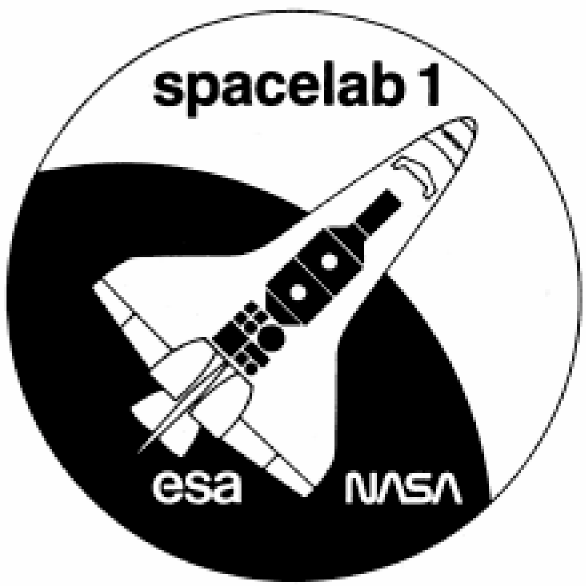
esa
european space agency

NASA
National Aeronautics and
Space Administration

STS-9
Spacelab 1



Press Kit **November 1983**

Original STS-9 press kit cover

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

SPACE SHUTTLE MISSION STS-9

PRESS KIT
NOVEMBER 1983

SPACELAB 1 (VERIFICATION FLIGHT TEST)

STS-9 INSIGNIA

S83-32900 – The space shuttle Columbia appears in the center of the mission insignia ,its open payload bay doors revealing the Spacelab in its first flight configuration. The nine stars and the path of the orbiter tell the flight's numerical designation in the shuttle mission sequence.

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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RELEASE NO: 83-173 **November, 1983**

STS-9 TO CARRY EUROPEAN-BUILT SPACELAB ON ITS FIRST MISSION

The ninth flight of the Space Shuttle, STS-9/Spacelab 1, is a nine-day, international space research expedition. It will mark the maiden flight of the newest element of the Space Transportation System, the European Space Agency (ESA)-developed laboratory called Spacelab.

STS-9/Spacelab 1 is scheduled for launch from Complex 39A, at Kennedy Space Center, Fla., Nov. 28, 1983, at 16:00 GMT (11 a.m. EST) . Columbia and the Spacelab will operate in a 250-kilometer (135-nautical mile) circular orbit inclined to the equator at 57 degrees.

This flight will be the first time ever that career scientists from outside NASA's astronaut corps will fly aboard a United States spacecraft to conduct research.

For STS-9, Spacelab will occupy orbiter Columbia's cargo bay, temporarily transforming the Shuttle orbiter into a space-based orbital research center -- a short-stay scientific space station.

Spacelab was designed, developed, funded and built by the European Space Agency as Europe's contribution to the United States Space Transportation System. It represents a European investment of approximately $1 billion.

The first Spacelab mission is designed to test the laboratory, and to conduct more than 70 separate investigations in five broad areas of scientific research: life sciences; atmospheric physics and earth observations; astronomy and solar physics; space plasma physics; and materials science and technology

Spacelab 1 is a joint mission of NASA and ESA with each organization sponsoring half (by resources) of the scientific payload. Experiments for the mission are being provided and supported by scientists in 11 European nations, the United States, Canada and Japan. Marshall Space Flight Center, Huntsville, Ala., is responsible for the NASA-sponsored portion of the payload, and for overall management of the first mission. ESA's Spacelab Payload Integration and Coordination in Europe (SPICE) team is responsible for the European portion of the payload.

The six-man crew of STS-9/Spacelab 1 is the largest crew yet to fly aboard a single spacecraft, the first international Shuttle crew, and the first crew to include a new category of spaceborne research scientists called payload specialists.

Mission commander is John W. Young, veteran of five previous space flights and commander of the first Space Shuttle mission. Pilot is Brewster H. Shaw Jr., who is making his first space flight. Mission specialist astronauts are Dr. Owen K. Garriott, a veteran of NASA's Skylab 3 mission, and Dr. Robert A. R. Parker, who is making his first space flight. The payload specialists are Dr. Byron Lichtenberg, a member of the research staff at the Massachusetts Institute of Technology, Cambridge, Mass., and Dr. Ulf Merbold, representing ESA, from the Federal Republic of Germany. Merbold is the first non-American to fly on a U.S. spacecraft.

Payload specialists are career scientists and engineers -men and women -- selected by their peers to fly in space on a particular mission and devote themselves to conducting experiments. They are not trained to fly the Shuttle or operate its systems.

The STS-9 orbiter and Spacelab's basic systems will be controlled from the Mission Control Center at Johnson Space Center, Houston Texas.

All Spacelab 1 science operations on orbit will be managed and controlled from the Payload operations Control Center situated in the same building as Mission Control. Members of the Marshall Center/SPICE mission management team, along with the teams of scientists who have experiments aboard Spacelab, will monitor, direct and control experiment operations throughout the mission.

During the mission, NASA's new Tracking and Data Relay Satellite System (TDRSS) will handle most of the communications and data transmissions between Columbia/Spacelab 1 and Mission and Payload Control. NASA's worldwide Ground Space Tracking and Data Acquisition Network (GSTDN) will continue to be used; however, the addition of TDRSS will vastly increase the amount of data and communications that can be exchanged between the spacecraft and the ground during the mission. STS-9/Spacelab 1 will also mark the first use of the Spacelab Data Processing Facility at Goddard Space Flight Center, Greenbelt, Md.

During the STS-9/Spacelab 1 mission, mission specialist Owen Garriott, who is an amateur radio operator, will use a hand-held radio during part of his off-duty time to communicate with ham radio operators around the world. Garriott's call sign is W5LFL. All ham radio operations for STS-9 will be in the 2-meter band. Transmissions will be in the range 145.51 MHz to 45.770 MHz FM.

Reception will be in the range 144.910 to 145.470 MHz FM. Twenty kilohertz steps will be used to both transmit and receive. The times when Garriott will communicate with ham operators will be announced when known.

After 9 days, 11 minutes of around-the-clock scientific operations and Spacelab hardware verification, the Columbia with its laboratory cargo will land on lakebed Runway 17 at Edwards Air Force Base, Calif. Reentry will begin with the firing of the orbiter's orbital Maneuvering System engines over the Indian ocean as Columbia makes its 145th revolution of the earth. Landing is set for 16:11 GMT (11:11 a.m. EST) Dec. 7. Spacelab will be the heaviest payload to be returned to earth in the Shuttle orbiter's cargo bay.

(END OF GENERAL RELEASE; BACKGROUND INFORMATION FOLLOWS.)

HOW TO COVER THE STS-9/SPACELAB 1 MISSION

This mission will be one of the most challenging of NASA's manned space flight missions for media to adequately cover due to the doubling of air-to-ground (A/G) communications between the spacecraft and the mission control complex in Houston and the 24-hour-a-day operations .

Each day there will be as many as three change-of-shift briefings for the orbiter flight director, one change-of-shift briefing for the payload mission manager and a daily science summary briefing.

News Center Operations

Johnson Space Center, Houston, Texas:

This will be the principal news dissemination center for STS-9 and Spacelab 1 information. All mission briefings after launch and before landing will originate from the Johnson news facility. Press in attendance at Johnson will have facilities to allow the coverage of both A/G circuits and will have considerable opportunity to participate in interviews with principal investigators and mission managers.

Kennedy Space Center, Fla.:

This will be the principal news dissemination center for STS-9 and Spacelab 1 information for the pre-launch and launch activities. Briefings covering the mission, science, objectives and equipment will be held here beginning two days prior to launch. Following the launch, the Kennedy newsroom will be able to receive all NASA Select Video and Audio as well as Mission Audio. News media choosing to remain at Kennedy will be able to participate in change-of-shift briefings through two-way audio circuits.

Marshall Space Flight Center, Huntsville, Ala.:

This will be a news dissemination center for information on the Huntsville Operations Support Center (HOSC) which will support the Marshall Spacelab and Spacelab Payloads activities at Johnson during the mission. No formal briefings are planned though media may interview HOSC participants and can participate in the Kennedy, Johnson and Dryden mission briefings via satellite television and audio links.

Dryden Flight Research Center, Edwards, Calif.:

This will be the principal news dissemination center for STS-9 and Spacelab 1 landing activities and for crew information during the post-landing Baseline Data Collection.

News media at Dryden will also be able to receive NASA Select Video and Audio and Mission Audio throughout the mission and will be able to participate in briefings through two-way audio circuits.

Cologne-Porz, Federal Republic of Germany:

This is the main European information center for the Spacelab 1 mission. The news and information facilities are on the grounds of the German Aerospace Research and Development Center (DFVLR) near Bonn. Media who choose to attend this center will have a daily program of events scheduled for their information, including portions of NASA Select Video. Mission Audio and NASA Select Audio should be available as well as facilities for media to participate in two-way Q and A sessions following scheduled briefings originating from the Kennedy, Johnson or Dryden news centers. There will be special programs for each of the 10 days of activities at the Cologne-Porz news center as well as mockups of the Spacelab and of the different experiments.

NASA Select Audio, Mission Audio and Transcripts

Due to the double nature of the air-to-ground conversations on Spacelab 1 there will be some modifications to the normal NASA Select and Mission Audio configurations after the Spacelab activation at MET 5 hours and 15 minutes. The Spacelab 1-to-Payload operations Control Center (POCC) communications will take place over air-to-ground #1 (A/G-1). This configuration provides the maximum audio contact for the Spacelab and POCC crews through both the Tracking and Data Relay Satellite System (TDRSS) and through the Ground Spacecraft Tracking and Data Network (GSTDN) stations. A/G-2 will be used as the orbiter-Mission Control Center voice link.

NASA Select audio will be available from the NASA satellite (RCA II-R, transponder 13) whenever video is being produced. The NASA Select audio will consist of Mission Audio when NASA Select Video is releasing spacecraft or Spacelab downlink video. NASA Select audio will consist of the audio portion of briefings when NASA Select Video is being used for briefings.

Only the audio available on the actively mixed Mission Audio circuit will be transcribed. This means that the transcript of the STS-9/Spacelab 1 mission will jump from orbiter/MOCR to Spacelab/POCC to briefings and back. There will be no attempt made to maintain a continuous transcript of either the orbiter/ MOCR or Spacelab/POCC air-to-ground. Mission Audio will be selected to follow the activity of the mission as it progresses.

Status Reports

Status reports on countdown progress, mission progress, science and experiment progress and landing preparations will be produced by the appropriate NASA news center (Kennedy for launch, Johnson and Marshall for mission and Dryden for landing and post landing). These status reports as well as transcripts will be made available at the NASA news centers through the NASA Public Affairs Media Services Information System facilities. Limited selections from these status reports and transcripts will also be available at the ESA Cologne-Porz news center.

Interview Requests

Interview requests from media representatives at Kennedy, Johnson and Dryden for subjects located at the same center as the media representative will be honored to the degree that subjects are available.

Briefings

Orbiter flight control personnel will be on eight-hour shifts. Change-of-shift briefings for the MOCR Flight Director will occur at eight-hour intervals.

Spacelab mission operations and experiment management personnel will be on 12-hour shifts. one POCC change-of-shift briefing will be held concurrent with one of the MOCR briefings daily.

A daily science summary briefing will be held.

Media at Johnson, Kennedy, Marshall, Dryden and Cologne-Porz will be able to participate through two-way audio circuits during these briefings. A transcript of these briefings will be available.

STS-9/Spacelab 1 Flight Timelines

Detailed flight crew and payload crew activity plot and summary time lines will be issued separately.

Greenwich Mean Time Conversion Table

Because of the international nature of this mission, all times in this press kit will be expressed in terms of Greenwich Mean Time. To compute local time in Europe, the United States and Japan, use the conversion table below.

European Standard	Eastern Standard	Central Standard	Mountain Standard	Pacific Standard	Tokyo Standard
GMT + 1	GMT - 5	GMT - 6	GMT - 7	GMT - 8	GMT + 9

FLIGHT PLAN SUMMARY

Flight Day 1
Spacelab Systems Activation
Trim Burn 1, if Required
Payload Experiment Activation
Verification Flight Test (VFT) Thermal Attitudes
Initial Spacelab Scientific Airlock (SAL) Operations
Payload Experiment Operations

Flight Day 2
Payload Experiment Operations
Initiate 24 Hour VFT Cold Thermal Test Attitude
Trim Burn 2, if required
TACAN Nav Test

Flight Day 3
Payload Experiment Operations
Complete 24 Hour VFT Cold Test Attitude, Initiate 12 Hour VFT Hot Test Attitude

Flight Day 4
Payload Experiment Operations
SSC

Flight Day 5
Payload Experiment Operations

Flight Day 6
Payload Experiment Operations
Trim Burn 3, if required

Flight Day 7
Payload Experiment Operations

Flight Day 8
Payload Experiment Operations
Orbiter Flight Control System Checkout For Entry

Flight Day 9
Payload Experiment Operations
Cabin Stow
Payload Experiment Deactivation
Spacelab Systems Deactivation
Deorbit Preparation
Entry/Landing
Time

FLIGHT PLAN SUMMARY

FLIGHT DAY 1
- SPACELAB SYSTEMS ACTIVATION
- TRIM BURN 1, IF REQUIRED
- PAYLOAD EXPERIMENT ACTIVATION
- VERIFICATION FLIGHT TEST (VFT) THERMAL ATTITUDES
- INITIAL SPACELAB SCIENTIFIC AIRLOCK (SAL) OPERATIONS
- PAYLOAD EXPERIMENT OPERATIONS

FLIGHT DAY 2
- PAYLOAD EXPERIMENT OPERATIONS
- INITIATE 24 HOUR VFT COLD THERMAL TEST ATTITUDE
- TRIM BURN 2, IF REQUIRED
- TACAN NAV TEST

FLIGHT DAY 3
- PAYLOAD EXPERIMENT OPERATIONS
- COMPLETE 24 HOUR VFT COLD TEST ATTITUDE, INITIATE 12 HOUR VFT HOT TEST ATTITUDE

FLIGHT DAY 4
- PAYLOAD EXPERIMENT OPERATIONS

SUBJECT:

FLIGHT PLAN SUMMARY (CONTINUED)

FLIGHT DAY 5
- PAYLOAD EXPERIMENT OPERATIONS

FLIGHT DAY 6
- PAYLOAD EXPERIMENT OPERATIONS
- TRIM BURN 3, IF REQUIRED

FLIGHT DAY 7
- PAYLOAD EXPERIMENT OPERATIONS

FLIGHT DAY 8
- PAYLOAD EXPERIMENT OPERATIONS
- ORBITER FLIGHT CONTROL SYSTEM CHECKOUT FOR ENTRY

FLIGHT DAY 9
- PAYLOAD EXPERIMENT OPERATIONS
- CABIN STOW
- PAYLOAD EXPERIMENT DEACTIVATION
- SPACELAB SYSTEMS DEACTIVATION
- DEORBIT PREPARATION
- ENTRY/LANDING

STS-9/SPACELAB 1 BRIEFING SCHEDULE

Time	Briefing	Origin
T-2 Days		
9:00 a.m. EST	Countdown Status	KSC
9:30 a.m. EST	Mission Summary/Timeline; Columbia Modifications	KSC
10:30 a.m. EST	TDRSS Status	KSC
11:15 a.m. EST	Spacelab Development, NASA/ESA	KSC
1:00 p.m. EST	Spacelab 1 Mission Manager, NASA/ESA	KSC
2:00 p.m. EST	Spacelab 1 Science	KSC
T-1 Day		
9:00 a.m. EST	Countdown Status	KSC
10:00 a.m. EST	Cooperative Spacelab Mission, NASA Administrator, ESA Director General	KSC
11:00 a.m. EST	Prelaunch Press Conference	KSC
T-Day		
12:00 Noon EST (approx)	Post-launch Press Conference	KSC
Launch Through End-of-Mission		
Times will be announced on NASA Release	Flight Director Change of Shift Briefings (See Change of Shift Schedule)	
T+1 Through End-of-Mission		
10:00 a.m. EST (approx)	Daily Science Briefings	JSC
10:00 p.m. EST (approx)	Overnight Science Status Report (from POCC)	JSC
T+8		
5:00 p.m. EST	Post-landing Baseline Data DFRF; Collect ion Facility operations	DFRF
T+9		
12:15 p.m. EST	Post-landing Press Conference	DFRF
2:00 p.m. EST (approx)	Crew Ceremony	DFRF
T+10		
1:00 p.m. EST	Baseline Data Collection	DFRF
2:00 p.m. EST	Orbiter/Spacelab Status	DFRF

NASA SELECT TELEVISION SCHEDULE

The schedule for television transmissions from Columbia and Spacelab and for change of shift and other mission status briefings will be available during the mission at Kennedy Space Center, Marshall Space Flight Center, Johnson Space Center, Dryden Flight Research Facility, Goddard Space Flight Center and NASA Headquarters news centers. The television schedule will be updated daily to reflect any changes dictated by mission operations.

Video recordings of the NASA Select television program will be available at the European Information Center in Cologne-Porz (Federal Republic of Germany) together with mission status reports.

SPACELAB -- THE LABORATORY

Description

Spacelab is a reusable, research laboratory facility. When carried in the payload bay of the Space Shuttle orbiter, it converts the Shuttle into a versatile, on orbit research center.

Modular in design and construction, Spacelab consists of several interchangeable components that can be assembled in different ways to meet the needs of a particular scientific research mission.

Spacelab consists of two major elements: a pressurized, habitable laboratory called a module, in which scientists can work without cumbersome space suits; and unpressurized platforms called pallets designed to support instruments such as telescopes, sensors and antennas which require direct exposure to space. These elements may be used separately or in various combinations, returned to earth, and reused on other flights.

The module comes in two 4-meter (13.1-foot) diameter sections -- a core segment and an experiment segment. The core segment houses data processing equipment and utilities for the module and pallets when both are flown together. It also has laboratory fixtures such as air-cooled, standard 48.26-centimeter (19-inch) experiment racks, a work bench, and provision for accommodating a high-quality window/viewport assembly for optical experiments and photography.

The second section, called the experiment segment, provides further pressurized work area, space for additional experiment racks, and provision for mounting either the window assembly or a scientific airlock designed to enable the crew to expose experiments carried in the module to the space environment.

The core segment can be flown by itself, in what is called the short module configuration, or coupled in tandem with the experiment segment in the long module configuration.

The short module measures 4.26 m (15.4 ft.) in length overall and consists of the core segment and two cone-shaped end sections. The long module, including end cones, is 7 m (23 ft.) long.

