NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

SPACE SHUTTLE MISSION STS-49

PRESS KIT
MAY 1992

INTELSAT VI (F-3) REPAIR MISSION

STS-49 INSIGNIA

STS049-S-001 -- *The STS-49 insignia, designed by its crew members, captures space flight's spirit of exploration which has its origins in the early seagoing vessels that explored the uncharted reaches of Earth and its oceans. The ship depicted on the insignia is H.M.S. Endeavour, the sailing vessel which Captain James Cook commanded on his first scientific expedition to the south Pacific. Just as Captain Cook engaged in unprecedented feats of exploration during his voyage, on Endeavor's maiden flight, its crew will expand the horizons of space operations with an unprecedented rendezvous and series of three space walks. During three consecutive days of extravehicular activity, the crew will conduct one space walk to retrieve, repair and deploy the Intelsat IV-F3 communications satellite, and two additional EVAs to evaluate potential Space Station Freedom assembly concepts. The flags flying high on Endeavor's masts bear the colors of the two schools that won the nationwide contest when Endeavor was chosen as the name of NASA's newest space shuttle: Senatobia (Mississippi) Middle School and Tallulah Falls (Georgia) School.*

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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SATELLITE RESCUE, SPACEWALKS MARK ENDEAVOUR'S FIRST FLIGHT

Endeavour's maiden space flight, STS-49, features rendezvous, repair and reboost of a crippled communications satellite. Also astronauts will perform spacewalks over three consecutive days, a first on a Space Shuttle mission, to demonstrate Space Station Freedom assembly techniques.

The launch of STS-49 is currently planned for 8:03 p.m. EDT May 5. Endeavour will be placed into an elliptical orbit of 183 by 95 n.m. with an inclination of 28.35 degrees to the equator. With an on-time launch, landing would be at 7:58 p.m. EDT May 12 at Edwards Air Force Base, CA. Mission duration is 6 days, 23 hours and 55 minutes.

Endeavour's crew -- Commander Dan Brandenstein, Pilot Kevin Chilton and Mission Specialists Pierre Thuot, Rick Hieb, Kathy Thornton, Tom Akers and Bruce Melnick -- will rendezvous with the Intelsat VI (F-3) communications satellite on the 4th day of the flight. The Intelsat VI was launched 2 years ago by an unmanned Titan rocket and stranded in a useless, low orbit when the Titan's second stage failed to separate.

During the first spacewalk on flight day 4, Thuot will grasp the satellite using a specially designed capture mechanism. Thuot and Hieb will attach a new solid rocket motor and then deploy the satellite. Intelsat VI's final destination will be a 22,300 n.m. high orbit where it will be stationary above the Atlantic Ocean, providing telecommunications services to more than 180 countries for at least the rest of this decade.

On flight days 5 and 6, a Thornton and Akers team and a Thuot and Hieb team will perform spacewalks to evaluate equipment and techniques for constructing Space Station Freedom. The evaluations will include construction of a pyramid simulating the space station truss structure; the ability of an astronaut to manipulate large, heavy objects in weightlessness; and the usefulness of five prototype devices to assist a spacewalker, whose tether has come loose, in getting back to his spacecraft.

In addition, Endeavour will carry the Commercial Protein Crystal Growth experiment in its middeck, an ongoing series of experiments that grow near-perfect protein crystals in weightlessness for use in developing new products and drugs. The Air Force Maui Optical Station, a facility located on the Hawaiian island of Maui, will attempt to calibrate its equipment by viewing jet firings and water dumps from Endeavour. An Ultraviolet Plume Instrument on the LACE satellite will observe the Shuttle for calibration information. Endeavour's first flight will be the 47th Space Shuttle mission.

(END OF GENERAL RELEASE; BACKGROUND INFORMATION FOLLOWS.)

MEDIA SERVICES

NASA Select Television Transmission

NASA Select television is available on Satcom F-2R, Transponder 13, located at 72 degrees west longitude; frequency 3960.0 MHz, audio 6.8 MHz.

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

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

Status Reports

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

Briefings

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

STS-49 QUICK LOOK FACTS

Orbiter	Endeavour (OV-105)
Launch Date/Time	May 5, 1992 - 8:03 p.m. EDT
Launch Window	53 minutes
Launch Site	Kennedy Space Center, FL, Pad 39-B
Altitude/Inclination	183 x 95 n.m./28.35 degrees
Duration	7 Days
Landing Date/Time	May 12, 1992 - 7:58 p.m. EDT (6/23:55 MET)
Primary Landing Site	Edwards Air Force Base, CA
Abort Landing Sites	Return to Launch Site - Kennedy Space Center, Fla. Transoceanic Abort Landing - Ben Guerir, Morocco Abort Once Around - Edwards Air Force Base, CA
Crew:	Daniel C. Brandenstein - Commander Kevin P. Chilton - Pilot Bruce E, Melnick - Mission Specialist Pierre J. Thuot - Mission Specialist (EV1) Richard J. Hieb - Mission Specialist (EV2) Kathryn C. Thornton - Mission Specialist (EV3) Thomas D. Akers - Mission Specialist (EV4)
Cargo Bay:	Assembly of Station Methods (ASEM) Intelsat-VI Repair & Reboost Equipment
Middeck:	Commercial Protein Crystal Growth (CPCG)

Maiden Voyage Of Endeavour

STS-49 Launch Period

	Launch Period Opens			Launch Period Closes			
Launch Date	**GMT**	**EDT**	**CDT**	**GMT**	**EDT**	**CDT**	**Duration**
05/05/92	00:03 (5/6)	8:03 p.m.	7:03 p.m.	00:56 (5/6)	8:56 p.m.	7:56 p.m.	53 minutes
05/06/92	23:37	7:37 p.m.	6:37 p.m.	00:25 (6/7)	8:25 p.m.	7:25 p.m.	48 minutes
05/07/92	23:06	7:06 p.m.	6:06 p.m.	23:55	7:55 p.m.	6:55 p.m.	49 minutes
05/08/92	22:36	6:36 p.m.	5:36 p.m.	23:29	7:29 p.m.	6:29 p.m.	53 minutes
05/09/92	22:06	6:06 p.m.	5:06 p.m.	22:58	6:58 p.m.	5:58 p.m.	52 minutes
05/10/92	21:39	5:39 p.m.	4:39 p.m.	22:27	6:27 p.m.	5:27 p.m.	48 minutes
05/11/92	21:08	5:08 p.m.	4:08 p.m.	22:00	6:00 p.m.	5:00 p.m.	52 minutes
05/12/92	20:37	4:37 p.m.	3:37 p.m.	21:30	5:30 p.m.	4:30 p.m.	53 minutes
05/13/92	20:13	4:13 p.m.	3:13 p.m.	21:00	5:00 p.m.	4:00 p.m.	47 minutes
05/14/92	19:40	3:40 p.m.	2:40 p.m.	20:29	4:29 p.m.	3:29 p.m.	49 minutes

STS-49 SUMMARY OF MAJOR ACTIVITIES

Flight Day 1
Ascent
Orbital Maneuvering System-2
First orbit - raising burn

Flight Day 2
Cabin depressurization to 10.2 psi
Spacesuit checkout;
Mechanical arm checkout;
Second orbit-raising burn

Flight Day 3
Detailed Test Objectives (DTOs) and Detail Supplementary Objectives (DSOs)
Orbit, circularization, plane correction burns

Flight Day 4
Intelsat rendezvous
Spacewalk to attach perigee kick motor
Intelsat deploy

Flight Day 5
Assembly of Space Station by Extravehicular Activity Methods spacewalk

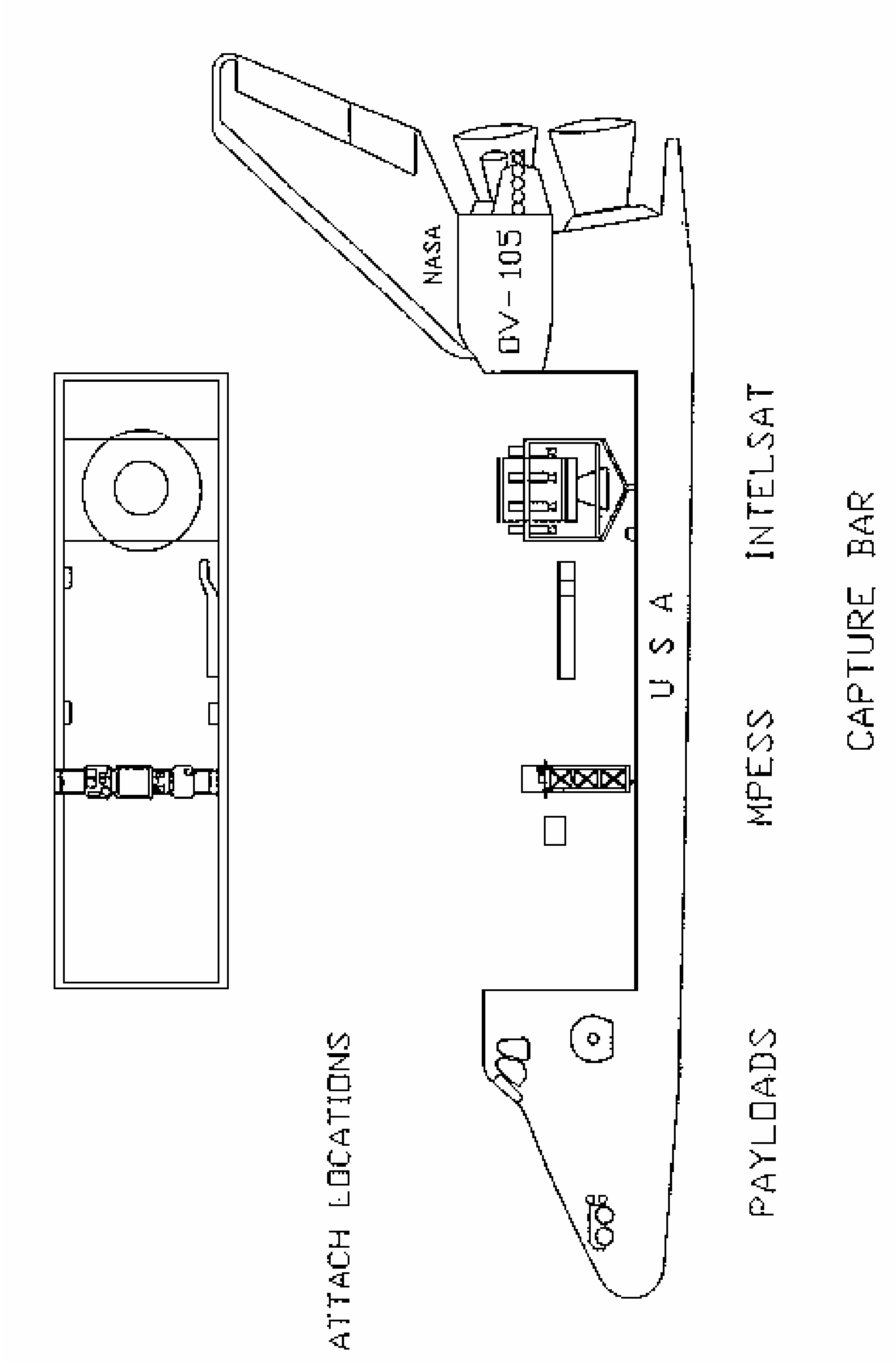
Flight Day 6
Assembly of Space Station by Extravehicular Activity Methods spacewalk

Flight Day 7
Flight control systems checkout
Reaction control system hot fire
DTOs, DSOs

