NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

SPACE SHUTTLE MISSION
STS-41D

PRESS KIT
AUGUST 1984

FIRST FLIGHT OF DISCOVERY
SBS-4, LEASAT-2, TELSTAR-3 DEPLOYMENT; OAST-1

STS-41D INSIGNIA

S84-26391 -- The insignia for the STS-41D mission features the Discovery, NASA's third orbital vehicle, as it makes its maiden voyage. The ghost ship represents the orbiter's namesakes which have figured prominently in the history of exploration. The space shuttle Discovery heads for new horizons to extend that proud tradition.

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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DISCOVERY TO MAKE MAIDEN FLIGHT ON MISSION 41-D

Spaceship Discovery, the newest addition to NASA's fleet of reusable orbiters, will be launched on its maiden flight on mission 41-D, the 12th flight in the Space Shuttle program. Launch is set for no sooner than Aug. 29 during a 14-minute launch window that opens at 8:35 a.m. EDT.

The mission features a combination cargo that includes some of the payloads originally manifested to fly on Mission 41-D and some of the payload elements that were slated to fly on Discovery’s second mission, 41-F. The decision to remanifest followed the aborted launch of Discovery on June 26, and provides for the minimum distortion to the launch schedule while maintaining NASA's launch commitments to commercial cargo customers.

Cargo bay payloads on the combined mission include: LEASAT-2 (SYNCOM IV-2) for Hughes Communications Services, Inc.; SBS-4 for Satellite Business Systems; TELSTAR 3 for American Telephone and Telegraph (AT&T); and OAST-1 for NASA's office of Aeronautics and Space Technology (OAST). The three commercial communications satellites were originally scheduled to fly on Mission 41-F. The OAST-1 payload was retained from the original 41-D flight. To accommodate the combined mission, several payloads had to be dropped from the cargo bay roster, including the LEASAT-1 (SYNCOM IV-1) satellite, the Large Format Camera, the Cinema-360 special camera and one Getaway Special canister.

Experiments located in Discovery's crew compartment remain the same for this combined mission. They are the commercial Continuous Flow Electrophoresis System (CFES), an IMAX special motion picture camera and a Shuttle Student Involvement Project (SSIP) experiment.

Veteran Shuttle astronaut Henry Hartsfield is the commander of the six-member crew. Hartsfield was the pilot on STS-4, the last of the Shuttle test flights. He will be joined by pilot Michael Coats, and three mission specialists: Judith Resnik, Steven Hawley and Richard Mullane. McDonnell Douglas engineer Charles Walker will serve as a payload specialist on the 41-D mission. He will be responsible for operating the CFES onboard experiments and is the first commercial payload specialist.

Discovery will be launched from Kennedy Space Center's Pad A at Complex 39 into a circular 184-statute-mile orbit with an inclination to the equator of 28.5 degrees. Activities during the crew’s first day in space will include activation of the OAST-l solar cell wing experiment and deployment of the SBS-4 commercial communications satellite. About 45 minutes after deployment, the satellite will fire its Payload Assist Module (PAM-D) boost motor to place the satellite into a geosynchronous transfer orbit.

Highlights on the second day of the mission will include the deployment into orbit of LEASAT-2, the first in a series of LEASAT (for LEAsed SATellite) spacecraft. Also known as SYNCOM IV-2, the satellite represents a new type of spacecraft designed specifically for launch from the Space Shuttle. Deployment of LEASAT-2 is scheduled to take place a little more than 24 hours after launch, during the 18th orbit. Equipped with its own unique upper stage, LEASAT-2 will fire a solid propellant rocket motor, 45 minutes after it is sprung out of the cargo bay, to inject it into an egg-shaped transfer orbit. Liquid-fueled engines will be used to progressively raise the transfer orbit altitude until the 1,315 kilograms (2,900 pounds) spacecraft is in its final geosynchronous orbit.

LEASAT-2 is being flown before LEASAT-1 at the request of Hughes Communications Services, Inc. LEASAT-1 has been placed on the manifest for reflight on mission 51-A.

Flight day three will complete the satellite deployment triple play with ejection of the TELSTAR 3 spacecraft and its PAM-D boost stage. Both the TELSTAR 3 and the SBS-4 satellite utilize the Hughes 376 spacecraft and are, therefore, nearly identical from an outward appearance. For deployment of the TELSTAR 3 satellite, the flight crew will follow deployment and separation maneuver procedures similar to those used to release the SBS-4 satellite on the first day of the mission.

Also tucked inside Discovery's cargo bay on mission 41-D is a versatile, NASA-developed Mission Peculiar Experiment Support Structure (MPESS). The triangular-shaped assembly serves as the mounting structure for the three OAST-1 experiments. The most distinguishing feature of the OAST-1 payload is a collapsible solar wing that will be unfolded to its fully extended height of 32 meters (102 feet). other OAST-1 experiments will measure deflections and bending motions on the fully deployed solar wing, and gather solar cell performance data.

Flight days three and four will be mostly spent working with the OAST-l payload, including experimentation with both the Solar Cell Calibration Facility (SCCF) and the large solar array. Day six will feature checkout of the orbiter's flight control system, final OAST-1 activities and an orbital news conference with the crew.

Day seven will be entry day. The deorbit burn will be performed on orbit 96. Discovery is scheduled to end its maiden flight in the first portion of orbit 97 with a lakebed landing at Edwards Air Force Base, Calif. Touchdown on prime runway 17 is planned to occur at approximately 144 hours and 57 minutes mission elapsed time.

(END OF GENERAL RELEASE; BACKGROUND INFORMATION FOLLOWS.)

41-D BRIEFING SCHEDULE

TIME	BRIEFING	ORIGIN
T-1 Day		
9:00 a.m. EDT	SBS-4	KSC
9:30 a.m. EDT	LEASAT (SYNCOM IV) -2	KSC
10:00 a.m. EDT	AT&T TELSTAR 3	KSC
10:30 a.m. EDT	OAST-l	KSC
11:00 a.m. EDT	CFES	KSC
1:30 p.m. EDT	Prelaunch Press Conference	KSC

(Although SSIP experimenter Shawn Murphy will not be briefing again, he will be available for interviews at KSC on T-1.)

Launch Day		
9:45 a.m. EDT (approximately)	Post Launch Press Conference	KSC (local only)
Launch Through End-of-Mssion		
Times announced an NASA Select	Flight Director Change of Shift Briefings	JSC
T+3 Days		
3:00 p.m. EDT (approximately)	41-G Flight Director Briefing	JSC
T+4 Days		
7:23 a.m. EDT	Inflight Press Conference	JSC
3:00 p.m. EDT (approximately)	41-G Crew Briefing (followed by round robins)	
Landing Day		
9:35 am. EDT (approximately)	Post Landing Briefing	DFRF
Landing+1 Day		
1:00 p.m. EDT	Orbiter Status	DFRF

GENERAL INFORMATION

NASA Select Television Transmission

The schedule for television transmissions from Discovery and for the change of shift briefings from the Johnson Space Center (JSC), Houston, Texas, will be available during the mission at the Kennedy Space Center (KSC), Fla.; Marshall Space Flight Center (MSFC), Huntsville, Ala.; and NASA Headquarters, Washington, D.C. The television schedule will be updated daily to reflect any changes dictated by mission operations.

