrometer (ORFEUS) satellites. The free-flying WSF created a super vacuum in its wake and grew thin film wafers for use in semiconductors and other high-tech electrical components. The ORFEUS instruments, mounted on the reusable Shuttle Pallet Satellite, studied the origin and makeup of stars. In completing his second spaceflight, Rominger orbited the earth a record 278 times, traveled over 7 million miles and logged 17 days, 15 hours and 53 minutes in space.

BIOGRAPHICAL DATA

JAN DAVIS (PH.D.)
STS-85 PAYLOAD COMMANDER/MISSION SPECIALIST

PERSONAL DATA - Born November 1, 1953, at Cocoa Beach, Florida, but considers Huntsville Alabama, to be her hometown. Married to astronaut Mark Lee from Viroqua, Wisconsin. She enjoys flying, ice skating, snow skiing, water sports, and needlework. She is a volunteer Girl Scout troop assistant leader, and is a member of the Lakeview Quilters Guild.

EDUCATION - Graduated from Huntsville High School in 1971; received bachelor of science degrees in applied biology from Georgia Institute of Technology and in mechanical engineering from Auburn University in 1975 and 1977, respectively; received a master of science degree and a doctorate in mechanical engineering from University of Alabama in Huntsville, in 1983 and 1985, respectively.

ORGANIZATIONS - Fellow, American Society of Mechanical Engineers. Member, Tau Beta Pi, Omicron Delta Kappa, Pi Tau Sigma, and Sigma Gamma Tau honoraries, and Alpha Xi Delta social sorority. Board Member, Ice Skating Institute of America Education Foundation, Greater Houston Skating Council, and Georgia Tech Advisory Board.

SPECIAL HONORS - Recipient of NASA Exceptional Service Medal (1995), NASA Space Flight Medal (1992, 1994), Marshall Space Flight Center Director's Commendation (1987), NASA Fellowship for Full-Time Study (1983), ASME National Old Guard Prize (1978), and Alpha Xi Delta Woman of Distinction (1993).

EXPERIENCE - After graduating from Auburn University in 1977, Dr. Davis joined Texaco in Bellaire, Texas, working as a petroleum engineer in tertiary oil recovery. She left there in 1979 to work for NASA's Marshall Space Flight Center as an aerospace engineer. In 1986, she was named as team leader in the Structural Analysis Division, and her team was responsible for the structural analysis and verification of the Hubble Space Telescope (HST), the HST maintenance mission, and the Advanced X-Ray Astrophysics Facility. In 1987, she was also assigned to be the lead engineer for the redesign of the solid rocket booster external tank attach ring. Dr. Davis did her graduate research at the University of Alabama in Huntsville, studying the long-term strength of pressure vessels due to the viscoelastic characteristics of filament-wound composites. She holds one patent, has authored several technical papers, and is a Registered Professional Engineer.

JSC EXPERIENCE - Dr. Davis became an astronaut in June 1987 and is qualified for assignment as a mission specialist on Space Shuttle flight crews. Her initial technical assignment was in the Astronaut Office Mission Development Branch, where she provided technical support for Shuttle payloads. She then served as a CAPCOM in Mission Control communicating with Shuttle crews for seven missions. After her first space flight, Dr. Davis served as the Astronaut Office representative for the Remote Manipulator System (RMS), with responsibility for RMS operations, training, and payloads. After her second space flight, she served as the Chairperson of the NASA Education Working Group and as Chief for the Payloads Branch, which provided Astronaut Office support for all Shuttle and Space Station payloads. A veteran of two space flights, STS-47 in 1992 and STS-60 in 1994, Dr. Davis has logged over 389 hours in space.

Dr. Davis was a mission specialist on STS-47, Spacelab-J, the 50th Space Shuttle mission. Launched on September 12, 1992, this cooperative venture between the United States and Japan, conducted 43 experiments in life sciences and materials processing. During the eight-day mission, she was responsible for operating Spacelab and its subsystems and performing a variety of experiments. After completing 126 orbits of the Earth, STS-47 Endeavour landed at Kennedy Space Center on September 20, 1992.

Dr. Davis was also a mission specialist on STS-60, which was the second flight of Spacehab (Space Habitation Module) and the first flight of the Wake Shield Facility (WSF). Launched on February 3, 1994, this flight was the first Space Shuttle flight on which a Russian Cosmonaut was a crew member. During the eight-day mission, her prime responsibility was to maneuver the WSF on the RMS, to conduct thin film crystal growth. She also was responsible for performing scientific experiments in the Spacehab, and was trained to perform extravehicular activity (EVA), if required. The STS-60 Discovery landed at Kennedy Space Center on February 11, 1994, after completing 130 orbits of the Earth.

CURRENT ASSIGNMENT - Dr. Davis is assigned as the payload commander for STS-85, scheduled for August 1997. On this eleven-day mission she will deploy and retrieve the CRISTA-SPAS payload, and will operate the Japanese Manipulator Flight Demonstration (MFD) robotic arm. This flight on Discovery will also include several other scientific payloads that will conduct research on astronomy, Earth sciences, life sciences, and materials science.