Flight Day 8
Deorbit
Entry
Landing

VEHICLE AND PAYLOAD WEIGHTS

	Pounds
Orbiter (Endeavour) empty, and 3 Shuttle Main Engines	173,314
Intelsat perigee kick motor	23,195
Intelsat cradle, airborne support equipment	4,418
Intelsat support equipment	76
Assembly of Space Station by EVA Methods (ASEM)	3,990
ASEM support equipment	273
Commercial Protein Crystal Growth	69
Detailed Supplementary Objectives	35
Detailed Test Objectives	171
Total Vehicle at Solid Rocket Booster Ignition	4,522,750
Orbiter Landing Weight	201,088



STS-49 CARGO BAY CONFIGURATION

STS-49 TRAJECTORY SEQUENCE OF EVENTS

Event	MET (d/h:m:s)	Relative Velocity (fps)	Mach	Altitude (ft)
Launch	00/00:00:00			
Begin Roll Maneuver	00/00:00:10	185	0.16	782
End Roll Maneuver	00/00:00:15	319	0.28	2,720
SSME Throttle to 89%	00/00:00:20	447	0.40	3,980
SSME Throttle to 67%	00/00:00:32	742	0.67	10,301
SSME Throttle to 104%	00/00:00:59	1,325	1.28	33,760
Maximum Dyn. Pressure	00/00:01:02	1,445	1.43	38,079
SRB Separation	00/00:02:05	4,151	3.81	154,985
Main Eng. Cutoff (MECO)	00/00:08:30	24,542	22.61	364,738
Zero Thrust	00/00:08:36	24,541	N/A	363,652
External Tank Separation	00/00:08:48			
OMS-2 Burn	00/00:39:58			
Landing	06/23:55:00			

Apogee, Perigee at MECO: 179 x 32 nautical miles
Apogee, Perigee post-OMS 2: 183 x 95 nautical miles

SPACE SHUTTLE ABORT MODES

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

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

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

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

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

STS-42 contingency landing sites are Edwards Air Force Base, Kennedy Space Center, White Sands Space Harbor, Ben Guerir, Moron and Rota.

STS-49 PRE-LAUNCH PROCESSING

Endeavour arrived at KSC on May 7, 1991, several days after it rolled off the assembly floor of Rockwell International in Palmdale, CA. Many systems on board Endeavour feature design changes or updates as part of continued improvements to the Space Shuttle. The upgrades include several improved or redesigned avionics systems, the drag chute and modifications to pave the way for possibly extending shuttle flights to last as long as 16 days.

Endeavour underwent rigorous first flight processing required of new orbiters during its stay in the Orbiter Processing Facility (OPF). The Shuttle team installed major components associated with a new vehicle and performed general processing operations.

Endeavour was transferred out of the OPF on March 7, just 10 months after its arrival at Kennedy Space Center. Endeavour was towed several hundred yards to the Vehicle Assembly Building and connected to its external tank and solid rocket boosters on the same day.

The new orbiter spent 6 days in the VAB while technicians connected the 100-ton space plane to its already stacked solid rocket boosters and external tank. Endeavour was transferred to newly refurbished launch pad 39-B on March 13. This marks the first use of pad B since it served as the launch pad for Columbia (STS-40) last June.

A flight readiness firing (FRF) was conducted on April 6 in which Endeavour's three main engines were fired for 22 seconds. The FRF is a required test of all new Shuttles to verify the integrated operation of the three main engines, the main propulsion system and pad propellant delivery systems.

Following a review of the information from Endeavour's FRF, two irregularities were identified in two of the high pressure oxidizer turbo pumps on engines 1 and 2. Shuttle managers decided on April 8 to replace all three main engines at the launch pad with three spares. The decision to replace the engines was dictated by prudence and the fact that the work was expected to have little impact on the launch preparation schedule. The engines were replaced the following week.

Extensive post-FRF inspections of Endeavour's main propulsion system were performed as well as required tests of the main engines to make sure all systems are flight ready.

STS-49 payload elements, the perigee kick motor and the ASEM multi-purpose experiment support structure were scheduled to be installed in Endeavour's payload bay at the launch pad on April 14.

Routine operations and tests are planned while at the launch pad. This includes the Terminal Countdown Demonstration Test with the STS-49 flight crew, which was scheduled for April 16-17.

A standard 43-hour launch countdown is scheduled to begin 3 days prior to launch. During the countdown, the orbiter's fuel cell storage tanks will be loaded with fuel and oxidizer and all orbiter systems will be prepared for flight.

About 9 hours before launch, the external tank will be filled with its flight load of a half million gallons of liquid oxygen and liquid hydrogen propellants. About 2 1/2 hours before liftoff, the flight crew will begin taking their assigned seats in the crew cabin.

Endeavour's end-of-mission landing is planned at Edwards Air Force Base, CA. Endeavour's landing will be the first Shuttle landing to use the new drag chute. STS-49 astronauts will manually deploy the chute after the nose gear has touched down. KSC's landing and recovery teams will be on hand to prepare the vehicle for the cross-country ferry flight back to Florida.

INTELSAT VI RENDEZVOUS, CAPTURE AND DEPLOY

Endeavour will rendezvous with Intelsat VI on flight day four of STS-49. Intelsat-VI is currently in an orbit of approximately 299 n.m. by 309 n.m. Within 46 hours after Endeavour's launch, satellite controllers in Washington, DC. will maneuver Intelsat so that its orbit moves within a "control box" area within 6 degrees of arc of a 200 n.m. by 210 n.m., 28.35 degree inclination orbit. In addition, the controllers will slow the satellite's rotation from 10.5 to about 0.65 revolutions per minute.

As Endeavour approaches Intelsat in the final phase of rendezvous, crew members Pierre Thuot and Rick Hieb will begin a spacewalk to capture the satellite, install a perigee kick motor and deploy the satellite. The spacewalk is planned to begin about 1.5 hours prior to capture of the satellite.

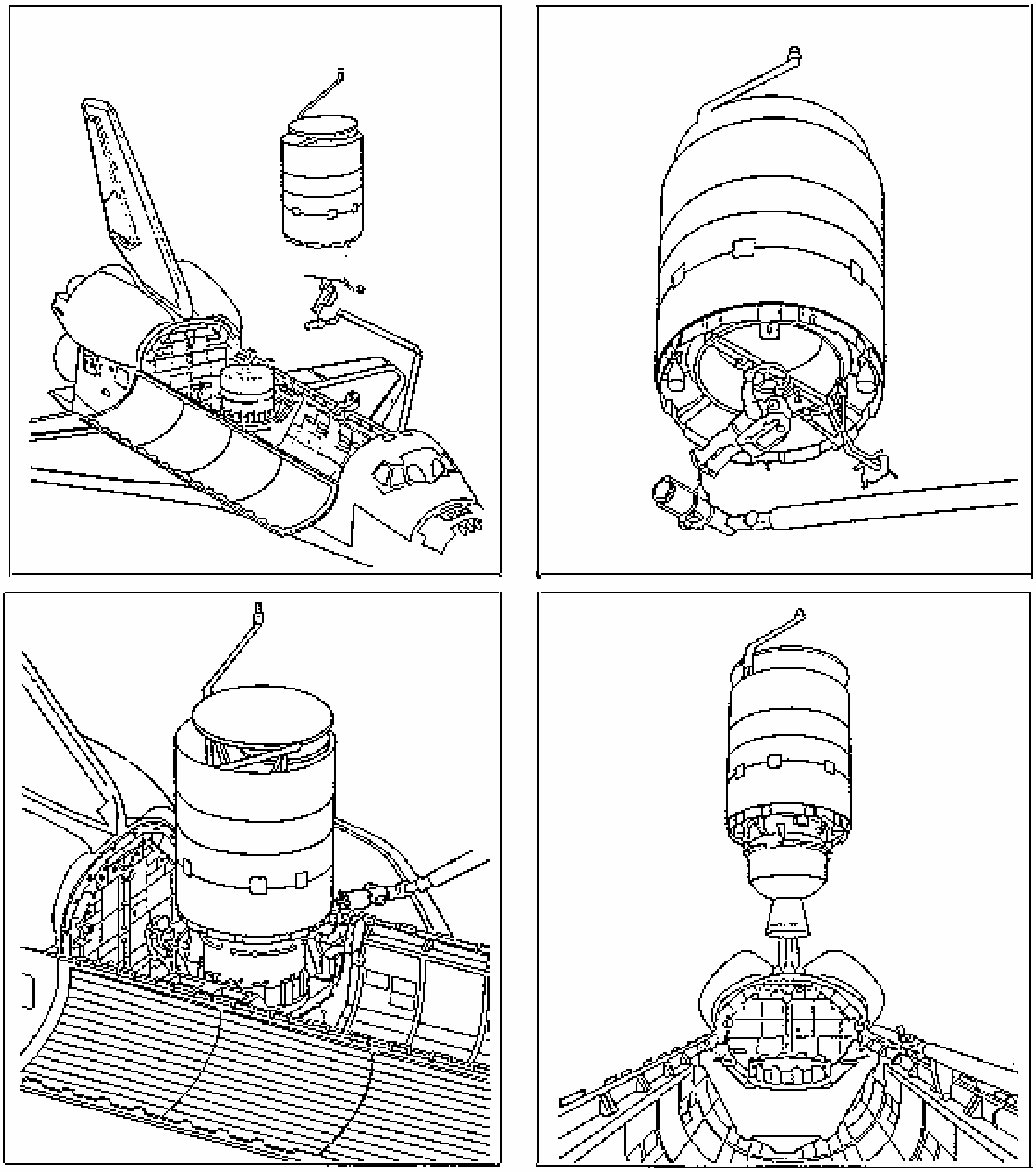
As Endeavour closes in, Thuot will position himself on a foot restraint at the end of Endeavour's mechanical arm. From Endeavour's crew cabin, fellow crew member Bruce Melnick will maneuver the robot arm. As Endeavour holds a position in formation with the satellite, Melnick will move the arm and Thuot toward the slowly rotating Intelsat. Once within reach, Thuot will install a specially designed "capture bar" on the aft end of the satellite in a soft attached mode. After it is soft attached, the attachment will be rigidized by Thuot with the installation of a locking device using a specially built power tool. Thuot will then manually halt the satellite's rotation using a special "steering wheel" on the capture bar. Once the satellite is stabilized, Melnick will grapple the Intelsat with Endeavour's mechanical arm.

While Thuot is capturing the Intelsat, Hieb will be preparing clamps and electrical connections in Endeavour's cargo bay for the satellite. Once Intelsat has been grappled, Melnick will move the mechanical arm to position Thuot and the Intelsat above the cargo bay, where Thuot will exit the foot restraint. The foot restraint then will be removed from the mechanical arm and Hieb will remove the steering wheel assembly and install an extension to the capture bar in preparation for docking Intelsat to the new perigee kick motor located in Endeavour's cargo bay.

