Original STS-1 press kit cover artwork

This water color of the Space Shuttle Orbiter Enterprise by Nicholas Solovioff was done as part of NASA's art program through which nationally known artists are invited to document pictorially major NASA activities for an archival history of the exploration of space.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

SPACE SHUTTLE MISSION
STS-1

PRESS KIT
APRIL 1981

FIRST SPACE SHUTTLE ORBITAL FLIGHT TEST (OFT-1)
FIRST FLIGHT OF COLUMBIA

STS-1 INSIGNIA

S79-30685 -- *This is the official insignia for the first space shuttle orbital flight test. The crew of the 102 Columbia on STS-1 will be Astronauts John W. Young, commander, and Robert L. Crippen, pilot. The art work was done by artist Robert McCall.*

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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COLUMBIA'S FIRST FLIGHT SHAKES DOWN SPACE TRANSPORTATION SYSTEM

The Space Shuttle orbiter Columbia, first in a planned fleet of spacecraft in the nation's Space Transportation System, will liftoff on its first orbital shakedown flight in April 1981. Launch will be no earlier than 45 minutes after sunrise from the NASA Kennedy Space Center Launch Complex 39A.

Crew for the first orbital flight will be John W. Young, commander, veteran of two Gemini and two Apollo space flights, and U.S. Navy Capt. Robert L. Crippen, pilot. Crippen has not flown in space.

Columbia will have no payloads in the payload bay on this first orbital flight, but will carry instrumentation for measuring orbiter systems performance in space and during its glide through the atmosphere to a landing after 54 1/2 hours.

Extensive testing of orbiter systems, including the space radiators and other heat rejection systems, fills most of the STS-1 mission timeline. The clamshell-like doors on Columbia's 4.6 by 18-meter (15 by 60-foot) payload bay will be opened and closed twice during the flight for testing door actuators and latch mechanisms in the space environment.

Other tests will measure performance of maneuvering and attitude thrusters, the Columbia's computer array and avionics "black boxes," and, during entry, silica-tile heatshield temperatures.

The first of four engineering test flights, STS-1, will be launched into a 40.3 degree inclination orbit circularized first at 241 kilometers (130 nautical miles) and later boosted to 278 km (150 nm). Columbia will be used in these four test flights in proving the combined booster and orbiter combination before the Space Transportation System becomes operational with STS-5, now forecast for launch in September 1982.

After "tower clear" the launch team in the Kennedy Space Center Firing Room will hand over STS-1 control to flight controllers in the Mission Control Center, Houston, for the remainder of the flight.

Columbia's two orbital maneuvering system hypergolic engines will fire at approximately 53 1/2 hours over the Indian ocean to bring the spacecraft to a landing on Rogers Dry Lake at Edwards Air Force Base, Calif., an hour later. The approach to landing will cross the California coast near Big Sur at 42,670 m (140,000 ft.) altitude, pass over Bakersfield and Mojave, and end with a sweeping 225-degree left turn onto final approach.

Young and Crippen will land Columbia manually on this first test flight. A microwave landing system on the ground will be the primary landing aid in subsequent flights, with optional manual takeover. Kennedy landing teams will remove the flight crew and "safe" the orbiter after landing.

The first three test flights land on Rogers Dry Lake, the fourth on the main runway at Edwards Air Force Base, and STS-5 will land on the 4,570-m (15,000-ft.) concrete Shuttle Landing Facility runway at Kennedy Space Center.

STS-1 will be the first manned flight using solid rocket boosters. No previous U.S. space vehicle has been manned on its maiden flight.

(END OF GENERAL RELEASE; BACKGROUND INFORMATION FOLLOWS.)

Note: Technical descriptions of orbiter and booster structures and systems are in the Space Shuttle News Reference book mailed to correspondents accredited to cover STS-1. Mission press kits will contain information on payloads, timelines, flight crew and other details peculiar to each flight.

STS-1 OBJECTIVES: PROVING THE SYSTEM

STS-1 and the three flights following are engineering test flights to prove out the Shuttle system in launch, orbital and landing operations. As the first manned orbital flight, STS-l's flight profile has been designed to minimize structural and operational loads on the spacecraft and its boosters. orbiter Columbia's cargo bay will be bare for this first test flight except for a data collection and recording package called developmental flight instrumentation (DPI) and an aerodynamic coefficient identification package (ACIP).

The data collection package consists of three magnetic tape recorders, wideband frequency division multiplexers, a pulse code modulation master unit and signal conditioners. The recorders can record 28 tracks of wideband analog data on systems conditions and performance simultaneously. This package will be removed after STS-4 from Columbia's cargo bay, where it is mounted at fuselage station 1069. The aerodynamic package is described under the "orbital Experiments Program."

A lengthy list of flight test objectives, detailed test objectives and two categories of supplementary objectives spell out what information is sought from STS-1, ranging from thermal responses to systems performance.

The basic STS-1 flight objective is to demonstrate safe launch into orbit and return to landing of Columbia and its crew. Secondarily, the flight will verify the combined performance of the entire Shuttle vehicle -- orbiter, solid rocket boosters, external tank -- up through separation and retrieval of the spent solid rocket boosters. The flight will also gather data on the combined vehicle's aerodynamic and structural responses to the stress of launch. At mission end, similar data will be gathered on orbiter energy characteristics, such as crossrange steering capabilities, structural loads on entry, and performance of silica-tile thermal protection system.