BIOGRAPHICAL DATA

ROBERT L. CURBEAM Jr., (LIEUTENANT COMMANDER, USN)
STS-85 MISSION SPECIALIST

PERSONAL DATA - Born March 5, 1962, in Baltimore, Maryland. Married to the former Julie Dawn Lein; two children. He enjoys weightlifting, biking, and family activities.

EDUCATION - Graduated from Woodlawn High School, Baltimore County, Maryland, 1980. Bachelor of science degree in aerospace engineering from the United States Naval Academy, 1984. Master of science degree in aeronautical engineering from the Naval Postgraduate School, 1990. Degree of aeronautical & astronautical engineering from the Naval Postgraduate School, 1991.

ORGANIZATIONS - Member of the U.S. Naval Academy Alumni Association and the Association of Old Crows.

SPECIAL HONORS - Fighter Wing One Radar Intercept Officer of the Year for 1989, U.S. Naval Test Pilot School Best Developmental Thesis (DT-II) Award, two Navy Commendation Medals, the Navy Meritorious Unit Commendation, the Armed Forces Expeditionary Medal, the National Defense Service Medal, the Navy Battle Efficiency Award, and the Sea Service Deployment Ribbon.

EXPERIENCE - Upon graduation from the U.S. Naval Academy, Curbeam commenced Naval Flight Officer training in 1984. In 1986 he reported to Fighter Squadron 11 and made overseas deployments to the Mediterranean and Caribbean Seas, and the Arctic and Indian Oceans onboard the USS Forrestal (CV-59). Upon completion of Test Pilot School in December 1991, he reported to the Strike Aircraft Test Directorate where he was the project officer for the F-14A/B Air-to-Ground Weapons Separation Program. In August 1994, he returned to the U.S. Naval Academy as an instructor in the Weapons and Systems Engineering Department.

NASA EXPERIENCE - Selected by NASA in December 1994, Curbeam reported to the Johnson Space Center in March 1995. He completed a year of training and evaluation and was assigned to the Computer Support Branch of the Astronaut Office.

CURRENT ASSIGNMENT - Curbeam will serve as a mission specialist on the crew of STS-85 during Discovery's 11-day mission to study changes in the Earth's atmosphere. STS-85 is targeted for an August 1997 launch.

BIOGRAPHICAL DATA

STEPHEN K. ROBINSON (PH.D.)
STS-85 MISSION SPECIALIST

BIRTHDATE/PLACE - Born October 26, 1955, in Sacramento, California. His parents, William and Joyce Robinson, reside in Moraga, California

PHYSICAL DESCRIPTION - Brown hair; hazel eyes; 6 feet; 165 pounds.

EDUCATION - Graduated from Campolindo High School, Moraga, California, 1973; Bachelor of Science degree in mechanical/aeronautical engineering from University of California at Davis, 1978; Master of Science degree in mechanical engineering from Stanford University, 1985; Doctorate in mechanical engineering, with a minor in aeronautics and astronautics from Stanford University, 1990.

MARITAL STATUS - Unmarried.

RECREATIONAL INTERESTS - Flying, antique aircraft, swimming, canoeing, hiking, music, art, computer graphics and stereo photography.

ORGANIZATIONS - American Institute of Aeronautics and Astronautics, Aerospace Medical Association, Aircraft Owners and Pilots Association, Experimental Aircraft Association.

SPECIAL HONORS - NASA Ames Honor Award for Scientist (1989); American Institute of Aeronautics and Astronautics Outstanding Technical Paper Award for Applied Aerodynamics (co-author) (1992); NASA/Space Club G.M. Low Memorial Engineering Fellowship (1993).

EXPERIENCE - Robinson started work for NASA in 1975 as a student co-op at NASA's Ames Research Center in Mountain View, California. After graduation from University of California at Davis, he joined NASA Ames as a research scientist in the fields of fluid dynamics, aerodynamics, experimental instrumentation, and computational scientific visualization. While at Ames, Robinson earned masters and doctorate degrees in mechanical engineering at Stanford University, with research emphasis in turbulence physics, and additional research in human eye dynamics. In 1990, Robinson was selected as Chief of the Experimental Flow Physics Branch at NASA's Langley Research Center in Hampton, Virginia, with responsibility for 8 wind tunnels and an engineering staff engaged in aerodynamics and fluids research. In 1993, Robinson was awarded the NASA/Space Club G.M. Low Memorial Engineering Fellowship, and was assigned for 15-months to the Massachusetts Institute of Technology (MIT) as Visiting Engineer in the Man Vehicle Laboratory (MVL). As an MVL team-member, he conducted neurovestibular research on astronauts on the Spacelab Life Sciences 2 Shuttle mission (STS-58). Other MIT research included EVA dynamics for satellite capture and space construction. While in Cambridge, Massachusetts, Robinson was also a visiting scientist at the U.S. Department of Transportation's Volpe National Transportation Systems Center, doing research on environmental modeling for flight simulation, cockpit human factors for GPS-guided instrument approach procedures, and moving-map displays. Robinson returned to NASA Langley in September 1994, where he accepted a dual assignment as research scientist in the Multidisciplinary Design Optimization Branch, and as leader of the Aerodynamics and Acoustics element of NASA's General Aviation Technology program. Robinson has over 1000 hours in aircraft ranging from antique taildraggers to NASA jets.