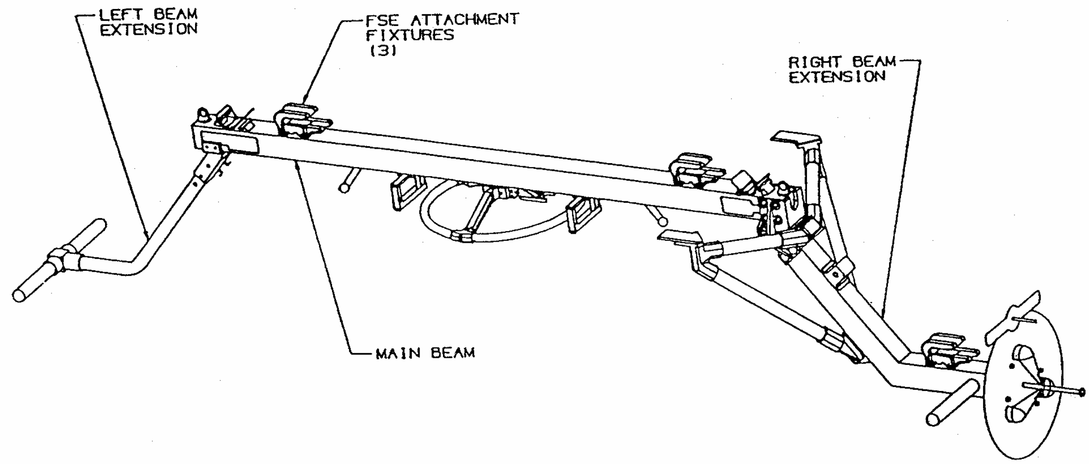
Melnick then will move the arm to position the satellite next to the motor's docking clamps. Thuot and Hieb will manually move the satellite into a final position within the four clamps, close the latches and attach two electrical umbilicals from the motor to Intelsat. The capture bar will be released from Intelsat and secured to the kick motor so that it will be jettisoned with the motor when the satellite reaches the proper altitude. Once all of the connections are completed, the spacewalkers will activate four springs that will eventually eject Intelsat from the cargo bay.

Thuot and Hieb will activate two timers for the solid rocket kick motor and move to Endeavour's airlock to await Intelsat's ejection from the payload bay. After a switch is thrown from the aft flight deck of Endeavour, Intelsat VI will be ejected by the springs at about 0.6 feet per second and with a slight rotation of about 0.7 revolutions per minute. After it has sufficiently cleared the orbiter, Endeavour will slowly back away. About 35 minutes later, satellite controllers will position Intelsat for the motor firing and increase the spin rate.

Intelsat eventually will take position in geosynchronous orbit at an altitude of about 22,300 n.m. above the Atlantic Ocean. It is expected to be in full service by mid-1992.



REBOOST SEQUENCE—left to right starting at the top, major points in the mission: (1) Astronaut approaches satellite with the capture bar. New motor and hardware can be seen resting in a cradle in the cargo bay. (2) Astronaut attaches capture bar, brings satellite back to cargo bay. (3) Once satellite is inside the shuttle, astronauts attach new hardware and boost motor. (4) Spacecraft with new motor is released from shuttle. When Endeavour is a safe distance away, the motor will be ignited to boost Intelsat VI to a 45,000-mile transfer orbit, from where it will be maneuvered into its proper position 22,300 miles above Earth.

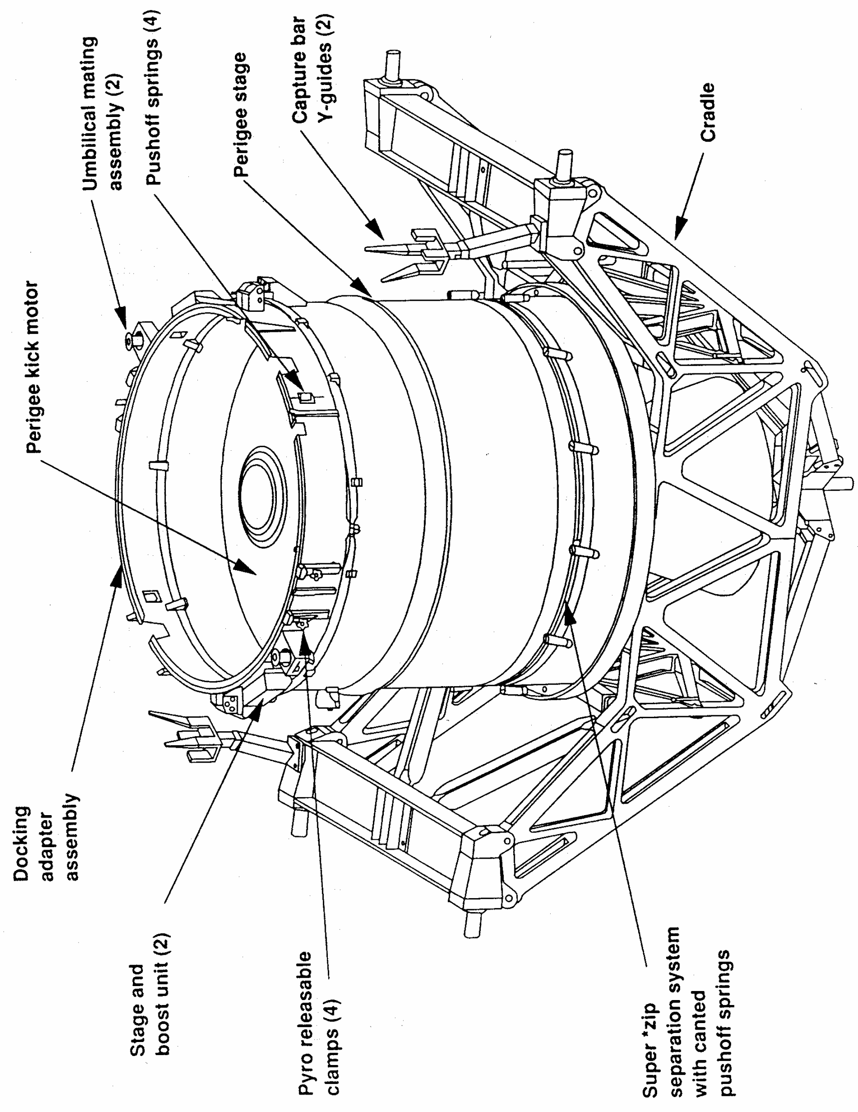


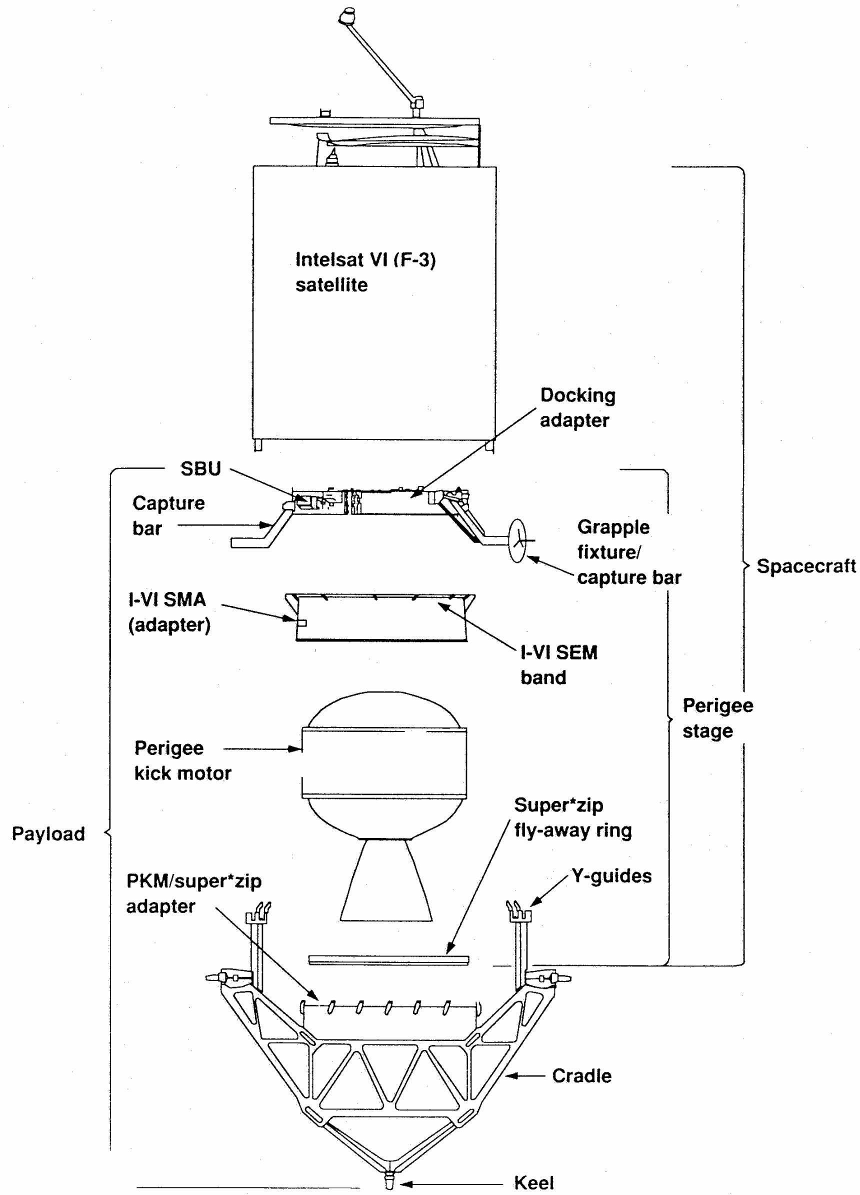
INTELSAT Capture Bar Assembly

INTELSAT-VI

Intelsat-VI (F-3) is a communications satellite of the International Telecommunications Satellite Consortium (Intelsat), owned by 124 member nations and formed in the late 1960s to create a global telecommunications system. The system has a network of 17 satellites and the Intelsat-VI series is the latest generation of satellites manufactured by Hughes Aircraft Co., El Segundo, CA. The first Intelsat-VI was launched in the fall of 1989. Three more successful launches followed. Of these, two are now in service over the Atlantic Ocean region and two above the Indian Ocean region. Intelsat-VI (F-3) was launched on March 14, 1990, by a commercial Titan rocket. A launch vehicle malfunction left the Titan's second stage attached to the satellite, thus prohibiting the firing of a solid rocket motor that was to raise it to geosynchronous orbit. Satellite controllers later jettisoned the solid rocket motor with the Titan second stage attached and raised the satellite to its current orbit.

Intelsat-VI (F-3) weighs about 8,960 pounds, has a diameter of 11.7 feet and a height of 17.5 feet. With its solar arrays fully deployed, the satellite's height will be almost 40 feet. Each satellite's expected operational lifetime is 10 years. It is designed to provide a variety of voice, video and data communications with 48 transponders powered by 2,600 watts of direct current. Two nickel-hydrogen batteries can supply power for short periods when solar power is unavailable as the satellite passes through Earth's shadow.


Umbilical mating
assembly (2)
Pushoff springs (4)
Perigee stage
Capture bar
Y-guides (2)
Cradle
Perigee kick motor
Docking
adapter
assembly
Stage and
boost unit (2)
Pyro releasable
clamps (4)
Super *zip
separation system
with canted
pushoff springs



INTELSAT VI F-3 REBOOST
PAYLOAD LAYOUT

INTELSAT-VI REBOOST EQUIPMENT

Perigee Kick Motor (PKM) -- The perigee kick motor weighs 23,000 pounds, is 127.22 inches tall and 92.52 inches in diameter. It is an Orbus 215 solid propellant motor built by United Technologies Corp. and provided by Hughes Aircraft Co., El Segundo, CA, for the mission.

Capture Bar Assembly -- The capture bar assembly was designed by engineers in the Crew and Thermal Systems Division, Johnson Space Center, Houston. It weighs 162 pounds, is 181.37 inches long, 40.75 inches tall and 37.38 inches wide. The capture bar has a detachable right beam extension, left beam extension and steering wheel. All of the capture bar equipment is constructed of aluminum and stainless steel.

