NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

SPACE SHUTTLE MISSION
STS-51D

PRESS KIT
APRIL 1985

LEASAT 3; ANIK C1

STS-51D INSIGNIA

S85-28989 **--** *The dominant feature of the STS-51D insignia is an orbit formed by a colonial American flag and a space orbiter. The flag in orbit signifies the U.S. presence in space and pre-eminence in manned spaceflight as exemplified by the shuttle. The orbiter flies out of the U.S. flag to indicate that is comes from this country and the American people. The original 13-star flag is used to symbolize a continuity of technical achievement and progress since colonial times. The name Discovery preceding the flag represents the spirit of discovery and exploration of new frontiers which have been a hallmark of American people even before they were formed together as a nation.*

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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CONTACTS

Sarah Keegan
Headquarters, Washington, DC
(Phone: 202/453-8590)

Barbara Selby
Headquarters, Washington, DC
(Phone: 202/453-8400)

Jim Ball
Kennedy Space Center, FL
(Phone: 305/867-2468)

David Alter
Johnson Space Center, Houston, TX
(Phone: 713/483-5111)

Robert Ruhl
Marshall Space Flight Center, Huntsville, AL
(Phone: 205/453-0034)

James Elliott
Goddard Space Flight Center, Greenbelt, MD
(Phone: 302/344-6256)

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TWO SATELLITE DEPLOYMENTS TO HIGHLIGHT 16TH SHUTTLE MISSION

The fourth flight of orbiter Discovery will be highlighted by two satellite deployments when NASA conducts its 16th Space Shuttle mission.

The remanifested mission 51-D is scheduled for liftoff from Pad 39-A at Kennedy Space Center, FL, no earlier than April 12, 1985. Launch window opportunities on that day extend from 8:04 to 8:18 a.m. and from 8:45 to 9 a.m. EST. The 5-day, 78-orbit mission is slated to conclude with a landing on KSC's Shuttle runway.

Mission 51-D was originally set for a March launch and included deployment of the Hughes LEASAT 3 spacecraft and retrieval of NASA's Long Duration Exposure Facility. It was remanifested following the decision to cancel Mission 51-E, which was to have been flown by orbiter Challenger.

The revised 51-D cargo includes the Hughes satellite plus the Canadian communications spacecraft Anik C-1. Other payloads include the Continuous Flow Electrophoresis System, the American Echocardiograph Experiment, two middeck student experiments and two Getaway Special canisters.

Also scheduled to fly are a variety of simple toys intended to demonstrate the unique properties of space flight for elementary and junior high school students.

The 51-D crew consists of Karol J. Bobko, commander; Donald E. Williams, pilot; M. Rhea Seddon, Jeffrey A. Hoffman and S. David Griggs, mission specialists. Bobko served as pilot on STS-6.

Also flying as part of the crew will be payload specialists Charles D. Walker, making his second trip into space to operate the McDonnell Douglas electrophoresis equipment, and E. J. "Jake" Garn, a U.S. Senator from Utah, who will be the first public official to fly aboard the Space Shuttle. Garn is onboard as a Congressional observer.

Garn has completed payload specialist training to carry out numerous medical physiological tests and measurements designed to detect and record changes the body undergoes in weightlessness.

All members of the crew, except Walker, were reassigned from the cancelled 51-E flight.

After liftoff, Discovery will be flown into an elliptical orbit ranging from 244 x 160 nautical miles, inclined 28.5 degrees to the equator.

After achieving orbit, Discovery's crew will open the payload bay doors and begin preparations for deployment of the Canadian satellite. The Anik C-1 spacecraft and its attached upper stage, a McDonnell Douglas Payload Assist Module (PAM), is scheduled to be spring-ejected from the cargo bay as Discovery crosses the equator on the seventh orbit at approximately 9 hours, 38 minutes mission elapsed time (MET).

After a separation burn to move the orbiter to a safe distance from Anik, the crew will observe ignition of the PAM upper stage booster, using the camera on the end of the orbiter's robot arm.

Ignition of the PAM will occur about 45 minutes, or a half an orbit, after deployment and will place the 7,386-pound spacecraft into a highly elliptical transfer orbit with a high point of about 22,300 miles.

Discovery's separation burn also will raise its altitude to 191 by 281 miles in preparation for the LEASAT deployment on the following day.

At a selected apogee, ground controllers will fire another small rocket motor attached to the Canadian spacecraft to circularize the satellite's orbit at geosynchronous altitude.

Also on Discovery's first day in orbit, crewmembers assigned to the American Echocardiograph Experiment (AFE) and the Continuous Flow Electrophoresis System (CFES) will activate their equipment and initiate operations. A checkout of the Shuttle's robot arm also is planned.

During the crew's second day in space, AFE and CFES operations will continue while the flight crew prepares and deploys the LEASAT 3 spacecraft as Discovery crosses the equator on orbit 17.

Deployment will take place about 1 day, 1 hour into the mission. Another separation maneuver will put a safe distance between the orbiter and the satellite prior to perigee kick motor ignition and will place Discovery in a 201-by-283-mile orbit.

About 45 minutes after deployment from the cargo bay, onboard timers will fire LEASAT's perigee kick motor to begin a series of orbital changes which will eventually place it in geosynchronous orbit.