NASA EXPERIENCE - Selected by NASA in December 1994, Dr. Robinson reported to the Johnson Space Center in March 1995. He completed a year of training and evaluation and was assigned to the Shuttle Avionics Integration Laboratory (SAIL) for the Astronaut Office Computer Support Branch.

CURRENT ASSIGNMENT - Dr. Robinson will serve as a mission specialist on the crew of STS-85 during Discovery's 11-day mission to study changes in the Earth's atmosphere. STS-85 is targeted for a August 1997 launch.

BIOGRAPHICAL DATA

BJARNI V. TRYGGVASON
CANADIAN ASTRONAUT
STS-85 PAYLOAD SPECIALIST-1

PERSONAL DATA - Born September 21, 1945, in Reykjavik, Iceland. He has two children. Mr. Tryggvason has about 4,000 hours of flight experience, holds an Airline Transport Rating and has been a flight instructor for 10 years. He is currently active in aerobatic flight and is qualified as Captain in the Tutor jet trainer with the Canadian Air Force. He maintains a high level of physical fitness, enjoys scuba diving, skiing, and has made 17 parachute jumps.

EDUCATION - Attended primary schools in Nova Scotia and British Columbia; completed high school in Richmond, B.C. He received a Bachelor of Applied Science in Engineering Physics from the University of British Columbia in 1972 and did postgraduate work in engineering with specialization in applied mathematics and fluid dynamics at the University of Western Ontario.

ORGANIZATIONS - Member of the Canadian Aeronautics and Space Institute.

SPECIAL HONORS - Recipient of numerous scholarships throughout his university years.

EXPERIENCE - Worked as a meteorologist with the cloud physics group at the Atmospheric Environment Service in Toronto in 1972 and 1973. In 1974, he joined the University of Western Ontario to work as a research associate at the Boundary Layer Wind Tunnel Laboratory working on projects involving rigid and aero-elastic model studies of wind effects on structures.

In 1978, he was a guest research associate at Kyoto University, Japan, followed by a similar position at James Cook University in Townsville, Australia. In late 1979, he returned to the University of Western Ontario as a lecturer in applied mathematics.

In 1982, Mr. Tryggvason joined the Low Speed Aerodynamics Laboratory at the National Research Council (NRC). He became part of the NRC team assembled to study the sinking of the Ocean Ranger oil rig in support of the Royal Commission investigation into that tragedy. He designed and led the aerodynamics tests, which established the wind loads acting on the rig.

He was one of the six Canadian astronauts selected in December 1983. He was back-up Payload Specialist to Steve MacLean for the CANEX-2 set of experiments which flew on Mission STS-52, October 22 to November 1, 1992.

He was the Project Engineer for the design of the SVS target spacecraft which was deployed during that mission.

He is the principal investigator in the development of the Large Motion Isolation Mount (LMIM) which has flown numerous times on NASA's KC-135 and DC-9 aircraft. He is also the principal investigator in the development of the Microgravity vibration Isolation Mount (MIM). The MIM has been in operation on board the Russian Mir Space Station since April 1996 and was first operated by U.S. astronaut Shannon Lucid during her historic six month flight on the Mir. The MIM is being used on the Mir to support several Canadian and U.S. experiments in material science and fluid physics.

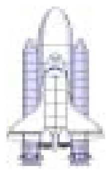
He was active in supervising undergraduate student projects at several universities across Canada. Between 1982 and 1992, he was a part-time lecturer at the University of Ottawa and Carleton University, teaching graduate courses on structural dynamics and random vibrations.

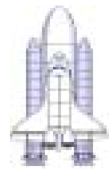
He also served as a Canadian Space Agency representative on the NASA Microgravity Measurement Working Group, and the International Space Station (ISS) Microgravity AIT (Analysis and Integration Team).

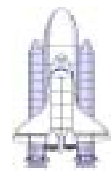
CURRENT ASSIGNMENT - Mr. Tryggvason will serve as a Payload Specialist on the crew of STS-85 during Discovery's 11-day mission to study changes in the Earth's atmosphere. STS-85 is targeted for an August 1997 launch. His major role on the flight will be focusing on further tests of the Microgravity Vibration Isolation Mount (MIM) and performing fluid physics experiments designed to examine sensitivity to spacecraft vibrations. This work is directed as developing better understanding of the need for systems such as the MIM on the International Space Station and on the effect of vibrations on the many experiments to be performed on the ISS.

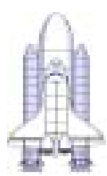
SHUTTLE FLIGHTS AS OF AUGUST 1997

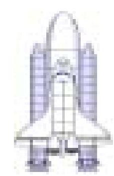
85 TOTAL FLIGHTS OF THE SHUTTLE SYSTEM -- 60 SINCE RETURN TO FLIGHT











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