Status Reports

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

Briefings

Flight control personnel will be on eight-hour shifts. Change-of-shift briefings by the off-going flight director will occur at approximately eight-hour intervals.

Transcripts

Beginning with mission 41-D, only transcripts of the change-of-shift briefings will be available at the Shuttle news centers. Transcripts of air-to-ground transmissions have been discontinued.

Miscellaneous

Information about pre-launch countdown activities, tracking and data information, Huntsville operations and other activities related to the mission will be made available to the media at the news centers in separate publications.

SHUTTLE MISSION 41-D REMANIFEST -- QUICK LOOK FACTS

Crew:	Henry Hartsfield, Commander Michael Coats, Pilot Judith Resnik, Mission Specialist Steven Hawley, Mission Specialist Richard Mullane, Mission Specialist Charles Walker, Payload Specialist
Orbiter:	Discovery (OV-103)
Launch Site:	Pad 39A, Kennedy Space Center, Fla.
Launch date/time:	August 29; 8:35 a.m. (EDT)
Window:	14 minutes to 8:49 a.m. (EDT)
Orbital Inclination:	28.45 degrees
Altitude:	184 s. mi. apogee, initial orbital requirement
Mission duration:	6 days, 00 hours, 56 minutes, 30 seconds (MET), 96 full orbits; land on 97
Landing:	September 4, 6:32 a.m. (PDT); 9:32 a.m. (EDT)
Primary Landing Site:	Edwards Air Force Base, Calif, runway 17; Weather Alternate, Kennedy Center, Fla.
Cargo and Payloads:	LEASAT-2 (Syncom IV) Satellite Satellite Business Systems (SBS-4) AT&T Telecommunications Satellite (TELSTAR 3) Office of Aeronautics and Space Technology-1 (OAST-1) Continuous Flow Electrophoresis System (CFES) IMAX (cabin camera) CLOUDS Radiation Monitoring Experiment Student Experiment (Purification and Growth of a Simple Gallium Crystal)
Mission Firsts:	First flight of orbiter Discovery First commercial payload specialist LEASAT-2 (SYNCOM IV) -- first "Frisbee" deployment

SUMMARY OF MAJOR ACTIVITIES

Flight Day 1

Orbit Insertion at 184 s. mi.
Payload Bay Doors Open
OAST-1 Activation
Remote Manipulator System (RMS) Checkout
SBS-4/PAM-D 6D Deploy (7A Injection)
Separation Burn after Deploy to 191 s. mi.

Flight Day 2

LEASAT-2 (SYNCOM IV) 17D Deploy (18A Injection)
Separation Burn after Deploy to 206 s. mi.
CFES Activation
Backup SBS-4/PAM-D Deploy (23A Injection)

Flight Day 3

TELSTAR 3 33D Deploy (34A Injection)
Separation Burn after Deploy to 206 s. mi.
Perigee Adjust Maneuver 183/18S s. mi.
OAST-l Activities
Extension/Retraction Testing
Solar Array Dynamics at 70 percent
Solar Array Dynamic Augmentation Experiment (DAE) at 70 percent

Flight Day 4

Backup TELSTAR 3/PAM-D Deploy (49A Injection)
Backup LEASAT-2/Unique Deploy (49A Injection)
OAST-l Activities
- Solar Array Performance at 70 percent
- Solar Array Dynamics at 100 percent
- Solar Array Dynamics at 70 percent
- Solar Cell Calibration Facility (SCCF) Data Take

Flight Day 5

OAST-l Activities
- Solar Array DAE Dynamics at 70 percent
- Solar Array Dynamics at 100 percent
- Solar Array Mini Performance Test
- SCCF Data Take

D = Descending orbital Node
A = Ascending orbital Node

Flight Day 6

Primary Reaction Control System Hot Fire Test
SSIP Experiment
Crew Press Conference
Flight Control System Checkout
OAST-l Activities
    SCCF Data Take

Flight Day 7

Close Payload Bay Doors
OAST-l Deactivation
Deorbit on orbit 96
Landing at Edwards AFB, Runway 17 (6:32 a.m. PDT) on Rev 97

Flight Day 8

Flight Extension Day 1
Landing at Edwards AFB, Runway 17 on Rev 113
Perigee Adjust for Flight Extension Day 2 - Rev 112

Flight Day 9

Flight Extension Day 2
Landing at Edwards AFB, Runway 17 on Rev 129

41-D REMANIFEST SEQUENCE OF EVENTS

EVENT	ORBIT	MET (h:m:s)	BURN	DELTA V (fps)	HP/HA* (s. mi)	COMMENTS
LAUNCH		0:00:00				12:35 GMT 8:35 EDT
OMS-1	1	0:00:10	2:30.0	238.0	58.5/184.8	
OMS-2	1	0:00:47	2:02.0	195.0	183.8/185.2	
DEPLOY	6	0:07:58			183.6/185.3	SBS-4
OMS-3	6	0:08:13	0:09.6	11.0	185.0/190.5	SEP MNVR
DEPLOY	17	1:00:33			185.0/189.7	SYNCOM
OMS-4	17	1:00:48	0:11.6	15.0	185.0/199.6	SEP MNVR
DEPLOY	33	2:00:42			185.1/199.2	TELSTAR
OMS-5	33	2:00:57	0:09.0	11.0	186.5/205.9	SEP MNVR
OMS-6	34	2:22:7	0:22.7	35.1	182.8/185.1	PERIGEE ADJ
DEORBIT	96	5:23:59	2:36.0	287.5		
LANDING	97	6:00:56				

OMS = Orbital Maneuvering System

*Note: To convert from nautical miles to statute miles, use n. mi. x 1.15 = s. mi. To convert from nautical miles to kilometers. use n. mi. x 1.85 = km.

CONFIGURATION

This will be the first flight of Discovery, the third space-capable orbiter off the production line. Discovery will go into orbit lighter than its two sister ships, Challenger and Columbia, and will be capable of greater heat loads during entry.