When the habitable module is flown, a 1-m (3.3-ft.) diameter enclosed passageway called the Spacelab Transfer Tunnel, connects the module with the mid-deck of the orbiter. The tunnel can be assembled in two lengths. A 2.7-m (8.7-ft.) tunnel can be used for missions during which the module is carried in the forward portion of the payload bay. A 5.8-m (18.8-ft.) tunnel can be used for missions on which the module is carried in the aft portion of the bay.

Spacelab pallets are U-shaped aluminum frame and panel structures 4 m (13.1 ft.) wide and 3 m (10 ft.) long. Heavy equipment is mounted on the pallet frame using a series of connectors called hard points. Light weight equipment can be mounted directly onto the panels.

As many as five Spacelab pallets can be flown in the cargo bay, individually or with two or three linked together to form trains. When pallets are flown without the module, the subsystems necessary for experiment operation are contained in a pressurized cylinder called an "igloo." When no module is flown, payload specialists operate the experiments from the aft flight deck of the Shuttle orbiter.

When the module is flown, the Spacelab subsystems are carried in the module.

Spacelab 1 makes use of the long module and a single pallet. For this mission, the scientific window adapter assembly is installed in the ceiling of the core segment, and the scientific airlock is installed in the ceiling of the experiment segment. A viewport, which will enable the crew to observe pallet-mounted experiments, is installed in the end cone of the experiment segment. Since the module and pallet are mounted in the aft portion of the bay for Spacelab 1, the long tunnel will be used.

Spacelab Development and Integration

Spacelab was designed, developed, funded and built by ESA as Europe's contribution to the Space Transportation System. ESA's Spacelab team was located at European Space Technology Center, Noordwijk, the Netherlands. At its peak, the team consisted of about 10 0 engineers.

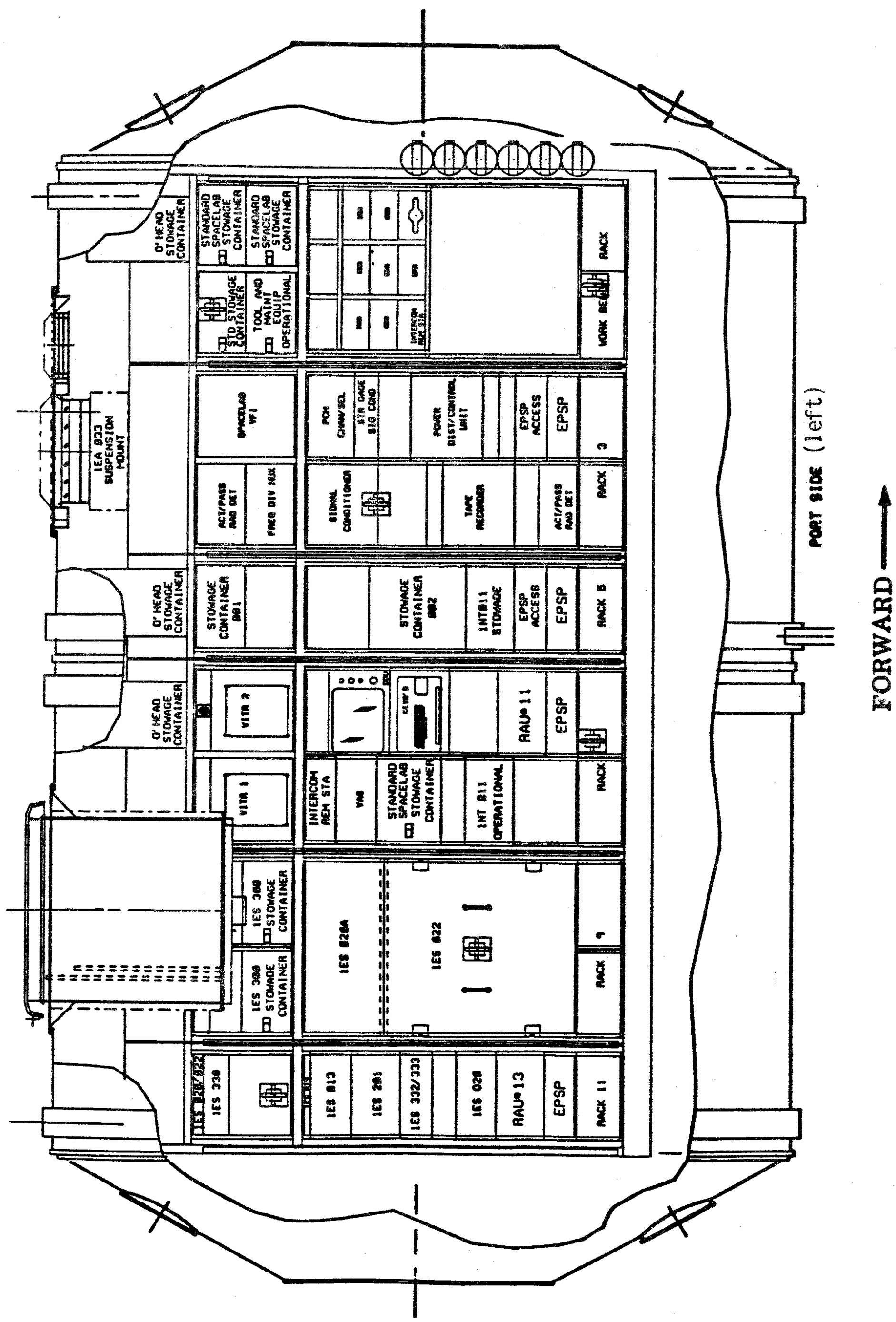
Considered one of ESA's most important programs, Spacelab represents a European investment of almost $1 billion. Nine ESA Member States - Belgium, Denmark, France, Germany, Italy, the Netherlands, Spain, Switzerland and the United Kingdom, and one state with Associate Member status -- Austria -- participated in the endeavor.

The following is a breakdown of the estimated contributions made by the participating states at the end of the program:

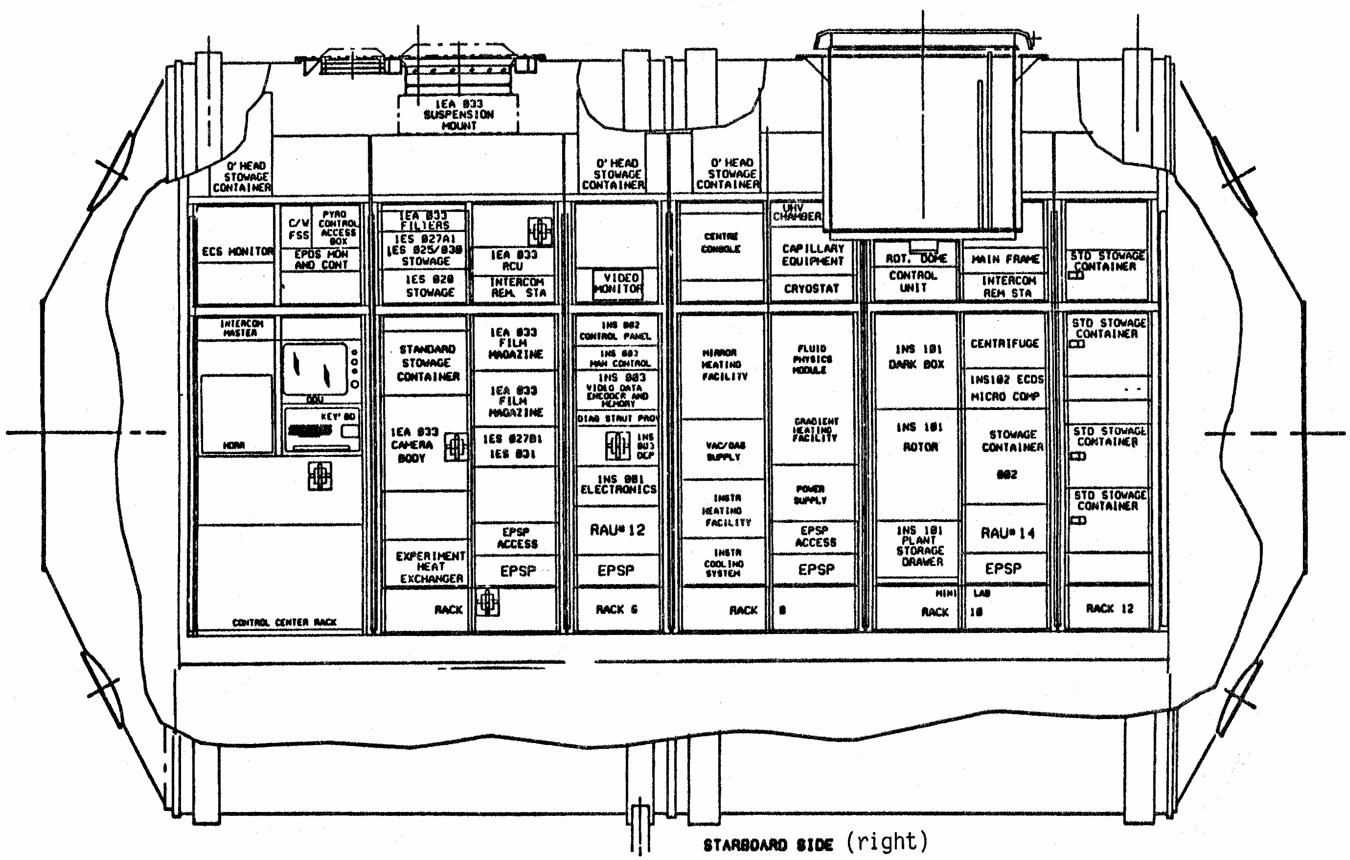
Federal Republic of Germany	54.94
Italy	15.57
France	10.29
United Kingdom	6.51
Belgium	4.32
Spain	2.88
The Netherlands	2.16
Denmark	1.54
Switzerland	1.0
Austria	0.79
TOTAL	100.00

An industrial consortium of some 50 firms in 10 European countries participated in the construction of Spacelab hardware. These firms, as well as ESA contractors in the United States, supplied Spacelab parts to the German firm VFW ERNO (now MBB-ERNO), prime contractor for Spacelab assembly.

SPACELAB 1 MODULE

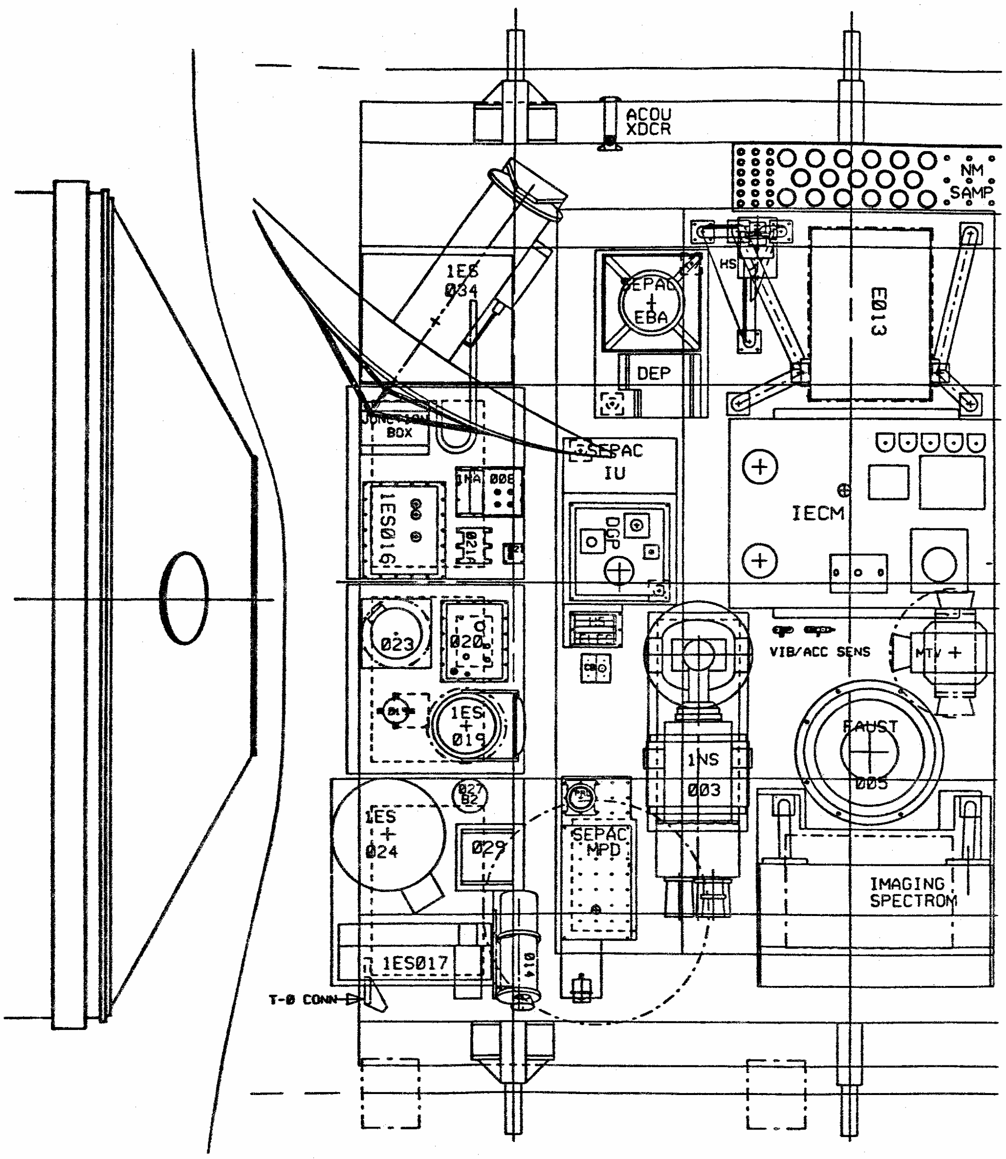


SPACELAB 1 MODULE



FORWARD

SPACELAB 1 PALLET



FORWARD

SPACELAB PROGRAM, HISTORICAL BACKGROUND

In 1969 Europe was invited by the United States to participate in the post-Apollo space program. The European Space Conference in 1970 authorized studies of a transportation system and various orbital systems. When the United States approved NASA's Space Transportation System in 1972, it was deemed that Spacelab was the most suitable system for Europe to provide. At the Ministerial Meeting of the European Space Conference in Brussels in December 1972, the European ministers responsible for space entrusted the European Space Research organization (ESRO -- one of the predecessor agencies to the European Space Agency) with the task of implementing the Spacelab Program as a special project.

During Phase A concept studies, close ties were established between ESRO and NASA at the working level with joint participation in Spacelab payload group meetings and coordination of technical activities.

Phase B system-definition studies were carried out to provide ESRO Member States with a firm costing on which to base their final choice among alternative design concepts. When that decision was made in August 1973, Spacelab became a confirmed ESRO program and an integral part of the Space Shuttle program.

The keys to this cooperative program were, and remain, two agreements: a Memorandum of Understanding between NASA and ESRO, and an Intergovernmental Agreement between the United States and nine participating European states. The Intergovernmental Agreement, signed in Paris in August 1973, delegates responsibility for the cooperative program to ESRO (later ESA) and NASA. The Memorandum of Understanding was initialed in Paris in August 1973 and was signed by Dr. James Fletcher, then NASA Administrator, and Dr. Alexander Hocker, then User's Director General, in September 1973 in Washington. It apportions responsibilities, specifies the deliverables associated with the program and provides guidelines for the program elements.

The Memorandum assigned certain tasks to each agency and established the following major objectives of the cooperative program:

1) Design, development, manufacture and delivery by ESRO of the first Spacelab Flight Unit as an element to be integrated with the Space Shuttle;

2) Use of the Space Shuttle and Spacelab systems for peaceful purposes;

3) Procurement by NASA of additional Spacelab flight units;

4) Possible extension of this cooperation as warranted by the mutual interests of the European partners and the United States.

To ensure efficient coordination of the ESA and NASA programs, a Joint Spacelab Working Group was formed. This group comprised representatives from ESRO (later ESA) and NASA.

ESA, representing the European partners, has the following responsibilities:

1. To fund, design, develop, manufacture and deliver a Spacelab and associated equipment according to mutually agreed specifications and time schedule;

2. To establish in Europe the production capability to ensure that the United States can procure additional Spacelabs, components and spares at reasonable prices;

3. To ensure a sustained engineering capability to meet the Spacelab mission operating requirements of the United States; and NASA, representing the United States, has the following responsibilities:

    a. To provide information and advice;

    b. To provide assistance, technical advice and information and hardware as mutually deemed necessary for the development and manufacture of Spacelab;

    c. To procure only from the European partners additional Spacelabs, components and spares;

    d. To refrain from separate and independent development of any Spacelab substantially duplicating the design and capabilities of the first Spacelab (unless the European Partners fail in their responsibilities);

    e. To use Spacelab as an integrated element in the Space Transportation System for the peaceful exploration and use of space; and

    f. To inform the European partners of plans for future use of the Space Shuttle system, especially of future concepts that may lead to modifications of the present Spacelab, with a view to extending cooperation beyond the present agreement.

Throughout the design and development process the two agencies have interacted to meet such common objectives in the Spacelab program as versatile laboratory facilities, rapid user access and minimum interference with Shuttle turn-around activities. operational concepts influenced the design and construction of Spacelab elements to ensure that the experiment cycle, Spacelab cycle and Shuttle cycle of operations would interlock smoothly. Just as Shuttle development impacted Spacelab design, so did Spacelab design affect the Shuttle concept. During the decade of development leading to Spacelab's first flight, NASA and ESA have worked cooperatively toward the realization of this integral component of the Space Transportation System.

Further detail on the history of the development is available in the ESA/NASA Spacelab News Reference and in the ESA Spacelab Data Book.

STS-9/SPACELAB 1 MAJOR FLIGHT OBJECTIVES

There are two major flight objectives for the STS-9/Spacelab 1 mission:

- Verify the Spacelab system and its subsystem performance capability, Spacelab's compatibility with the orbiter and measure the environment in and around the Spacelab.

- Obtain valuable scientific and applications data from a common U.S./European multi-disciplinary payload and demonstrate to potential users of the Shuttle/Spacelab system, the broad capability of Spacelab for scientific research .

LAUNCH PREPARATIONS

Spacelab Preparations

Preparations for launch of STS-9/Spacelab 1 began in late 1981 with arrival at Kennedy Space Center, Fla., of major components of the space laboratory facility and the first pieces of Spacelab mission 1 experiment hardware.

The first major pieces of experiment equipment -- the contents of the life sciences mini-lab, a double rack of scientific equipment used inside the Spacelab module -- arrived in early October 1981. over the next 10 months, experiment equipment continued to arrive at Kennedy where the equipment was functionally tested prior to integration into the experiment racks and on the Spacelab pallet.

The first major components of the flight laboratory, including the habitable module and pallet, arrived at Kennedy from Europe Dec. 11, 1981.

Checkout and assembly of the hardware for the Spacelab mission began soon after arrival in the high bay of the operations and Checkout Building.