Mission days 3 and 4 will see continuation of the CFES and AFE operations, and medical experiments. Flight day 3 provides backup deploy opportunities for both Anik and LEASAT.

On flight day 5, the astronauts will perform routine tests of orbiter systems in preparation for the spaceship's return to Earth. The crew will check out the primary reaction control system, the hydraulic system, and aerodynamic controls. An on-orbit press conference is also planned.

The final flight day will include student experiments and 11 orbit preparations such as equipment stowage, closing of the payload bay doors and crew preparation for reentry.

A burn of Discovery's orbital maneuvering system engines over the Indian Ocean will initiate the spaceship's reentry to a landing on Kennedy's 15,000-foot Shuttle runway. The deorbit burn is scheduled to occur on orbit 78 at 4 days, 23 hours, 3 minutes MET. Touchdown will come at 5 days, 11 minutes MET, or 8:15 a.m. EST, April 17.

(END OF GENERAL RELEASE; BACKGROUND INFORMATION FOLLOWS.)

51D BRIEFING SCHEDULE

Time (EST)	Briefing	Origin
T-1 Day		
9:00 a.m.	KSC Turnaround Briefing	KSC
9:30 a.m.	Telesat (Anik)	KSC
10:00 a.m.	Continuous Flow Electrophoresis System (CFES)	KSC
10:30 a.m.	MSFC Experiments	KSC
11:00 a.m.	Getaway Specials	KSC
11:30 a.m.	Shuttle Student Involvement Program	KSC
1:30 p.m.	Prelaunch Briefing	KSC
T-Day		
9:15 a.m.	Post Launch Press Conference	KSC
Launch Through End of Mission		
Times announced on NASA Select	Flight Director Change-of-Shift Briefings	JSC
Landing Day		
9:15 a.m.	Post Landing Briefing	KSC

GENERAL INFORMATION

NASA Select Television Transmission

The schedule for television transmissions from Discovery and for the change-of-shift briefings from the Johnson Space Center, Houston, will be available during the mission at the Kennedy Space Center, FL; Marshall Space Flight Center, Huntsville, AL; Johnson Space Center; and NASA Headquarters, Washington, DC. The television schedule will be updated on a daily basis to reflect changes dictated by mission operations.

NASA has leased from RCA Satcom F-1R, Transponder 18 (full transponder), to carry NASA Select television from launch through landing of Shuttle flight 51-D.

Satcom F-1R is located 139 degrees west longitude. Transponder 18 transmits on a frequency of 4060.0 MHz. Operating hours (EST) are:

April 11 (T-1)	8:30 a.m. to 3:30 p.m.
April 12 (Flight Day 1)	4:30 a.m. to 9:30 p.m.
April 13 (Flight Day 2)	8:00 a.m. to 9:30 p.m.
April 14 (Flight Day 3)	9:00 a.m. to 8:30 p.m.
April 15 (Flight Day 4)	10:00 a.m. to 7:30 p.m.
April 16 (Flight Day 5)	8:30 a.m. to 5:30 p.m.
April 17 (Landing Day)	6:00 a.m. to 1:00 p.m.

Special Note to Broadcasters

Beginning April 8, and continuing through the end of the mission, approximately 15 minutes of audio interview material with the crew of 51-D will be available to broadcasters by calling 202/737-6911.

Status Reports

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

Briefings

Flight control personnel will be on 8-hour shifts. Change-of-shift briefings by the off-going flight director will occur at approximately 8-hour intervals.

Transcripts

Transcripts of the change-of-shift briefings will be available at the Shuttle news centers.

SHUTTLE MISSION 51-D -- QUICK LOOK FACTS

Crew:	Karol J. Bobko, Commander Donald E. Williams, Pilot M. Rhea Seddon, Mission Specialist S. David Griggs, Mission Specialist Jeffrey A. Hoffman, Mission Specialist Charles Walker, Payload Specialist E. J. "Jake" Garn, Payload Specialist
Orbiter:	Discovery (OV-103)
Launch Site:	Pad 39-A, Kennedy Space Center, FL
Launch Date:	April 12, 1985
Launch Windows:	14 minutes: 8:04 a.m. to 8:18 a.m. EST 15 minutes: 8:45 a.m. to 9:00 a.m. EST
Orbital Inclination:	28.5 degrees
Altitude:	160 by 244 n. mi. for Telesat deploy 166 by 244 n. mi. for Syncom deploy
Mission Duration:	5 days, 11 minutes
Orbits:	78 full orbits; land on 79th
Landing Date/Time:	April 17; 8:15 a.m. EST
Primary Landing Site:	Kennedy Space Center, FL, Runway 15
Weather Alternate:	Edwards AFB, CA, Runway 17
Payloads:	Synchronous Communications Satellite (Syncom IV-3/(LEASAT 3) Canadian Communications Satellite (Telesat-I/Anik C-1)

Experiments:	American Flight Echocardiograph (AFE)
	Continuous Flow Electrophoresis System (CFES III)
	Student Experiments (2):
	    Statoliths in Corn Root Caps
	    Effects of Weightlessness on Aging of Brain Cells
	Getaway Specials (2):
	    Capillary Pump Loop (CPL)
	    Physics of Solids and Liquids in Zero Gravity
	Educational Experiments (Toys in Space)
	Medical Experiments
	Protein Crystal Growth Experiment
	Phase Partitioning Experiment
	Astronomy Photography Verification Experiment