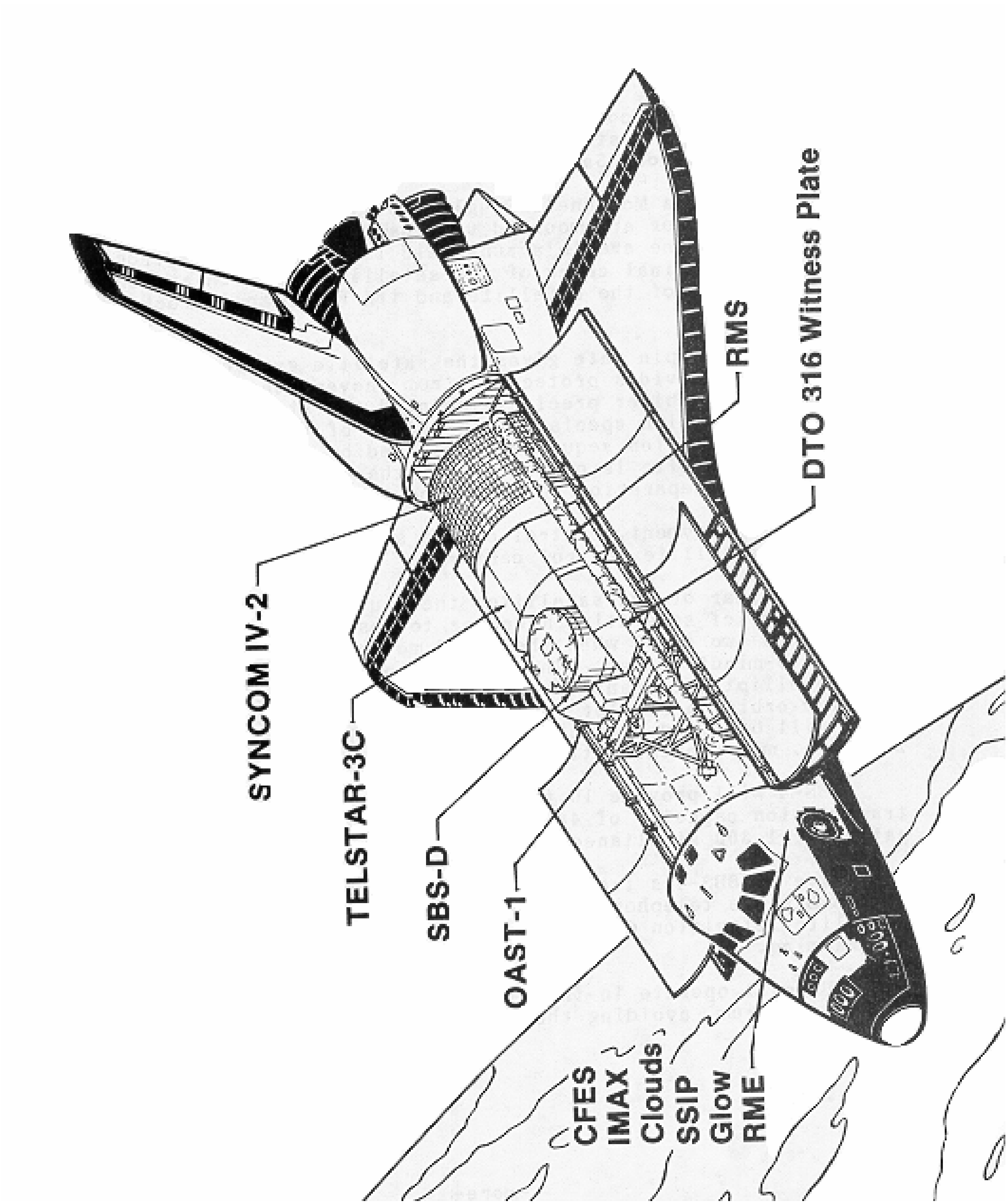
Low temperature (white-colored) tiles throughout most of the upper wings and fuselage have been replaced with Advanced Flexible Reusable Surface Insulation (AFRSI). The advanced insulation is also installed on the payload bay doors and on Discovery's vertical stabilizer.

Discovery's orbital Maneuvering System (OMS) pods have also been covered with the thicker insulation to protect the graphite epoxy skins. Graphite epoxy has replaced some internal aluminum spars and beams in the wings and in the payload bay doors. Discovery's onboard systems have been updated and are of more advanced construction than either of its predecessors.

Use of the quilt-like material, as well as manufacturing changes to airframe internal structures, enabled engineers to trim the dry weight of the vehicle to about 67,100 kg (147,925 lb.). Challenger weighed 67,418 kg (148,633 lb.) before its Solar Max repair mission in April and Columbia (inert) weighed 70,470 kg (155,359 lb.) before STS-9, its last mission.

WEIGHTS

SBS-4	3,349 kg	7,384 lb.
SBS-4 Support Equipment	1,098 kg	2,427 lb.
TELSTAR 3	3,395 kg	7,503 lb.
TELSTAR Support Equipment	1,097 kg	2,425 lb.
OAST-l	1,544 kg	3,405 lb.
LEASAT-2 (SYNCOM IV) Spacecraft	6,950 kg	15,306 lb.
LEASAT-2 (SYNCOM IV) Support Equipment	790 kg	1,743 lb.
IMAX (Cabin Camera)	131 kg	290 lb.
Student Experiments	30 kg	66 lb.
CFES	288.4 kg	634.4 lb.
Orbiter at Liftoff	119,475 kg	264,000 lb.
Total Vehicle at Liftoff	2,045,633 kg	4,520,850 lb.


SYNCOM IV-2
TELSTAR-3C
SBS-D
OAST-1
CFES
IMAX
Clouds
SSIP
Glow
RME
RMS
DTO 316 Witness Plate

SATELLITE BUSINESS SYSTEMS (SBS) - 4

On its maiden flight, Discovery will carry into space three deployable satellites destined for geosynchronous orbits, the most yet boosted aboard a single Space Shuttle mission.

The first to be deployed will be SBS-4, the fourth in a series of corporate communications satellites launched for Satellite Business Systems, a communications company owned by Aetna, Communications Satellite Corp. (COMSAT) and IBM.

SBS-4 and its McDonnell Douglas-built Payload Assist Module (PAM-D) boost motor are mounted vertically in a special cradle. For deployment, the cradle's sunshield is opened, the astronaut crew conducts a final check of the satellite's health and then initiates spin-up of the satellite and its PAM-D solid rocket motor.

The 50 rpm spin rate gives the satellite gyroscopic stability and provides protection from uneven heating from the sun. With the orbiter precisely pointed and at the correct instant, the mission specialist in charge of the deployment will initiate the ejection sequence. Released by an explosive bolt/clamp, the satellite is pushed out of the cargo bay by powerful springs with a separation speed of about three feet per second.

After deployment, control of the satellite passes to the customer's satellite control center.

Once clear of the satellite, the Shuttle flight crew will perform a brief separation maneuver to insure a safe distance between the two craft when the PAM-D motor fires automatically after a 45-minute delay. The PAM-D motor places the spacecraft into an elliptical transfer orbit. At the high point of a selected orbit, a smaller onboard solid propellant apogee kick motor will be fired to stabilize the satellite at its final 22,300 s. mi. orbital altitude.

SBS-4 will provide 10 transponders, each with a digital transmission capacity of 48 million bits per second or, alternatively, 1,300 simultaneous telephone calls.

Five of SBS-4's transponders will be used for the expansion of SBS Skyline telephone service. The other five are leased to Satellite Television Corp. for transmission of television programming.

SBS will operate in the 14/12 GigaHertz Ku-band of the frequency spectrum, avoiding the congestion encountered in C-band frequencies.