NASA formally accepted the flight hardware during an unveiling ceremony in February 1982, attended by European and American dignitaries, including U.S. Vice President George Bush.

Experiment integration began that same month when the life sciences mini-lab hardware was integrated with its flight rack.

Installation of experiments on the Spacelab pallet began in May 1982. The first piece of equipment installed was a high voltage power supply for Space Experiments with Particle Accelerators (1NS002).

The European Bridge Assembly, a platform supporting 12 European experiments, was attached to the pallet during the first week of August 1982, concluding physical integration of Spacelab l experiment hardware.

Initial integration activities culminated in November 1982 with the successful completion of an eight-segment Mission Sequence Test designed to verify the compatibility of experiments with each other and with simulated Spacelab support subsystems.

The integrated Spacelab pallet was moved into place behind the shell of the module; and experiment racks were moved into the module in December 1982.

The Spacelab was moved to the Cargo Integration Test Equipment (CITE) stand for testing in May 1983. CITE duplicates the mechanical and electronic systems of the orbiter and is used to verify that the Spacelab is compatible with the Shuttle.

In early July 1983, experiments aboard Spacelab were operated briefly by remote control from the Payload operations Control Center (POCC) at Johnson, during a Closed Loop Test that lasted just over a day. Commands initiated at consoles in the Payload Control Center, were processed through the POCC and Mission Control Center computers enroute to the Spacelab which was mounted in the CITE stand at Kennedy.

Spacelab was transferred from the operations and Checkout Building to the orbiter Processing Facility (OPF) and installed in the payload bay of the orbiter Columbia Aug. 16, 1983.

Spacelab experiments were operated again by remote control from the POCC during an end-to-end test Sept. 7 and 8, 1983. It was similar to the Closed Loop Test, except that the TDRSS and Columbia were included in the loop and high rate data mode was used.

The Spacelab Transfer Tunnel was installed in late August.

Columbia Preparations and Modifications

Columbia (OV-102) preparations for the STS-9/Spacelab 1 mission began shortly after the orbiter completed its fifth flight (STS-5) in November 1982.

Columbia was ferried back from California to Florida on Nov. 23, 1982 to begin the necessary modifications in Kennedy's orbiter Processing Facility (OPF) .

Columbia spent the first three months in Bay 1 of the OPF where residual hypergolic propellants were drained and the orbital Maneuvering and Reaction Control Systems were taken off for refurbishment.

The modification period to accommodate Spacelab 1 began on Dec. 20, 1982. on Feb. 27, 1983, Columbia was moved to the OPF High Bay 2 where modifications were completed.

Substantial changes were made to Columbia's structural, propulsion and on-board capabilities to meet Spacelab 1 requirements. Significant systems additions or modifications were:

- Replacement of the three original main engines with uprated 104 percent thrust level engines (see below).
- Addition of an airlock and tunnel adapter to Permit crew to transfer between the pressurized orbiter crew module and Spacelab 1 laboratory module.
- Installation of additional crew seats on the middeck, for both payload specialists and one mission specialist, including provisions for communications and emergency oxygen, addition of three bunk bed sleeping stations and three hammock-type sleeping bags, and more lockers and compartments for storing extra equipment to accommodate the six-man crew.
- Installation of a galley and personal hygiene station on the middeck to serve as an eating and food storage area.
- Replacement of three fuel cells with new, higher producing cells, and increasing the number of fuel cell cryogenic storage tanks from three sets to five sets.
- Installation of a new Ku-band antenna required for transmitting real-time Spacelab 1 data to the POCC in Houston over the Tracking and Data Relay Satellite System.

Columbia has been outfitted with three new main engines, (2011, 2018 and 2019) capable of operating at 104 percent of rated power. Columbia's original engines will be refurbished and serve as the flight engines on orbiter Atlantis (OV-104).

Columbia's new engines underwent acceptance testing at the National Space Technology Laboratories' engine test facility at Bay St. Louis, Miss., April through June 1983. Each engine underwent ignition, calibration and full duration test firings. The engines were then given detailed electrical, mechanical and leak checks before being accepted by NASA from the Rocketdyne Div. of Rockwell International, Canoga Park, Calif. The engines were delivered individually to the Kennedy Space Center between May 17 and July 7, 1983. Installation of the three engines was completed on July 19, 1983.

Power-on testing of the spacecraft began on May 23, 1983.

The Spacelab systems operations were verified during a series of "end-to-end" tests with systems controllers at Kennedy, by flight operations personnel at Johnson and Spacelab mission personnel from Marshall and other participating centers. The last experiment and interface test was completed in early September 1983.

Stowage of Spacelab experiment hardware also continued into September 1983.

Columbia was moved from the orbiter Processing Facility to the Vehicle Assembly Building for mating with the external tank and solid rocket boosters on Sept. 23.

The STS-9 Space Shuttle vehicle was rolled out to Complex 39's Pad A on Sept. 28. A Terminal Count Demonstration Test (full dress rehearsal) with the entire six-man flight crew took place successfully on Oct. 1, 1983.

On Oct. 14, NASA and the European Space Agency jointly agreed to postpone the STS-9/Spacelab 1 mission because of a suspect nozzle on one of the solid rocket boosters that was part of the vehicle on the launch pad.

To replace the aft assembly (which included the suspect nozzle) on the right SRB, the STS-9 vehicle had to be rolled back to the Vehicle Assembly Building on Oct. 17. Columbia was demated from the external tank and moved back into the orbiter Processing Facility on Oct. 19. The external tank was disconnected from the twin SRBs and the right booster rocket was disassembled.

The replacement right SRB aft assembly was bolted atop the mobile launcher platform on Oct. 21, and restacking of the right booster was completed on Oct. 26. The external tank was rejoined with the booster rockets on Oct. 27. Columbia was moved from the orbiter Processing Facility back to the Vehicle Assembly Building on Nov. 3 and remated with the other STS-9 elements.

STS-9 was returned to launch pad 39-A on Nov. 8, 1983.

LAUNCH WINDOW

The launch window for the STS-9/Spacelab 1 mission opens Nov. 28, 1983 at 16:00 GMT (11:00 p.m. EST) for 14 minutes, closing at 16:14 GMT (11:14 p.m. EST). The launch window will open again at approximately the same time each day through Dec. 5. On Dec. 5. the window will have diminished to 12 minutes.

This is because of the requirement for daylight at the transatlantic abort landing sites. The orbiter can land no later than 15 minutes after sunset at a Spanish Air Force Base near Zaragoza, Spain or Cologne/Bonn Airport, Federal Republic of Germany.

The launch window opening is also determined by several scientific considerations peculiar to Spacelab 1 experiments. Some astronomy experiments require a maximum amount of orbital dark time while other earth observation experiments require good lighting on the earth's surface. Space physics experiments require darkness at maximum north and south latitudes. The astronomy and space plasma physics experiments aboard Spacelab call for a new moon on about flight day five.

WHAT IF THINGS GO WRONG

Shuttle launch abort philosophy aims toward safe and intact recovery of the flight crew, the orbiter and the payloads.

In descending order of desirability, abort modes are as follows:

- Abort-to-orbit (ATO) -- partial loss of main engine thrust late enough to permit reaching a minimal 194-km (105-nm) orbit with orbital maneuvering system engines.

- Abort-once-Around (AOA) -- earlier main engine shutdown, but near enough orbital speed to allow one orbit around to Space Harbor (Northrup Strip), N.M.

- Trans-Atlantic Abort Landing (TAL) -- loss of two main engines midway through powered flight, forcing a landing at a Spanish Air Force Base near Zaragoza, Spain (prime) or Cologne/Bonn Airport, Federal Republic of Germany (inplane backup).

- Return to Launch Site (RTLS) -- early shutdown of one or more engines and without enough energy to make a TAL site; pitch-around and thrust back toward Kennedy Space Center until within gliding distance of Shuttle runway.

STS-9 contingency landing sites are Kennedy; Edwards; Space Harbor, White Sands, N.M.; Hickam Air Force Base/Honolulu International, Hawaii; and Kadena Air Force Base, Okinawa.

MAJOR COUNTDOWN MILESTONES

Count Time	Event
T-44 hours	Perform the call to stations.
T-38 hours	Start external tank loading preparations.
T-34 hours	Begin orbiter and ground support equipment closeouts for launch.
T-26 hours	Clear pad to load fuel cell storage tanks.
T-24 hours	Load fuel cell liquid oxygen tanks.
T-21 hours 30 minutes	Load fuel cell liquid hydrogen tanks.
T-19 hours 30 minutes	Activate orbiter navigation aids and Inertial Measurement Units and begin warm up period.
T-19 hours	Perform communications check with Merritt Island Launch Area tracking station and Mission Control-Houston.
T-18 hours	Activate orbiter communication systems.
T-15 hours	Perform pre-ingress switch list and prepare service tower for retraction.
T-12 hours	Start Gaseous oxygen (GOX) vent hood preparations for external tank loading and remove flight deck platforms.
T-11 hours	Start built-in hold. Duration of hold dependent upon launch time.
T-11 hours	Retract rotating service structure.
T-8 hours 40 minutes	Activate fuel cells.
T-8 hours	Configure mission control communications for launch
T-7 hours 15 minutes	Purge payload bay with gaseous nitrogen prior to main propellant load.
T-6 hours	Load external tank with Propellants.
T-5 hours	Begin Inertial Measurement Unit (IMU) pre-flight calibration and perform Range Safety open loop checks.
T-3 hours	2 hour hold begins. External tank loading is complete. Wake flight crew (4 hours 20 minutes to launch).
T-2 hours 30 minutes	Crew departs for pad (2 hours, 50 minutes to launch).
T-1 hour 55 minutes	Crew enters orbiter vehicle (2 hours 15 minutes to launch) .
T-1 hour 1 minute	Start preflight alignment of IMUs.
T-20 minutes	10 minute built-in hold begins.
T-20 minutes	Configure orbiter computers for launch.
T-9 minutes	10 minute built-in hold begins. Perform status check and receive Launch Director "Go".
T-9 minutes	Start Ground Launch Sequencer.
T-7 minutes 30 seconds	Retract orbiter access arm.
T-5 minutes	Start orbiter Auxiliary Power Units. Arm External Tank (ET) and Solid Rocket Booster (SRB) range safety devices.
T-3 minutes 30 seconds	Orbiter goes on internal power.
T-2 minutes 55 seconds	Pressurize liquid oxygen tank and retract GOX oxygen vent hood.
T-1 minute 57 seconds	Pressurize liquid hydrogen tank.
T-28 seconds	T-31 seconds "Go" from Ground Launch Sequencer for Columbia’s onboard computers to start automatic launch sequence.
T-10 seconds	“Go” for main engine start.
T-6.6 seconds	Start orbiter main engines.
T-3 seconds	Main engines at 90 percent thrust.
T-0	Holddown post release, SRB ignition and liftoff.

MAJOR FLIGHT EVENTS SEQUENCE

Event	MET (h:m:s)	Delta V (m/s (fps)	Apogee/Perigee km (n mi)
Launch	000:00:00		
SRB separation	000:02:24		
MECO	000:08:21		
ET separation	000:08:39		
OMS-1 TIG (1 min 10 sec)	000:10:21	36.9 (112.4)	250 x 83 (135 x 45)
OMS-2 TIG (1 min 41 sec)	000:49:29	53.7 (163.6)	250 x 2250 (135 x 135)
Activate Spacelab	002:30:00		
Trim 1	005:00:00		
Trim 2	045:00:00	Delta V computed in real time to adjust for orbit decay	
Trim 3	138:00:00		
Cease Exper. Ops.	205:15:00		
Deactivate Spacelab	206:15:00		
Deorbit burn (2 min 19 sec)	215:18:21	76.2 (232.3)	-239 x -1.85 (129 x -1)
Land Edwards AFB 17	216:11:17		

LANDING AND POST-LANDING OPERATIONS

Kennedy Space Center is responsible for ground operations of the orbiter once it has rolled to a stop on the runway at Edwards Air Force Base, including preparations for returning the Columbia/ Spacelab to Kennedy.

After Columbia rolls to a stop, the flight crew will begin "safing" vehicle systems. At the same time the recovery crew will make its way toward the orbiter. Immediately after wheel stop on runway 17, specially garbed technicians will first determine that any residual hazardous vapors are below significant levels in order for other safing operations to proceed. A mobile wind machine is positioned near the vehicle to disperse highly concentrated levels of toxic vapors.

Once the initial safety assessment is made, access vehicles will be positioned around the rear of the orbiter so that lines from the ground purge and cooling vehicles can be connected to the umbilical panels on the aft end of the Columbia.

Freon line connections will be completed and coolant will begin circulating through the umbilicals to aid in heat rejection and protect the orbiter's electronic equipment. other lines will provide cooled, humidified air to the cargo bay and other cavities to remove any residual toxic or explosive fumes and provide a safe environment inside the Columbia.

A mobile white room will be moved into place around the crew hatch once it is verified that there are no concentrations of toxic gases around the forward part of the vehicle. The crew is expected to egress the Columbia about 30 to 40 minutes after wheel stop. Technicians will replace the flight crew to complete the vehicle safing activity.

Post-landing operations associated with the Spacelab 1 payload will include removal of certain time-critical items, such as tape and film, one hour after landing, and another middeck group within 39 hours. No attempt will be made to enter the Spacelab itself at this time.

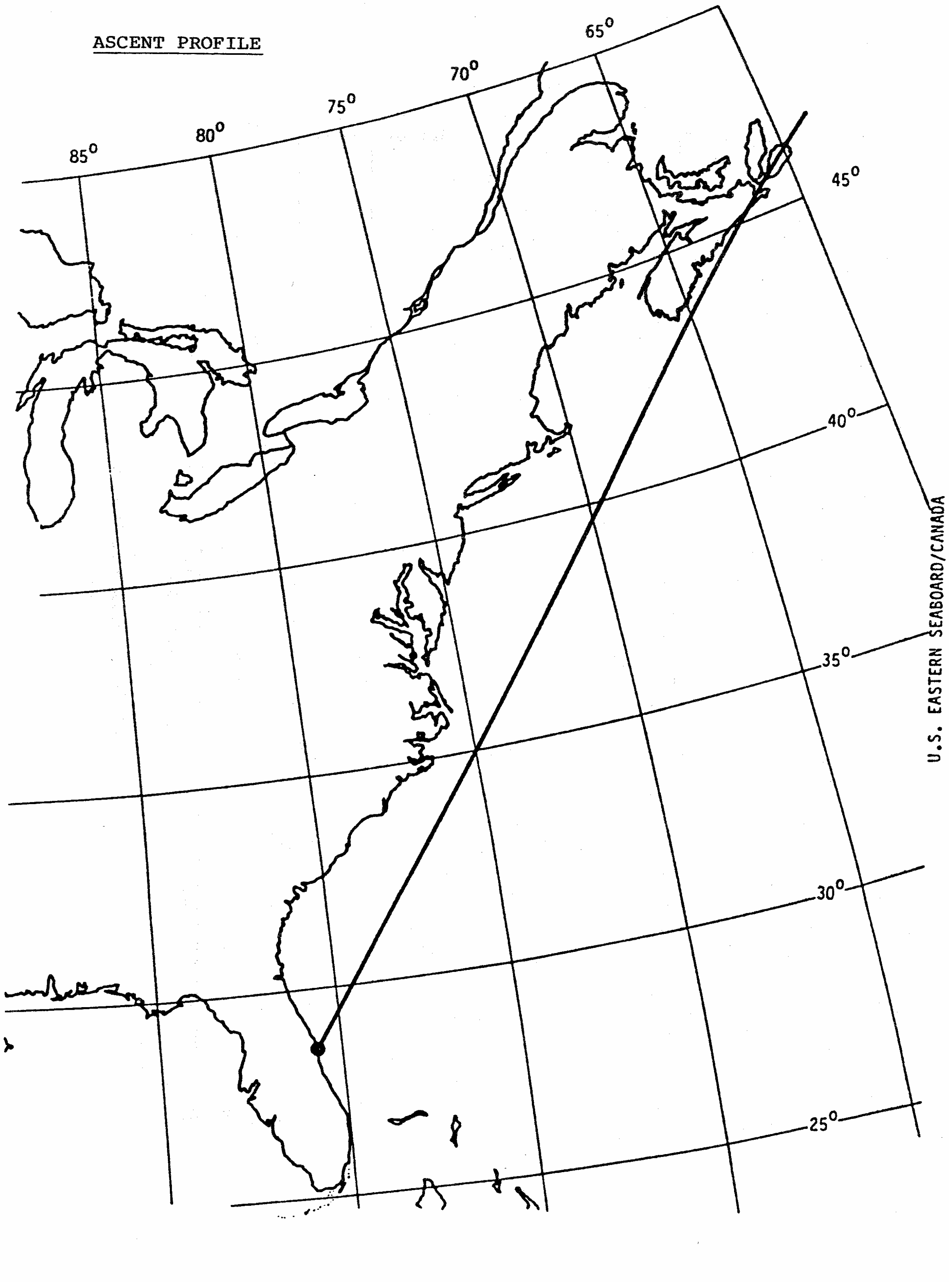
A tow tractor will be connected to Columbia and the vehicle will be pulled off the runway at Edwards and positioned inside the Mate Demate Device at the nearby Dryden Flight Research Facility.