Highlights:	Deployment of Telesat (Anik) satellite Deployment of Syncom-IV-3 (LEASAT-3) satellite First public official to fly aboard a Space Shuttle

SUMMARY OF MAJOR ACTIVITIES

Flight Day 1

Ascent
SRB Ignition
Pitchover
Max Dynamic Pressure
SRB Separation
Main Engine Cutoff
External Tank Separation
OMS-2
External Tank Tracking at Hawaii

On Orbit
Payload Bay Doors Open
AFE Activities
CFES Activation
TV-Deploy Activities
Telesat Deploy
OMS-3 Sep Maneuver
Sleep

Flight Day 2
Awake
TV-Deploy Activities
Syncom Deploy
OMS-4 Sep Maneuver
CFES Activities
GAS Activities
VTR Playback - Syncom Deploy
GAS Activities
Sleep

Flight Day 3
Awake
CFES Activities
TV Cabin Activities
AFE Activities
Sleep

Flight Day 4
Awake
CFES Activities
TV-Cabin Activities
AFE Activities
Sleep

Flight Day 5
Awake
CFES Activities
RCS Hot Fire Test
TV - Crew Press Conference
GAS Activities
AFE Activities
CFES Deactivation
Sleep

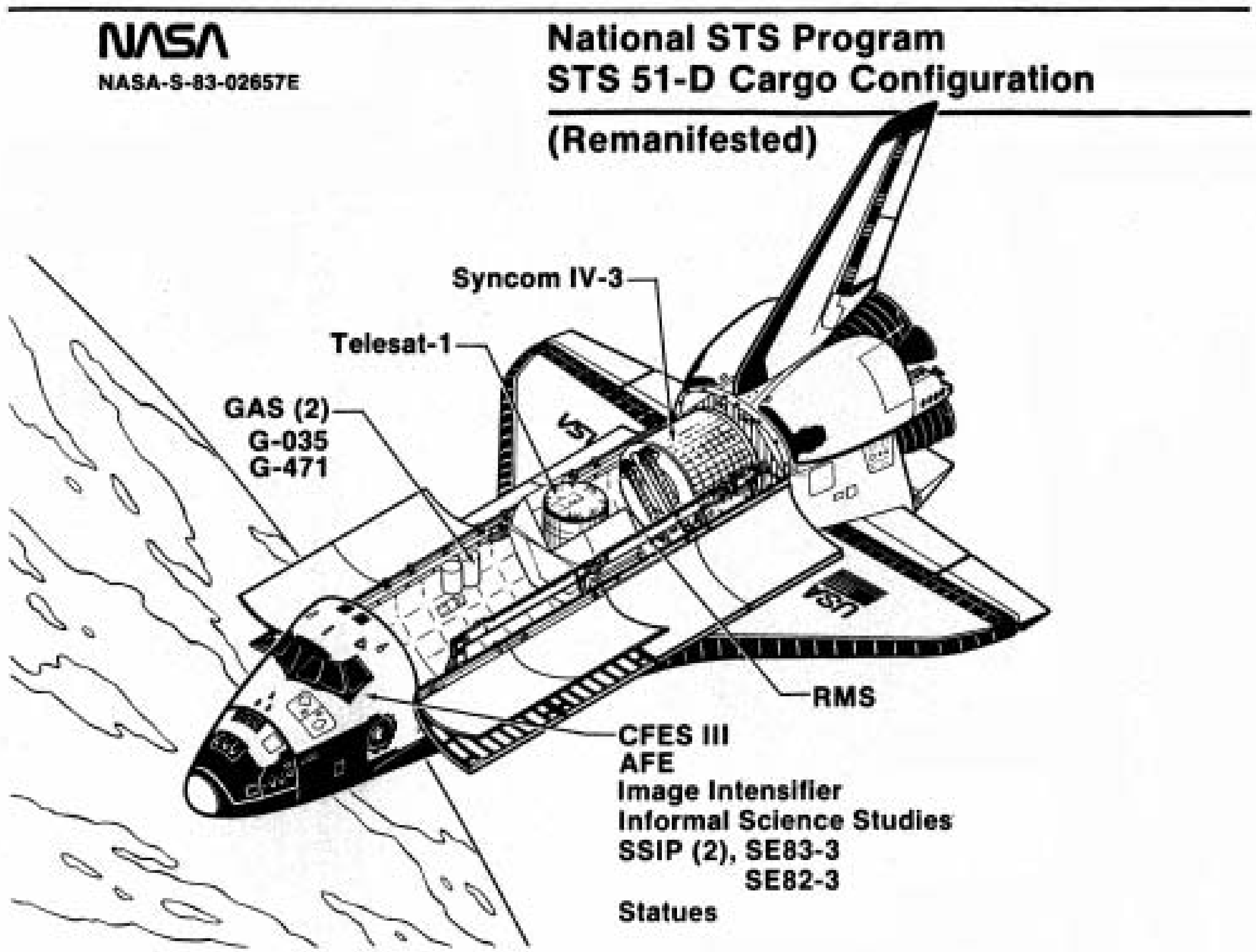
Flight Day 6
Awake
Student Experiments -- Corn Roots
Begin Deorbit Preparation