The McLean, Va., firm operates three previous satellites of the Hughes 376 design launched by NASA in 1980, 1981 and 1982. SBS-1 and SBS-2 were launched by NASA Delta rockets and SBS-3 was deployed by the orbiter Columbia on STS-5, the first operational flight of the Space Shuttle. The first three are in full-time service, providing long-distance telephone service, advance of private communications networks and television distribution. They are positioned over the equator at 95 degrees west longitude, 97 degrees W. longitude and 100 degrees W. longitude, respectively.

The physical characteristics of SBS-4 are similar to those of its predecessors. In a launch configuration, the satellite is 2.16 m (7 it. 1 in.) in diameter and 2.82 m (9 ft. 3 in.) tall. The gross weight of the payload, including the PAM-D, is 3,349 kg (7,384 lb.). The satellite weighs 485 kg (1,069 lb.), exclusive of its 508-kg (1,119-lb.) apogee kick motor and 149 kg (328 lb.) of hydrazine attitude control fuel. Deployed in orbit, the satellite is 6.6 m (21.6 ft.) high.

LEASAT 2 -- (SYNCOM IV-2)

LEASAT is the first satellite designed exclusively for launch aboard the Space Shuttle. Measuring 4.2 m (14 ft.) across, the spacecraft is too large to fit in the protective nose cone that sits on top of an expendable booster, such as a Delta or Atlas Centaur rocket. Unlike the two other satellites carried on this mission, LEASAT is mounted horizontally in the orbiter's cargo bay.

Installation of the spacecraft in the payload bay is accomplished with the aid of a cradle structure. The cradle permits the spacecraft to be installed laying on its side, with its retracted antennas pointing toward the nose of the orbiter and its propulsion system pointing toward the back. Mounting the antennas on deployable structures allows them to be stowed for launch.

Five trunnions (four longeron and one keel) are used to attach the cradle to the Shuttle. Five similarly located internal attach points are used to attach the spacecraft to the cradle.

Another unique feature of the LEASAT series of satellites is that they do not require a separately purchased upper stage, as have all the other communications satellites launched to date from the Shuttle. The LEASAT satellites contain their own unique upper stage to transfer them from the Shuttle deploy orbit of about 182 s. mi. to a circular orbit 22,300 s. mi. over the equator.

Each satellite is 6 m (20 ft.) long with the UHF and omnidirectional antennas deployed. Total payload weight in the Shuttle will be 7,740 kg (17,049 lb.). The satellite's weight on station at the beginning of its planned seven year life will be nearly 1,315 kg (2,900 lb.). Hughes Space and Communications Group builds the satellites.

Ejection of the spacecraft from the Shuttle is initiated when locking pins at the four contact points are retracted. An explosive device then releases a spring that ejects the spacecraft in a "Frisbee" motion. This gives the satellite its separation velocity and gyroscopic stability during the 45 minute coast period between deployment and ignition of the perigee kick motor. The satellite separates from the Shuttle at a velocity of 0.7 m (1.5 ft.) per second and a spin rate of about two rpm.

Deployment of the LEASAT satellite triggers an onboard automatic sequencer. The sequencer configures the satellite for firing of the solid propellant perigee motor. The telemetry, tracking and command antenna is deployed, attitude electronics, spacecraft power and telemetry are initialized, and the spacecraft spin rate is increased to 30 rpm.

A series of maneuvers, performed over a period of several days, will be required to place LEASAT into its synchronous orbit over the equator. The process starts 45 minutes after deployment from the Discovery with the ignition of the solid propellant perigee motor, identical to that used as the third stage of the Minuteman missile, which will raise the high point of the satellite's orbit to about 9,545 s. mi.

Two liquid fuel engines that burn hypergolic propellants, monomethyl hydrazine and nitrogen tetroxide, are used to augment the velocity on successive perigee transits, to circularize the orbit, and to align the flight path with the equator. The first of three such maneuvers raises the apogee to 12,420 s. mi., the second raises the apogee to 16,445 s. mi. and the third to geosynchronous orbital altitude. At this point the satellite is in a transfer orbit with a 182 s. mi. perigee and a 22,300 s. mi. apogee. The final maneuver, again performed by the liquid propellant engines, circularizes the orbit at the apogee altitude.

The satellites are spin-stabilized with the spun portion containing the solar array and the sun and Earth sensors for attitude determination and Earth pointing reference, three nickel-cadmium batteries for eclipse operation, and all the propulsion and attitude control hardware. The despun platform contains two large helical UHF Earth-pointing communications antennas, 12 UHF communication repeaters, and the majority of the telemetry, tracking and command equipment.

Hughes Communications Services, Inc., will operate the worldwide LEASAT satellite communications system under a contract with the Department of Defense, with the U.S. Navy acting as the executive agent. The system will include five LEASAT satellites, one of which will be a spare, and the associated ground facilities. Users will include mobile air, surface, subsurface and fixed Earth stations of the Navy, Marine Corps, Air Force and Army. The satellites will occupy geostationary positions south of the United States and over the Atlantic, Pacific and Indian oceans .

TELSTAR 3

The second in the TELSTAR 3 series of communications satellites, representing the latest in satellite communications technology, will be deployed on flight day three during the ascending half of orbit 34. When combined with the new single sideband Earth station equipment developed by Bell Labs, each TELSTAR 3 satellite is capable of relaying nearly four times the number of simultaneous telephone calls commonly carried by satellites of the previous generation.

The current AT&T Communications space network consists of the first TELSTAR 3 satellite and four COMSTAR satellites leased from COMSAT. AT&T Communications -- the AT&T organization responsible for long-distance and international services -- launched the first of its TELSTAR 3 satellites in 1983 on a Delta rocket. This particular satellite is scheduled to replace two COMSTAR satellites that currently work as a single unit. The third and fourth TELSTAR 3 satellites should replace the other two COMSTARs in 1985 and 1988. respectively.

Designed for domestic communications, TELSTAR satellites operate in the 6/4 GigaHertz C-band and serve the continental United States, Hawaii, Puerto Rico or Alaska, depending on exact orbital placement over the equator. Each satellite is able to relay hundreds of video teleconferences, 24 color television programs or billions of bits of high speed data and facsimile signals. The second TELSTAR 3 will be placed at 76 degrees W. longitude. It will have a total of 24 working transponders, the equipment that receives and transmits communications signals, as well as six amplifiers held in reserve.

In addition, improved batteries and solid state amplifiers will allow the TELSTAR 3 series to operate three years longer than the previous generation of satellites -- for 10 rather than seven years.

TELSTAR 3 was designed by AT&T Bell Laboratories and built by the Hughes Aircraft Corp. utilizing the Hughes 376 spacecraft. Each TELSTAR 3 satellite consists of two primary sections containing the communications units and the support systems, surrounded by two concentric cylinders. once in space, the outer cylinder drops down about 1.8 m (6 ft.) exposing the solar cells on the inner cylinder. With its antenna fully deployed in space, the satellite will have an overall length of 6.83 m (22.4 ft.) and a diameter of 2.16 m (7.1 ft.). The two cylinders are covered with 15,588 solar cells. When the satellite is in the sun's path, these cells, thin silicon chips, covert solar energy to electrical power to energize the satellite. When not operated by solar power, the TELSTAR 3 satellite uses nickel-cadmium, long-life batteries.