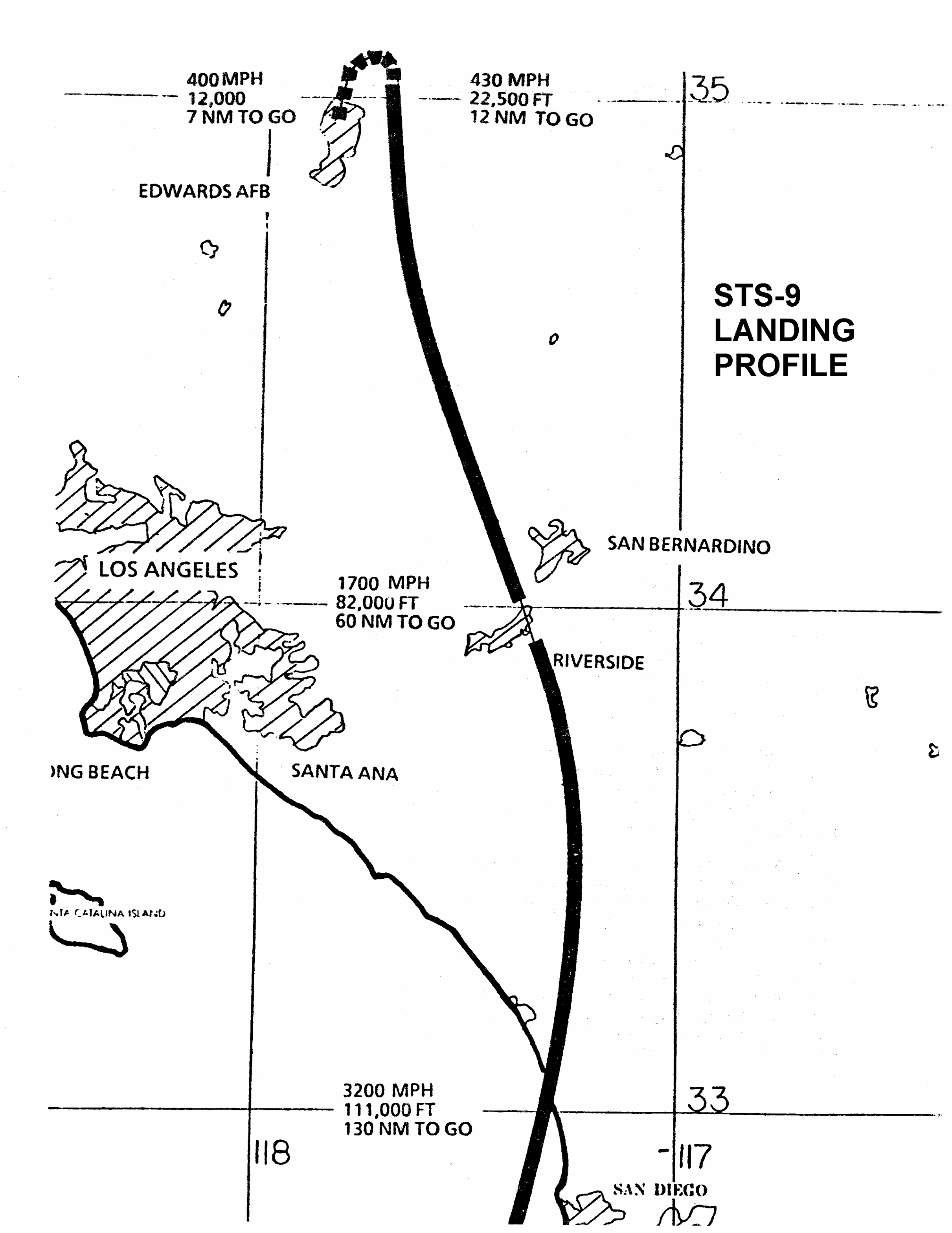
After Columbia has been jacked and leveled in the Mate Demate Device workstands, the remainder of the Spacelab 1 experiment samples and data to be recovered prior to the return of the orbiter to Kennedy Space Center will be removed. Residual fuel cell cryogenics will be drained and unused pyrotechnic devices will he disconnected.

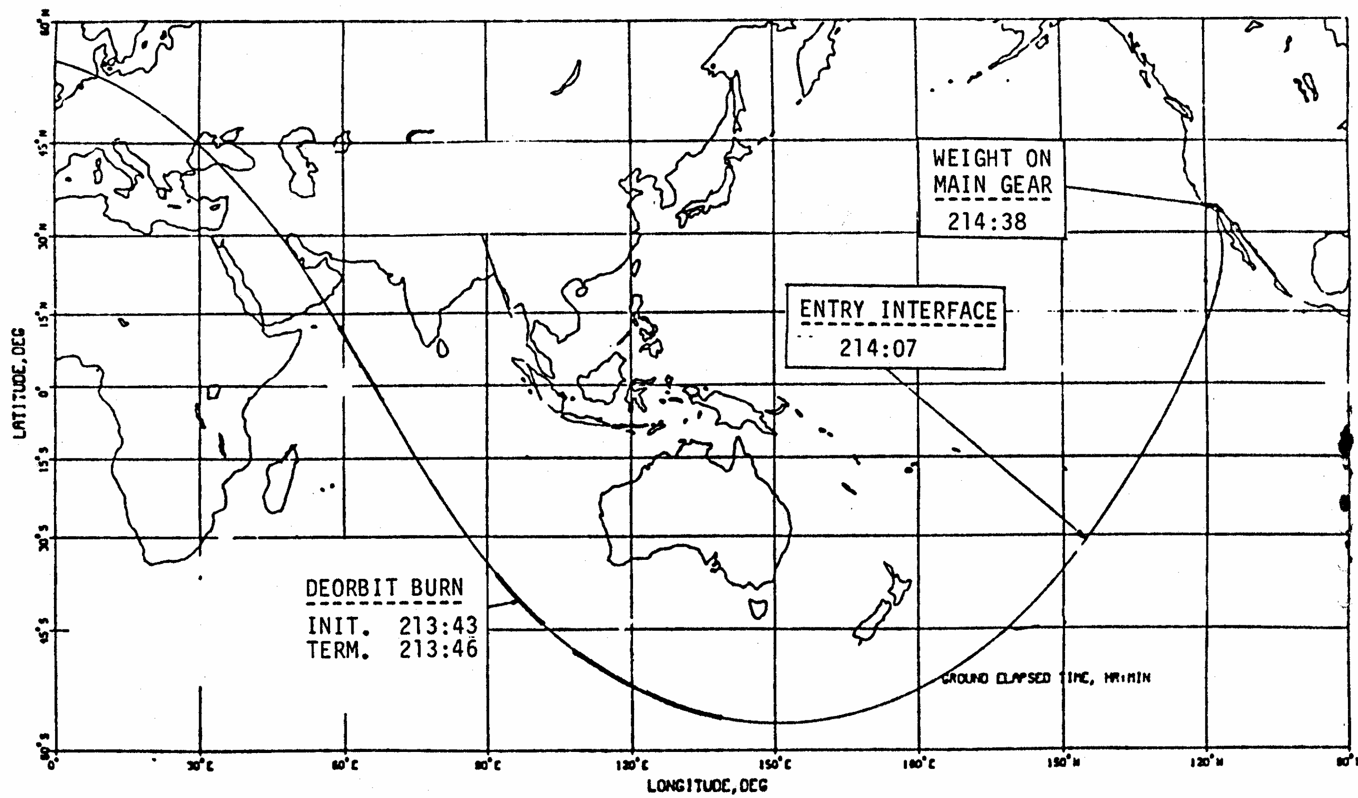
After the aerodynamic tail cone has been installed over the three main engines, the orbiter will be bolted on top of the 747 Shuttle carrier aircraft for the ferry flight back to Florida.

The 747 is scheduled to leave California about six days after landing. There will be an overnight stop to refuel the 747, and the ferry flight will continue the next day.

Once back at Kennedy, removal and de-integration of Spacelab will proceed in nearly reverse order of assembly, but without the elaborate testing stages. In most cases, disassembly will be only a temporary state for Spacelab, as much of the hardware will be immediately taken to checkout areas for use on upcoming missions.


ASCENT PROFILE
85°
80°
75°
70°
65°
45°
40°
35°
30°
25°
U.S. EASTERN SEABOARD/CANADA


400 MPH
12,000
7 NM TO GO
430 MPH
22,500 FT
12 NM TO GO
35
EDWARDS AFB
STS-9
LANDING
PROFILE
SAN BERNARDINO
LOS ANGELES
1700 MPH
82,000 FT
60 NM TO GO
34
RIVERSIDE
SANTA ANA
3200 MPH
111,000 FT
130 NM TO GO
33
118
117
SAN DIEGO



STS-9 deorbit-through-landing groundtrack.

SPACELAB 1 -- THE MISSION

The Spacelab 1 mission is the culmination of a decade-long cooperative development effort on behalf of both NASA and ESA to expand the capabilities of the Space Transportation System by the creation of a reusable laboratory to complement the scientific and engineering capabilities of the orbiter.

The primary objective of the STS-9 flight is the Verification Flight Test of the Spacelab/orbiter. There are eight major functional test objectives associated with the Verification Flight Test. An additional objective of the flight is the execution of more than 70 experiments timelined throughout the mission. The NASA entity responsible for the determination of the experiment objectives for the 11 NASA experiments is the office of Space Science and Applications, Spacelab Flight Division. The responsible agent for the determination of experiment requirements for the 60 European experiments is the European Space Agency.

Because of the complexity of the mission, the eight broad Verification Flight Test objectives, the more than 70 experiment objectives, and the six-person crew, crew activity has been split into two 12-hour duty cycles. Each duty cycle has an astronaut, mission specialist and payload specialist comprising a Red team and a Blue team.

For this mission, the long configuration of the habitable module will be used with a single pallet. The module will be connected to the orbiter cabin by the long transfer tunnel.

Spacelab 1 is a joint mission of ESA and NASA. Each agency is sponsoring approximately half the scientific payload. NASA is funding Spacelab integration and the operational costs of the mission.

Marshall Space Flight Center was assigned responsibility for the NASA-sponsored portion of the payload and for overall management of the first Spacelab mission.

Marshall, as mission manager aided by ESA SPICE, was responsible for planning and directing the overall Spacelab 1 mission which included training the crew on experiment operations in the center’s Payload Crew Training Complex (POTC) and at off-center experiment investigator's facilities. The experiment scientists were also trained in mission science operations.

The center's Spacelab Payload Project office has responsibility for ensuring that the experiments met agreed-upon criteria; that equipment was shipped to the launch site at Kennedy on schedule; that integration was accomplished and checkout completed; and that the mission is carried out as planned.

Responsibility for the ESA-sponsored portion of the payload, referred to as the First Spacelab Payload (FSLP), was entrusted to a technical management team known as Spacelab Payload Integration and Coordination in Europe (SPICE). This team was set up by ESA in 1976, at the German Aerospace Research Establishment (DFVLR), Cologne-Porz. SPICE is composed of ESA and DFVLR personnel on a 50-50 basis.

The principle task of SPICE is to ensure that all European experiments are integrated into a functional payload. SPICE is responsible for accommodation analysis, resource evaluation, crew training in Europe, supervising the manufacture of supporting hardware, preparation of software, and control of physical integration of experiments in Europe which was carried out at the ERNO facilities in Bremen, Germany. The SPICE team supported by European industry, has also participated in the integration of the ESA payload with the rest of the Spacelab payload at the Kennedy Space Center.

STS-9 STATISTICS

Columbia/ET/SRB Total Liftoff Mass	204,686 kg (4,503,095 lb.)
Columbia Dry Mass	70,618 kg (155,359 lb.)
Total Cargo Mass, (Spacelab, ancillary equipment, cables, fixture, cargo bay equipment)	15,265 kg (33,252 lb.)
Spacelab Mass (structural total)	12,780 kg (28, 115 lb.)
Spacelab Module	8,145 kg (18,135 lb.)
Spacelab Pallet	3,386 kg (7,449 lb.)
Experiment, Associated Equipment Mass	3,982 kg (8,802 lb.)
Verification Flight Instrumentation Mass	856 kg (2,123 lb.)
Total Payload Weight	15,265 kg (33,252 lb.)
Experiment Equipment Volume:	
Pressurized	22.2 cu. m (784 cu. ft.)
Unpressurized	33.3 cu. m (1,176 cu. ft.)
Electrical supply	(28 v DC, 115/200 v 400 Hz AC), Average power 2 kw; Energy 67.5 each
Experiment Computer Memory	64,000 or 64 k (16 bit words)
Central Processing Unit	320,000 or 320 k instructions/second (kips)
Data Handling:	
Through orbiter/TDRS system	Up to 50 megabits/second (mb/s)
Onboard storage capacity	Up to 32 mb/s
Spacelab Module Dimensions:	
Diameter	4.0 m (13 ft.)
Length	7.5 m. (23 ft.)
Spacelab Tunnel (inside diameter)	1.1 m (40 in.)

VERIFICATION FLIGHT TEST

The primary purpose of the first Spacelab mission is to verify the laboratory and to prove-out the thousands of structural, mechanical and electronic parts that make up the laboratory.

The Spacelab Verification Flight Test (VET) program was developed by the Marshall Space Flight Center and will be implemented by the Johnson Space Center to accomplish this objective.

Specifically, the program as carried out on STS-9/Spacelab 1 (and later on Spacelab 2) is designed to verify the Spacelab system and the performance capabilities of its subsystems; to verify the compatibility of the Spacelab with the orbiter and with the experiments to be conducted on board; and to measure the Spacelab induced environment.

A set of special instrumentation, called Verification Flight Instrumentation (VFI), and standard orbiter and Spacelab operational instrumentation, will be used to gather data on Spacelab's performance during the mission. More than 200 VFI sensors situated throughout the Spacelab and the orbiter will provide information on how well the Spacelab itself responds to the demands of flight.

Special tests, involving the Spacelab subsystems, will be conducted during the flight. Additional data will be gathered from normal subsystem and experiment operations.

The following is a description, by category, of the specific VFT objectives for STS - 9/ Spacelab 1:

Environmental Control Subsystem -- Tests will be conducted to verify that the passive thermal control subsystem maintains the Spacelab structural elements within specified temperature limits, prevents condensation within the habitable module, meets the specified heat leak requirements and, in conjunction with the active thermal control system, meets specified temperature limits inside the module. Additional tests will be conducted to verify the capability of the active thermal control subsystem to control the crew life support systems and equipment temperatures.

Structures Subsystem -- The Spacelab structure will be monitored during ascent, on orbit operations, descent and landing. Sensors will monitor the response of the habitable module, transfer tunnel and pallet to low frequency vibration during ascent and descent to verify load criteria. Sensors will also gather data to verify Spacelab's random vibration and acoustic design and test criteria during ascent; define mission load levels to verify mathematical models and service life prediction. They will also verify that the system used to attach Spacelab to the orbiter is reacting to loads as was predicted. -35

During the mission, the crew will also perform functional testing of the scientific airlock to verify that it can be pressurized, depressurized and operated, and to verify the experiment deployment technique.

Command and Data Management Subsystem -- Tests are designed to demonstrate the satisfactory integrated operation and performance of the Command and Data Management System (CDMS) and associated equipment and software in an orbital flight environment.

The communications link between the Spacelab and the Tracking and Data Relay Satellite System will be checked as a function of the mission operations. The performance of all operating displays and controls including the effect of all interior lighting and any sunlight/shadow effects will also be checked.

Habitability -- The habitability of Spacelab, from the standpoint of the crew working environment, is also a factor in the verification of the Spacelab habitable module.

Tests will verify: various equipment stowage techniques; operational adequacy of a general purpose work station; and various handrails, foot restraints and restraining devices used to aid the crew in moving about the module and in supporting the efficiency of crew emergency egress. other tests will determine the actual module internal noise characteristics.

Environment - Tests have been designed to compare the radiation environment actually experienced to the specified and predicted levels of radiation; determine if the radiation protection offered in the film storage areas is adequate; and provide data on radiation components for which no predictive calculations are available and which are likely to be significant for Spacelab users.

Attempts will also be made to verify predicted acceleration levels inside the module and at one location on the Pallet.

Electrical Power Distribution Subsystem -- This aspect of the VFT is designed to verify the Electrical Power Distribution Subsystem performance characteristics by operating all power distribution, conditioning and conversion devices at minimum and maximum mission achievable load levels.

Materials -- Tests will be conducted to verify the compatibility of Spacelab exterior materials with the space environment.

Contamination -- Analysis will be made of the cargo bay/ pallet environment and the induced external environment to verify that the established contamination limits have not been exceeded on sensitive optical surfaces and other experiments.

The contamination level will be monitored by the Induced Environment Contamination Monitor (IECM) -- a desk-sized, 800-lb. detector containing 10 instruments. Measurements will be made during pre-launch, ascent, on-orbit, descent, landing and post landing periods. on orbit the monitor will measure background spectral intensity, molecular deposition and optical surface effects. During the other mission phases, dew-point, humidity, aerosol content and trace gasses will be measured as well as optical surface effects and molecular deposition.

After the mission, applicable measurements taken by two pallet-mounted Spacelab 1 experiments, the Atmospheric Emission Photometric Imaging (AEPI)(1NS003) experiment and the Ultraviolet Spectrometer on the Imaging Spectrometric observatory (1NS001) experiment, will be compared with those by the IECM to verify that contamination levels are within limits for experiment operations.

SPACELAB 1 -- THE SCIENCE

Spacelab 1 is a multi-disciplinary mission of more than 70 experiments in five areas of scientific research: Astronomy and Solar Physics; Space Plasma Physics; Atmospheric Physics and Earth observations; Life Sciences; and Materials Science.

There are 38 different experiment facilities. Sixteen of the 38 experiments required to conduct investigations are situated on the pallet and 20 in the module. Two of the 38 experiments have components both on the pallet and in the module.

Some of the experiments on the pallet and in the module operate automatically, while others are operated from the ground or by the crew remotely through the computer or by means of controls located on the instrument front panels. other experiments in the module are operated directly by the crew.

The Spacelab 1 science mission is jointly sponsored by NASA and ESA with experiments being provided by scientists in 14 nations: Austria, Belgium, Canada, Denmark, France, Italy, Japan, The Netherlands, Federal Republic of

Germany, Spain, Sweden, Switzerland, United Kingdom and the United States. The payload is approximately equally divided between NASA and ESA experiments in terms of weight. NASA and ESA each are sponsoring approximately 1,392 kg (3,062 lb.) experiment hardware.

Of the 38 experiments, 13 are sponsored by NASA for scientists in the United States, Canada, France and Japan, 25 by ESA for its Member States' investigators. Nearly 60 of the more than 70 individual investigations are sponsored by ESA.

The European experiments themselves were developed under national funding. However, the integration and coordination tasks managed by SPICE were funded under an ESA budget of about $35 million.

of the European experiments, 11 are situated on the pallet and the rest are in the module, with two having components both on the pallet and in the module.

of the 13 NASA experiments, five are located on the pallet and eight are in the module, with three having components in both locations.

The experiments for the first Spacelab mission were selected from more than 400 proposals solicited by NASA and ESA in 1976. An international panel selected the experiments for flight based on each experiment's scientific merit and suitability for flight on the Shuttle/Spacelab.

Once the proposed investigations were evaluated by an independent group of experts, more than 70 investigations for the mission were selected. The principal investigators, or chief scientists for each experiment, then formed a cooperative body called the Investigators Working Group (IWG), comprised of 35 of the lead scientists from all five disciplines represented on Spacelab 1. The IWG, chaired by the Mission Scientist, guided the incorporation of the many experiments into a single payload and served to coordinate and communicate the needs of the scientists to the Mission Manager.

Another of the group's tasks was to recommend which of the many scientists -- only one from Europe and one from the United States -- would fly the first mission. NASA's scientists chose two payload specialist candidates from 35 nominees, while the ESA selection process picked two candidates from an initial application list of 2,000. Detailed information on those selected is available in the crew section of this kit.

Astronomy and Solar Physics

The investigations in astronomy and solar physics will study astronomical sources of radiation in the ultraviolet and X-Ray wavelengths, performing both surveys and detailed studies of specific objects. The solar experiments will measure the energy output of the sun using three different methods, with a view to quantitative measurement of variations in the solar energy output or "solar constant."