Descent

Deorbit Burn
Entry Interface
Begin S-Band Blackout
End S-Band Blackout
Entry/TAEM Interface
Landing (KSC Runway 15)

STS-51B TRAJECTORY SEQUENCE OF EVENTS

Event	Orbit	Tig MET (d/h:m)	Burn Duration (min:sec)	Delta V (fps)	Post Burn Apogee/Perigee (n mi)
Launch		0/00:00			
SRB Separation		0/00:02			
Main Engine Cutoff (MECO)		0/00:09			
ET Separation		0/00:09	144	230	244x161
OMS-2		0/00:43			244x159
Deploy Telesat	7	0/09:39			
Separation Burn (OMS-3)		0/09:54	9	11	246x167
Deploy Syncom	17	1/01:00			
Separation Burn (OMS-4)		1/01:15	11	15	244x166
Deorbit Burn	78	4/23:03	266	495	246x175
Entry Interface		4/23:40			
KSC Landing	79	5/00:11 8:15 a.m. EST			



NASA
NASA-S-83-02657E
National STS Program
STS 51-D Cargo Configuration
(Remanifested)
Syncom IV-3
Telesat-1
GAS (2)
G-035
G-471
RMS
CFES III
AFE
Image Intensifier
Informal Science Studies
SSIP (2), SE83-3
SE82-3
Statues

STS 51-D (R) PAYLOAD AND VEHICLE WEIGHTS SUMMARY

	Pounds
Telesat-I (Anik C-1)	7,386
Pallet - Attach Structure	2,406
Syncom-IV-3 (LEASAT-3)	15,190
Pallet - Attach Structure	1,810
American Flight Echocardiograph (AFE)	89
Continuous Flow Electrophoresis System (CFES III)	791
Student Experiments	50
Getaway Specials (2)	876
Total Payload Bay and Middeck Summary	28,747
Orbiter Plus Cargo at Liftoff	248,927
Total Vehicle Stack at Liftoff	4,504,882

LEASAT 3 (SYNCOM IV-3)

LEASAT 3, also known as Syncom IV-3, is the third of four satellites which will be leased by the Department of Defense to replace older FleetSatCom spacecraft for worldwide UHF communications between ships, planes and fixed facilities. A Hughes HS-381 design, LEASAT spacecraft are designed expressly for launch from the Space Shuttle and use the unique "Frisbee" or rollout method of deployment. The first two spacecraft were deployed during the 41-D and 51-A Shuttle missions.

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

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

Another unique feature of the LEASAT series of satellites is no requirement for a separately purchased upper stage, as have all the other communications satellites launched to date from the Shuttle.

The LEASAT satellites contain their own unique upper stage to transfer them from the Shuttle deploy orbit of about 182 mi. to a circular orbit 22,300 mi. over the equator.

Each satellite is 20 ft. long with UHF and omni-directional antennas deployed. Total payload weight in the Shuttle is 17,000 lb. The satellite's weight on station at the beginning of its planned 7-year life will be nearly 7,900 lb. Hughes Space and Communications Group builds the satellites.

Ejection of the spacecraft from the Shuttle is initiated when locking pins at the four contact points are retracted. An explosive device then releases a spring that ejects the space craft in a "Frisbee" motion. This gives the satellite its separation velocity and gyroscopic stability during the 45-minute coast period between deployment and ignition of the perigee kick motor. The satellite separates from the Shuttle at a velocity of about 1.5 feet per second and a spin rate of about 2 rpm.

A series of maneuvers, performed over a period of several days, will be required to place LEASAT into its synchronous orbit over the equator. The process starts 45 minutes after deployment from Discovery with the ignition of the solid propellant perigee motor, identical to that used as the third stage of the Minuteman missile, which will raise the high point of the satellite's orbit to about 9,600 mi.

Two liquid fuel engines that burn hypergolic propellants, monodimethyl hydrazine and nitrogen tetroxide, are used to augment the velocity on successive perigee transits, to circularize the orbit and to align the flight path with the equator. The first of three such maneuvers raises the apogee to 12,300 mi., the second raises the apogee to 16,100 mi. and the third to geosynchronous orbital altitude. At this point the satellite is in a transfer orbit with a 182-mi. perigee and a 22,300-mi. apogee. The final maneuver, again performed by the liquid propellant engines, circularizes the orbit at the apogee altitude.

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

ANIK C-1 (TELESAT-I)

Anik C-1 is owned and operated by Telesat Canada, Ottawa. Anik C-1 is the last of Telesat's trio of 14/12 GHz Anik C satellites. Anik C-1 will be the first satellite placed in final orbit using Telesat's new global tracking antenna system.

Anik C communications satellites are identical, cylindrical, spin-stabilized spacecraft that operate exclusively in the high frequency (14 and 12 GHz) satellite radio bands, with 16 transponders (communications repeaters) each.

Each of these 16 satellite channels is capable of carrying two color TV signals, together with their associated audio and cue and control circuits, for a total TV signal capacity of 32 programs per satellite. Anik C-3 and Anik C-2 are currently carrying Canadian pay television service, educational broadcasting and long distance telephone and data traffic.