Cradle -- The cradle holds the perigee kick motor in Endeavour's cargo bay during launch and weighs 3,749 pounds. It is constructed of aluminum and is 193 inches wide, 93.53 inches long and 151.48 inches tall. It was provided by Hughes Aircraft Co.

Docking Adapter -- The docking adapter allows attachment of the perigee kick motor to the Intelsat- VI and weighs 152.8 pounds. It is 92.52 inches in diameter and 12 inches thick, constructed of aluminum with some stainless steel components.

ASSEMBLY OF SPACE STATION BY EVA METHODS

STS-49 astronauts will venture out of the crew cabin two more times following the repair of Intelsat VI. The objective of the second EVA, performed by Thornton and Akers, and the third spacewalk, performed by Thuot and Hieb, will be to demonstrate and verify Space Station Freedom maintenance and assembly tasks.

The Assembly of Station by Extravehicular Activity Methods (ASEM) evaluation consists of hardware and techniques to construct a partial truss structure bay. Crew members will build a truss pyramid; unberth, maneuver and berth the Multiple Purpose Experiment Support Structure (MPESS) pallet to assess the mass handling capabilities of an EVA astronaut; and evaluate the ability to work with the mechanical arm at positions above and forward of the Shuttle's cargo bay.

The MPESS, located in the forward payload bay, will house two node boxes for the truss pyramid; a releasable grapple fixture and interface plate; a truss leg dispenser and legs and strut dispenser; and the struts for the truss pyramid.

Other tests will evaluate the assembly area and MPESS berthing operations guided by the spacewalker and a spacesuit-mounted camera. The three consecutive days of spacewalks will evaluate the capability to perform day-after-day spacewalks by a variety of astronauts, a procedure that will be needed to build Space Station Freedom.

Another of the ASEM drills will be a demonstration of crew rescue device prototypes. Five concepts will be tested by all of the spacewalkers -- the astrorope, telescopic pole, bi-stem pole, inflatable pole and the crew propulsive device.

The astrorope uses an approach similar to the concept of a bola-type lasso. It is comprised of two cleats attached to a Kevlar cord. The astrorope is thrown by hand and is meant to wrap around an element of the space station structure. The astrorope must be manually retracted prior to throwing it again and has an effective reach range of about 20 feet.

The telescopic pole uses a design similar to a telescoping radio antenna. It has a grapple fixture on the end and seven sections that can be manually extended. This concept would allow an unlimited number of grapple attempts and reaches up to 12 feet.

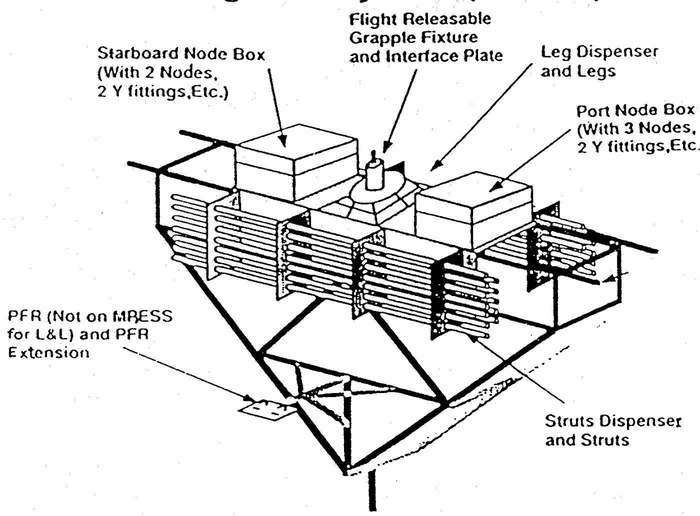
The bi-stem pole consists of two thin strips of spring steel which, when allowed to return to their equilibrium state during deployment, overlap one another to form a rigid pole. It has a grapple fixture attached to one end and would be used with a power tool for extension and retraction. This powered approach design also is capable of unlimited grapple attempts. Its reach range is about 20 feet.

The inflatable pole uses a tubular sock that when pressurized forms a rigid pole. It has a grapple fixture attached to the end and can accomplish unlimited grapple attempts. Once it is attached, the sock is deflated and a hand-over-hand reapproach can be performed. This design does not allow reuse and has a reach range of 15 feet.

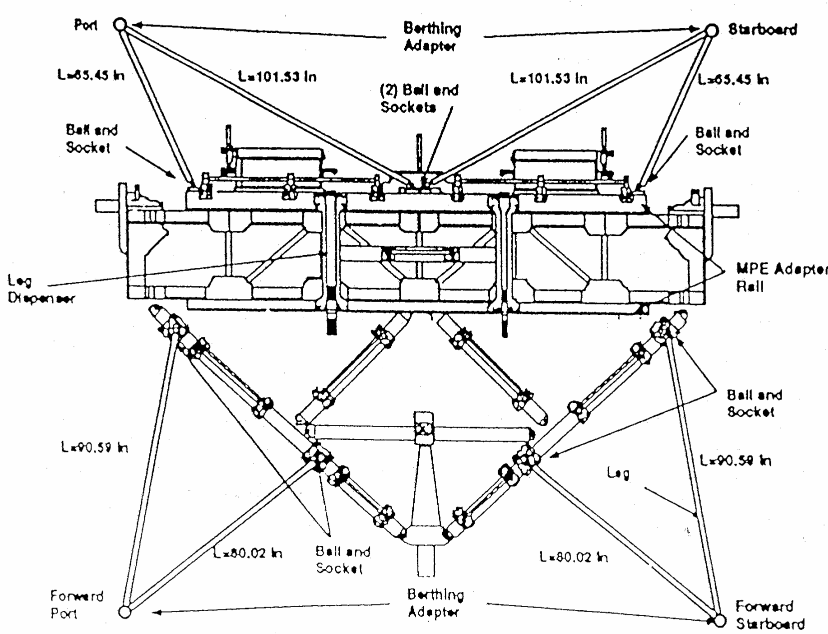
The crew propulsive device is essentially a redesigned handheld maneuvering unit from the Skylab program. The device can be unfolded and small jets are used as thrusters, powered by a small canister of pressurized nitrogen. Using a powered reapproach, its reach range is limited by its nitrogen supply.

Only three of the concepts have spacewalk time dedicated to them -- the crew propulsive device, the bi-stem and the inflatable pole -- and will take place on flight days 5 and 6. The astrorope and the telescoping pole concepts will be evaluated as time permits during the spacewalks. The crew self rescue hardware was developed by the Crew and Thermal Systems Division at the Johnson Space Center.

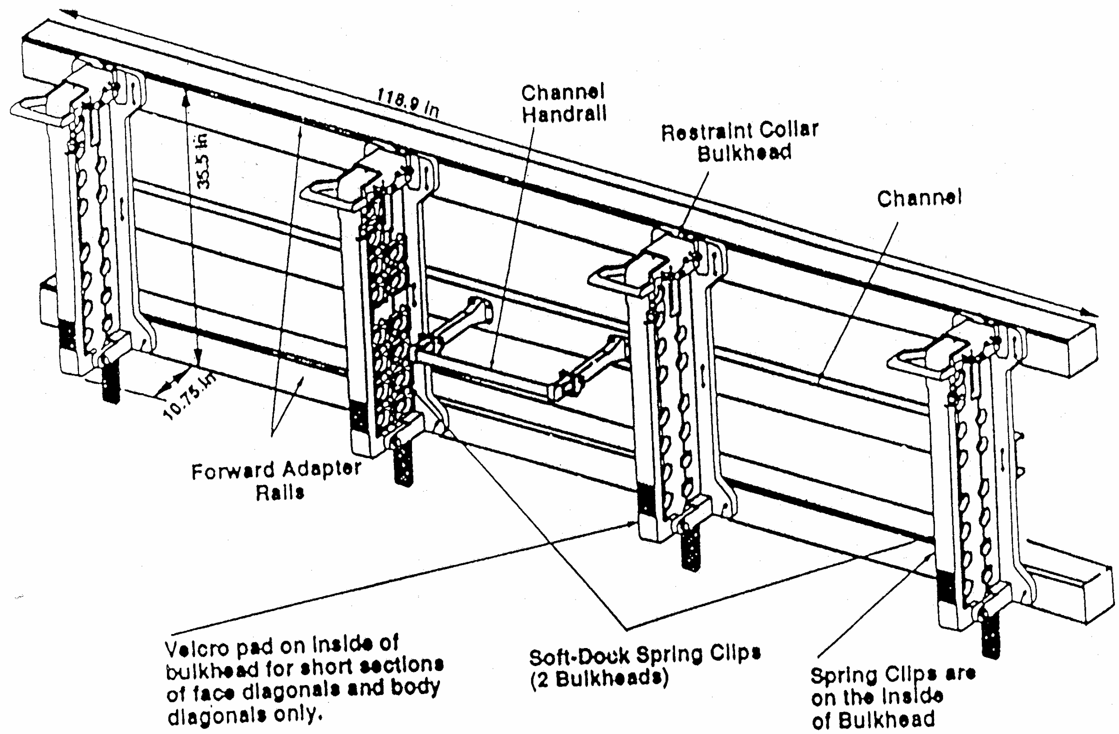
Stowage Subsystem (MPESS)