A major portion of the flight and detailed test objectives is aimed toward wringing out orbiter hardware systems and their operating computer software, and toward measuring the overall orbiter thermal response while in orbit with payload doors opened and closed. Still other test objectives evaluate orbiter's attitude and maneuvering thruster systems and the spacecraft's guidance and navigation system performance.

ORBITER EXPERIMENTS PROGRAM

A complete and accurate assessment of Shuttle performance during the launch, boost, orbit, atmospheric entry and landing phases of a mission requires precise data collection to document the Shuttle's response to these conditions.

The office of Aeronautics and Space Technology, through its orbiter Experiments Program, is providing research-dedicated experiments on board the Shuttle orbiter to record specific, research-quality data. This data will be used to verify the accuracy of wind tunnel and other ground-based simulations made prior to flight; to verify ground-to-flight extrapolation methods; and to verify theoretical computational methods. The data will also be useful to the office of Space Transportation Systems in their efforts to further certify the Shuttle and expand its operational envelope.

The prime objective of the these experiments is to increase the technology reservoir for development of future (21st century) space transportation systems such as single-stage-to-orbit, heavylift launch vehicles and orbital transfer vehicles that could deploy and service large, automated, man-tended, multi-functional satellite platforms and a manned, permanent facility in Earth orbit.

The orbiter Experiments Program experiments include:

- ACIP - Aerodynamic Coefficient Identification Package;
- SEADS - Shuttle Entry Air Data System;

- SUMS - Shuttle Upper Atmospheric Mass Spectrometer;
- TFI - Technology Flight Instrumentation;
- DATE - Dynamic, Acoustic and Thermal Environment Experiment;
- IRIS - Infrared Imagery of Shuttle;
- SILTS - Shuttle Infrared Leeside Temperature Sensing;
- TGH - Tile Gap Heating Effects Experiment;
- CSE - Catalytic Surface Effects.

Aerodynamic Coefficient Identification Package and Infrared Imagery of Shuttle are the experiments which will obtain data during the STS-1 mission.

ACIP - Aerodynamic Coefficient Identification Package

The Shuttle orbiter presents an unprecedented and continuing opportunity to obtain full-scale flight data for an aircraft-type reentry vehicle throughout the complete aerodynamic regime.

The primary objectives of ACIP are:

- To collect aerodynamic data during the launch, entry and landing phases of the Shuttle;
- To establish an extensive aerodynamic data base for verification of and correlation with ground-based test data, including assessments of the uncertainties in such data:
- To provide flight dynamics data in support of other technology areas, such as aerothermal and structural dynamics.

The Aerodynamic Coefficient Identification Package incorporates three triads of instruments: one of dual-range linear accelerometers; one of angular accelerometers; and one of rate gyros. Also included in this package are the power conditioner for the gyros, the power control systems and the housekeeping components. The package will be installed co-linearly with the geometric axes of the orbiter and post-installation measurements will be made to establish the position within 1O arc minutes. The instruments continuously sense the dynamic X, Y and Z attitudes and performance characteristics of the orbiter through these critical flight phases. In addition, the package receives orbiter control surface position data and converts these into higher orders of precision before recording them with the attitude data. Aerodynamic Coefficient Identification Package Principal Technologist is D. B. Howes, Johnson Space Center.

IRIS - Infrared Imagery of Shuttle

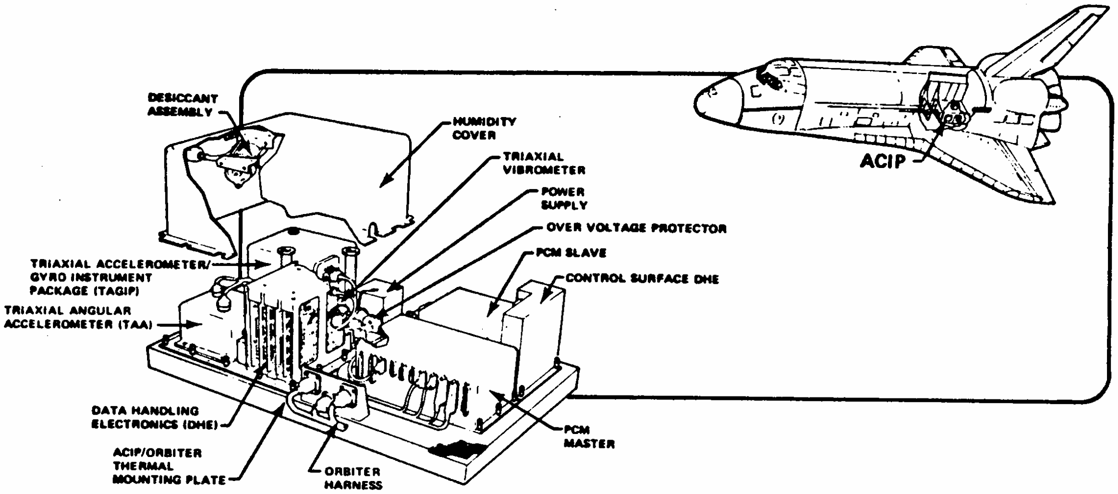
The objective is to obtain high-resolution infrared imagery of the orbiter lower (windward) and side surfaces during entry from which surface temperatures and hence aerodynamic heating may be inferred. The imagery will be obtained using a 91.5 centimeter (36-inch) telescope mounted in the NASA C-141 Gerald P. Kuiper Airborne observatory positioned appropriately at an altitude of 13,716 m (45,000 ft.) along the entry ground track of the orbiter. A single image will be obtained during each flight.