Upon launch from the orbiter by springs, the 2,557-lb. satellite will be spinning at about 50 rpm for stability. About 45 minutes later, or one-half Earth orbit, its PAM-D boost motor will be ignited by an onboard timer, kicking the satellite into an approximately 190-by-23,000-mi. elliptical orbit. At a selected high point in that orbit, another, smaller rocket motor inside the satellite will be fired by ground controllers to increase the satellite's speed and circularize the orbit at geosynchronous altitude of roughly 22,300 mi.

Controllers will then properly orient the spacecraft, despin its antenna section to point at Earth, extend the lower skirt to expose additional solar cell banks and begin circuit testing in preparation for commercial use.

Anik C-1 was built for Telesat Canada by Hughes Aircraft Co., Los Angeles, with Spar Aerospace Ltd. and other Canadian companies as subcontractors.

CONTINUOUS FLOW ELECTROPHORESIS SYSTEM

The middeck Continuous Flow Electrophoresis System (CFES) unit will make its sixth spaceflight on mission 51-D. Payload specialist Charles D. Walker, of McDonnell Douglas, will operate the system. This is the second Space Shuttle flight for Walker as a payload specialist.

The primary objectives of the flight are to separate and collect a quantity of protein material and to evaluate contamination control and sample stream dynamics.

McDonnell Douglas expects to process 1.1 liters of concentrated protein material over the course of 3 flight days. On the final flight day, nine separate tests will be conducted to determine the optimum ratio between sample and buffer concentrations.

During the 41-D mission early last fall, the middeck CFES unit separated 83 percent of the concentrated protein material on board. However, post flight assays revealed levels of endotoxin contamination which rendered the hormone unsuitable for animal testing. To prevent a recurrence, stronger sterilizing chemicals will be used preflight to cleanse the middeck unit. Also, procedures have been modified to maintain cooler operating temperatures throughout the course of the mission in an effort to retard bacterial growth.

These changes proved successful in maintaining acceptable levels of sterility during recent CFES flight simulations with the middeck hardware. These simulations were conducted in Florida prior to the hardware's installation onboard the orbiter.

Additionally, the degassing units and sensors which failed during the August mission have been replaced. Software modifications have been made to the system's computer control device to lengthen the unit's response time between commands. Difficulties in the automation software were causing the system to adjust too quickly.

Once each day Walker will test for the presence of microbes and endotoxins. These tests will be made by withdrawing a small sample of fluid from five locations and incubating them in vials which have been loaded previously with freeze-dried reactants.

Although there are no corrective actions possible during flight, this information will be helpful in determining possible sources of contamination.

When the McDonnell Douglas hormone material is returned to St. Louis, it will be stored in a frozen state. A third middeck production flight has been scheduled for later this year. It is hoped that sufficient material will be available from the two flights to allow Ortho Pharmaceuticals, the co-experimenter with McDonnell Douglas, to begin the necessary testing to obtain Food and Drug Administration approval.

Because of delays in producing sufficient test material, McDonnell Douglas-Ortho now believes it will be some time in 1988 before the first product will be available for market.

PROTEIN CRYSTAL GROWTH EXPERIMENT

Detailed knowledge of the composition and structure of proteins is extremely important to the understanding of their nature, chemistry and the ability to manufacture them for medical purposes. However, for most complex proteins, it has not been possible to grow, on Earth, crystals large enough to permit X-ray or neutron diffraction analyses to obtain this information.

A device has been developed by Marshall Space Flight Center, Huntsville, Ala., that should enable the growth of such crystals in the weightlessness of orbital spaceflight where gravity-driven convection currents are minimized, and where the crystals do not sediment but remain suspended while they develop optimum size and conformation.

The first exploratory flight of such equipment involves the use of a small device that will fit within a part of a standard middeck locker. McDonnell Douglas Astronautics has agreed to include this unit in one of the middeck lockers used in conjunction with the flight of the CFES experiment on this flight.

The CFES payload specialist, Charles Walker, has been trained in the preparation of the unit.

A key objective of the overall protein crystal growth program is to enable drug design without the present empirical approach to enzyme engineering and the manufacture of chometherapeutic agents.

The Commercial Development Division of the Office of Commercial Programs and the Microgravity Science and Applications Division of the Office of Space Science and Applications are the program sponsors of the Protein Crystal Growth program. Marshall Space Flight Center is responsible for mission implementation.

SHUTTLE STUDENT INVOLVEMENT PROGRAM

Two Space Shuttle Student Involvement Program experiments will fly aboard Shuttle mission 51-D.

Statoliths in Corn Root Caps

One experiment, proposed by Sean Amberg of Seward, NE., is titled "Statoliths in Corn Root Caps." This experiment will look at the effect of weightlessness on the formation of statoliths (gravity sensing organs) in plants, and will be tested by exposing plants with capped and uncapped roots to space flight. The root caps of the flight and control plants will be examined post-flight by an electron microscope for statolith changes. Amberg's experiment is being sponsored by Martin Marietta Aerospace, Denver.