Spacelab 1 will carry a group of telescopes, cameras and other detectors that can see the sun and stars with greater clarity than normally possible from ground-based observatories.

Space Plasma Physics

The five space plasma physics experiments on Spacelab 1 will measure and characterize the magnetized, electrified gas or plasma in the earth's upper atmosphere (ionosphere).

These experiments will study the plasma envelope which surrounds the earth and investigate key cause-and-effect relationships that couple the earth's magnetosphere and atmosphere.

Some involve emitted beams of charged particles into space and measure the resultant changes in the environment. others will create artificial aurorae that help to explain how natural particle beams carry energy from the solar wind and the magnetosphere into the earth's atmosphere.

Television cameras, sensors and optical instruments will monitor natural processes as well as the effects of the emitted beam experiments.

Atmospheric Physics and Earth Observations

The atmospheric physics investigators will perform studies of the earth's environment through surveys of temperature, composition and motion of the atmosphere. These investigations will employ remote sensing and imaging techniques to study the emissions or absorptions from the atmospheric gases to determine their sources, flow patterns and decay mechanisms.

The Earth observations experiments will demonstrate advanced measuring systems which will be used on future Spacelab missions. There are six atmospheric physics and earth observations experiments on Spacelab 1.

A large film metric camera will produce high-resolution photographs for possible use in making better maps. A microwave remote sensing facility on Spacelab 1 will provide all-weather radar viewing of the earth's surface, regardless of cloud cover.

Life Sciences

The life sciences investigations will be concerned with the effects of the space environment (microgravity and hard radiation) on human physiology and on the growth, development, and organization of biological systems. Two experiments will study the effects of direct exposure to space on biological materials.

In this low-gravity environment a special category of experiments will probe the interaction between man's vestibular system and the brain, with a view to understanding the causes of space motion sickness (Space Adaptation Syndrome) and providing information that can be used in more general aspects of vestibular research on earth.

Another set of experiments will assess the effects of radiation and weightlessness on other organisms. In particular, scientists are interested in possible disturbances of cell growth, development and organization. New "mapping" techniques will be used to measure the level of space radiation that penetrates the wall of the Spacelab module.

Bacteria and other microbes on Spacelab 1 will be examined after the flight to determine the biological hazards of exposure to ambient ultraviolet and cosmic radiation. Observations of sunflower seedlings and fungi growing in Spacelab 1 will yield new information on plant growth patterns normally influenced by gravity and 24-hour circadian rhythms.

There are 16 life sciences experiments on Spacelab 1.

Materials Sciences

The 36 material sciences experiments will test low-gravity techniques for processing materials. These experiments take advantage of the microgravity conditions to perform studies in such areas as tribology, fluid physics, crystal growth and metallurgy.

A Material Sciences Double Rack facility will be carried on the flight. It contains furnaces and other equipment that will be shared by investigators from 10 European countries. Most of the experiments use the facility for studies of crystal growth, fluid physics, chemistry and metallurgy.

More: detailed information on the following experiments is contained in the publication "Spacelab I Experiments" available at all news centers.

NASA EXPERIMENTS ON SPACELAB 1

The following is a list of NASA experiments by discipline, title and number scheduled to fly aboard Spacelab l. Also listed is the principal investigator and the NASA center responsible for the experiment development.

Atmospheric Physics and Earth Observations

1NS001 -- An Imaging Spectrometric Observatory -- Dr. Marsha R. Torr, University of Michigan, Ann Arbor, Mich.; managed by Marshall Space Flight Center.

Space Plasma Physics

1NS002 -- Space Experiments with Particle Accelerators -Prof. Tatsuzo Obavashi, University of Tokyo, Tokyo, Japan; managed by Marshall.

lNS003 -- Atmospheric Emission Photometric Imaging -- Dr. Stephen B. Mende, Lockheed Palo Alto Research Laboratory, Palo Alto, Calif.; managed by Marshall.

Astronomy

1NS005 -- Ear UV Observations Using the Faust Instrument -Prof. C. Stuart Bowyer, University of California, Berkeley; managed by Marshall.

Life Sciences

1NS006 -- Radiation Environment Mapping -- Prof. Eugene V. Benton, University of San Francisco, Calif.; managed by Johnson Space Center.

1NS007 -- Characterization of Persisting Circadian Rhythms -- Dr. Frank M. Sulzman, Harvard Medical School, Boston, Mass.; managed by Johnson.

lNS101 -- Mutation of Helianthus Annuus -- Prof. Allan H. Brown, University of Pennsylvania, Philadelphia.; managed by Johnson.

1NSl02 -- Vestibular Experiments -- Prof. Laurence R. Young, Massachusetts Institute of Technology, Cambridge; managed by Johnson.

1NS103 -- Influence of Space Flight on Erythrokinetics in Man -- Dr. Carolyn Leach, Johnson Space Center; managed by Johnson.

1NS104 -- Vestibulo-Spinal Reflex Mechanisms -- Dr. Millard F. Reschke, Johnson Space Center; managed by Johnson.

lNS105 -- Effects of Prolonged Weightlessness on the Humoral Immune Response in Humans -- Prof. Edward W. Voss Jr., University of Illinois, Urbana; managed by Johnson.

Solar Physics

1NA008 -- Active Cavity Radiometer Solar Irradiance Monitor -- Dr. Richard C. Willson, Jet Propulsion Laboratory, Pasadena, Calif.; managed by JPL.

Technology

1NT011 -- Tribological Experiments in Zero-Gravity -Dr. Raymond L. Gause, Marshall Space Flight Center; managed by Marshall.

ESA EXPERIMENTS ON SPACELAB 1

The following is a list of ESA experiments by discipline, name and number, selected to fly aboard Spacelab I. Also listed is the principal investigator for each experiment.

Atmosphere Physics and Earth Observations

1ES013 -- Grille Spectrometer -- Dr. M. Ackermann, Institut d'Aeronomie Spatiale de Belgique, Brussels, Belgium; Dr. A. Girard, office National d'Etudes et de Recherches Aerospatiales, Chatilln, France.

1ES014 -- Waves in the OH Emission Layer -- Dr. M. Herse, Service d'Aeronomie du CNRS, Verrieres-le-Buisson, France.

1ES017 -- Lyman Alpha H and A -- Dr. J.-L. Bertaux, Service d'Aeronomie du CNRS. Verrieres-le-Buisson, France.

1EA033 -- Metric Camera -- A. Langner (Project Manager), DFVLR, Cologne, Federal Republic of Germany; Dr. M. Reynolds (Project Scientist), ESTEC, Noordwijk, the Netherlands; Dr. G. Koneney (Chairman Metric Camera Working Group), Technische Universitat Hannover, Hannover, Federal Republic of Germany.

1EA034 -- Microwave Scatterometer-Radiometer -- Dr. M. Wahl (Project Manager), DFVLR, Cologne, Federal Republic of Germany; G. Dieterle (Project Scientist), ESTEC, Noordwijk, the Netherlands; Dr. G-P De Loor (Chairman, Microwave Remote Sensing Experiment Working Group), Physics Laboratory, TNO, The Hague, the Netherlands.

Space Plasma Physics

1ES019 -- Low Energy Electron Flux and its Reaction to Active Experimentation -- Dr. Claus Wilhelm, Max-Planck Institut fur Aeronomie, Watlenburg-Lindau, Federal Republic of Germany.

1ES020 -- Phenomena Induced by Charged Particle Beams -Dr. C. Beghin. CRPE/CNET/CKRS Orleans, France.

1ES024 -- Isotopic Stack Measurement of Heavy Cosmic Ray Isotopes -- Dr. R. Beaujean, Institut fur Reine und Angewandte Kernphysik der Universitat Kiel, Kiel, Federal Republic of Germany.

Astronomy and Solar Physics

1ES016 -- Measurement of Solar Spectrum -- Dr. G. Thullier, Service d'Aeronomie du CNRS, Verrieres-le-Buisson, France.

1ES021 -- Solar Constant Measurement -- Dr. D. Grommelynck, Institut Royal Meteorologique de Belgique, Brussels, Belgium.

1ES022 -- Very Wide Field Camera -- Prof. G. Courtes, Laboratoire d'Astronomie Spatiale, Marseilles, France.

1ES023 -- Spectroscopy in X-Ray Astronomy -- Dr. R.D. Andresen, ESA/ESTEC, Noordwijk, The Netherlands.

Life Sciences

1ES025 -- Mass Discrimination During Weightlessness -Dr. H. Ross, University of Stirling, Stirling, United Kingdom.

1ES026 -- Measurement of Intrathoracic Venous Pressure Via a Peripheral Vein -- Prof. Dr. K. Kirsch, Physiologisches Institut der Freien Universitat Berlin, Berlin, Federal Republic of Germany.

1ES027 -- Advanced Biostack Experiment -- Prof. Dr. H. Bucker, DFVLR Institut fur Flugmedizin, Cologne, Federal Republic of Germany.

1ES028 -- Ballistocardiographic Research in Weightlessness -- Prof. Aristide Seano, University of Rome, Rome, Italy.

1ES029 -- Micro-organisms and Biomolecules in Space Environment -- Dr. G. Horneck, DFVLR Institut fur Flugmedizin, Cologne, Federal Republic of Germany.

1ES030 -- Personal Miniature Electro-Physiological Tape Recorder -- Dr. H-L. Green, Clinical Research Centre, Harrow, United Kingdom.

1ES031 -- Effect of Weightlessness on Lymphocyte Proliferation -- Dr. A. Gogoli, Eidgenossische Technische Hoehschule, Zurich, Switzerland.

1ES032 -- Collection of Blood Samples for the Determination of Antidiuretic Hormones, Aldosterone, and other Hormones -Prof. Dr. K. Kirsch, Physiologisches Institut der Freien Universitat Berlin, Berling, Federal Republic of Germany.

1ES201 -- Effect of Rectilinear Accelerations, Optokinetics and Caloric Stimulations on Vestibular Reactions and Sensations in Space -- Prof. Dr. R. von Baumgarten, Physiologischen Institut der Johannes Gutenberg Universitat, Mainz, Federal Republic of Germany.

Material Sciences

1ES300 -- Material Science Double Raci Facility -- H. Stetmle (Project Manager), DFVLR/BPT, Cologne, Federal Republic of Germany; M. Brook (Project Manager), ESA-SPICE, Cologne, Federal Republic of Germany; U. Huth (Project Scientist), ESA-D/STS, Microgravity office, Paris, France; Prof. Y. Malmijac, Centre d'Energie Atomique, Grenoble, France; Prof. L.G. Napolitano, Universita degli Studi, Naples, Italy; Prof. R. Nitsche, Universitat Freiburg, Freiburg, Federal Republic of Germany.

NOTE: 35 investigations will use the material science facility. The following experiments use the Isothermal Heating Facility:

1ES301 -- Solidification of Monotectic Alloys -- Prof. H. Ahlborn, Universitat Hamburg, Germany.

1ES302 -- Interaction Between an Advancing Solidification Front and Suspended Particles -- Dr. D. Neuschutz, Dr. D. Poetschke and F. Krupp Gmbh, Essen, Federal Republic of Germany.

1ES303 -- Skin Technology -- Dr. H. Sprenger, Maschinen fabrik Auzsburg-Nurnberg AG. Munich Federal Republic of Germany.

1ES304 -- Vacuum Brazing -- Prof. W. Schonherr and E. Siegfried, Bundesanstalt fur Materialprufung, Berlin, Federal Republic of Germany.

1ES305 -- Vacuum Brazing -- Prof. R. Stickler Dr. K. Frieler. University of Vienna Austria.

1ES306 -- Solidification of Monotectic Alloys -- Prof. H. Ahlborn, Universitat Hamburg, Hamburg, Federal Republic of Germany.

1ES307 -- Reaction Kinetics in Glass Melt -- Prof. G.H. Frischat and Dr. M. Braedt, Universitat Clausthal, Clausthal Zellererfeld, Federal Republic of Germany.

1ES309 -- Metallic Emulsions AI-Pb -- Dr. P.D. Caton and Dr. W.G. Hopkins, Fulmer Research Institute Ltd., Stoke Poges, United Kingdom.

1ES311 -- Bubble Reinforced Materials -- Prof. P. Gondi, Universita degli Studi di Bologna, Bologna, Italy.

1ES312 -- Nucleation of Eutectic Alloys -- Prof. Y. Malmejac, Centre d'Energie Atomique, Grenoble, France.

1ES313 -- Solidification and Oswald Ripening of Near Monotectic Zn-Pb Alloys -- Prof. H. Fischmeister and Dr. A. Kneissel, Montanuniversitat Leoben, Leoben, Austria.

1ES314 -- Dendrite Growth and Microsegregation of Binary Alloys -- Prof. H. Fredriksson, The Royal Institute of Technology, Stockholm, Sweden.

1ES315 -- Melting and Solidification of Metallic Composites -- Prof. A. Deruyttere and L. Froyen, Katholicke Universiteit Leuven. Leuven, Belgium.

1ES325 -- Unidirectional Solidification of Cast Iron -Dr. T. Luyendijk and Dr. H. Nieswaag, Delft University of Technology, Delft, the Netherlands.

The following experiments use the Gradient Heating Facility:

1ES316 -- Solidification of Al-Zn Emulsions -- Dr. C. Potard. Centre d'Energie Atomique. Grenoble, France.

1ES317 -- Unidirectional Solidification of Eutectics Alloys -- Dr. J.J. Favier and J.P. Praizey, Centre d' Energie Atomique, Grenoble, France.

1ES318 -- Lead Telluride Crystal Growth -- Dr. H. Rodot, CNRS Laboratoire d'aerothermique, Meudon, France.

1ES319 -- Unidirectional Solidification of Eutectics (InSbNiSb) -- Dr. G. Muller, Universitat Erlangen, Erlangen, Federal Republic of Germany.

1ES320 -- Thermodiffusion in Tin Alloys -- Prof. Y. Malmejac and J.P. Praizey, Centre d'Energie Atomique, Grenoble, France.

The following experiments use the Mirror Heating Facility:

1ES321 -- Floating Zone Growth of Silicon -- Prof. R. Nitsche and Dr. E. Eyer, Kritallographisches Institut der Universitat Freiburz. Freiburg. Federal Republic of Germany.

1ES322 -- Growth of Cadmium Telluride by Traveling Heater Method -- Prof. R. Nitsche, Dr. R. Dian and Dr. R. Schonhold, Kritallographisches Institut der Universitat Freiburg, Frieburg, Federal Republic of Germany.

1ES323 -- Growth of Semi-Conductor Crystals of the Traveling Heater Method -- Dr. K.W. Benz, Universitat Stuttgart, Stuttgart, Federal Republic of Germany; and Dr. G. Muller, Universitat Erlanzen. Erlanzen, Federal Republic of Germany.

1ES324 -- Crystallization of Silicon Drop -- Dr. H. Kolker, Wacker-Chemie, Munich, Federal Republic of Germany.

The following experiments will use the Fluid Physics Module:

1ES326 -- Oscillation of Semi-Free Liquid in Space -- Dr. H. Rodot, CNRS Laboratorie d'Aerothermique, Meudon, France.

1ES327 -- Kinetics of Spreading of Liquids on Solids Dr. J.M. Haynes, University of Bristol, Bristol, United Kingdom.

1ES328 -- Free Convection in Low Gravity -- Prof. L.G. Napolitano, Universita Degli Studi, Naples, Italy.

1ES329 -- Capillary Forces -- Dr. J.F. Padday, Kodak Limited, Harrow, United Kingdom.

1ES330 -- Coupled Motion of Liquid-Solid Systems in Near Zero Gravity -- Dr. J.P.B. Vreeberg, National Aerospace Laboratory, NLR, Amsterdam, the Netherlands.

1ES331 -- Floating Zone Stability in Zero Gravity -- Prof. I. Da Riva and Prof. I. Martines, ETSI Aeronauticos, Madrid, Spain.

1ES339 -- Interfacial Instability and Capillary Hysteresis -- Dr. J.M. Haynes, University of Bristol, Bristol, United Kingdom.

The following single experiments use special equipment:

1ES334 -- Crystal Growth of Proteins -- Dr. W. Littke, Universitat Freiburg, Freiburg, Federal Republic of Germany.

1ES335 -- Self-Diffusion in Liquid Metals -- Prof. H. Wever, Prof. G. Frohberg and Dr. K.M. Kraatz, Technische Universitat Berlin, Berlin, Federal Republic of Germany.

1ES340 -- Adhesion of Metals (UHV Chamber) -- Prof. G. Ghersini, G. Grugni and P.G. Sona, Centro Informazioni Studi Esperienze, Milan, Italy; and Dr. F. Rossitto, Politechnico di Milano Milan Italy.

1ES332 -- Organic Crystal Growth -- Dr. K. F. Nielsen, G. Galster and I. Johannson, Technical University of Denmark, Lyngby, Denmark.

1ES333 -- Crystal Growth by Co-Precipitation in Liquid Phase -- Prof. A. Authier, Dr. F. Lefaucheux and Dr. M.C. Robert, Universite Pierre et Marie Curie, Paris, France.

1ES338 -- Mercury Iodide Growth -- Prof. R. Cadoret, Universite de Clermont-Ferrano, Aubiere, France

NOTE: Due to the delay in launching STS-9 from late October to late November, it is expected that some scientific data will be degraded. There is a fact sheet available at all centers that details what experiments will be affected and the expected results.

LIFE SCIENCES BASELINE DATA COLLECTION

Several of the life sciences experiments on Spacelab 1 will gather data on the physiological responses of humans to weightlessness. In support of these experiments ground data has been collected to enable scientists to determine by comparison the physiological changes induced by spaceflight.

A series of preflight measurements have been made on each payload crewman to establish a set of normal or "baseline" values for the physiological system(s) under study. The same or similar data obtained during the flight itself can then be directly compared with the baselines to determine what, if any, changes have occurred during exposure to weightlessness.

Scientists are also interested in how the changes seen in space are reversible once the crewmen return to earth and over what period of time. This is accomplished by conducting another series of ground-based, postflight measurements on each payload crewmember.

To compare the earth-based and space-based data, the preflight and postflight phases of the experiment are performed with equipment and under test conditions which are the same as, or at least similar to, those of the inflight portion of the experiment

To this end, a special facility -- the Baseline Data Collection Facility (BDCF) -- has been established at NASA's Dryden Flight Research Facility at Edwards Air Force Base.

The Dryden facility consists of approximately 470 square m (5,000 sq. ft.) of laboratory space. It was used for preflight data collection at 120 days, 90 days and 30 days before launch. Additional data are to be collected 11 days before launch.

Following landing, an extensive series of tests will be made in the facility to measure the crew readaptation process to a 1-G environment. These tests will begin within minutes after the payload crew leaves the orbiter and will continue during the next seven days. one additional test day will occur 14 days after landing. A typical test day for the crew lasts between 10 and 12 hours. For this reason, the payload and mission specialists will be unavailable for traditional post landing ceremonies for several days after their return.