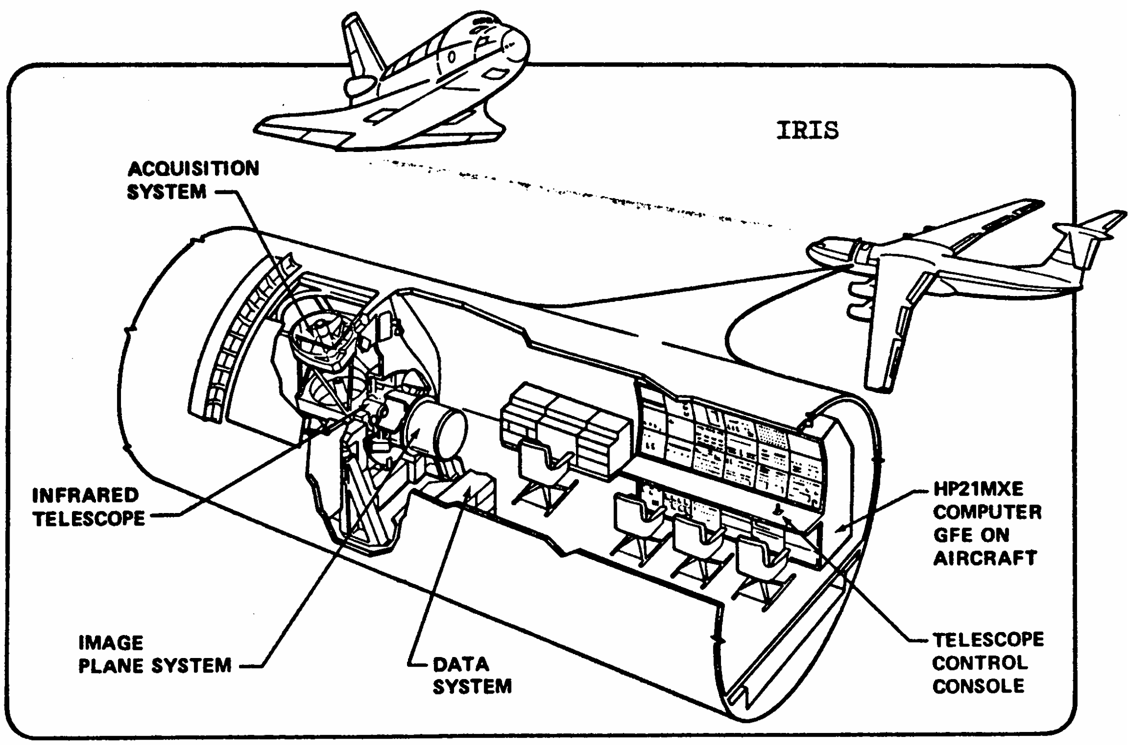
The primary technology objective is to decrease the current level of uncertainty associated with various entry aerothermodynamic phenomena that affect the thermal protection system design. The phenomena include boundary layer transition, flow separation and reattachment, flow/surface interactions, and surface catalyses to flow chemistry. These data will provide for improved computational procedures and lead to the development of advanced thermal protection systems.

The Infrared Imagery of Shuttle system consists of the C-141 aircraft and its optical system, a 6-cm (2.36-in.) aperture acquisition telescope focal plane system with detector array, and a high-speed data handling and storage system. To conduct the observations, the aircraft will operate from Hickam Air Force Base, Hawaii. The aircraft will be stationed along the orbiter entry ground track about one hour prior to reentry. As the orbiter passes through the field of view of the telescope, the orbiter windward or side surface will be observed by the detector system and the data recorded on tape.

After the flight, these data will be supplemented by orbiter-derived data of velocity, altitude, angle-of-attack, yaw and roll conditions existing during the period of observation by the Infrared Imagery of Shuttle.

Analysis of these data involves computer arrangement of data into a two-dimensional image format, radiometric analysis and detailed comparisons of the aerodynamic heating rates with analytical predictions and ground-based experimental data. Infrared Imagery of Shuttle Principal Technologist is B. L. Swenson, Ames Research Center.


DESICCANT ASSEMBLY
HUMIDITY COVER
TRIAXIAL VIBROMETER
POWER SUPPLY
OVER VOLTAGE PROTECTOR
PCM SLAVE
CONTROL SURFACE DHE
TRIAXIAL ACCELEROMETER/ GYRO INSTRUMENT PACKAGE (TAGIP)
TRIAXIAL ANGULAR ACCELEROMETER (TAA)
DATA HANDLING ELECTRONICS (DHE)
ACIP/ORBITER THERMAL MOUNTING PLATE
ORBITER HARNESS
PCM MASTER
ACIP


IRIS
ACQUISITION SYSTEM
INFRARED TELESCOPE
IMAGE PLANE SYSTEM
DATA SYSTEM
HP21MXE COMPUTER GFE ON AIRCRAFT
TELESCOPE CONTROL CONSOLE

LAUNCH PREPARATIONS, COUNTDOWN AND LIFTOFF

Assembly of the Space Shuttle "stack" for the STS-1 mission began in December 1979, and January 1980, with the erection of the twin solid rocket boosters on a mobile launcher platform in the Kennedy Space Center Vehicle Assembly Building's High Bay 3.

The Space Shuttle orbiter Columbia arrived at Kennedy Space Center from Dryden Flight Research Center in California aboard the 747 Shuttle Carrier Aircraft on March 24, 1979, and was immediately moved into the orbiter Processing Facility for systems checkout and the completion of installing its thermal protection system.