Effect of Weightlessness on the Aging of Brain Cells

The second student experiment is "The Effect of Weightlessness on the Aging of Brain Cells," proposed by Andrew Fras of Binghamton, NY. This experiment (using houseflies) is expected to show accelerated aging in their brain cells, based on an increased accumulation of age pigment in, and deterioration of, the neurons.

AMERICAN FLIGHT ECHOCARDIOGRAPH

Understanding the effects of weightlessness on the cardiovascular system of astronauts is important for both personal and operational safety reasons. The dynamics of the heart pump action is one possible factor in the adaptation of the cardiovascular system to weightlessness.

Equipment and techniques using very high frequency sound waves have been developed to produce excellent data with respect to proposed mechanisms for cardiovascular responses to space flight. They are safe and non-evasive.

The newly available American Flight Echocardiograph (AFE) instrument will be used to acquire in-flight data on these effects during the course of space adaptation for the purpose of developing optimal counter measures to crew cardiovascular changes (particularly during reentry) and to ensure long-term safety to people living in weightlessness.

The AFE weighs about 43 lb. and will be carried within a standard locker from which it will be operated. One crewmember has been trained in the technique of obtaining clinical grade self-administered echocardiograms, to be taken as soon as possible after orbit insertion, midway through Flight Day 1, and prior to sleep on Day 1. An echocardiogram will then be taken once a day on each remaining flight day.

Echocardiograms may be also obtained on other crewmembers, as time permits. This is the first of at least three flights planned for the AFE.

The Life Sciences Division of NASA's Office of Space Science and Applications is the sponsor of the AFE which was developed by the Johnson Space Center.

GETAWAY SPECIALS

G-0471 - Capillary Pump Loop Experiment (CPL)

The principle that trees and other plants transport water and nutrients from their roots to their leaves may provide designers with answers to temperature control requirements in space stations and other spacecraft.

NASA's Goddard Space Flight Center, Greenbelt, MD, is conducting an experiment on mission 51-D to determine the capability of a system similar to that employed by Mother Nature in the plant kingdom.

The experiment consists of two capillary pump evaporators with heaters and is designed to demonstrate that such a system can be used under zero-gravity conditions of spaceflight to provide thermal control of scientific instruments, advanced orbiting spacecraft and space station components.

The capillary pumps have no moving parts but contain wicks of porous material saturated with fluid. As heat is added to the fluid, it evaporates and travels at nearly a constant temperature from the heat source to a condenser. The difference from the plant system is that the CPL returns the fluid directly to the pumps while the plants return the fluid to roots by condensation of water from clouds in the form of rain.

During the Shuttle flight the experiment will be turned on within 24 hours of launch and continue for at least 60 hours and up to 96 hours, if possible.

Principle investigator for the CPL experiment is Roy McIntosh of the Goddard Space Flight Center.

G-0035 - Physics of Solids and Liquids in Zero Gravity

The Asahi National Broadcasting Co., Ltd., Tokyo, with Kazuo Fujimoto as the payload manager, will conduct two kinds of experiments in weightlessness. The experiment was originally flown on Shuttle mission 41-G in October 1984. However, it was unsuccessful and is being reflown on 51-D after having been repaired.

One experiment is designed to provide clear-cut answers on what happens when a metal or plastic (solid) is allowed to collide with a water ball (liquid) in weightlessness. The behavior of the metal or plastic ball and the water ball after collision will be observed on video systems.

The other experiment is designed to produce five kinds of new materials simultaneously in space. The formation of crystals of three metal alloys and two glass composites in five small electrical furnaces will be observed.

PHASE PARTITIONING EXPERIMENT

Phase partitioning is a selective, yet gentle and inexpensive technique, ideal for the separation of biomedical materials such as cells and proteins. It involves establishing a two-phase system by adding various polymers to a water solution containing the materials to be separated. Two phase systems most familiar to us are oil and water or cream and milk. When two phase polymer systems are established, the biomedical material they contain tend to separate or "partition" into the different phases.

Theoretically, phase partitioning should separate cells with significantly higher resolution than is presently obtained in the laboratory. It is believed that when the phases are emulsified on Earth, the rapid, gravity-driven fluid movements occurring as the phases coalesce tend to randomize the separation process. It is expected that the theoretical capabilities of phase partitioning systems can be more closely approached in the weightlessness of orbital spaceflight where gravitational effects of buoyancy and sedimentation are minimized.

The first exploratory flight of Phase Partitioning Experiment (PPE) equipment involves the use of a small, handheld device, a little larger than a cigarette box and weighing about 1 pound. This unit will fit within a small part of a standard middeck locker. On flight 51-D, it is planned that payload specialist Sen. Jake Garn will conduct this experiment in addition to some investigations in the space adaptation syndrome. The unit has 15 chambers to allow the test of different volume ratios and compositions of the phases and differences in wall coatings with in the chambers.

The Microgravity Science and Applications Division of the Office of Space Science and Applications sponsors the experiment. Marshall Space Flight Center is responsible for mission implementation.

MEDICAL EXPERIMENTS

E. J. "Jake" Garn, a U.S. Senator from Utah, is the first public official to fly aboard the Space Shuttle. Garn is onboard as a payload specialist and Congressional observer. As payload specialist, he will carry out medical physiological tests and measurements.

About half of the tests are being performed in the U.S. space program for the first time, having been deferred from previous missions because of limited crewmember time or moved to 51-D from later flights because of the availability of a test subject.