Like SBS-4, the TELSTAR 3 spacecraft will use a PAM-D for transfer orbit insertion. Ground controllers will monitor the satellite until it reaches a selected apogee, or high point, at which time they will fire the onboard apogee kick motor to circularize the orbit at the geosynchronous altitude of 22,300 s. mi.

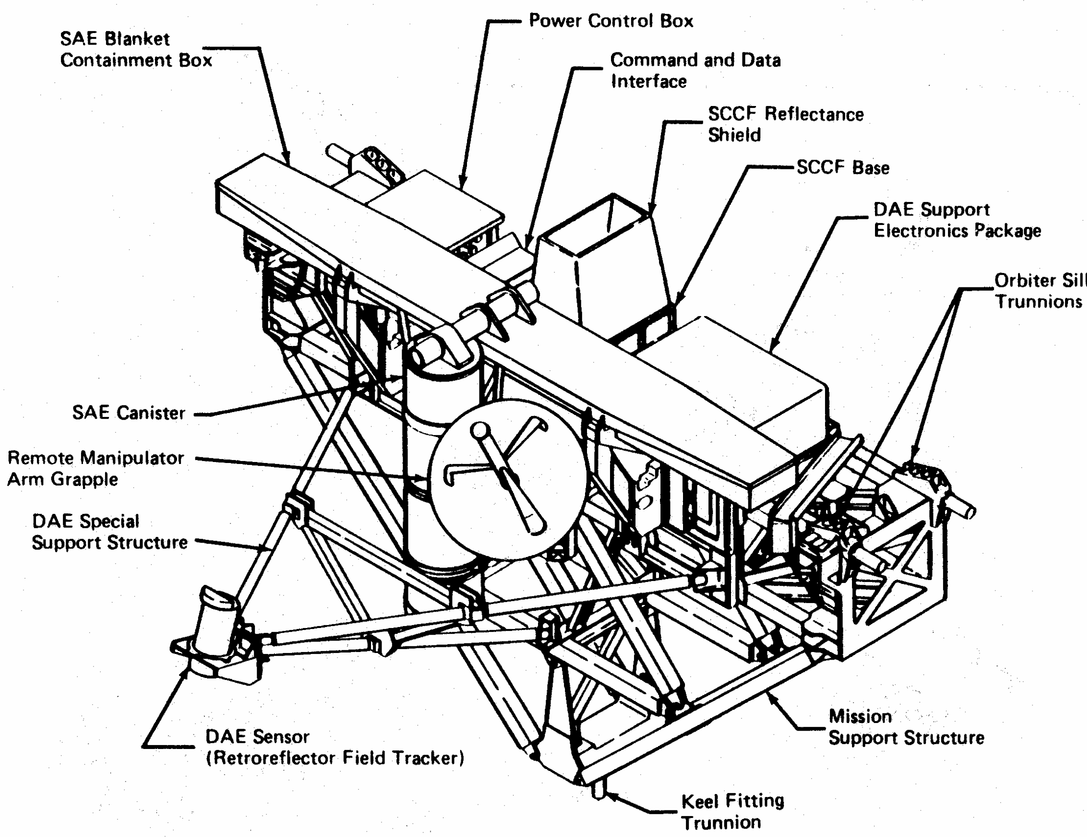
OAST-1

NASA's office of Aeronautics and Space Technology (OAST-1) payload includes advanced solar array technology that can be applied to the conversion of the sun's energy to electricity for use aboard future spacecraft. OAST-1 will mark the first demonstration in space of a large, lightweight solar array that can be retracted and restowed after deployment.

OAST-1 consists of three major experiments: the Solar Array Experiment (SAE); the Dynamic Augmentation Experiment (DAE); and the Solar Cell Calibration Facility (SCCF). Major payload components are carried on a triangular, truss-like MPESS in the orbiter's cargo bay.

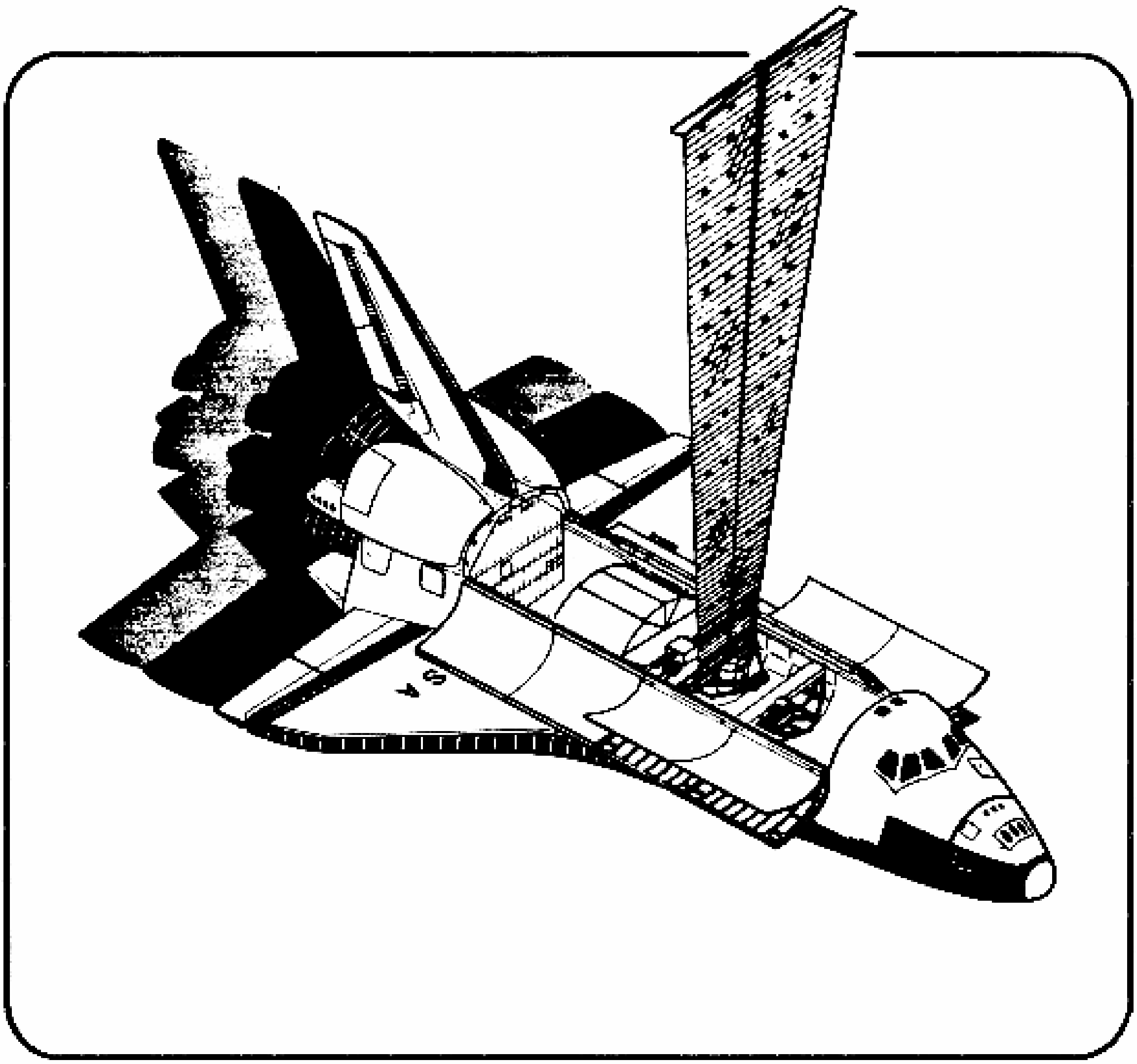
The primary objectives of OAST-1 are: to demonstrate the performance of a large, low-cost, lightweight, deployable/ retractable solar array; to demonstrate methods to define the structural dynamics of large space structures; and to evaluate solar cell calibration techniques as well as calibrate various types of solar cells.