The external tank arrived at Kennedy by barge from the Michoud Assembly Facility in New Orleans, La., in July 1979, and underwent processing in the Vehicle Assembly Building's High Bay 4.

The tank was mated with the solid rocket boosters on the mobile launcher platform in early November 1980.

The Columbia was moved from the orbiter Processing Facility on Nov. 24, 1980, to the adjacent Vehicle Assembly Building where it was mated with the external tank and solid rocket boosters to complete the space vehicle for the STS-1 mission.

The Shuttle Interface Test was conducted in the Vehicle Assembly Building in December to checkout the mechanical and electrical connections between the various elements and the functioning of onboard flight systems.

The assembled Space Shuttle aboard its mobile launcher platform was moved the 5.6 km (3.5 mi.) from the Vehicle Assembly Building to Pad A on Dec. 29, 1980, to undergo final processing for launch.

Pad/flight vehicle interfaces were validated during January and a further series of tests led to the wet (or fueled) Countdown Demonstration Test which culminated in the successful 20-second Flight Readiness Firing of Columbia's three main engines on Feb. 20, 1981.

Upon the conclusion of the readiness firing, steps were taken to repair a small portion of the external tank's super light ablator insulation which became debonded during a tanking test of the orbiter's supercold liquid oxygen and liquid hydrogen propellants in January.

Major tests conducted during March included the Launch Readiness Verification runs in which flight and landing events were simulated and a "dry" Countdown Demonstration Test. The latter test was a dress rehearsal for launch in which prime crew astronauts John Young and Bob Crippen went through a countdown and simulated liftoff. The dry demonstration test differed from the wet one in that the Shuttle's external tank was not loaded with the orbiter's liquid hydrogen and liquid oxygen propellants and did not include a test firing of the orbiter's engines.

The completion of the dry Countdown Demonstration Test and other major tests cleared the way for countdown and launch.

The countdown for the STS-1 mission will be conducted in Firing Room 1 of the Complex 39 Launch Control Center by a government/industry launch team of about 200.

The STS-1 pre-count will be picked up at the T-73-hour mark and includes a number of built-in holds. The hypergolic propellants for the orbiter's orbital maneuvering and reaction control systems were loaded aboard prior to the wet Countdown Demonstration Test/Flight Readiness Firing. They were not de-tanked after the test and it will not be necessary to service these systems during the countdown.
The hydrazine-fueled auxiliary power units aboard Columbia and the solid rocket boosters' hydraulic power units will be serviced prior to the beginning of the STS-1 pre-count.

Among the early pre-count activities are powering up the Shuttle vehicle, pressurizing the orbital Maneuvering System and Reaction Control System propellant tanks, software loading of the orbiter's general purpose computer's mass memory units, battery connections and range safety checks and servicing the fuel cells with liquid oxygen and liquid hydrogen.

Among the major functions in the launch countdown are:

Count Time	Functions
T-15 hours	Retract external tank intertank access arm.
T-14 hrs	Start retraction of rotating service structure. Task completed by T-12 hours.
T-8 hrs	Lower vent hood (beanie cap) of external tank gaseous oxygen vent over nose cone of external tank.
T-7 hrs	Start clearing pad for countdown. Clearing completed by T-5 hours.
T-5 hrs	Begin countdown.
T-4 hrs, 30 min	Begin chilldown of liquid oxygen transfer system.
T-4 hrs, 20 min	Begin chilldown of liquid hydrogen transfer system. Begin liquid oxygen fill of external tank.
T-4 hrs, 10 min	Begin liquid hydrogen fill of external tank.
T-2 hrs, 15 min	Wake up flight crew.
T-2 hrs, 4 min	Two-hour built-in hold. External tank loading complete. External tank ice inspection and evaluation will be performed during this hold. Crew will also leave operations and Checkout Building for pad during hold.
T-1 hr, 50 min	Crew entry begins.
T-1 hr, 25 min	Crew entry complete.
T-20 min	20-minute built-in hold.
T-9 min	10-minute built-in hold.
T-9 min	Go for launch. Start launch processing system ground launch sequencer (automatic sequence).
T-7 min, 5 sec	Start orbiter access arm retraction (Fixed Service Structure). Retraction completed by T-4 min, 55 sec.
T-5 min	Start orbiter auxiliary power units.
T-3 min, 45 sec	Run orbiter aero surfaces profile.
T-3 min, 30 sec	orbiter placed on internal power.
T-3 min, 10 sec	Run gimbal slew profile, Space Shuttle main engines.
T-2 min, 55 sec	External tank liquid oxygen to flight pressure.
T-2 min, 50 sec	Start retraction of external tank gaseous oxygen vent arm.
T-1 min, 57 sec	External tank liquid hydrogen to flight pressure.
T-25 sec	Solid rocket booster hydraulic power units activated. orbiter onboard general purpose computer assumes control of terminal countdown. Ground launch sequencer remains on line supporting and monitoring launch commit criteria redlines.
T-18 sec	Verify solid rocket booster nozzle positions.
T-11 sec	Initiate pre-liftoff sound suppression system water.
T-3.8 sec	Main engine start sequence command.
T+0.24 sec	All engines at 90 percent thrust.
T+2.88 sec	External tank umbilical retracted. solid rocket boosters are ignited and holddown posts are released. Post-liftoff sound suppression water ("rainbirds") initiated.
T-0	LIFTOFF (Mission elapsed time begins with liftoff.)