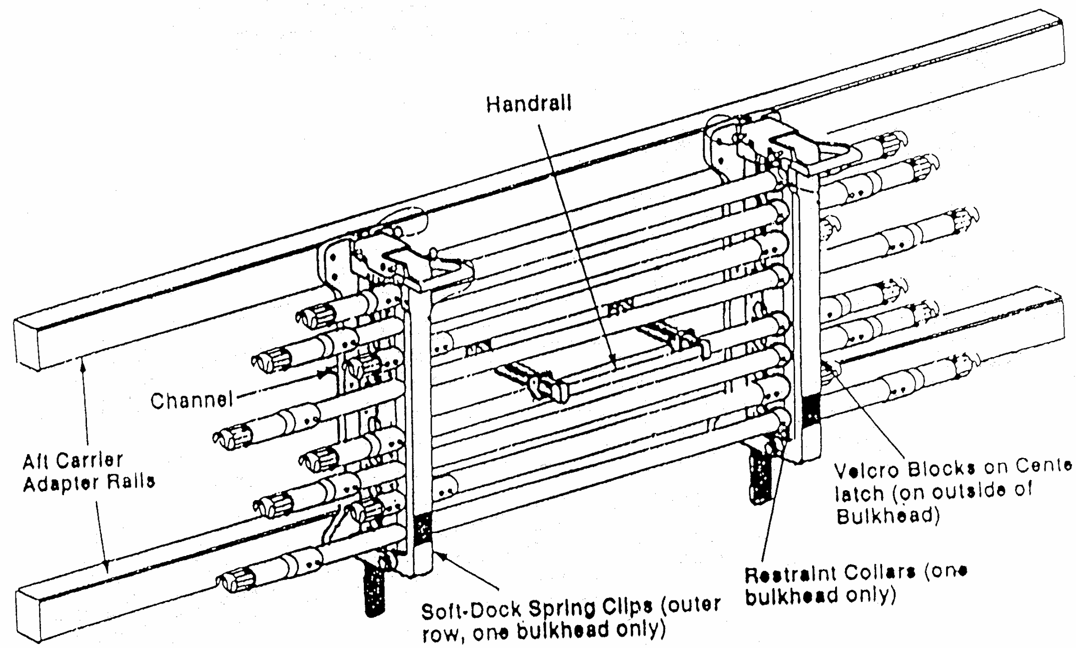
ASEM MPESS with Legs Attached



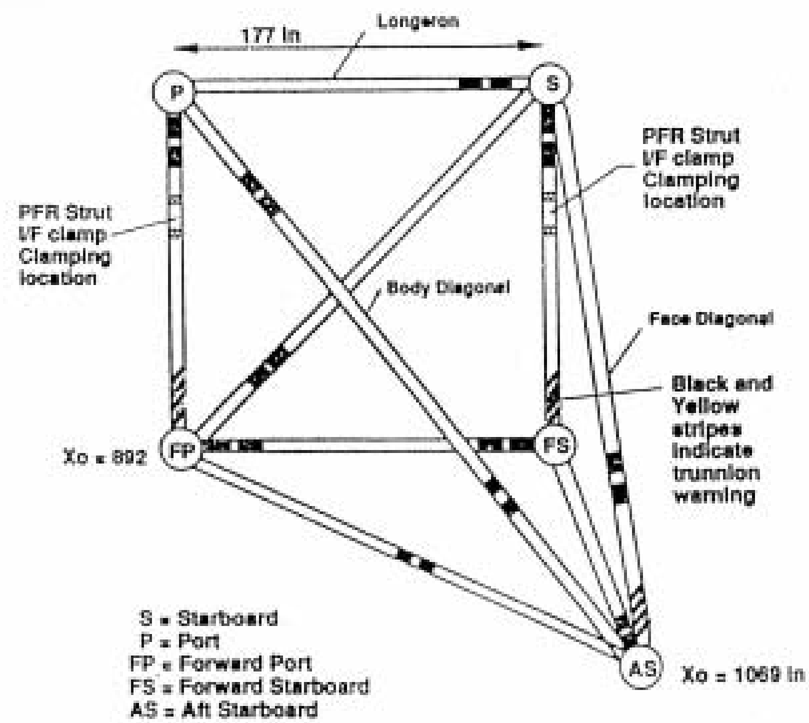
Strut Dispenser
(Struts not shown)



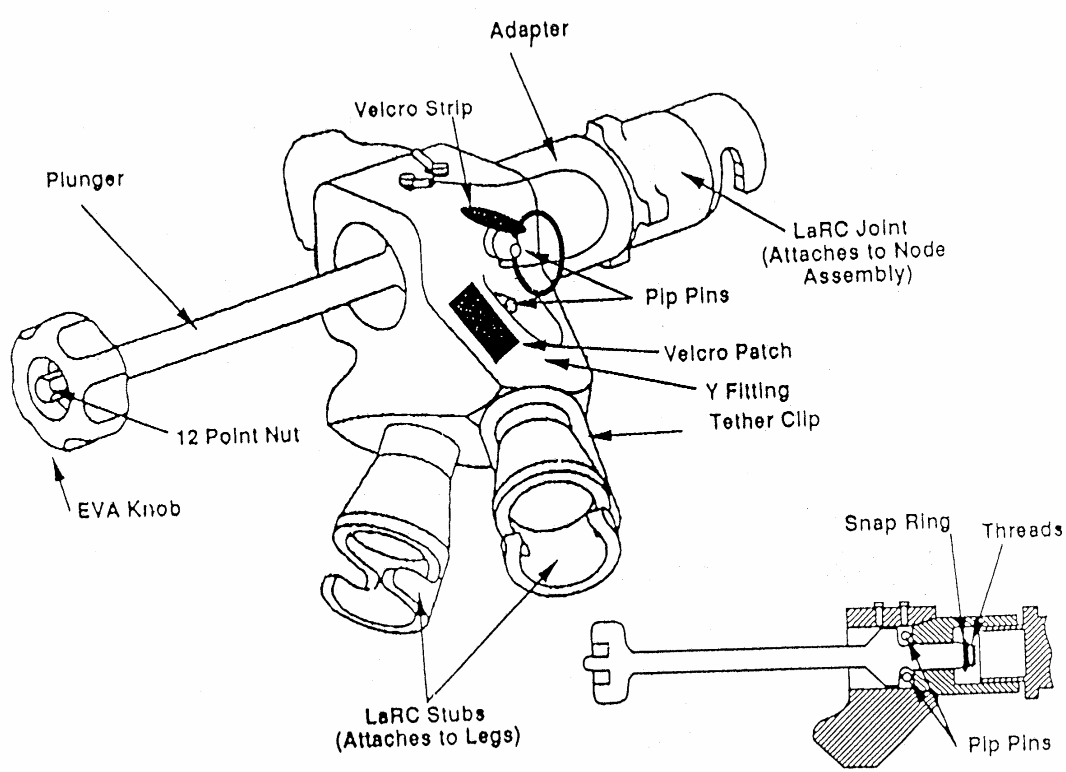
Leg Dispenser
(Legs shown)



ASEM Attachment Fixture

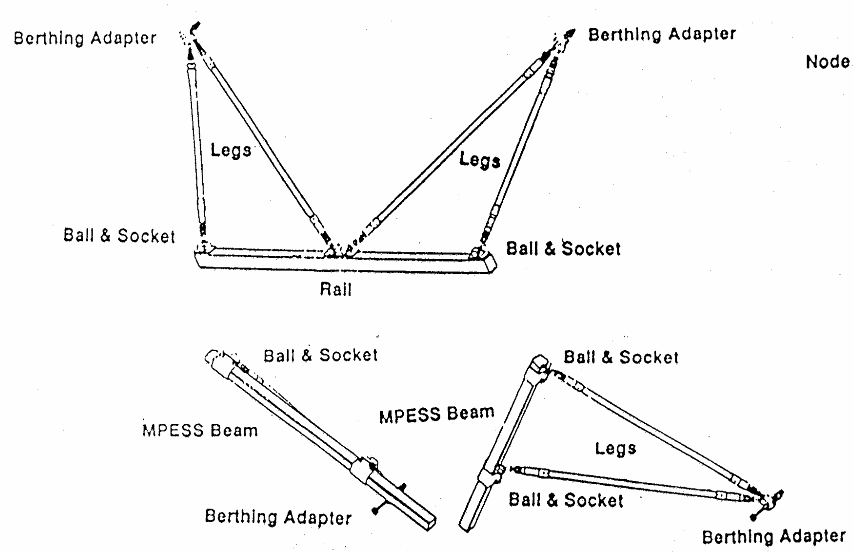


ASEM Berthing Adapter

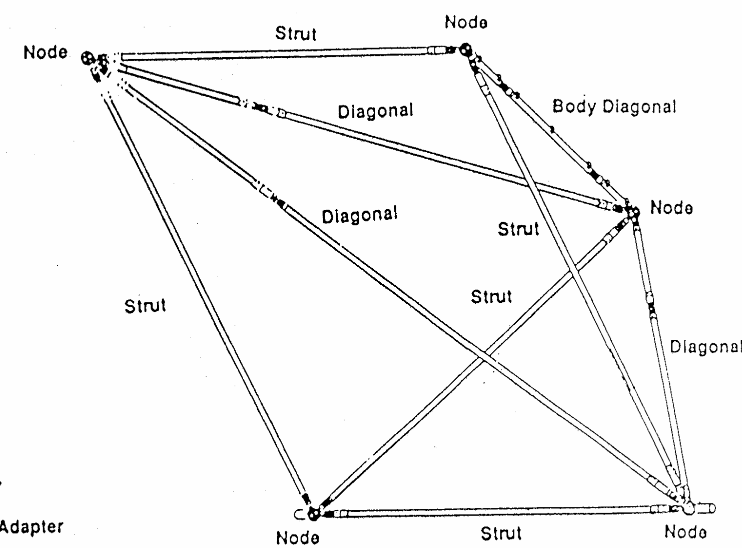


Assembly of Station by EVA Methods (ASEM)