The heart of the payload is the solar array wing. When fully extended, it will rise more than 10 stories (31.5 m or 102 ft.) above the Shuttle cargo bay. Yet, when stowed for launch and landing, the wing folds into a package only 17.78 cm (7 in.) deep.



THE OAST-1 PAYLOAD ELEMENTS — The OAST-1 payload consists of three experiment systems which will investigate solar energy and large space structures technology (both are vital parts of a space station).

OAST-1



During the mission, the array will be deployed and retracted several times, and data will be gathered on how the system performs. The deployed wing will also be vibrated by controlled firings of the orbiter's vernier reaction control system thrusters. Movements of the wing will be sensed and recorded for post-flight analysis. Additionally, a facility for calibrating solar cells will be operated.

OAST-l will be operated from the aft flight deck of the orbiter by the Shuttle crew. Payload operations will be controlled from the Mission Control Center at the Johnson Space Center. An OAST-1 mission management team will support these operations from the Customer Support Room in Mission Control, and teams of engineers and investigators will provide technical support from the Marshall Space Flight Center's Huntsville Operations Support Center (HOSE). This group will receive and monitor mission data in real-time and will advise the mission team at Johns on .

Solar Array Experiment

The solar array is 31.5 m (102 ft.) tall by 4 m (13 ft.) wide. Its primary structure is a thin blanket of plastic material called Kapton. The blanket consists of 84 panels that fold accordion-style when the structure is retracted.

The solar array blanket is deployed by extending an epoxyfiberglass mast, stored in a 43 cm (17-in.) diameter, 1.5 m (5 ft.) tall canister. The mast consists of three continuous longerons, about 0.63 cm (1/4 in.) in diameter, interconnected by three battens at intervals of 23 cm (9 in.). The result is a structure with a triangular cross section that is longitudinally stabilized by short guy wires between batten attachments. Rollers are located on the outside of all three longerons at the intersections with the battens.

To extend the mast, a "nut" with internal threads rotates at the top of the canister. As it rotates, the rollers move up through the threads of the nut, allowing the longerons to straighten and the guy wires to hold the structure in a rigid form. Rotation of the nut in the opposite direction drives the rollers back into the canister, retracting the mast and coiling it back into the canister.

The initial few inches of mast extension unlatches the containment box lid holding the array blanket. As the mast is extended, it unfolds the blanket. When the blanket is 70 percent deployed, a tension bar is also deployed that applies about 66.7 Newtons of pull (about 15 lb.) in the direction of the containment box. This assures that the section of blanket deployed up to that point will be pulled flat.

Another tension bar at the bottom of the blanket applies another 22.7 Newtons (5 lb.) of pull to flatten the last 30 percent of the blanket when the array is fully extended. Structural dynamics tests will be conducted with the solar array at both 70 percent and 100 percent of its fully deployed height.

The mast is extended and retracted at about 4 cm (1.5 in.) per second. It takes about 14 minutes to fully extend the wing. When the wing is retracted, small springs at the panel hinges "remind" the blanket of which direction to collapse as it refolds.

The mast canister and solar array containment box are mounted on the side of the MPESS by bracketry. Also mounted on this bracketry is a tape recorder and other support electronics. Accelerometers mounted to the cover of the containment box provide data on the movement of the top of the structure. Additional data will be gathered by television cameras located in the cargo bay. These cameras will be used to observe mechanical motions of the blanket panels as they are deployed and restowed. other sensors will monitor the thermal environment of the structure and the solar cells mounted near the top of the blanket. Data from accelerometers and thermal sensors, and the electrical performance of the solar cells on the wing, will be stored on the recorder.

The solar array wing will carry active solar cell modules located on panels near its top. All other solar array panels will carry dummy cells. Covering the entire array with active cells is neither necessary nor cost effective for accomplishing experiment objectives. However, a solar array of this size, fully populated with active cells, would be capable of producing 12.5 kilowatts of power.

The electrical and thermal performance of these cells will be determined by measuring the current-voltage characteristics and the temperature of the cells. As the solar array wing is placed in various positions relative to the sun, different levels of solar radiation will fall on the cells. Acquiring data in these different positions will enable the complete characterization of cell performance.

Dynamic Augmentation Experiment

The Dynamic Augmentaton Experiment (DAE) will gather information on the solar array structural vibrations and will validate an on-orbit method of defining and evaluating the dynamic characteristics of large space system structures. Data will be analyzed on the ground. Validation will include verification of the performance of the remote sensing system and data evaluation techniques.

Experiment operations will involve exciting the array using the Shuttle's reaction control system and will generally be conducted on the nightside of orbits to reduce background sunlight.

Solar Cell Calibration Facility

The Solar Cell Calibration Facility (SCCF) will evaluate and validate solar cell calibration techniques currently used by NASA's Jet Propulsion Laboratory, Pasadena, Calif. This validation involves comparing the performance of cells on orbit with the same cells flown on a high altitude balloon flight. This data will validate the factors used to compensate for the residual atmosphere that remains above balloon flight altitudes.

Cells used in the experiment represent a variety of state of the art and advanced devices, including samples similar to those on the solar array wing. Also included are a number of specially fabricated cells designed to make the experiment more sensitive to any differences between the exposure on the Shuttle and the exposure on the balloon. The experiment will also verify the accuracy of laboratory-generated solar cell temperature coefficients. These solar cell temperature coefficients are used to determine the actual solar cell output at a given temperature, information that is important for the design of all solar cell arrays to be used in space.

The calibration hardware is mounted on top of the MPESS in a rectangular case. The sample solar cells are mounted on top of the case. System components inside the case include the data acquisition and control system and a tape recorder. on top of the case is a reflective shield shaped like a truncated pyramid. This shield protects the solar cells from reflected light from the orbiter and other objects in the cargo bay.

The facility requires a total of about seven orbits to acquire its data. After the flight, data will be processed at JPL.

OAST-1 Team

Responsibility for the OAST-1 payload is shared by NASA Headquarters and three NASA Centers. The Marshall Space Flight Center developed and managed the OAST-1 mission for the Shuttle Payloads Engineering Division of the office of Space Science and Applications, NASA Headquarters. Marshall was also responsible for developing the SAE and DAE hardware, and will manage the analysis of the augmentation experiment structural dynamics data on behalf of the office of Aeronautics and Space Technology.