PROFILE TO ORBIT

STS-1 will be launched from Pad A at the Kennedy Space Center's Launch Complex 39 no earlier than the week of April 5, 1981. Launch windows open at local sunrise plus 45 minutes and are more than 6 hours in duration.

Among the key considerations in establishing the launch windows are lighting conditions which will permit engineering photographic documentation at the launch site, provide adequate lighting for a landing at the Northrup Strip at the White Sands Missile Range, N.M., in the event of an Abort once Around, and provide for adequate lighting for a landing at the end of the nominal mission at the Dryden Flight Research Center, Edwards Air Force Base, Calif.

Windows for the week of April 5, which are about one minute earlier each day, are as follows:

Window Open (EST)	**Duration (Hours)**
April 5 0653	6.5
April 6 0652	6.6
April 7 0651	6.6
April 8 0650	6.6
April 9 0649	6.6

STS-1 will be launched on a relative flight azimuth varying from 58 to 66 degrees east of north between liftoff, solid rocket booster jettison and main engine cutoff. The orbit at Space Shuttle main engine cutoff will have a relative azimuth (heading) of 66 degrees east of north and be inclined 40.3 degrees to the equator.

The table below illustrates the time, altitude, relative velocity and downrange distance for the major events in the flight ascent profile. The solid rocket boosters, jettisoned 2 minutes, 12 seconds, after liftoff will impact in the Atlantic ocean 5 minutes, 11 seconds, after separation at a downrange distance of approximately 256 km (160 mi.).

The external tank, jettisoned 8 minutes, 51 seconds after liftoff, will be on a suborbital trajectory that results in an impact location in the Indian Ocean.

SPACE SHUTTLE LAUNCH EVENTS

Event	**Time (mm:ss)**	**Alt (km)**	**Alt (mi)**	**Rel Vel (km/hr)**	**Rel Vel (mph)**	**Range (km)**	**Range (mi)**
SSME	- 00:03.46	0	0	0	0	0	0
SSMEs at 90 percent thrust	+00:00.24	0	0	0	0	0	0
SRB ignition/holddown bolts triggered	+00:02.64	0	0	0	0	0	0
LIFTOFF (see note)	+00:00.00	0	0	0	0	0	0
Clear tower	+00:06	106 a	347 b	120	75	0	0
Begin pitchover	+00:08	137 a	400 b	123	77	0	0
SRB separation	+02:12	49.7	30.8	4,625	2,891	48	30
Main engine cutoff	+08:32	118.5	73.6	26,715	16,697	1,363	852
External tank jettisoned	+08:51	118.7	74.2	26,710	16,694	1,472	920

NOTE: Clock for Mission Elapsed Time reverts to 0 at liftoff. (a = Meters; b = Feet)

FLIGHT PROFILE

During the second orbit Columbia's payload bay doors will be opened, and the space radiators will take over the job of dumping systems and metabolic heat into space. Except for lining up for an orbital Maneuvering System burn or inertial platform alignment, Columbia will spend most of its first flight with her topside and open payload bay doors facing Earth. Much of the engineering data expected from STS-1 are measurements of how well orbiter thermal loads are handled by the space radiators, flash evaporators and ammonia boiler heat rejection systems.

Young and Crippen will remove their escape pressure suits three and a half hours after launch, and except for a suit donning/doffing checkout early in the second day of flight, will wear the two-piece flight coveralls until again donning pressure suits four hours before entry and landing.

A carry-on food warmer will be used for the first several flights until the orbiter galley is installed. The STS-1 crew will sleep in their flight deck seats rather than in sleep restraints on the lower deck planned for later flights. Flight plan updates will be uplinked by Mission Control Center, Houston, to a teleprinter aboard Columbia.

In addition to extensive orbiter systems tests and performance measurements planned for STS-1, Columbia's ability to hold attitude will be tested several times during the flight. Steady attitude control will be essential for operating many planned scientific experiments that require accurate pointing, and for future rendezvous with other space vehicles.

Columbia's payload bay doors will be closed about four hours prior to landing. A 91-meter-per-second (299-feet-per-second) orbital Maneuvering System retrograde deorbit burn at 2 days, 5 hours, 28 minutes over the Indian ocean will bring Columbia to a landing an hour later on the hard-packed sand of Rogers Dry Lake at Edwards Air Force Base, Calif. Columbia will touch down at 185 knots (213 mph) with a vertical sink rate of .23 m/s (2.4 fps). Young and Crippen will fly a manually-controlled landing.