Tests on Garn will seek to detect and record changes the body undergoes in weightlessness, an ongoing program that began with astronauts on the fourth Shuttle flight.

The first, during launch, has Garn wearing a waist belt with two stethoscope microphones fastened to an elastic bandage. At main engine cutoff, about 8 1/2 minutes into the flight, the belt is plugged into a portable tape recorder stored in the seat flight bag and begins recording bowel sounds to evaluate early inflight changes in gastric mobility.

An electrocardiogram will record electrical heart rhythm in the event of space motion sickness in orbit.

Garn also will be launched with a leg plethysmography stocking to measure leg volume. It will record the shifting of fluids during adaptation to weightlessness.

Blood pressure and heart rate will be recorded in orbit and during entry.

Another test will measure Garn's height and girth in space to determine the amount of growth and change in body shape associated with weightlessness. Space travelers may grow up to 2 inches while weightless.

Whether medication dosage on Earth is adequate in space will be tested with acetaminophen, a non-aspirin pain killer. Garn's saliva will be collected for analysis after each dose.

A non-medical activity planned for Garn is the Phase Partitioning Experiment (PPE) in which fluid mixtures of different densities are photographed to analyze the characteristics of their separation during weightlessness.

TOYS IN SPACE

The 5l-D crew will demonstrate the behavior of simple toys in a weightless environment. The results, recorded and video taped, will become part of a curriculum package for elementary and junior high students through the Houston Museum of Natural Science.

Studies have shown that students can learn physics concepts by watching mechanical systems in action. In an Earth-based classroom, the gravitational field has a constant value of 1-g. Although the gravity force varies greatly throughout the universe and in non-inertial reference frames, students can only experiment in a constant 1-g environment. The filming of simple generic- motion toys in the zero-g environment of the Space Shuttle will enable students of all ages to share a learning experience and discover how the different toy mechanical systems work without gravity.

The following members of the 51-D crew will demonstrate the effects of weightlessness on "dime-store" toys:

- Karol Bobko -- a spinning top and three unrestrained gyroscopes:
- Donald Williams -- a spring-wound flipping mouse and a paddle ball. He will also try to perform a juggling act in zero-g
- Rhea Seddon -- a ball and jacks and a Slinky
- David Griggs -- a yo-yo
- Jeffrey Hoffman -- a Wheelo, magnetic marbles and a spring-wound,

Carolyn Sumners, Director of Astronomy and Physics, Houston Museum of Natural Science, is directing the Toys in Space curriculum program. This program is being funded by a Department of Education grant to the University of Houston. The results of the toy experiments in space will be made available to school districts around the country through the National Diffusion Network.

ASTRONOMY PHOTOGRAPHY VERIFICATION TEST

An experiment to test low light level photographic equipment, in preparation for next year's visit by Halley's Comet, is planned.

Mission specialist Jeffrey A. Hoffman, an astronomer and astrophysicist, will check out an image intensifier coupled with a Nikon camera, a combination that intensifies usable light by a factor of about 10,000.

Originally developed to photograph and study the Shuttle orbiter's skin, Hoffman believes the equipment can be used to observe objects of astronomical interest through the Shuttle's windows.

One of them is Comet Halley when it is closest to the sun late next year. At that time, it will be under its greatest influence of the solar winds and most difficult to observe from the surface of the Earth.

During this mission, Hoffman will photograph objects at various distances from the sun when it is below the horizon, similar to lighting conditions next year when the comet appears.

STS-51D CREWMEMBERS

S85-28647 -- The STS-51D crewmembers are (front row, left to right), Karol J. Bobko, crew commander; Donald E. Williams, pilot; Rhea Seddon and Jeffrey A. Hoffman, mission specialists; and (back row) S. David Griggs, mission specialists; and Charles D. Walker and U.S. Senator Jake Garn (R. Utah) both payload specialists.

PHOTO CREDIT: NASA or National Aeronautics and Space Administration.

BIOGRAPHICAL DATA

KAROL J. BOBKO, 47, Colonel, USAF, commands the mission. Born in New York City, he became a NASA astronaut in 1969.

Bobko was pilot for STS-6, launched from Kennedy Space Center, FL, April 4, 1983. During this maiden voyage of the spacecraft Challenger, the crew deployed a communications satellite (TDRS).

Bobko was a crew member on the Skylab Medical Experiments Altitude Test (SMEAT), a 56-day ground simulation of the Skylab Mission, enabling crewmen to collect medical experiments baseline data and evaluate equipment, operations and procedures.

A graduate of the Air Force Academy in 1959, Bobko received a bachelor of science degree. He earned a master of science degree in aerospace engineering from the University of Southern California in 1970. Bobko has logged more than 5,600 hours in fighter, trainer and other aircraft.

DONALD E. WILLIAMS, 42, Commander, USN, pilot, will make his first flight on 51-D. A native of Lafayette, IN, he was graduated from Purdue University in 1964 with a bachelor of science degree in mechanical engineering.

Commissioned through the NROTC program at Purdue, he was fighter pilot and flight instructor, and made four Vietnam deployments aboard the USS Enterprise, completing a total 330 combat missions. He has logged more than 4,000 hours flying time, including 3,800 in jets and 745 carrier landings.