The development of photogrammetric techniques used to acquire structural dynamics data and the post flight analysis of that data will be managed by the Langley Research Center in Hampton, Va. The SCCF experiment development and data analysis activity will be managed by the Jet Propulsion Laboratory. These activities are also being conducted on behalf of the office of Aeronautics and Space Technology.

Investigators for SAE and DAE include: L.E. Young, principal investigator, MSFC; R.W. Schock, co-investigator, DAE structural dynamics, MSFC; M.L. Brumfield, co-investigator, photogrammetry-structural dynamics, LaRC; and SCCF, R.G. Downing, principal investigator, JPL.

CONTINUOUS FLOW ELECTROPHORESIS SYSTEM

McDonnell Douglas engineer Charles D. Walker will become the first non-astronaut to fly into space under a NASA policy that allows major Space Shuttle customers to have one of their own people onboard to operate their payloads. Payload specialists will most often be scientists or engineers with special skills to operate a scientific experiment or to run a unique and critical processing system.

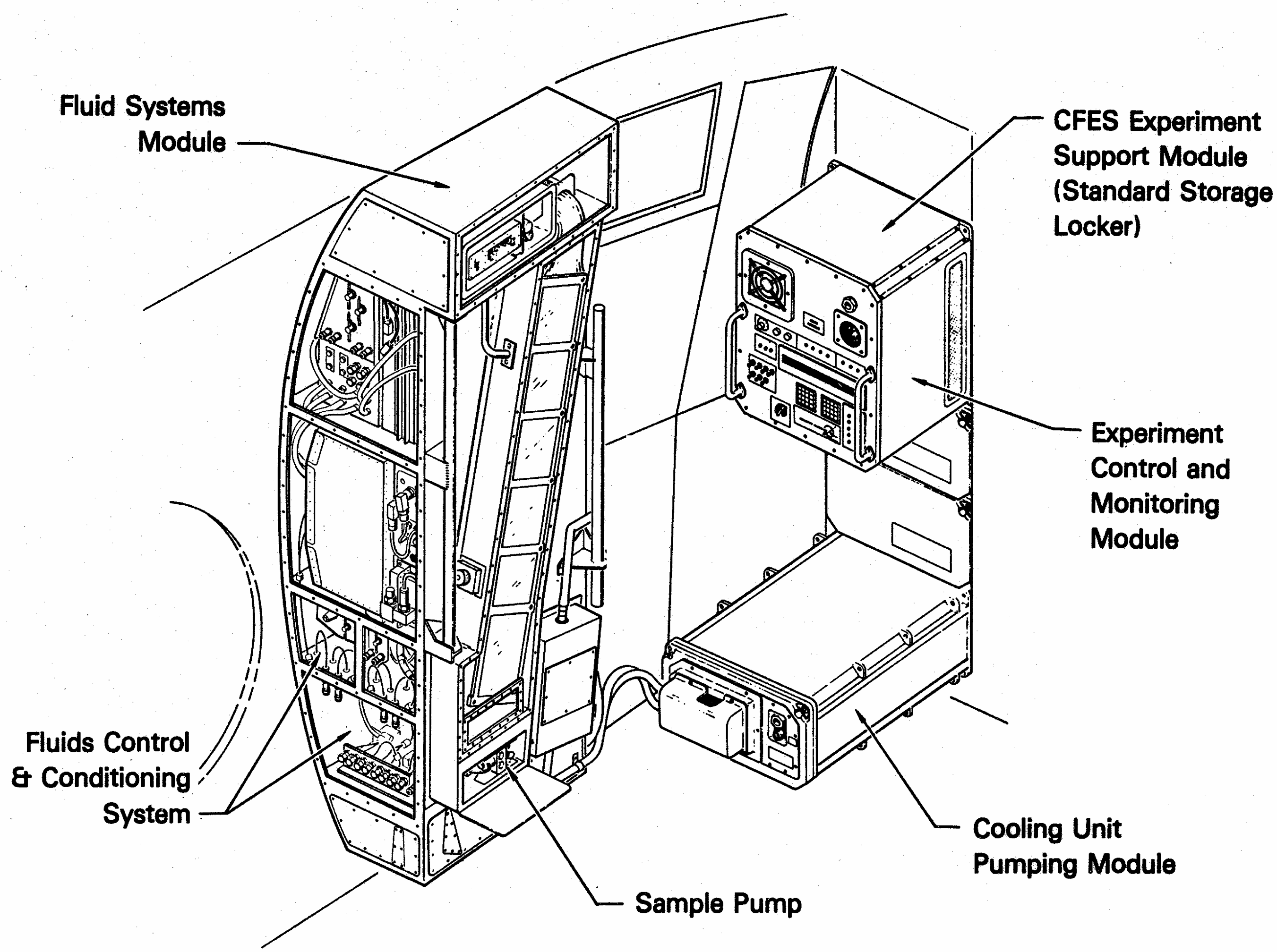
Walker's job will be to operate the CFES, which is a modified version of the device that has been flown on four previous Shuttle missions. His presence is needed because the device has been changed significantly to operate continuously for about 100 hours during the mission. Instead of processing several small samples, the CFES will collect one large sample on this mission.

The large quantities of material processed will be furnished to Ortho Pharmaceutical Corp., Raritan, N.J., for clinical testing. McDonnell Douglas has an agreement with Ortho Pharmaceutical Corp. to study jointly the commercial feasibility of using space-based processing to manufacture pharmaceuticals. McDonnell Douglas will separate material in increasing quantities so that Ortho will be able to conduct research and clinical testing needed to gain Food and Drug Administration approval for a new pharmaceutical product. Both companies hope this new product will be ready for the commercial market by the late 1980s.

The CFES is a device that separates materials in solution by subjecting them to an electrical field. In this process, a continuous stream of biological material is injected into a buffer solution flowing through a thin, rectangular chamber. When the electrical field is applied, the biological materials pull apart into separate streams. These streams flow out of the top of the chamber and are collected.

The CFES is mounted on the middeck of the Discovery. The system weighs about 288.4 kg (634.4 lb.). The orbiter supplies the necessary power to the unit and access to a cooling system to dissipate the heat generated by the process.

Continuous Flow Electrophoresis System Middeck Galley Location



VEHICLE GLOW EXPERIMENT

A flight experiment to characterize surface-originated vehicle glow will be conducted during flight 41-D. observations made during recent Shuttle flights (STS flights 3-8) indicate that optical emissions originate on spacecraft surfaces facing the direction of orbital motion. Material specimens flown on STS-8 have shown spectral distribution and intensity of the glow to be different for different materials, and that the intensity becomes stronger as spacecraft altitude is reduced. These results are of principal concern to mission scientists for the Space Telescope and for the astronomical observatories that will be aboard the Space Station, because slight orbit degradations will cause the glow to become more intense and possibly interfere with faint star-light measurements for attitudes where the telescope optics are oriented toward the "windward" direction.