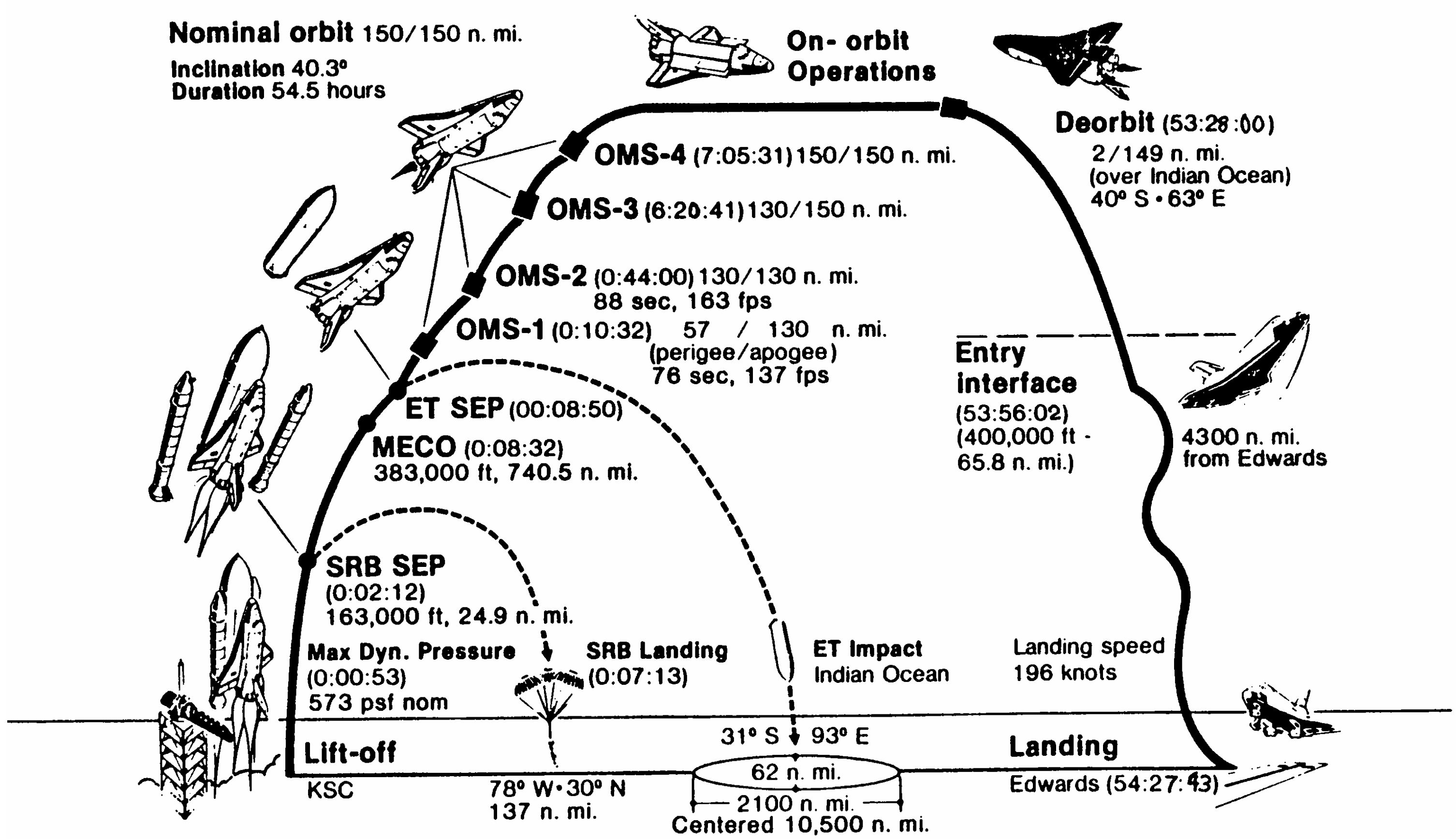
The following tables cover STS-1 flight events and maneuvers and the summary flight plan.