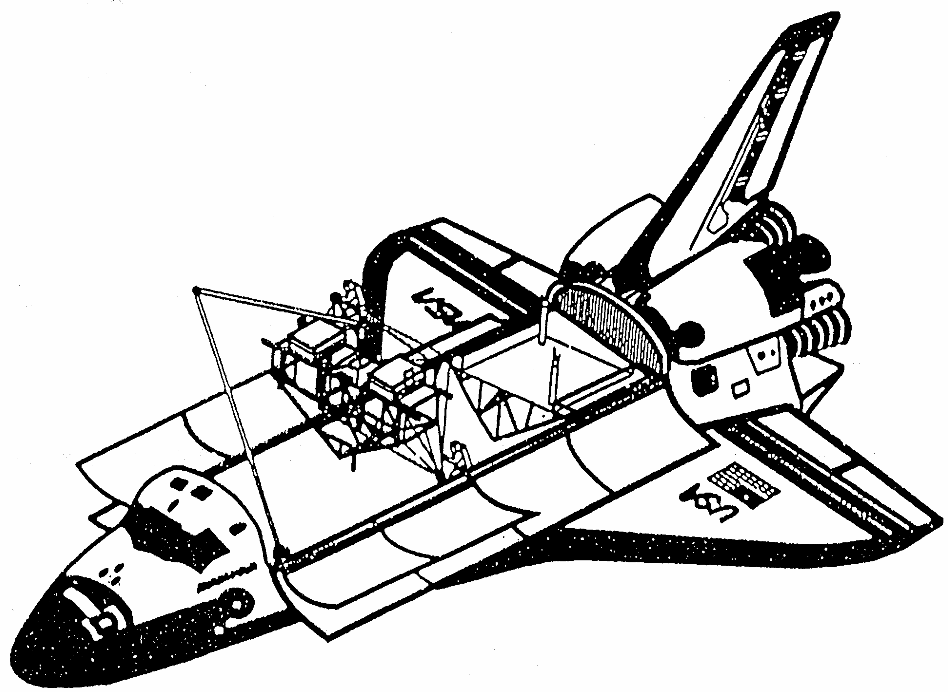
Carrier Attach Subsystem



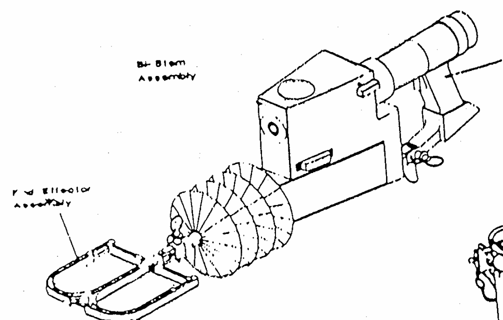
Attachment Fixture Subsystem



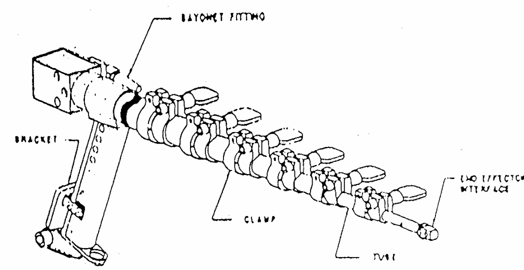
ASEM On-Orbit Configuration



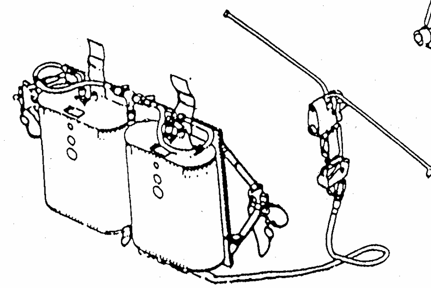
Crew Self Rescue Hardware



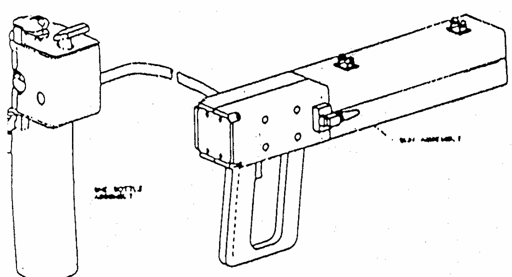
BI-Stem Pole



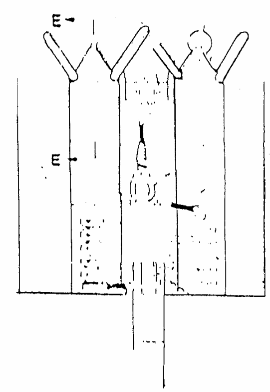
Telescopic Pole



Crew Propulsive Device



Inflatable Pole

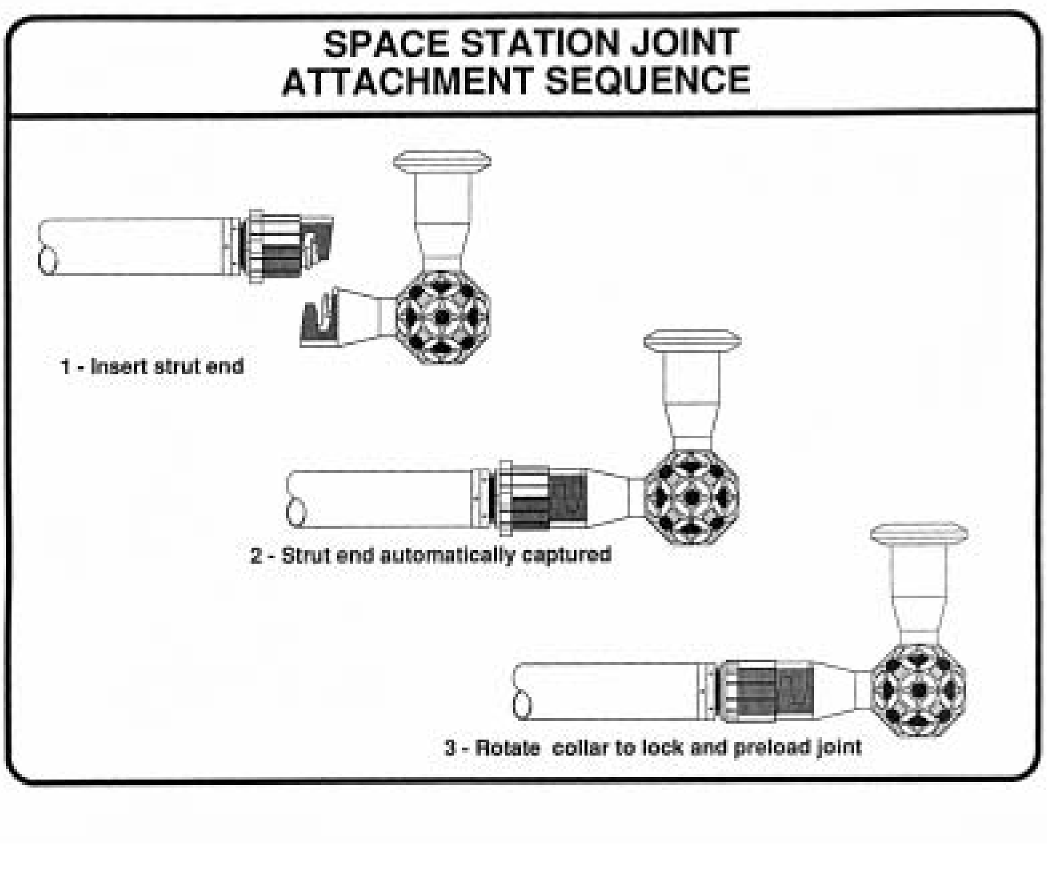


Astro-Rope

Langley Truss Joint Used in ASEM Flight Experiment

During the ASEM flight experiment, astronauts will assemble a truss structure segment using an advance truss joint, designed and fabricated at the NASA Langley Research Center, Hampton, Va.. The truss joint (see illustration) is easily operated without the aid of tools and provides a strong and stiff connection between truss components. The truss joint, which only requires the simple rotation of a collar to lock, was designed to be operated either manually by the astronauts or robotically if required in future applications. The joint which measures approximately 2 inches in diameter, has been tested extensively by the astronauts on the ground and in neutral buoyancy, and their evaluations have lead to improvements in the design. However, the ASEM flight experiment will be the first time a truss structure has been assembled in space using this truss joint.

This truss joint is a key product of an extensive NASA Langley Research Center program to develop the technology for efficient on-orbit construction of spacecraft which are too large to be boosted into orbit intact. It was selected as the baseline structural joint for the original larger, erectable Space Station Freedom design. The joint components are produced at Langley Research Center on numerically controlled machine tools for accuracy and economy and are made of a high strength aluminum alloy. A total of 137 strut end joint assemblies were supplied to the Johnson Space Center, which permitted assembly of the three sets of experimental hardware required for neutral buoyancy training certification and flight.



COMMERCIAL PROTEIN CRYSTAL GROWTH EXPERIMENT

In the past decade, exponential growth in the use of protein pharmaceuticals has resulted in the successful use of proteins in insulin, interferons, human growth hormone and tissue plasminogen activator. Pure protein crystals are facing an increase in demand by the pharmaceutical industry because such purity will facilitate Federal Drug Administration approval of new protein-based drugs. Pure, well-ordered protein crystals of uniform size are in demand by the pharmaceutical industry as special formulations for use in drug delivery.

During the past 6 years, a variety of hardware configurations have been used to conduct Protein Crystal Growth (PCG) experiments aboard 12 Space Shuttle flights. These experiments have involved minute quantities of sample materials to be processed. On STS-49, the Protein Crystallization Facility (PCF), developed by the Center for Macromolecular Crystallography (CMC), a NASA Center for the Commercial Development of Space at the University of Alabama-Birmingham, will use much larger quantities of materials to grow crystals in batches, using temperature as a means to initiate and control crystallization.

The PCF has been reconfigured to include cylinders with the same height, but varying diameters to obtain different volumes (500, 200, 100, 20 ml). These cylinders allow for a relatively minimal temperature gradient and require less protein solution to produce quality crystals. This is an industry-driven change brought about by a need to reduce the cost and amount of protein sample needed to grow protein crystals in space, while at the same time increasing the quality and quantity of crystals.

Also flying on STS-49 as part of the CPCG payload complement is a newly-designed, "state-of-the-art" Commercial Refrigerator Incubator Module (CRIM) which allows for a pre-programmed temperature profile. The CRIM temperatures are programmed prior to launch and a feedback loop monitors CRIM temperatures during flight. Developed by Space Industries, Inc., Webster, Texas, for CMC, the CRIM also provides improved thermal capability and has a microprocessor that uses "fuzzy logic" (a branch of artificial intelligence) to control and monitor the CRIM's thermal environment. A thermoelectric device is used to electrically "pump" heat in or out of the CRIM.

The PCF serves as the growth chamber for significant quantities of protein crystals. Each of the PCF cylinders on STS-49 is encapsulated within individual aluminum containment tubes and supported by an aluminum structure. Prior to launch, the cylinders will be filled with bovine insulin solution and mounted into a CRIM set at 40 degrees C. Each cylinder lid will pass through the left wall of the aluminum structure and come into direct contact with a metal plate in the CRIM that is temperature-controlled by the thermoelectric device.

Shortly after achieving orbit, the crew will activate the PCF experiment by initiating the pre-programmed temperature profile. The CRIM temperature will be reduced automatically from 40 degrees C to 22 degrees C over a 4-day period. The change in CRIM temperature will be transferred from the cold plate through the cylinders' lids to the insulin solution.

Decreasing the temperature of the solution by 18 degrees C will effect the resulting crystals' formation, which should be well ordered due to the reduced effects the Earth's gravity. Once activated, the payload will not require any further crew interaction (except for periodic monitoring), nor will it require any modifications for landing.

In general, purified proteins have a very short lifetime in solution; therefore, the CPCG payload and CRIM will be loaded onto the Shuttle no earlier than 24 hours prior to launch. Due to the instability of the resulting protein crystals, the CRIM will be retrieved from the Shuttle within 3 hours of landing. The CRIM will be battery-powered continuously from the time the samples are placed in the CRIM and it is loaded onto the Shuttle, until the time it is recovered and delivered to the investigating team. For launch delays lasting more than 24 hours, the payload will need to be replenished with fresh samples.

Once the samples are returned to Earth, they will be analyzed by morphometry to determine size distribution and absolute/relative crystal size. They also will be analyzed with X-ray crystallography and biochemical assays of purity to determine internal molecular order and protein homogeneity, respectively.

The Commercial Protein Crystal Growth payload, sponsored by NASA's Office of Commercial Programs, is developed and managed by the Center for Macromolecular Crystallography. Dr. Charles E. Bugg, Director, CMC, is lead investigator for the CPCG experiment. Dr. Marianna Long, CMC Associate Director for Commercial Development also is a CPCG investigator.

AIR FORCE MAUI OPTICAL SYSTEM (AMOS)

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

SPACE SHUTTLE ENDEAVOUR (OV-105)

Construction of Endeavour

Rockwell International's Space Systems Division (SSD) received authority to proceed with construction of a fifth Space Shuttle orbiter -- designated OV-105 -- from NASA on Aug. 1, 1987. OV-105 is the replacement orbiter for OV-099 which was lost in the Space Shuttle Challenger accident.

Rockwell managed the OV-105 construction program under the direction of NASA's Johnson Space Center. The division fabricated the orbiter's forward and aft fuselages, forward reaction control systems, crew compartment and secondary structures at its Downey, CA, headquarters facility. Final assembly, test and checkout took place at Rockwell's orbiter assembly facility in Palmdale, CA. In addition, more than 250 major subcontractors and thousand of associated suppliers across the nation performed work on Shuttle components and support services, which accounted for nearly 50 percent of the total work on the program. OV-105 was officially turned over to NASA on April 25, 1991 at a ceremony at Rockwell's Palmdale facility.

IMPROVED FEATURES OF SPACE SHUTTLE ENDEAVOUR

Many systems onboard Endeavour have had design changes or have been updated from earlier equipment to take advantage of technological advances and continue improvements to the Space Shuttle. The upgrades include several improved or redesigned avionics systems; installation of a drag chute as part of a series of landing aid additions to the orbiters; and modifications to pave the way for possibly extending Shuttle flights to last as long as 3 weeks in the future.

Some such updated systems already have been installed in the rest of the shuttle orbiters as well as Endeavour; some will be installed in all orbiters in the near future; and others will be used on Endeavour only.

UPDATED AVIONICS SYSTEMS

Advanced General Purpose Computers

The advanced general purpose computers (GPCs) are now in the process of being incorporated into the entire orbiter fleet and will be installed and used on Endeavour for its first space flight. The updated computers have more than twice the memory and three times the processing speed of their predecessors. Officially designated the IBM 10-101S, built by IBM, Inc., they are half the size, about half the weight and require less electricity than the first-generation GPCs. The central processor unit and input/output processor, previously installed as two separate boxes, are now a single unit.

The new GPCs use the existing Shuttle software with only subtle changes. However, the increases in memory and processing speed allow for future innovations in the Shuttle's data processing system. Although there is no real difference in the way the crew will operate with the new computers, the upgrade increases the reliability and efficiency in commanding the Shuttle systems. The predicted "mean time between failures" (MTBF) for the advanced GPCs is 6,000 hours. The flight computers are already exceeding that prediction with an MTBF of 18,500 hours. The MTBF for the original GPCs is 5,200 hours.