SPACELAB 1 PAYLOAD OPERATIONS AND CONTROL

Payload Operations Control Center

The Payload operations Control Center (POCC), situated in building 30 at Johnson Space Center, is the command post for the management of Spacelab 1 scientific payload activities during STS-9 and Spacelab flight. The POCC does for the Spacelab payload what Mission Control does for the Shuttle and Spacelab. Mission Control has overall responsibility for the flight and operation of the orbiter while the POCC is responsible for all the scientific activities.

Members of the Marshall mission management team, ESA payload managers, principal investigators and their research teams work in the POCC in shifts around the clock. From there, they monitor, control and direct experiment operations aboard Spacelab.

Command and data links to the POCC enable scientists to follow the progress of their experiments, assess and respond to real-time information and be actively involved in the investigative process. From the POCC, scientists can communicate directly with the Spacelab crew. If necessary they can instruct the crew by voice, text or graphic links, or they can send automated commands directly to the onboard computer to control experiments onboard Spacelab. In this way, the experimenters on the ground can participate directly in operations of their Spacelab experiments.

The POCC, which covers an area of just over 370 sq. m (4,000 sq. ft.), is composed of a payload control room, a mission planning room, and six user rooms.

The payload control room houses the mission management team which controls the overall science mission.

The capabilities of the POCC include some data Processing. Multiplexed Spacelab 1 data are received at up to 48 megabits (megabits per second) and converted into separate channels in original input form. These channels are routed to recorders, to the experimenters ground support equipment, or to experiment consoles for display.

Each user room contains three work stations, each having a cathode ray tube terminal and keyboard, a floppy disk unit and a hard copy unit for the users' own payload monitoring and control.

POCC Positions

The following is a general description of the labeled positions in the Spacelab 1 Payload operations Control Center (POCC) at the Johnson Space Center:

POD (Payload Operations Director) -- Is the senior member of the mission manager's cadre team in the POCC and directs the payload operations team and payload crew in accomplishing Spacelab 1 mission operations. An assistant payload operations director sits on his left.

MSCI (Mission Scientist) -- Represents scientists with experiments on the flight to mission management and interfaces with the mission manager and the POD with respect to mission science operations and accomplishments. An assistant mission scientist sits on his right.

MUM (Mass Memory Unit Manager) -- Initiates experiment command uplinks to the Spacelab after receiving data set changes from the POCC operations team.

OC (Operations Controller) -- Coordinates the activities of the payload operations team to efficiently accomplish POCC functions required to support the real-time execution of the approved mission timeline. Assesses proposed crew timeline alterations and coordinates the implementation of approved actions with the POCC cadre positions.

PAYCOM (Payload Command Controller) -- Configures the POCC for ground command operation and controls the flow of experiment commands from the POCC as required and troubleshoots any problems in the rejection of those commands. Advises OC on command system status.

CIC (Crew Interface Coordinator) -- Manages POCC use of air-to-ground voice loop and serves as a focal point for communications with payload crew and enables and coordinates principal investigator voice activity with payload crew.

APS (Alternate Payload Specialist) -- Assists the payload operations team and Payload crew in devising solutions to problems, troubleshooting and changing crew procedures where necessary. Advises the mission scientist of possible impacts or problems. Assists the CIC in direct voice contact with the Payload crew, as required.

DMC (Data Management Coordinator) -- Responsible for maintaining and coordinating the flow of payload data to and within the POCC for the cadre and principal investigators. Assesses proposed real-time changes to the experiment timeline and payload data requirements which affect the payload downlink data.

PAP (Payload Activity Planner) -- Directs the mission replanning activity by receiving proposed changes to the mission timeline and coordinating them with the POCC operations team. Assesses proposed changes to the current timeline and advises the POD on potential impacts to the timeline.

OPS (TV operations Controller) -- Serves as the focal point within the POCC for Spacelab/payload inflight television and photographic operations, specifically with regard to scene development of flight crew activities.

PAO (Public Affairs Officer) -- Provides Spacelab 1 mission commentary and serves as the focal point for Spacelab payload in formation.

Science Monitoring Area

During flight, all of the Spacelab 1 life sciences experiments except 1ES201 will be monitored and controlled from the Science Monitoring Area (SMA), located in Building 36, at Johnson. While the monitoring area is physically separated from the rest of the Payload operations Control Center, the two facilities are linked together by data and communications lines. The monitoring area is similar in function to one of the six POCC user rooms.

The science teams will man modular consoles which have been configured for the individual experiments.

Oberpfaffenhofen, Federal Republic of Germany

A large number of European scientists have provided experiments that will be conducted in the Material Science Double Rack (MSDR) in the Spacelab 1 module. Since not all of these investigators are able to follow the mission from the POCC at Johnson, the data from the experiments will be transmitted in real-time to the German Aerospace Research Establishments Satellite Operations Center (GSOC) at Oberpfaffenhofen (near Munich, Federal Republic of Germany). There, experimenters will be able to monitor their experiments, though without the direct communication with the Spacelab-1 crew and experiment equipment available at the POCC in Houston.

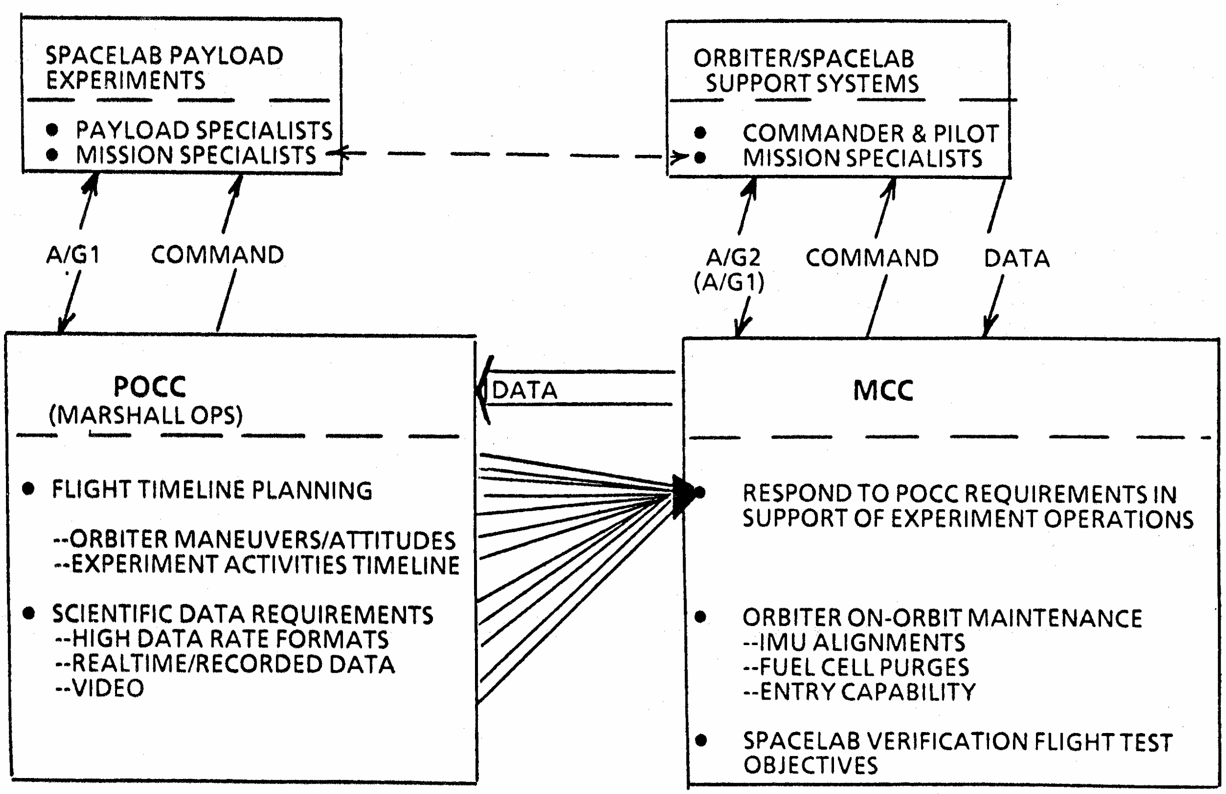
The experience gained at the GSOC during the Spacelab 1 mission will be of prime importance for the forthcoming German Spacelab mission, D-1, when the POCC will be set up at Oberpfaffenhofen.

JSC MISSION OPERATIONS

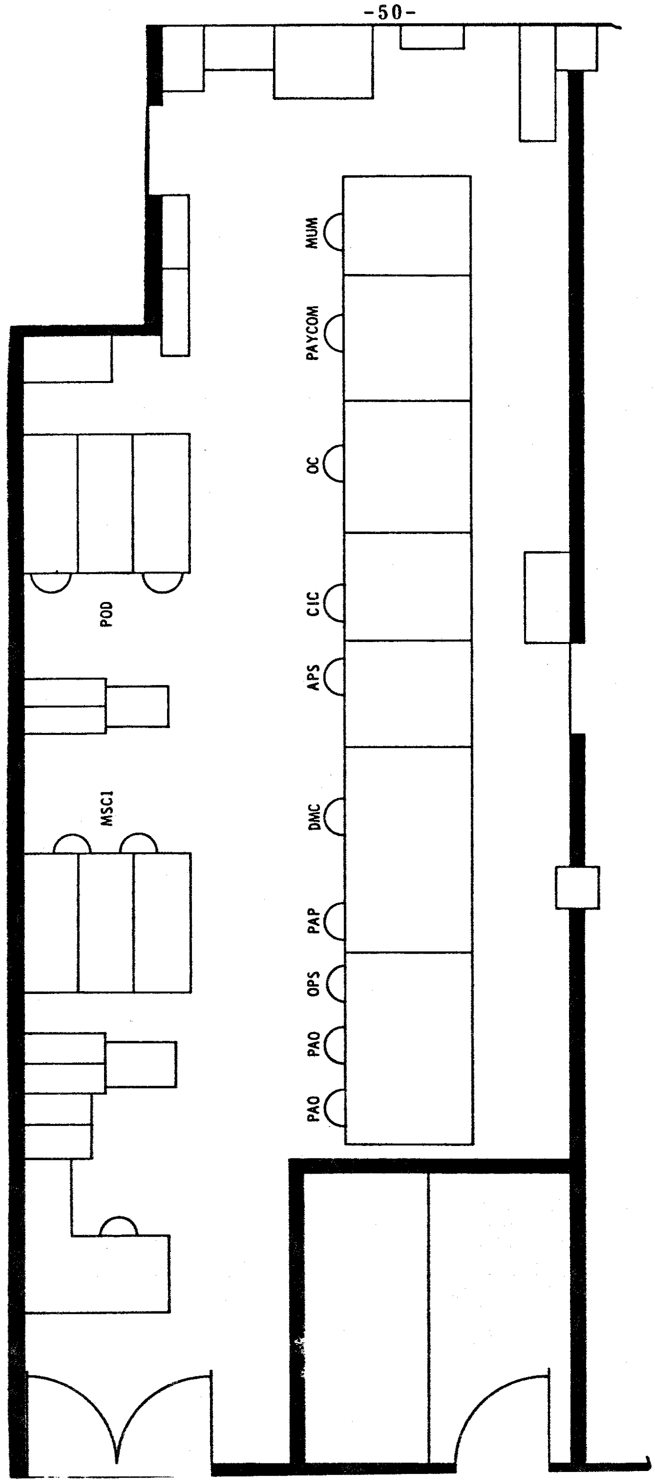
SUBJECT:

OPERATIONS CONCEPT

- IN SUPPORT OF PAYLOAD OPERATIONS, THE STS ORGANIZATION WILL OPERATE IN A "HOST" MODE.



POCC FRONT ROOM



JSC MISSION OPERATIONS

SUBJECT:

MANNING

- <u>FLIGHT CREW (DUAL SHIFT OPERATIONS)</u>

-	RED TEAM	CDR	J. YOUNG
		MS1	R. PARKER
		PS1	U. MERBOLD
-	BLUE TEAM	PLT	B. SHAW
		MS2	O. GARRIOTT
		PS2	B. LICTENBURG

- POCC (2 TEAMS, 12 HOUR SHIFTS)
  - RED TEAM PAYLOAD OPERATIONS DIRECTOR (POD), T. RECIO
  - BLUE TEAM POD, C. OWEN

- MCC (3 TEAMS)
  - ASCENT FLIGHT DIRECTQR (FD) - J. GREENE
  - ORBIT TEAM 1 F D - C. LEWIS
  - ORBIT TEAM 2 F D - J. COX
  - ORBIT TEAM 3 F D - L. BOURGEOIS
  - ENTRY F D - G. COEN

STS-9/SPACELAB 1 CREW

The STS-9/Spacelab 1 crew, consisting of six members, wall be the largest vet to fly aboard a single spacecraft, the first international Shuttle crew, and the first crew to include a new category of spaceborne research scientist called Payload specialists. STS-9/Spacelab 1 also marks the first time astronauts will be working around the clock in space.

The crew will include: two pilot astronauts, John W. Young, commander and Brewster H. Shaw Jr., pilot; two mission specialist-astronauts, Dr. Owen K. Garriott, and Dr. Robert A. R. Parker; and two payload specialist-scientists, Dr. Byron K. Lichtenberg and Dr. Ulf Merbold.

Members of NASA's career astronaut corps, Young and Shaw, are responsible for flying the Shuttle. Mission specialists Garriott and Parker are primarily responsible for managing the orbiter systems that provide resources to Spacelab and Spacelab systems. Since they are scientists they will also spend much of their time operating Spacelab experiments. The payload specialists, Lichtenberg and Merbold, are career scientists from outside the astronaut corps and are responsible only for carrying out scientific activities scheduled for the mission. Lichtenberg is a member of the research staff at the Massachusetts Institute of Technology, Cambridge, Mass., and Merbold, a German physicist, has been assigned to the mission by the European Space Agency.

During STS-9/Spacelab 1, the crew will operate in 12-hour shifts. A pilot astronaut, a mission specialist and a Payload specialist will be on duty during each shift. Young, Parker, and Merbold have been assigned to work the Red Shift which is generally on duty from about 02:30 to about 14:30 GMT; Shaw, Garriott, and Lichtenberg have been designated to the Blue Shift covering the remaining hours.

A detailed biography of each crewmember follows.

STS-9 CREWMEMBERS

S83-35017 -- Official Portrait of the STS-9 crewmembers. Seated from left to right are Owen Garriott, mission specialist; Brewster Shaw, pilot; John Young, commander; and Robert Parker, mission Specialist. Standing from left to right are the payload specialists, Byron Lichtenberg and Ulf Merbold.

PHOTO CREDIT: NASA or National Aeronautics and Space Administration.

BIOGRAPHICAL DATA

NAME: John W. Young (USN, Ret.) NASA Astronaut, STS-9 Commander

BIRTHPLACE AND DATE: Born in San Francisco, Calif., on Sept. 24, 1930.

EDUCATION: Graduated from Orlando High School, Orlando, Fla.; received a bachelor of science degree in aeronautical engineering with highest honors from the Georgia Institute of Technology in 1952.

MARITAL STATUS: Married to the former Susy Feldman of St. Louis. Mo.

CHILDREN: Sandy, April 30, 1957; and John, Jan. 17, 1959.

NASA EXPERIENCE: In September 1962 Young was selected as an astronaut. He is the first person to fly in space five times. The first flight was with Gus Grissom in Gemini 3, the first manned Gemini mission on March 23, 1965. This was a complete end-to-end test of the Gemini spacecraft. on Gemini 10, July 18-21, 1966, Young, as commander, and Michael Collins, as pilot, completed a dual rendezvous with two separate Agena target vehicles. Collins also did an extravehicular transfer to retrieve a micrometeorite detector from the second Agena. on his third flight, May 18-26, 1969, Young was command module pilot of Apollo 10. Tom Stafford and Gene Cernan were also on this mission which orbited the moon and completed a lunar rendezvous. His fourth space flight, Apollo 16, April 16-27, 1972, was a lunar exploration mission, with Young, as spacecraft commander, and Ken Mattingly and Charles Duke. Young and Duke set up scientific equipment and explored the lunar highlands at Descartes. They collected almost 200 pounds of rocks and drove more than 27 kilometers in the lunar rover while on the moon. Young's fifth flight was as spacecraft commander of STS-1, the first flight of the Space Shuttle Columbia, April 12-14, 1981, with Robert Crippen as pilot. The 54-1/2 hour, 36-orbit mission verified Space Shuttle systems performance during launch, on-orbit, and entry.

CURRENT ASSIGNMENT: John Young continues his assignment as Chief of the Astronaut office.

BIOGRAPHICAL DATA

NAME: Brewster H. Shaw Jr. (Major, USAF) NASA Astronaut, STS-9 Pilot

BIRTHPLACE AND DATE: Born May 16, 1945, in Cass City, Mich. His parents, Mr. and Mrs. Brewster H. Shaw, Sr., reside in Cass City.

education: Graduated from Cass City High School, Cass City, Mich., in 1963; received bachelor and master of science degrees in engineering mechanics from the University of Wisconsin (Madison) in 1968 and 1969, respectively.

MARITAL STATUS: Married to the former Kathleen Ann Mueller of Madison, Wis. Her parents, Mr. and Mrs. Robert E. Mueller, reside in Madison.

CHILDREN: Brewster Hopkinson III, Aug. 6, 1970; Jessica Hollis, Feb. 3, 1975; Brandon Robert, Aug. 15, 1976.

NASA EXPERIENCE: Major Shaw was selected as an astronaut candidate by NASA in January 1978. In August 1979, he completed a l-year training and evaluation period making him eligible for assignment as a pilot on future Space Shuttle flight crews. Major Shaw's NASA assignments have included Support crew and Entry CAPCOM for STS-3 and STS-4.

CURRENT ASSIGNMENT: Major Shaw has been selected to serve as pilot for STS-9, the first Spacelab mission.

BIOGRAPHICAL DATA

NAME: Owen K. Garriott NASA Astronaut, STS-9 Mission Specialist

BIRTHPLACE AND DATE: Born Nov. 22, 1930, in Enid, Okla. His mother, Mrs. Owen Garriott, resides in Enid.

EDUCATION: Graduated from Enid High School; received a bachelor of science degree in electrical engineering from the University of Oklahoma in 1953, a master of science degree and a doctorate in electrical engineering from Stanford University in 1957 and 1960, respectively; and presented an honorary doctorate of science degree from Phillips University (Enid, Oklahoma) in 1973.

MARITAL STATUS: Married to the former Helen Mary Walker of Enid, Okla. Her mother, Mrs. Glenn A. Walker, resides in Enid.