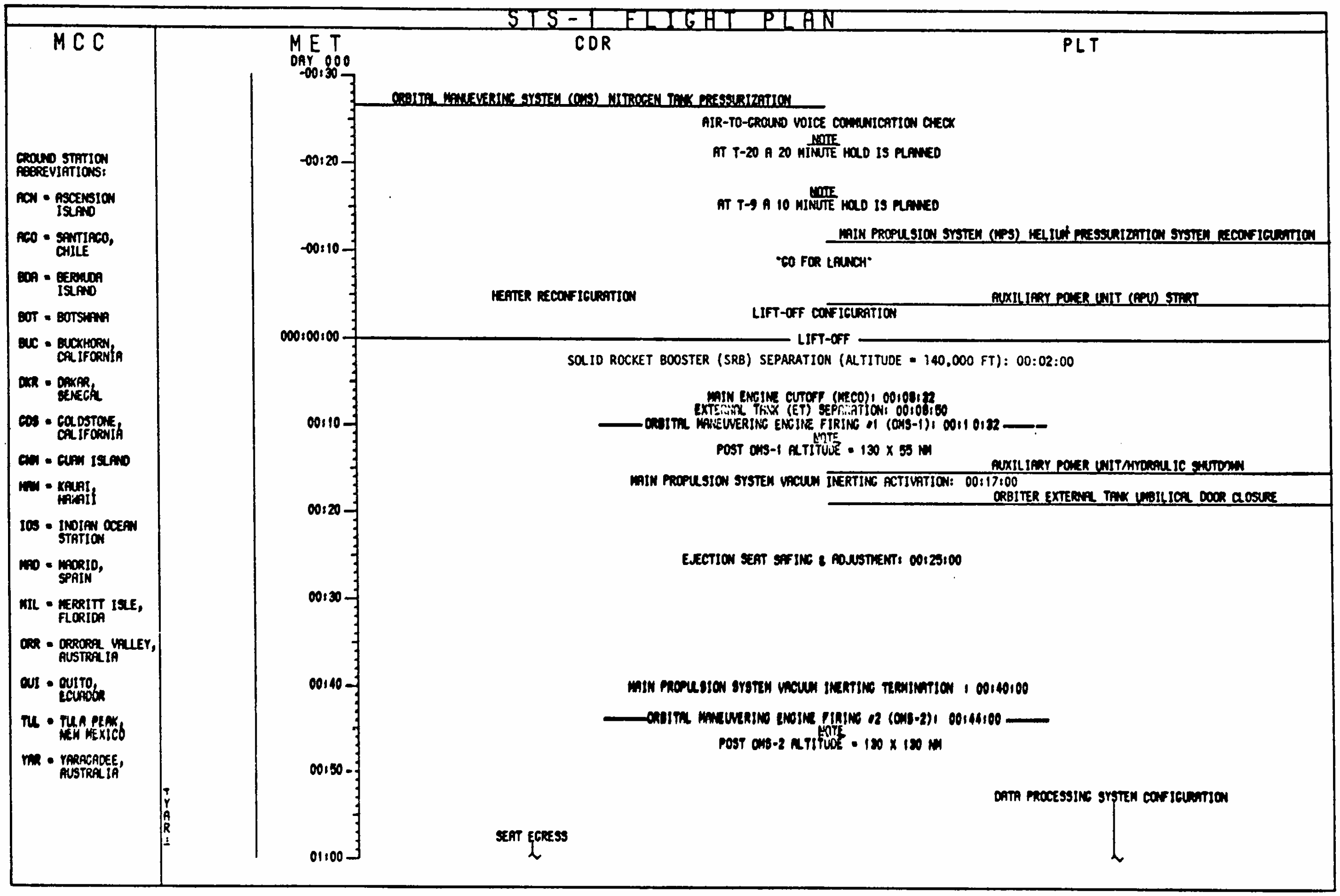
STS-1 FLIGHT SEQUENCE OF EVENTS

Event	Mission Elapsed Time Hr:Min:Sec	Comments
SRB Ignition	0:00:00	
Liftoff	0:00:00.3	
Pitchover	0:00:08	
Max Q	0:00:53	
SRB Separation	0:02:12	
MECO	0:08:32	Orbit = 13/80 n. mi.
ET Separation	0:08:50	
OMS-1 Ignition	0:10:32	Delta V=165 fps
OMS-1 Cutoff	0:12:01	Orbit=130/57 n. mi.
OMS-2 Ignition	0:44:00	Delta V-137 fps
OMS-2 Cutoff	0:45:15	Orbit=130/130 n. mi.
OMS-3 Ignition	6:20:41	Delta V-=36.5 fps
OMS-3 Cutoff	6:21:20	Orbit=150/134 n. mi.
OMS-4 Ignition	7:05:31	Delta V-37.5 fps
OMS-4 Cutoff	7:06:11	Orbit=150/150 n. mi.
Translation Maneuver Test:		
- No. 1	22:20:00	Orbit=150/150
- No. 2	26:22:00	Orbit=150/150
- No. 3	29:22:00	Orbit=150/150
Deorbit Ignition	53:28:00	Delta V-299.0 fps
Deorbit Cutoff	53:30:27	Orbit=149/2 n. mi.
Entry Interface	53:56:02	
Initiate Terminal Area Energy Management	54:21:30	
Landing	54:27:43	

NASA

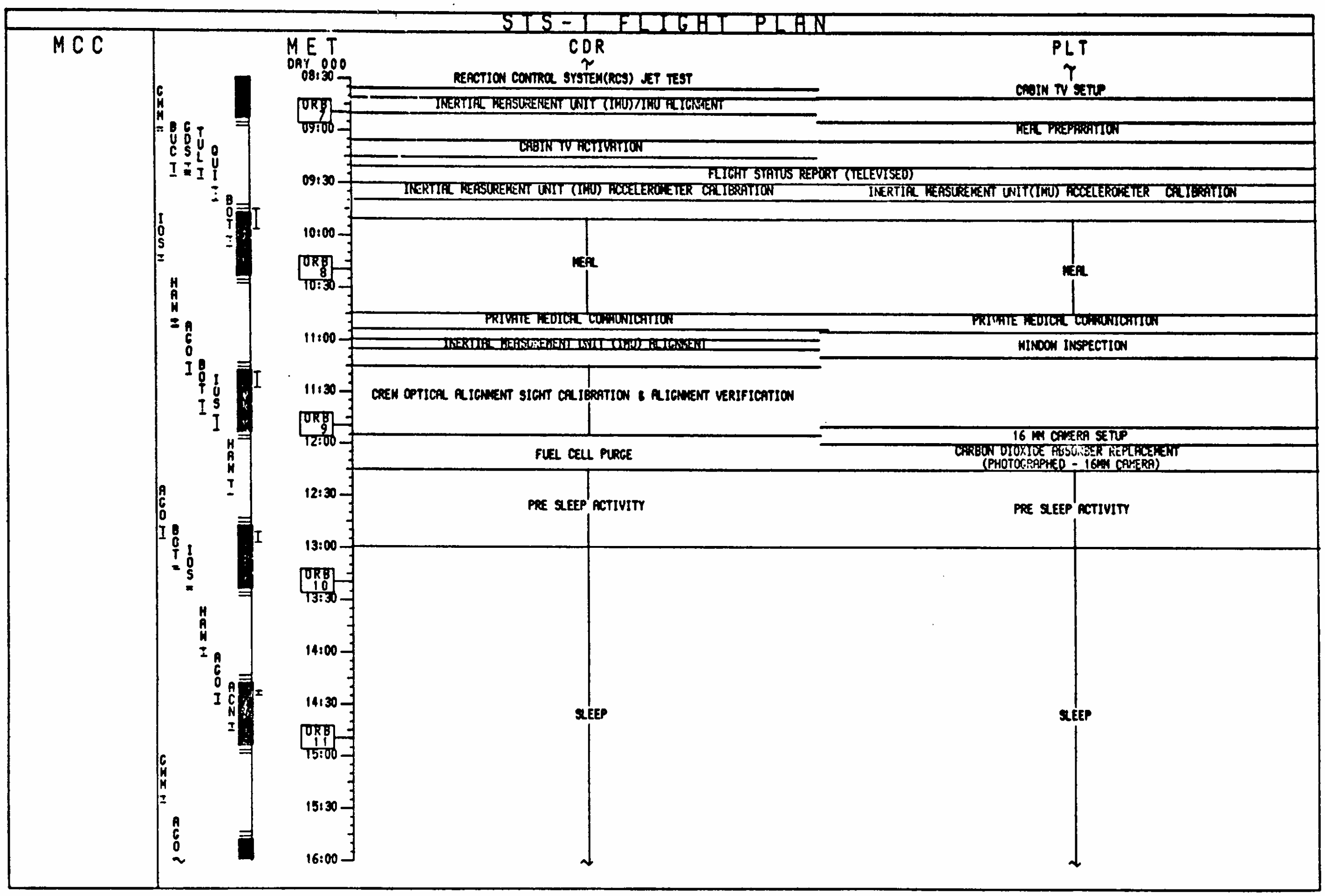
Space Shuttle Nominal Mission Profile for STS-1