New GPC Specifications

Dimensions: 19.52S x 7.62S x 10.2S Weight: 64 lbs. Memory Capacity: 262,000 words (32-bits each) Processing Rate: 1.2 million instructions per second Power Requirements: 550 watts

HAINS Inertial Measurement Units

The High Accuracy Inertial Navigation System (HAINS) Inertial Measurement Unit (IMU) will be incorporated into the orbiter fleet on an attrition basis as replacements for the current KT-70 model IMUs. The three IMUs on each Shuttle orbiter are four-gimbal, inertially stabilized, all-attitude platforms that measure changes in the spacecraft's speed used for navigation and provide spacecraft attitude information on flight control.

For Endeavour's first flight, one HAINS IMU will fly with two accompanying DT-70 IMUs to provide redundancy with proven hardware. The HAINS IMU for the Space Shuttle is a derivative of IMUs used in the Air Force's B-1B aircraft. It includes an improved gyroscope model and microprocessor and has demonstrated in testing improved abilities to hold an accurate alignment for longer periods of time. In addition, it has proven more reliable than the KT-70 IMUs. The new IMUs require no software changes on the orbiter or changes in electrical or cooling connections. The HAINS IMU is manufactured by Kearfott, Inc., of Little Falls, N.J.

Improved Tactical Air Navigation Systems

A complete set of three improved TACANs will fly on Endeavour's first flight. The improved TACAN is a modified off-the-shelf unit developed by Collins, Inc., of Cedar Rapids, Iowa, for military aircraft and slightly modified for the Shuttle. The improved TACAN operates on 28-volt direct current electricity as compared to the current TACANs that use 110-volt alternating current for power. Also, the new TACANs do not require forced air cooling as do the current TACANs.

The TACANs' connections to the Shuttle's guidance, navigation and control system are identical. The TACANs provide supplemental navigational information on slant range and bearing to the orbiter using radio transmissions from ground stations during the final phases of entry and landing. Enhanced Master Events Controller (EMEC)

The EMEC features improved reliability, lower power usage and less maintenance than current MECs. The new design uses 30 percent less electricity and has more internal backup components. The MECs, two aboard each Shuttle, are a relay for onboard flight computers used to send signals to arm and fire pyrotechnics that separate the solid rockets and external tank during assent. The EMEC were built by Rockwell's Satellite Space Electronics Division, Anaheim, CA. Present plans call for Endeavour to be the only orbiter with the EMECs. Mass Memory Unit Product Improvement

Improvements to the current MMUs in the form of modifications include error correction and detection circuitry to accommodate tape wear, tape drive motor speed reduction to extend the tape's lifetime. In addition, modifications were made to the tape drive head to extend its lifetime. The improvements have no effect on the current software or connections of the MMUs. Two MMUs are on each orbiter and are a magnetic reel-to-reel tape storage device for the Shuttle's onboard computer software. The modification to the MMUs will be done for the first flight of Endeavour and for the rest of the orbiter fleet during normal maintenance activities. The MMUs were built and upgraded by Odetics of Anaheim, CA. Enhanced Multiplexer-Demultiplexer

The EMDM uses state-of-the-art components to replace obsolete parts and improve maintenance requirements. The new components have simplified the structure of the EMDM by more than 50 parts in some instances. The EMDMs are installed on Endeavour, but plans have not been made to replace the current MDMs in other orbiter. The MDMs, 19 located throughout each orbiter, act as a relay for the onboard computer system as it attains data from the Shuttle's equipment and relays commands to the various controls and systems. The EMDMs are manufactured by Honeywell Space Systems Group, Phoenix, Ariz.

Radar Altimeter

The improved radar altimeter aboard Endeavour already has been installed and flown on all other Shuttle orbiters since STS-26. The altimeter is an off-the-shelf model originally developed for the military's cruise missile program. The altimeter has the capability to automatically adjust its gain control as a function of changes in altitude. Along with anti-false lock circuitry, the improvements have eliminated a problem frequently experienced with the original radar altimeter caused by interference from the Shuttle's nose landing gear. The radar altimeter is built by Honeywell, Minneapolis.

Improved Nosewheel Steering

Improvements to the nosewheel steering mechanisms include a second command channel, used as a backup in case of a failure in the primary channel, for controlling the steering through the onboard computers. In addition, a valve has been installed in the hydraulic system to switch in a secondary hydraulic pressure system in case of a failure in the primary system. Endeavour will have the modifications prior to its first flight, and the rest of the orbiter fleet will have the improvements made during their major modifications periods. The improved nosewheel steering was designed by Sterer Engineering and Manufacturing Components, Los Angeles.

Solid State Star Tracker

The SSST is a new star tracker design developed for Endeavour which takes advantage of advances in star tracker technology. The two star trackers on each Shuttle orbiter are used to search for, detect and track selected guide stars to precisely determine the orientation of the spacecraft. The precise information is used to periodically update the orbiter's IMUs during flight. The SSST uses a solid state charge coupled device to convert light from stars into an electric current from which the star's position and intensity are determined. The solid state design consumes less electricity and provides greater reliability than the current star trackers. The SSSTs require no modification to the orbiter or its software for installation. Current plans are for one SSST to be installed on Endeavour and another to be incorporated into the orbiter fleet on an attrition basis. The SSST was developed and built by Ball Aerospace Division, Boulder, CO.

UPDATED MECHANICAL SYSTEMS

Improved Auxiliary Power Units

An improved version of the APUs, three identical units that provide power to operate the Shuttle's hydraulic system, has been installed on Endeavour. The IAPUs will be installed on the rest of the orbiter fleet as each spacecraft is taken out of operation for a major modification period during the next 2 years.

The IAPU is lighter than the original system, saving about 134 pounds. The weight savings are due to the use of passive cooling for the IAPUs, eliminating an active water spray cooling system required by the original units. The redesigned APUs are expected to extend the life of the units from the current 20 hours or 12 flights to 75 hours or 50 flights. The increased lifetime is anticipated to result in fewer APU changeouts and improved ground turnaround time between flights.

Components of the APU that have been redesigned to improve reliability include gas generator, fuel pump, redundant seals between the fuel system and gearbox lubricating oil and a materials change in the turbine housings.

Orbiter Drag Chute

During construction, a drag chute was added to Endeavour to be deployed between main gear and nose gear touchdown to assist in stopping and add greater stability in the event of a flat tire or steering problem. The drag chute is another in a series of improvements to the Shuttle's landing aids. Other improvements recently installed in Shuttle orbiters and already in use include carbon brakes to replace the original beryllium brakes and nose wheel steering mechanisms.

The 40-foot diameter drag chute canopy will trail 87 feet behind the orbiter as it rolls out after landing. The main drag chute and a 9-foot diameter pilot chute are deployed by a mortar fired from a small compartment added to the bottom of the vertical stabilizer. The drag chute will be jettisoned when the spacecraft slows to less than 60 knots.

The drag chute is expected to decrease the orbiter's rollout distance by 1,000 to 2,000 feet. The drag chute is deployed using two switches located to the left of the commander's heads up display. One switch arms the mortar and a second switch fires it. A third switch, located to the right of the commander's heads up display, jettisons the drag chute. A second set of switches is mounted beside the pilot's heads up display.

From the time the pilot chute mortar is fired to full inflation of the main chute is anticipated to be less than 5 seconds. The drag chute system was designed by NASA's Johnson Space Center, Rockwell-Downey and Irvin Industries, Santa Ana, CA.

EXTENDED DURATION ORBITER MODIFICATIONS

Although there are no plans currently to use it as such, Endeavour has been fitted with internal plumbing and electrical connections needed for a series of Extended Duration Orbiter (EDO) modifications that could enable the spacecraft to stay in orbit as long as 28 days. The first extended duration flight is currently planned for June 1992, the USML-l flight aboard Columbia (modified between August 1991 and February 1992) is planned to be 13 days long.

Modifications necessary for extended stays include an improved waste collection system that compacts human waste, thus allowing greater capacity; extra middeck lockers for additional stowage; two additional nitrogen tanks for the crew cabin atmosphere; a regenerating system for removing carbon dioxide from the crew cabin atmosphere; and a set of supercold liquid hydrogen and liquid oxygen tanks mounted on a special pallet in the payload bay as supplemental fuel for the Shuttle's electrical generation system.

Modifications already made to Endeavour include:

Additional Nitrogen Tanks

The internal electrical and plumbing connections have been built into Endeavour to allow for nitrogen tank installation. At present, there is no timetable for installation of these tanks. If installed, they would be located near the current nitrogen tanks below the payload bay.

Additional Cryogenic Tanks

Endeavour has five liquid hydrogen and five liquid oxygen tanks installed internally. On the rest of the orbiter fleet, Columbia also has five tank pairs, and Atlantis and Discovery each have four tank sets. In addition, Endeavour has the internal connections needed to hook up an Extended Duration Orbiter cryogenic payload bay pallet, containing four additional tanks of both hydrogen and oxygen. The plumbing systems on board Endeavour could be hooked up to feed fuel from such a pallet to create electricity and water for the Shuttle. The four payload bay tank sets coupled with five internal sets provide a 16-day mission capability. For a 28-day mission, four additional tank sets would be required in the payload bay on either a second pallet or larger pallet.

Improved Waste Collection System

Hookups for an Improved Waste Collection System are built into Endeavour. The IWCS compacts human waste and has an increased capacity for storage of waste.

Regenerative Carbon Dioxide Removal System

Endeavour is outfitted with a Regenerative Carbon Dioxide Removal System that may be used in tandem with Lithium Hydroxide (LiOH) canisters to remove carbon dioxide from the crew cabin atmosphere. The regenerative system, if used alone, would eliminate the need to carry extensive amounts of LiOH canisters for a long flight. Currently, the crew must change out LiOH canisters daily as part of spacecraft housekeeping.

The regenerative system works by removing the CO2 and then releasing it to space through a vent. The new system will not be used alone for Endeavour's first flight, but will be tested. Enough LiOH canisters for the first flight will be flown aboard Endeavour to allow proven equipment to be used for the duration. The regenerative system is located under the middeck floor.

Additional Cabin Stowage

Endeavour is outfitted with brackets necessary to mount additional middeck lockers on board. About 127 cubit feet of additional stowage would be needed for an extended duration flight. The crew compartment size, however, is exactly the same as all other orbiters.

NAMING OF OV-105 AS SPACE SHUTTLE ENDEAVOUR

In response to the outpouring of concerns by students after the Challenger accident, Congressman Tom Lewis (R-FL) introduced a bill in Congress to established the NASA Orbiter-Naming Program. In October 1987, Congress authorized that the name for Orbiter Vehicle 105 be selected "from among suggestions submitted by students in elementary and secondary schools."

The name "Endeavour" resulted from a nationwide orbiter-naming competition supported by educational projects created by student teams in elementary and secondary schools. NASA's orbiters are named after sea vessels used in research and exploration. Therefore, the teams education project had to relate to exploration, discovery and experimentation.

The NASA Orbiter-Naming Program involved over 71,000 students with over 6,100 entries. In May 1989, President Bush selected and announced the winning name and met with the national winning teams of both divisions.

The winning team in Division I (K-6) was the fifth grade class from Senatobia Middle School, Senatobia, Miss. The winning team in Division II (7-12) was from the Tallulah Falls School, Inc., Tallulah Falls, Ga. Both winning teams proposed the name "Endeavour," the first ship commanded by Captain James Cook, a British explorer, navigator and astronomer. In August 1768, on Endeavour's maiden voyage, Cook observed and recorded the transit of the planet Venus.