Nine strips of material, representing different spacecraft materials, have been attached circumferentially to the orbiter's robot arm. The flight crew will take pictures of the strips from the orbiter's aft flight deck during two night passes late in the mission. Prior to each photographic opportunity, the attitude of the orbiter will be adjusted to produce direct impingement of the orbital environment onto the material strips.

One set of photographs will be obtained at an orbital altitude of 199 s. mi. and a second set at 139 s. mi. to evaluate the intensity of glow at these altitudes. To enhance the brightness level and reduce the exposure time, an image intensifier will be used with the camera system. Spectral information of the glow region above each material will be documented using a spectrometer assembly uniquely designed for this experiment.

CLOUDS

The Clouds payload consists of two, 250-exposure camera assemblies with battery-powered motor drives, l05 mm F/2 lenses and infrared filters. All of the hardware will be stowed in a middeck locker and will be used at the aft flight deck station for cloud photography data collection.

IMAX

Located in the middeck will be an IMAX motion picture camera, making the second of three scheduled trips into space aboard the Shuttle. Footage from the Shuttle flights will be assembled into a film called "The Dream Is Alive." The IMAX high-fidelity motion picture system uses a large 70 mm film frame that, because of its size, improves picture quality. IMAX films are displayed on a screen that is nine times larger than a conventional screen, producing a more compelling effect.

Fifteen IMAX theaters are now operating around the world and 13 are under construction. IMAX Systems Corp. is producing the film, which is expected to premiere at the National Air and Space Museum in Washington, D.C., in early summer 1985. About a month after it premieres in Washington, the film will be shown at the new IMAX theater at Kennedy Space Center's Visitors' Center.

The IMAX camera is part of a joint project among NASA, the National Air and Space Museum, IMAX Systems Corp. of Toronto, Canada, and the Lockheed Corp.

SHUTTLE STUDENT INVOLVEMENT PROJECT

There is one experiment chosen for mission 41-D from the Shuttle Student Involvement Project. This experiment was proposed by Shawn P. Murphy from Newburg, Ohio. It is sponsored by Rockwell International. The experiment is designed to compare a crystal grown by the "Float Zone" technique in a low gravity environment with one grown in an identical manner on Earth.

The material consists of a 25-cm (10-in.) rod of gallium impregnated with thallium. Heat is applied to the crystal interface until a molten zone is formed, and the zone then moves up the length of the rod. In the absence of gravity, a more uniform distribution of the thallium and a more perfect gallium crystal is expected to result. The experiment is contained in the middeck.

STS-41D CREWMEMBERS

S84-30259 -- Seated are (left to right): Richard M. (Mike) Mullane and Steven A. Hawley, mission specialists; Henry W. Hartsfield Jr., crew commander; Michael L. Coats, pilot. Standing are Charles D. Walker, pilot and Judith A. Resnik, mission specialist. Behind them is a model of the early sailing vessel Discovery and a model of the shuttle Discovery.

PHOTO CREDIT: NASA or National Aeronautics and Space Administration.

BIOGRAPHICAL DATA

HENRY W. HARTSFIELD Jr., 50, is commander of 41-D, the twelfth flight of the Space Shuttle. A native of Birmingham, Ala., he became a NASA astronaut in 1969 while with the Air Force.

Hartsfield was pilot for STS-4, the fourth and final orbital test flight of the Shuttle Columbia. In this seven-day mission, he completed 112 Earth orbits, logging 169 hours and 11 minutes in space.

Retiring from the Air Force in 1977 with more than 22 years of active service, he continued his assignment as a civilian NASA astronaut. He has logged more than 6,000 hours flying time -- of which 5,200 hours are in jet aircraft.

MICHAEL L. COATS, 38, USN Commander, is the pilot for 41-D. He was selected as a NASA astronaut candidate in 1978, completing his training the following year. He was capsule communicator for the fourth and fifth Shuttle missions.

Coats was graduated from U.S. Naval Academy in 1968 and became a naval aviator in 1969. While assigned to the USS Kittyhawk, he flew 315 combat missions in Southeast Asia.

He has logged 3,500 hours flying time and 400 carrier landings in 22 different types of aircraft.

JUDITH A. RESNIK, Ph.D., 35, is one of three mission specialists on this flight of Discovery. She became a NASA astronaut candidate in 1978 and completed the one-year training and evaluation period to become eligible for Space Shuttle flight crew assignment. She will be the second American woman to fly in space.

Resnik's projects in support of orbiter development at the Johnson Space Center include experiment software and the Remote Manipulator System.

Resnik received a bachelor of science degree in electrical engineering from Carnegie-Mellon University in 1970 and a doctorate in electrical engineering from the University of Maryland in 1977.

STEVEN A. HAWLEY, Ph.D., 32, is a mission specialist on Space Shuttle flight 41-D.

Hawley became a NASA astronaut candidate in 1978 and a year later became eligible for flight assignment. He was simulator pilot for software checkout at the Shuttle Avionics Integration Laboratory and a member of the astronaut support crew for orbiter test and checkout.

Graduated with highest distinction from the University of Kansas, he received bachelor of arts degrees in physics and astronomy and a doctor of philosophy in astronomy and astrophysics from the University of California.

Hawley is the husband of Astronaut Sally K. Ride, first American woman to fly in a Space Shuttle.

RICHARD M. MULLANE, Lt. Col., USAF, 38, the third mission specialist on Discovery, is a West Point graduate with 150 combat missions as a weapon system operator in Vietnam.

In 1979 he became eligible for assignment as Space Shuttle crew mission specialist.

Mullane received a bachelor of science degree in military engineering from the U.S. Military Academy in 1967 and was awarded a master of science degree in aeronautical engineering from the Air Force Institute.

CHARLES D. WALKER, 36, is the first commercial payload specialist assigned by NASA to a Space Shuttle flight crew.

Walker is chief test engineer for the McDonnell Douglas Electrophoresis operations in Space project. As payload specialist, Walker will operate the materials processing equipment, a project aimed at separating large quantities of biological materials in space for ultimate use in new pharmaceuticals.

Walker was graduated from Purdue University in 1971 with a bachelor of science degree in aeronautical and astronautical engineering.

Prior to joining McDonnell Douglas, Walker was project engineer responsible for computer-based manufacturing process controls and design of ordnance production equipment at the Naval Sea Systems Command Engineering Center, Crane, Ind.

SHUTTLE FLIGHTS AS OF AUGUST 1984

11 TOTAL FLIGHTS OF THE SHUTTLE SYSTEM

STS-9 11/28/83 - 12/08/83	
STS-5 11/11/82 - 11/16/82	STS-41C 04/06/84 - 04/13/84
STS-4 06/27/82 - 07/04/82	STS-41B 02/03/84 - 02/11/84
STS-3 03/22/82 - 03/30/82	STS-8 08/30/83 - 09/05/83
STS-2 11/12/81 - 11/14/81	STS-7 06/18/83 - 06/24/83
STS-1 04/12/81 - 04/14/81	STS-6 04/04/83 - 04/09/83
OV-102 **Columbia** **(6 flights)**	**OV-099** **Challenger** **(5 flights)**