Williams became a NASA astronaut in 1978. He worked as test pilot in the Shuttle Avionics Integration Laboratory at JSC and also participated in Orbiter test, checkout, launch and landing operations at the Kennedy Space Center. He was Deputy Manager of Operations Integration of the National Space Transportation System Program Office at the Johnson Space Center until his selection as pilot for mission 51-D.

M. RHEA SEDDON, 37, MD, a native of Murfreesboro, TN, is one of three mission specialists. Selected as a NASA astronaut in 1978, she will make her first space flight on 51-D.

At NASA, Seddon's work has touched on a variety of areas including orbiter and payload software, avionics, flight data file, the Shuttle medical kit and checklist, and serving as launch and landing rescue helicopter physician.

Seddon received a bachelor of arts degree in physiology from the University of California, Berkeley, and a doctorate of medicine from the University of Tennessee.

BIOGRAPHICAL DATA

S. DAVID GRIGGS, 45, Captain, USNR, is a mission specialist. He became an astronaut in 1978. He will make his first flight in space on mission 51-D. A native of Portland, Ore., Griggs received a bachelor of science degree from the U.S. Naval Academy in 1962 and master of science in administration from George Washington University in 1970.

A research pilot at the Johnson Space Center since 1970, he was project pilot for the Shuttle Trainer Aircraft which he helped design, develop and test.

Griggs became Chief of the Shuttle Training Aircraft Operations Office in 1976, a post he held until his selection as an astronaut candidate. Special honors include the Navy Distinguished Flying Cross, 15 Air Medals and three Navy Commendation Medals. He has logged 7,500 hours flying time -- 6,500 in jet aircraft.

JEFFREY A. HOFFMAN, 40, PhD, a mission specialist, will make his first space flight on 51-D. An astronaut since 1978, Hoffman worked in the Flight Simulation Laboratory at Rockwell International in Downey, CA, testing guidance, navigation and flight control systems during preparations for Shuttle orbital flight tests.

Born in Scarsdale, NY, Hoffman received a bachelor of arts degree in astronomy from Amherst College and a doctor of philosophy in astrophysics from Harvard.

Hoffman's research interests are in high-energy astrophysics -- cosmic gamma ray and X-ray astronomy. His doctoral work at Harvard was the design, construction, testing and flight of a balloon-borne, low-energy gamma ray telescope. Hoffman has been named as a mission specialist for another Space Shuttle flight in March of 1986.

CHARLES D. WALKER, 36, is one of two payload specialists. He is chief test engineer for the McDonnell Douglas Electrophoresis Operations in Space project.

Walker will operate the materials processing equipment, a project aimed at separating large quantities of biological materials in space for ultimate use in new pharmaceuticals.

Walker was graduated from Purdue University in 1971 with a bachelor of science degree in aeronautical and astronautical engineering. Prior to joining McDonnell Douglas, he was project engineer responsible for computer-based manufacturing process controls and design of ordnance production equipment at the Naval Sea Systems Command Engineering Center, Crane, IN. Walker flew as payload specialist on mission 41-D, operating the materials processing equipment.

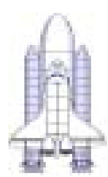
E. J. "JAKE" GARN, 52, U.S. Senator, is a payload specialist. A native of Richfield, Utah, Garn will take part in medical tests and carry out other tasks designated by NASA. He is the first public official to fly aboard the Space Shuttle.

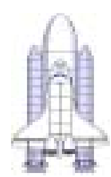
Garn was graduated from the University of Utah with a bachelor of science degree in business and finance. A former insurance executive, he served as a pilot in the U.S. Navy. He has flown more than 10,000 hours in military and civilian aircraft.

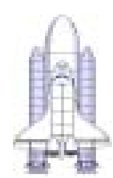
Prior to election to the U.S. Senate in 1974, he served on the Salt Lake City Commission for 4 years and was elected mayor in 1971. He was elected to a second term in the Senate in 1980. Garn has been associated with NASA programs for more than 10 years. He was a member of the Aeronautics and Space Committee during his first 2 years in the Senate, and for the past 4 years has been chairman of the HUD and Independent Agencies Sub committee, which provides funding for NASA programs.

SHUTTLE FLIGHTS AS OF APRIL 1985

15 TOTAL FLIGHTS OF THE SHUTTLE SYSTEM







OV-102 Columbia (6 flights)	**OV-099 Challenger (6 flights)**	**OV-103 Discovery (3 flights)**
STS-9 11/28/83 - 12/08/83	STS-41G 10/05/84 - 10/13/84	
STS-5 11/11/82 - 11/16/82	STS-41C 04/06/84 - 04/13/84	
STS-4 06/27/82 - 07/04/82	STS-41B 02/03/84 - 02/11/84	
STS-3 03/22/82 - 03/30/82	STS-8 08/30/83 - 09/05/83	STS-51C 01/24/85 - 01/27/85
STS-2 11/12/81 - 11/14/81	STS-7 06/18/83 - 06/24/83	STS-51A 11/08/84 - 11/16/84
STS-1 04/12/81 - 04/14/81	STS-6 04/04/83 - 04/09/83	STS-41D 08/30/84 - 09/05/84