President Bush said the teams "showed how the possibilities of tomorrow point us onward and upward. Both of your schools chose the name 'Endeavour' which Webster's defines as 'to make an effort, strive, to try to reach or achieve.' And each of your schools has lived that definition."

STS-49 CREWMEMBERS

STS049-S-002 **--** *Crewmembers for the first flight of Endeavour, Orbiter Vehicle (OV) 105, seen in the background, are (left to right) mission specialists Kathryn C. Thornton, Bruce E. Melnick, and Pierre J. Thuot; mission commander Daniel C. Brandenstein, pilot Kevin P. Chilton; and mission specialists Thomas D. Akers and MS Richard J. Hieb. This crew portrait was made by NASA JSC contract photographer Mark Sowa.*

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PHOTO CREDIT: NASA or National Aeronautics and Space Administration.

BIOGRAPHICAL DATA

DANIEL C. BRANDENSTEIN, 49, Capt., USN, is the Commander of STS-49. Selected as an astronaut in January 1978, Brandenstein was born in Watertown, Wis., and will be making his fourth space flight.

He was the Pilot on STS-8, the first Shuttle mission with a night launch and night landing. On his second mission, Brandenstein commanded the crew of STS-51G, deploying four satellites and retrieving one. In 1990, he commanded STS-32 which retrieved the 21,400 pound Long Duration Exposure Facility.

Brandenstein graduated from Watertown High School and received a bachelor of science in mathematics and physics from the University of Wisconsin in 1965.

He was designated a naval aviator in 1967 and served in a variety of operational and flight test billets. He has logged 6,300 hours flying time in 24 different types of aircraft, including 400 aircraft carrier landings. With the completion of his third space flight, Brandenstein has logged 576 hours in space.

KEVIN P. CHILTON, 36, Lt. Col., USAF, will serve as Pilot. Selected as an astronaut in June 1987, Chilton was born in Los Angeles, CA, and will be making his first space flight.

Chilton graduated from St. Bernard High School, Playa del Rey, CA, in 1972; received a bachelor of science in engineering sciences from the Air Force Academy in 1976; and received a master of science in mechanical engineering from Columbia University on a Guggenheim Fellowship in 1977.

He served as a combat ready pilot and instructor pilot in the RF-4 and F-15 from 1978 to 1983. In 1984, he graduated from the Air Force Test Pilot School and served as a test pilot until his selection as an astronaut in 1987.

RICHARD J. HIEB, 36, will serve as Mission Specialist 1 (MS1) and Extravehicular Activity crewman 2 (EV2). Born in Jamestown, ND, Hieb was selected as an astronaut in 1985 and will be making his second space flight.

He flew as a mission specialist on STS-39, operating the Shuttle's remote manipulator system to deploy and retrieve the SPAS satellite.

Hieb graduated from Jamestown High School in 1973; received a bachelor of arts in math and physics from Northwest Nazarene College in 1977 and received a master of science in aerospace engineering from the University of Colorado in 1979. After graduation, Hieb joined NASA to work in crew procedures development and crew activity planning. He worked in the Mission Control Center on the ascent team for STS-1 and during rendezvous phases on numerous subsequent flights.

He has logged 199 hours in space.

BIOGRAPHICAL DATA

BRUCE E. MELNICK, 42, Cmdr., USCG, will serve as Mission Specialist 2 (MS2). Selected as an astronaut in June 1987, Melnick was born in New York, NY, but considers Clearwater, Fla., to be his hometown and will be making his second space flight.

Melnick graduated from Clearwater High School, attended Georgia Tech, received a bachelor of science in engineering from the Coast Guard Academy in 1972 and received a master of science in aeronautical systems from the University of West Florida in 1975.

Melnick served as a mission specialist on STS-41, which deployed the Ulysses spacecraft. He has logged more than 4,900 hours aircraft flying time, predominantly in the H-3, H-52, H-65 and T-38 aircraft. Melnick has logged 98 hours in space.

PIERRE J. THUOT, 36, Cmdr., USN, will serve as Mission Specialist 3 (MS3) and Extravehicular Activity crewman 1 (EV1). Selected as an astronaut in June 1985, Thuot was born in Groton, Conn., but considers Fairfax, Va., and New Bedford, Mass., to be his hometowns and will be making his second space flight.

Thuot graduated from Fairfax High School, received a bachelor of science in physics from the Naval Academy in 1977 and received a master of science in systems management from the University of Southern California in 1985.

Thuot served as a mission specialist on STS-36, a Department of Defense-dedicated mission. He has more than 2,700 flight hours in more than 40 different aircraft, including 270 carrier landings. He has logged 106 hours in space.

KATHRYN C. THORNTON, 39, will serve as Mission Specialist 4 (MS4) and Extravehicular Activity crewman 3 (EV3). Selected as an astronaut in May 1984, Thornton was born in Montgomery, AL, and will be making her second space flight.

She received a bachelor of science in physics from Auburn University, a master of science in physics from the University of Virginia in 1977 and received a doctorate of philosophy in physics from the University of Virginia in 1979. Thornton was awarded a NATO postdoctoral fellowship to continue her research at the Max Planck Institute of Nuclear Physics in Heidelberg, Germany. Prior to being selected by NASA, she was a physicist at the U.S. Army Foreign Science and Technology Center in Charlottesville, Va.

Thornton was a mission specialist on STS-33, a Department of Defense-dedicated flight. She has logged 120 hours in space.

THOMAS D. AKERS, 40, Lt. Col., USAF, will serve as Mission Specialist 5 (MS5) and Extravehicular Activity crewman 4 (EV4). Selected as an astronaut in June 1987, Akers was born in St. Louis, MO, but considers Eminence, Mo., his hometown and will be making his second space flight.

He graduated from Eminence High School and received bachelor and master of science degrees in applied mathematics from the University of Missouri-Rolla in 1973 and 1975, respectively.

Akers was a National Park Ranger and spent 4 years as the high school principal in his hometown of Eminence before joining the Air Force in 1979. He served at Eglin Air Force Base, FL, and Edwards Air Force Base, CA, as a flight test engineer in F-4 and T-38 aircraft.

He flew as a mission specialist on STS-41, deploying the Ulysses spacecraft. Akers has logged 98 hours in space.

SHUTTLE MISSION STS-49 MANAGEMENT

NASA HEADQUARTERS, WASHINGTON, DC

Office of Space Flight

Thomas E. Utsman	Deputy Associate Administrator
Leonard Nicholson	Director, Space Shuttle Office of Commercial Programs
John G. Mannix	Assistant Administrator for Commercial Programs
Richard H. Ott	Director, Commercial Development Division
Garland C. Misener	Chief, Flight Requirements and Accommodations
Ana M. Villamil	Program Manager, Centers for the Commercial Development of Space

Office of Safety & Mission Quality

George A. Rodney	Associate Administrator
Charles Mertz	Deputy Associate Administrator (Acting)
Richard U. Perry	Director, Programs Assurance Division

KENNEDY SPACE CENTER, FL

Robert L. Crippen	Director
James A. "Gene" Thomas	Deputy Director
Jay Honeycutt	Director, Shuttle Management and Operations
Robert B. Sieck	Launch Director
John J. "Tip" Talone	Endeavour Flow Director
J. Robert Lang	Director, Vehicle Engineering
Al J. Parrish	Director of Safety Reliability and Quality Assurance
John T. Conway	Director, Payload Management and Operations
P. Thomas Breakfield	Director, Shuttle Payload Operations
Joanne H. Morgan	Director, Payload Project Management
Roelof L. Schuiling	STS-49 Payload Processing Manager

MARSHALL SPACE FLIGHT CENTER, HUNTSVILLE, AL

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

JOHNSON SPACE CENTER, HOUSTON, TX

Paul J. Weitz	Director (Acting)
Paul J. Weitz	Deputy Director
Daniel Germany	Manager, Orbiter and GFE Projects
Donald R. Puddy	Director, Flight Crew Operations
Eugene F. Kranz	Director, Mission Operations
Henry O. Pohl	Director, Engineering
Charles S. Harlan	Director, Safety, Reliability and Quality Assurance

STENNIS SPACE CENTER, BAY ST. LOUIS, MO

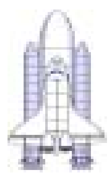
Gerald W. Smith	Director (Acting)
J. Harry Guin	Director, Propulsion Test Operations

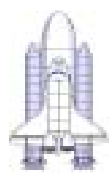
AMES-DRYDEN FLIGHT RESEARCH FACILITY, EDWARDS, CA

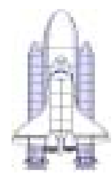
Kenneth J. Szalai	Director
T. G. Ayers	Deputy Director
James R. Phelps	Chief, Space Support Office

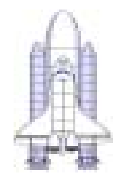
SHUTTLE FLIGHTS AS OF MAY 1992

46 TOTAL FLIGHTS OF THE SHUTTLE SYSTEM -- 21 SINCE RETURN TO FLIGHT









		STS-42 01/22/92 - 01/30/92	
		STS-48 09/12/91 - 09/18/91	
		STS-39 04/28/91 - 05/06/91	
STS-40 06/05/91 - 06/14/91		STS-41 10/06/90 - 10/10/90	STS-45 03/24/92 - 04/02/92
STS-35 12/02/90 - 12/10/90	STS-51L 01/28/86	STS-31 04/24/90 - 04/29/90	STS-44 11/24/91 - 12/01/91
STS-32 01/09/90 - 01/20/90	STS-61A 10/30/85 - 11/06/85	STS-33 11/22/89 - 11/27/89	STS-43 08/02/91 - 08/11/91
STS-28 08/08/89 - 08/13/89	STS-51F 07/29/85 - 08/06/85	STS-29 03/13/89 - 03/18/89	STS-37 04/05/91 - 04/11/91
STS-61C 01/12/86 - 01/18/86	STS-51B 04/29/85 - 05/06/85	STS-26 09/29/88 - 10/03/88	STS-38 11/15/90 - 11/20/90
STS-9 11/28/83 - 12/08/83	STS-41G 10/05/84 - 10/13/84	STS-51-I 08/27/85 - 09/03/85	STS-36 02/28/90 - 03/04/90
STS-5 11/11/82 - 11/16/82	STS-41C 04/06/84 - 04/13/84	STS-51G 06/17/85 - 06/24/85	STS-34 10/18/89 - 10/23/89
STS-4 06/27/82 - 07/04/82	STS-41B 02/03/84 - 02/11/84	STS-51D 04/12/85 - 04/19/85	STS-30 05/04/89 - 05/08/89
STS-3 03/22/82 - 03/30/82	STS-8 08/30/83 - 09/05/83	STS-51C 01/24/85 - 01/27/85	STS-27 12/02/88 - 12/06/88
STS-2 11/12/81 - 11/14/81	STS-7 06/18/83 - 06/24/83	STS-51A 11/08/84 - 11/16/84	STS-61B 11/26/85 - 12/03/85
STS-1 04/12/81 - 04/14/81	STS-6 04/04/83 - 04/09/83	STS-41D 08/30/84 - 09/05/84	STS-51J 10/03/85 - 10/07/85
OV-102 **Columbia** **(11 flights)**	**OV-099** **Challenger** **(10 flights)**	**OV-103** **Discovery** **(14 flights)**	**OV-104** **Atlantis** **(11 flights)**