CHILDREN: Randall O., March 29, 1955; Robert K., Dec. 7, 1956; Richard A., July 4, 1961; Linda S., Sept. 7, 1966.

NASA EXPERIENCE: Garriott was selected as a scientist-astronaut by NASA in June 1965. He has since completed a 53-week course in flight training at Williams Air Force Base, Ariz. Garriott was science-pilot for Skylab-3 (SL-3), the second manned Skylab mission, and was in orbit from July 28 to Sept. 25, 1973. With him on this 59-1/2-day flight were Alan L. Bean (spacecraft commander) and Jack R. Lousma (pilot). SL-3 accomplished 150 percent of many mission goals while completing 858 revolutions of the earth and traveling some 24,400,000 miles. The crew installed six replacement rate gyros used for attitude control of the spacecraft and a twin pole sunshade used for thermal control, and repaired nine major experiment or operational equipment items. They devoted 305 man-hours to extensive solar observations from above the earth's atmosphere, which included viewing several major solar flares and numerous smaller flares and coronal transients. over 40,000 photographs of the sun, showing views invisible from the earth's surface were returned. The crew of Skylab-3 logged 1,427 hours and 9 minutes each in space, setting a new world record for a single mission, and Garriott also spent 13 hours and 43 minutes in three separate extravehicular activities outside the orbital workshop. Since his flight, Garriott has served as Deputy and then Director of Science and Applications and as the Assistant Director for Space Science at the Lyndon B. Johnson Space Center.

ASSIGNMENT: Garriott is a mission specialist for the Spacelab-1 flight.

BIOGRAPHICAL DATA

NAME: Robert Allan Ridley Parker NASA Astronaut, STS-9 Mission Specialist

BIRTHPLACE AND DATE: Born in New York City on Dec. 14, 1936, but grew up in Shrewsbury, Mass., where his parents, Dr. and Mrs. Allan E. Parker. now reside.

Education: Attended primary and secondary schools in Shrewsbury, Mass.; received a bachelor of arts degree in astronomy and physics from Amherst College in 1958, and a doctorate in astronomy from the California Institute of Technology in 1962.

MARITAL STATUS: Married to the former Judy Woodruff of San Marino, Calif.

CHILDREN: Kimberly Ellen, Feb. 7, 1962; Brian David Capers, March 8, 1964.

NASA EXPERIENCE: Parker was selected as a scientist-astronaut by NASA in August 1967. He was a member of the astronaut support crews for the Apollo 15 and 17 missions and served as Program Scientist for the Skylab Program Director's office during the three manned Skylab flights.

CURRENT ASSIGNMENT: Parker has been designated as a mission specialist for the Spacelab-1 flight.

BIOGRAPHICAL DATA

NAME: Byron K. Lichtenberg, Spacelab 1 Payload Specialist

BIRTHPLACE AND DATE: Born Feb. 19, 1948, in Stroudsburg, Pa. His parents, Mr. and Mrs. Glenn Lichtenberg, reside in Wayne. Pa.

EDUCATION: Graduated from Stroudsburg High School, received his bachelor of science degree in electrical engineering from Brown University, Providence, R.I., in 1969. He did graduate work at the Massachusetts Institute of Technology, Cambridge, Mass., receiving his master's degree in mechanical engineering in 1975, and his doctorate in biomedical engineering in 1979.

MARITAL STATUS: Married to the former Lee Lombard of Farmington, Conn. Her parents live in Farmington.

CHILDREN: Kristin, Aug. 12, 1973; Kimberly, Oct. l, 1976.

ORGANIZATIONS: He is a member of Tau Beta Pi and Sigma Xi honor societies and the Aerospace Medical Association.

SPECIAL HONORS: Distinguished graduate, U.S. Air Force ROTC; graduated first in pilot training class, Williams Air Force Base, Ariz., 1970; two Distinguished Flying Crosses, Vietnam. 1972; 11 Air Medals. Vietnam, 1972.

EXPERIENCE: Lichtenberg is a member of the research staff at the Massachusetts Institute of Technology and is actively involved in the vestibular experiments being flown on Spacelab 1. His primary area of research is biomedical engineering. In June 1978, Lichtenberg was selected to train for the Spacelab 1 mission as one of two U.S. payload specialists. Between 1969 and 1973 he served in the U.S. Air Force. At present he is a fighter pilot in the Massachusetts Air National Guard, flying the A-10 close air support aircraft.

BIOGRAPHICAL DATA

NAME: Ulf Merbold (Dr. rer. nat.) Spacelab 1 Payload Specialist

BIRTHPLACE AND DATE: Born June 20, 1941, in Greiz. His mother, Mrs. Hildegard Merbold, lives in Stuttgart, Federal Republic of Germany.

EDUCATION: Graduated from high school in East Germany in 1960; received a diploma in physics in 1968 and a doctorate in science (Dr. rer. nat.) from Stuttgart University in 1976.

MARITAL STATUS: Married to the former Birgit Riester of Stuttgart.

CHILDREN: Susanette, Jan. 16, 1975; Hannes, March 26, 1979.

ORGANIZATIONS: Dr. Merbold is a member of the German Society for Physics. He holds a private pilot's license.

EXPERIENCE: Merbold joined the Max-Planck Gesellschaft at Stuttgart, first on a scholarship in l968, and later as a staff member. He worked as a solid-state physicist on a research team of the Max-Planck Institute for Metals Research. His main fields of research were crystal lattice defects and low-temperature physics. He was involved in the investigation of the irradiation damage on iron and vanadium produced by fast neutrons. In 1978 he was selected by the European Space Agency (ESA) as one of two European payload specialists to train for the Spacelab 1 mission.

PAYLOAD SPECIALISTS

The position of payload specialist is new to the space program.

Payload specialists are career scientists and engineers -men and women -- normally identified, evaluated and selected by their peers to fly into space on a particular mission and devote themselves to conducting EXPERIMENTS.

Spacelab 1 payload specialists will perform such tasks as removal of equipment from stowage, set-up, experiment operation, making minor repairs if needed, changing test specimens and equipment disassembly. The payload specialists will also be available if targets of opportunity appear or if re-adjustment or realignment of hardware or procedures in orbit are required.

For certain life sciences experiments, the payload specialists will act as test subjects. From an overall payload point of view, the payload specialist will play an invaluable role in executing the timeline and verifying the correct functioning of experiments.

For Spacelab 1, the payload specialists were identified and selected in a somewhat different way. Two American payload specialists were elected by the Investigators Working Group (IWG), a body consisting of the principal investigator, or chief scientist, for each experiment being carried out on the mission. The recommendations of the IWG also figured strongly in ESA's choice of three European payload specialists.

In December 1977, ESA selected Dr. Ulf Merbold, a German research scientist at Max Planck Institute in Stuttgart, Federal Republic of Germany; Dr. Wubbo Ockels, a Dutch physicist at Groningen University, the Netherlands; and Claude Nicollier, a Swiss astronomer and pilot working at ESTEC in the Netherlands, as payload specialist candidates for Spacelab 1. They were selected from about 2,000 applicants from ESA Member and Associate Member States.

During the first week in June 1978 NASA announced that Dr. Byron K. Lichtenberg, a biomedical engineer at the Massachusetts Institute of Technology, and Dr. Michael L. Lampton, a space physicist at the University of California at Berkeley, would train as the U.S. payload specialists. They were nominated by the IWG.

Nicollier was reassigned by ESA in 1980 to train as a mission specialist at the Johnson Space Center and is now a candidate for a mission specialist position on the German Spacelab mission, D-1, scheduled to fly aboard the Space Shuttle in 1985.

In September 1982, Lichtenberg and Merbold were named flight payload specialists for STS-9/Spacelab 1. They will fly aboard the Space Shuttle and Spacelab to operate the experiments.

At the same time, Lampton and Ockels were named as alternate payload specialists. They will serve as flight backups and as members of the mission management and science team responsible for controlling and directing experiment operations from the Payload operations Control Center (POCC) at the Johnson Space Center in Houston. Additionally, Ockels has been appointed as a member of the payload specialist team training for D-1. Merbold will be his backup for that mission.

Payload Specialist Training

STS-9/Spacelab 1 payload specialists underwent two basic types of training -- mission independent and mission dependent.

Mission-Dependent Training -- The training associated with Spacelab 1 experiments and payload operations is called mission-dependent. It represents the most important and longest part of the overall training program. Much of this training was defined and provided by the individual investigators in their laboratories. Training in the integrated operations of the payload was provided by the Marshall Space Flight Center.

Mission-Independent Training -- Regardless of payload scientific objectives, all flight personnel needed to possess certain fundamental skills necessary to live and work safely aboard the Shuttle and Spacelab. The training needed to acquire these skills is termed mission-independent and includes such areas as: habitability or familiarization with space-living conditions, medical, emergency, survival operations, and launch site familiarization. The Johnson Space Center was given the responsibility to both define and implement the major portion of this training. Those portions applicable to the launch and landing sites are the responsibility of the Kennedy Space Center.

The STS-9/Spacelab 1 payload specialists began their training with five days of general planning and orientation sessions at Marshall in early August 1978. As manager of the Spacelab 1 mission, Marshall is responsible for coordinating both mission dependent and mission independent payload specialist training.

For much of their training, the payload specialists (usually accompanied by the mission specialists) traveled to laboratories in the United States, Canada, Japan, and Europe to learn the operation and theoretical objectives of each experiment.

Since January 1982 the payload and mission specialists have been undergoing mission operational training in the Payload Crew Training Complex (PCTC) at Marshall.

In a high-fidelity mock up of the laboratory they were faced with operational situations very similar to those they will encounter during the Spacelab-1 flight. They thus gained considerable experience which will ensure a maximum scientific return from the flight.

The Spacelab module simulator at Marshall's PCTC did not include the Material Science Double Rack, therefore, training for the melting of materials samples, formation of crystals and fluid physics experiments was conducted at DFVLR in Cologne-Porz, Federal Republic of Germany, under the supervision of SPICE.

The payload crew also trained at the Kennedy Space Center during integration testing of the actual Spacelab 1 flight hardware.

During the two months before the mission, the payload specialists participated in integrated STS-9/Spacelab 1 simulations involving the entire mission crew and mission and payload ground controllers. These simulations involved simultaneous participation from the PCTC and Huntsville operations Support Center (HOSC) at MSFC and from the POCC, Mission Control, and the Shuttle and Spacelab simulators at JSC.

TRACKING AND DATA MANAGEMENT

A key element in any Shuttle mission is the capability to track the spacecraft, communicate with the astronauts, command the orbiter and obtain the telemetry data that informs ground controllers of the condition of the spacecraft and its crew.

For this mission, a second and equally important consideration is the return of the vast amounts of data from Spacelab. It requires a communications network unlike any NASA has used previously with the Space Transportation System.

NASA will handle STS-9/Spacelab 1 tracking and communications and Spacelab 1 experiment data through the Tracking and Data Relay Satellite System (TDRSS) and the Ground Space Tracking and Data Network (GSTDN), a combination of a large communications satellite and ground facilities linking the Shuttle to Goddard Space Flight Center in Greenbelt, Md., and Johnson Space Center, Houston, TX.

During the Spacelab 1 mission, TDRSS will be used to relay commands and data to and from the experiments aboard Spacelab 1. The GSTDN will supplement TDRSS and provide routine, real-time tracking and communications with the Shuttle orbiter and its crew.

Goddard will also house and manage the Spacelab Data Processing Facility (SLDPF), where all data from Spacelab 1 experiments will be received and processed prior to distribution to users in Europe (via ESA) and in the United States.

Tracking and Data Relay Satellite System

The first Tracking and Data Relay Satellite (TDRS-1) was deployed from the Space Shuttle Challenger on April 4, 1983. Problems developed during the Inertial Upper Stage boost phase after deployment from the orbiter, placing it into an unsatisfactory elliptical rather than a geosynchronous orbit. Goddard, TRW Defense & Space Systems Group, Redondo Beach, Calif., and Space Communications Co. (SPACECOM), Gaithersburg, Md., developed plans to correct the spacecraft’s orbit by a series of thruster firings and, on June 29, 1983, the satellite reached its planned geosynchronous orbit of 35,680 km (22,300 mi.) at 67 degrees west longitude northeast of Brazil. It has been moved to its operational location, 41 degrees west longitude, after a series of communications tests during the STS-8 mission were completed.

Later, a second TDRS is scheduled to be located at 171 degrees west longitude southwest of Hawaii. A third satellite will serve as an on-orbit spare. When completed, the TDRSS will have the capability of providing communications coverage over at least 85 percent of low-altitude spacecraft orbits.

The communications satellite measures more than 17.4 m (57 ft.) from one edge of the two attached and extended solar panels to the other. It weighs about 2,268 kg (5,000 lb.) and provides about 1,800 watts of electrical power. The spacecraft's umbrella-like S-band and Ku-band antennas measure 4.9 m (16 ft.) in diameter each.

NASA leases the TDRS system from SPACECOM. The company is under contract to NASA to provide 10 years of service. The two prime subcontractors to Spacecom are TRW Defense & Space Systems Group, Redondo Beach, Calif. and the Harris Government Communications System Div., Melbourne, Fla. (TRW built the spacecraft, the ground segment software and integrated the ground terminal equipment at White Sands, N.M. Harris furnished the ground terminal Equipment and the two single-access antennas.)

Ground Spacecraft Tracking/Data Network (GSTDN)

TDRSS is designed ultimately to replace all but a few of the GSTDN ground stations. However, until the TDRS system is fully operational, GSTDN will remain in place as NASA's primary window for spacecraft communications. The GSTDN stations, 15 in all, can transmit and receive only when a spacecraft is "in view" of the ground station. Depending on the orbital path of the spacecraft, Mission Control may be in touch with the Shuttle as little as 1S percent of each orbit.

During STS-9, the GSTDN will consist of 15 ground stations worldwide managed by Goddard and operated by approximately 2,500 personnel. The stations are equipped with 4.3-, 9-, 12-, and 26 m (14-, 30-, 40-, and 85-ft.) S-band antenna systems and C-band radar systems.

These are augmented by 15 DOD geographical locations providing C-band support and one DOD 18.3-meter (60-feet) S-band antenna system.

In addition, GSTDN will include six major computing interfaces. They are the Network operations Control Center and Operations Support Computing Facility, both at Goddard; facilities at the Western Space and Missile Center, Calif.; the Air Force Satellite Control Facility, Colo.; the White Sands Missile Range, N.M., and the Eastern Space and Missile Center, Fla., providing real-time network computational support.

The network also has agreements with the governments of Australia, Spain, Senegal, Botswana, Chile, the United Kingdom and Bermuda to provide NASA tracking station support to the Space Transportation System program.

The NASA Communications Network (NASCOM), managed by Goddard, provides the voice and data communications links connecting the network. During the flight, Spacelab 1 data flows from the Shuttle orbiter to TDRS-1 which transmits to the TDRSS ground station at White Sands, N.M. The data could also flow from the orbiter to one of the GSTDN stations. In either case, the data is retransmitted to a commercial communications satellite which sends the data to the Spacelab Data Processing Facility and the Johnson Space Center. The Network Control Center at Goddard coordinates all the scheduling activities.

Spacelab Data Processing Facility (SLDPF)

The Spacelab Data Processing Facility (SLDPF) at Goddard is an integral and important component for successful Spacelab 1 support. The facility was developed primarily as a generic system to handle the payload data from Spacelab missions which will be beamed down in voluminous data streams (up to data rates of 50 megabits per second) from as many as 70 or more widely varying scientific experiments. The facility can handle data from the Spacelab missions as well as other attached Shuttle payloads which use the Spacelab onboard data system.

It is divided into two major functional elements: the Spacelab Input Processing System (SIPS) and the Spacelab output Processing System (SOPS). After receiving the digital telemetry data stream, the data is formatted onto computer-compatible tapes. Further processing of the digital data is performed in the SOPS where the data are edited, quality checked, formatted for distribution and recorded onto tapes for shipment to the individual users.

Audio and analog data products, which are Processed in the SIPS, are provided directly to the users. When specifically requested by the user, selected digital tape products may also be obtained from the SIPS.

For Spacelab 1, approximately 60 percent of the experiment data will be shipped directly from the SIPS to ESA's Data Processing Center in Oberpfaffenhofen, Germany within 30 days. other users, mostly scientists in the United States, will receive their data from the SOPS within 60 days after receipt.

The data tapes that go to ESA consist of audio, unedited digital (SIPS tapes) and SOPS ancillary data. ESA will further process the tapes, where necessary, before sending them on to the scientific users in the ESA program.

During the flight, all data is received at Goddard, and at the Johnson Payload operations Control Center (POCC) over the TDRSS/NASCOM/Domsat satellite link.

In addition to its primary real-time function of receiving data, the facility supplements Johnson's role of real-time data quality monitoring. Whereas the POCC can monitor only 4 experiment data streams, the SLDPF monitors all 16 dedicated experiment data streams and the two computer input/output data streams as well as the composite multiplexed stream. Thus, the real-time data quality monitoring function must be closely coordinated between Johnson and the SLDPF over the voice data quality monitoring loop. If requested during the mission, the SLDPF will provide data quality reports to the POCC over voice and/or facsimile transmission machines.

In fulfilling its overall system requirements, the SLDPF interfaces with the Marshall. Johnson and Kennedy centers.

For prelaunch verification Kennedy provides test data for the SLDPF pre-mission Processing and shipment to the users. The Marshall Center levies project requirements upon the SLDPF and supplies pre-mission time-line and format tapes and information essential to mission specific support. Johnson and Marshall coordinate real-time mission support with the SLDPF relating to data quality monitoring and updating of the nominal timelines. After the mission is completed, Johnson also supplies Spacelab and orbiter ancillary data to the SLDPF.

HUNTSVILLE OPERATIONS SUPPORT CENTER

The Huntsville operations Support Center, a facility at the Marshall Space Flight Center, supports powered flight of STS-9 from Kennedy Space Center and Spacelab 1 systems and Payload operations at the Johnson space Center.

During STS-9 pre-mission testing, countdown, launch and powered flight toward orbit, Marshall and contractor engineers will man consoles in the support center to monitor real-time data being transmitted from the Shuttle. - RS

Their purpose is to evaluate and help solve problems that might occur with Marshall-developed Space Shuttle propulsion system elements, including the main engines, external tank and solid rocket boosters. They will also work problems with the overall main propulsion system and range safety system.

As part of the Verification Flight Test (VFT) activities for the Spacelab 1 mission, the support center will closely monitor Spacelab's temperatures, pressures, electrical measurements and onboard computer system during the nine-day flight. This activity includes tracking the functions of the Marshall-developed Induced Environment Contamination Monitor (IRCM) which is located on the pallet.

During the mission, support center scientists and engineers will view onboard crew activities via closed-circuit television, monitor air-to-ground communications and monitor experiment systems computers. If a problem is detected, the appropriate individuals in the Spacelab action center are notified. The information is then relayed via direct communications with their payload control and flight control counterparts in the Payload Operations Control Center and Flight Control Rooms within the Mission Control Center, Houston.

In addition, Marshall and European Space Agency (ESA) scientists and engineers in the support center will monitor real-time data on the "health" of three Spacelab experiments: 1NS002, 1NS003 and 1NT011.

STS AND SPACELAB PROGRAM MANAGEMENT

National Aeronautics and Space Administration

The National Aeronautics and Space Administration (NASA), headquartered in Washington D.C., is the United States Federal Agency responsible for developing advanced aeronautics and space vehicles. NASA research is carried out in the space sciences, life sciences, earth and planetary sciences, astronomy astrophysics, communications, materials processes, aeronautics and technology. NASA was founded in 1958 by an Act of Congress to consolidate all United States aeronautical and space research programs.

NASA Headquarters

James M. Beggs	Administrator
Dr. Hans Mark	Deputy Administrator

The **Office of Space Flight** at NASA Headquarters has overall responsibility for the Space Transportation System, including the Space Shuttle and the Spacelab.

Lt.Gen. James A. Abrahamson	Associate Administrator for Space Flight
Jesse W. Moore	Deputy Associate Administrator for Space Flight
L. Michael Weeks	Deputy Associate Administrator/Technical
Neil B. Hutchinson	Director, Space Shuttle Operations Office
James C. Harrington	Director, Spacelab Division
Robert L. Lohman Chief,	Developments Spacelab Division
Alfred L. Ryan	Chief, Operations, Spacelab Division

The **Office of Space Science and Applications (OSSA)** at NASA Headquarters is responsible for selection of NASA science payloads and development and Operations of all NASA Spacelab loads.

For Spacelab 1 OSSA was also responsible for payload integration and for the management of the payload operations during the mission.

Dr. Burton I. Edelson	Associate Administrator for Space Science and Applications
Samuel W. Keller	Deputy Associate Administrator for Space Science and Applications
Dr. Jeffrey D. Rosendahl	Assistant Associate Administrator for Space Science and Applications (Science)
Michael J. Sander	Director, Spacelab Flight Division
Richard Halperin	Acting Deputy Director, Spacelab Flight Division
Mary Jo Smith	Spacelab 1 Program Manager
Dr. Arnauld Nicogossian, M.D.	Director, Life Sciences Division

The **Office of Space Tracking and Data Systems** at NASA Headquarters is responsible for the operation of the Tracking and Data Relay Satellite System and the Ground Space Tracking and Data Network as well as the Spacelab Data Processing Facility at Goddard Space Flight Center.

Robert O. Aller	Associate Administrator for Space Tracking and Data Systems

Dryden Flight Research Facility (DFRF), Edwards, Calif., is responsible for landing and post-landing operations under the general management of the KSC landing team.

John Manke	Facility Manager
Gary Layton Shuttle	Project Manager

Goddard Space Flight Center (GSFC), Greenbelt, Md. is responsible for receiving, monitoring, processing, and distributing science and engineering data from Spacelab payloads. The center also manages the Tracking and Data Relay Satellite System (TDRSS) and the NASA Communications Network (NASCOM), which provides voice and data communications links between the Spacelab Data Processing Facility and the rest of the Spacelab data network.

Dr. Noel Hinners	Director
John Quann	Deputy Director
Richard Sade	Director of Networks
Gary A. Morse	Network Operations Director
J.M. Stevens	Network Support Manager
William P. Barnes	Head, High Rate Data Handling Section
Ron Browning	Project Manager, TDRSS

Jet Propulsion Laboratory (JPL), Pasadena, Calif., is responsible for the Active Cavity Radiometer (1NA008)

Dr. Lew Allen	Director

Johnson Space Center (JSC), Houston, Texas, is responsible for the development, production and delivery of the Shuttle orbiter. The center is also responsible for all Shuttle flight operations, including Shuttle flight planning, astronaut training, and the control and monitoring of Shuttle flights from lift-off until completion of landing. It is responsible for the Vestibulo-Spinal Reflex Mechanism experiment (1NS104) and the Erythrokinetics Influence of Space Flight experiment (1NS103). Additionally, the center is responsible for managing the Spacelab 4 mission.

Gerald D. Griffin	Director
Robert C. Goetz	Deputy Director
Glynn S. Lunney	Manager, National Space Transportation System Program Office
Arnold D. Aldrich	Manager, Space Shuttle Project Office
Clifford E. Charlesworth	Director, Space operations
Charles Lewis	Lead Flight Director, STS-9
Aaron Cohen	Director, Research and Engineering
William Huffstedtler	JSC Spacelab Mission Division Manager
John O’Loughlin	JSC Spacelab Mission Engineer

Kennedy Space Center (KSC), Fla., is responsible for Shuttle launch and recovery facilities, pre-launch checkout of the Space Shuttle and its payload, and ground turnaround and support operations, including development of Spacelab processing facilities, ground operations management and all launch operations until liftoff.

Richard G. Smith	Director
Thomas E. Utsman	Director, Shuttle Management and Operations
Thomas S. Walton	Director, Cargo Management and Operations
Alfred D. O'Hara	Director, Launch and Landing Operations
Wiley E. Williams	Director, STS Cargo Operations
Eldon Raley	Cargo Manager
James F. Harrington III	STS-9 Flow Director

Marshall Space Flight Center (MSFC), Huntsville, Ala., is responsible for overall management of Spacelab 1. The center is also responsible for managing the development of peripheral Spacelab components necessary for flight; technical and programmatic monitoring of the Spacelab design and development work in Europe; provision of technical expertise to support ESA; and verification flight testing of the Spacelab. The center is also responsible for development, production and delivery of the Space Shuttle main engines, solid rocket boosters and external tank. Additionally, the center is responsible for overall management of the first three Spacelab missions.

Dr. William R. Lucas	Director
Thomas J. Lee	Deputy Director
James E. Kingsbury	Director, Science and Engineering
Robert E. Lindstrom	Manager, Shuttle Projects Office
John W. Thomas	Manager, Spacelab Program Office
James A. Downey III	Managers Spacelab Payload Project Office
Harry G. Craft Jr.	Spacelab 1 Mission Manager
Dr. Charles Chappell	Spacelab 1 Mission Scientist

PROGRAM MANAGEMENT (ESA)

With the ratification of its Convention on Oct. 30, 1980, the European Space Agency (ESA), which de facto came into being in May 1973, acquired its legal existence. The agency groups in a single body the complete range of European space activities previously conducted by the European space Research organization (ESRO) and the European Launcher Development Organization (ELDO) in their respective fields of satellite development and launcher construction.

The 10 founder members of ESA are: Belgium, Denmark, France, Germany, Italy, the Netherlands, Spain, Sweden, Switzerland and the United Kingdom. The Republic of Ireland, although not a member of the previous space organizations, also signed the ESA Convention in December 1975 and is thus now a full member of the agency. Three other states are closely associated with the agency: Austria and Norway have associate member status. and Canada has an agreement for close cooperation.

The agency's purpose, as described in its Convention, is to provide for and to promote, for exclusively peaceful purposes, cooperation among European states in space research and technology, and their space applications, with a view to their being used for scientific purposes and for space applications systems.

The agency's policy-making body is the ESA Council, composed of representatives of the member states. The Council makes decisions on the policy to be followed by the agency, and on scientific, technical, administrative and financial matters, each state having one vote (but none in the ease of an optional program in which it is not participating). The Council has set up a number of subordinate bodies, including the Spacelab Programme Board.

The chief executive and legal representative of the agency is the Director General who is appointed by the Council for a defined period. He is assisted by six directors, responsible for the following directorates: Administration, Applications Programmes, Spacecraft Operations, Scientific Programmes, Space Transportation Systems. And the Technical Directorate.

The ESA Headquarters is located in Paris, France, and has a staff of some 280 people. Its main technical center, ESTEC, the European Space Research and Technology Centre, with a staff of about 780 people, is located at Noordwijk in the Netherlands. Its Space Operations Centre (ESOC) is located at Darmstadt, Federal Republic of Germany, and it has another center (ESRIH) in Frascati, near Rome, Italy, which houses the Information Retrieval Service and the Earthsat Programme office. The agency also has a liaison office in Washington. D.C.

The Spacelab Programme Board and the Spacelab Development and FSLP managerial organization are outlined on the following pages .

European Space Agency

The European Space Agency (ESA) is responsible for the funding, design and development of the Spacelab and for the management of the ESA experiments.

ESA Headquarters, Paris, France, is responsible for overall direction of projects under the overall direction and guidance of the ESA Council. The Council, comprised of members from the 11 Member States (Belgium, Denmark, France, Germany, Italy, the Netherlands, Spain, Switzerland, the United Kingdom, Sweden, Ireland) and two Associate Member States (Austria and Norway), provides overall decisions and major decisions affecting programs.

The Council, in turn, provides policy, direction and guidance for the Industrial Policy Committee, the Science Program Committee, the Administrative and Finance Committee and the Program Boards.

The Industrial Policy Committee provides contract decisions.

The Science Program Committee provides experiment planning in science.

The Administrative and Finance Committee resolves juridical and principle financial questions.

The Program Boards are comprised of boards for Aerosat, Ariane, Communication Satellites, Meteosat and Spacelab.

ESA Spacelab Programme Board

The ESA Spacelab Programme Board is composed of representatives from all member states participating in the Spacelab and FSLP programmes.

Prof. Dr. J. Ortner (Austria)	Chairman
A. Hicks (United Kingdom)	Vice Chairman

Program Board Delegates

Dr. E. Mondre G. Lennkh	Austria
M. Jacob	Belgium
Dr. A. Bahnsen H. Pers	Denmark
A. Perard	France
Dr. G. Greger H. Blaesing	Federal Republic of Germany
Prof. G. Formica Prof. L. G. Napolitano	Italy
R. A. van Welt D. de Hoop	The Netherlands
L. Pueyo	Spain
J.C. Joseph J.P. Ruder	Switzerland
A. Hicks R. Rissone	United Kingdom

The internal ESA organization of the Spacelab Development and FSLP programs, as well as the Industrial organization, are given below:

Overall Management:

Eric Quistgaard	ESA Director General
Michel Bignier	Director, Space Transportation
Jan A. Bijvoet	Spacelab Development Coordination
Dai J. Shapland	Spacelab Utilization

Spacelab Development:

Dr. B. Pfeiffer*	Spacelab Project Manager
F. Longhurst	Spacelab Sustaining Engineering
A. Thirkettle	Manager European Resident Team at KSC
L. Tegman	Produce Assurance and Safety
M. Legg	Project Control
J. Paque	Configuration Data Management
P. Wolf	IPS Development
D. von Eckardstein	Spacelab Follow-on Production
W. Nellessen**	Systems

*Succeeded by G. Altmann as per July 1, 1983.

**Now Manager of Eureca Project.

Spacelab Payload Integration and Coordination in Europe (SPICE):

D. Mullinger	Head, SPICE
A. Dodeck	Engineering
C. Reinhold	Experiment and Crew Activities
C. Nicollier U. Merbold W. Ockels	ESA Science Astronauts

Director General's cabinet members with specific responsibilities in the Spacelab and FSLP programs:

W. Brado	Head of Director General's Cabinet
Col. W. Mellors I. Pryke	ESA Washington office
J. Gomerieux	Public Relations - Press and Publications
M-P. Hubreht	Public Relations - Visuals
J. Arets	International Affairs
K. Barbance	North America Desk

Industrial organization (ERNO-MBB), Bremen, F.R.G. - Status at 1980:

H.E.W. Hoffmann	Technical Director
A. Kutzer	Spacelab Project Manager
W. Bark	Spacelab Software Project Office
S. Gazey	Spacelab Production Program
J. von der Lippe	Spacelab Integration and Testing
W. Sobotta	Spacelab operations
H.J. Pospieszezyk	Spacelab Engineering
Dr. F.W. Boykens*	Commercial Administration and Contract Management
D. Drewke	Project Control

*No longer a member of ERNO-MBB.

R. Schwenke*	Product Assurance
H. Trawiel*	Configuration Management

CONTRACTORS

ESA

Prime Contractor for Spacelab Development:

VFW-Fokker ERNO (now MBB-ERNO), Federal Republic of Germany, Project management, system engineering, product assurance, integration, test operations, crew habitability, igloo thermal control, miscellaneous Spacelab components and services.

Co-Contractors:

AEG Telefunken Industries, Federal Republic of Germany	Electrical power distribution subsystem
Aeritalia, Italy	Module structure environmental and thermal control subsystem, igloo
Bell Telephone Manufacturing Co., Belgium	Electrical systems ground support Equipment
Dornier Systems, Federal Republic of Germany	Instrument pointing system, pointing subsystem, environmental control/life support subsystem
Fokker, The Netherlands	Scientific airlock
British Aerospace, United Kingdom	Pallet structure
Kampsax, Denmark	Computer software
MATRA, France	Command and data management subsystem
SABCA, Sweden	Igloo structure, utility bridge, common Payload support equipment
Sener, Spain	Mechanical ground support equipment

*No longer a member of ERNO-MBB.

Subcontractors:

AEG - Ulm, Federal Republic of Germany	Intercom system and electrical harness
Aeritalia, Italy	Airlock manufacturing and handling equipment
Brunswick, United States	Nitrogen tank assembly
Carleton, United States	Hybrid system, atmospheric control assembly
Brunswick/Celesco, United States	Fire and smoke detector, fire suppression system
Casa, Spain	Mechanical ground support equipment items
CIMSA, France	Computers and software
Compagnie Industrielle, Radio Electronique, Switzerland	Simulators, orbiter interface adapter
Dornier Systems, Federal Republic of Germany	Subsystem computer operating system coding
Draeger, Federal Republic of Germany	Ground support equipment for environmental control life support
Elec. Zentr., Denmark	Pressure decay sensor
ERNO, Federal Republic of Germany	Condensate storage assembly
ETCA, Belgium	Measuring and stimuli equipment
Hamilton Standard, United States	Fan assembly, water separator, CO_2 control, humidity and temperature control assembly, pumps
Instituto Nacional de Technica, Spain	Mechanical ground support equipment, lighting

Martin Marietta, United States	Demultiplexer
Messerschmitt Bolkow Blohm (MBB), Federal Republic of Germany	Multiplexer
Microtecnica, Italy	Thermal control system components, pump package
Nord Micro Elektronix, Federal Republic of Germany	Avionics assembly
Odetics, United States	Digital recorder, mass memory
OKG (later replaced by VFW), Austria	Mechanical ground support equipment, viewport adapter assembly, manifolds, nitrogen shut off valve control
Rovsing, Denmark	Computer software
Standard Electric Lorenz (SEL), Federal Republic of Germany	Remote acquisition units, caution and warning system
Terma, Denmark	Power distribution box
Thomson CSF, France	CRT data display TV monitor
Vereinigte Flugtechnische Werke (VFW), Federal Republic of Germany	Mechanical ground support equipment

Consultants:

McDonnell Douglas and TRW, United States:

NASA

Prime Contractor for Spacelab Support (NASA):

McDonnell Douglas Technical Services Co., Huntsville, Ala., and Kennedy Space Center, Fla.	Integration of Spacelab into Shuttle

Subcontractors:

Brunswick Aerospace, Costa Mesa, Calif.	Smoke detector assemblies in tunnel
Carleton Group, MOOG, Inc., East Aurora, N.Y.	Partial pressure oxygen sensors, oxygen-nitrogen control panel, various assemblies and spares
EMI, United Kingdom	High density ground recorders
Ford Aerospace, Houston, TX	Mission Control Center (Payload Operations Control Center)
General Products, Brownsboro, Ala.	Fabrication of various mechanical parts for NASA provided hardware (e.g., brackets on Module Vertical Access Kit)
Goodyear Aerospace Corp., Akron, Ohio	Flexible sections of Spacelab Transfer Tunnel
Hamilton Standard, Windsor Locks, CT	Water and Freon pump packages and spares for atmosphere revitalization system
HTL K-West, Santa Ana, Calif.	Verification Flight Instrumentation avionics hardware/signal conditioners
IBM, Huntsville, Ala.	Software development and software integration for both experiment and subsystems computers
Intek, Inc., Columbus, Ohio	Water and Freon flow meter
Intergraph Corp., Madison, Ala.	Avionics software

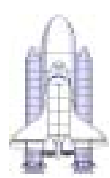
McDonnell Douglas Corp., Huntington Beach, Calif.	Spacelab transfer tunnel
McDonnell Douglas Corp., St. Louis, Mo.	Fabrication of frame for window adapter assembly
MK Associates, Huntsville, Ala.	Engineering/design support for NASA-provided hardware
O. C. Jean and Associates, Huntsville, Ala.	Engineering support
Odetics,. Anaheim, Calif.	High data rate recorder
Rockwell International, Houston, TX	Technical interface
Singer Link Div., Houston, TX	Simulation facilities
Systron Donner, Concord, Calif.	Verification Flight Instrumentation avionics hardware, accelerometers
Teledyne-Brown, Huntsville, Ala.	Technical support
TRW, Huntsville, Ala.	Software
Wyle Laboratories, Huntsville, Ala.	Test support for qualification mechanical parts

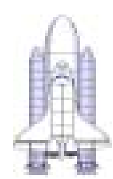
ABBREVIATIONS

DFRF	Dryden Flight Research Facility
ERNO	Entwicklungs Ring Nord (ESA prime contractor)
ESA	European Space Agency
ESRO	European Space Research Organization (ESA predecessor)
ESTEC	European Space Technology Center
FCR	Flight Control Room (within MCC, JSC)
GMT	Greenwich Mean Time
GSFC	Goddard Space Flight Center, Greenbelt, Md.
GSTDN	Ground Spacecraft Tracking/Data Network
JSC	Johnson Space Center, Houston, Texas
JSLWG	Joint Spacelab Working Group
KSC	Kennedy Space Center, Fla.
MCC	Mission Control Center (at JSC, Building 30)
MSFC	Marshall Space Flight Center, Huntsville, Ala.
NASA	National Aeronautics and Space Administration
NASCOM	NASA Communications Network
NCC	Network Control Center (NASCOM control center at GSFC)
POCC	Payload (or Project) Operations Control Center
SLDPF	Spacelab Data Processing Facility (at GSFC)
STDN	Spacecraft Tracking/Data Network
STS	Space Transportation System
TDRS	Tracking/Data Relay Satellite
TDRSS	Tracking/Data Relay Satellite System
VAB	Vehicle Assembly Building (at KSC)

SHUTTLE FLIGHTS AS OF NOVEMBER 1983

8 TOTAL FLIGHTS OF THE SHUTTLE SYSTEM





STS-5 11/11/82 - 11/16/82	
STS-4 06/27/82 - 07/04/82	
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** **(5 flights)**	**OV-099** **Challenger** **(3 flights)**