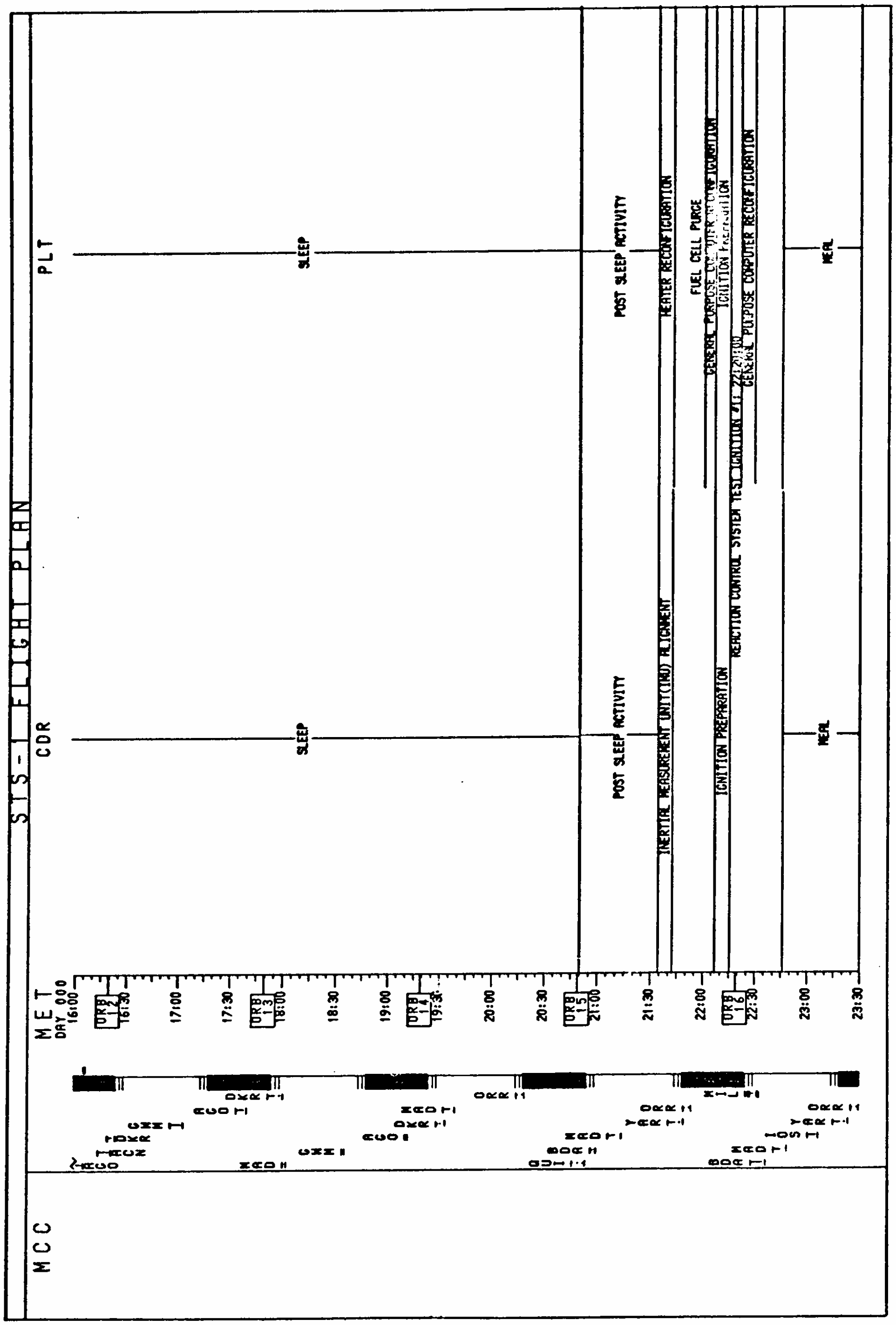



STS-1 FLIGHT PLAN
MCC
MET
CDR
PLT
GROUND STATION ABBREVIATIONS:
ACN = ASCENSION ISLAND
AGO = SANTIAGO, CHILE
BDA = BERMUDA ISLAND
BOT = BOTSWANA
BUC = BUCKHORN, CALIFORNIA
DKR = DAKAR, SENEGAL
GDS = GOLDSTONE, CALIFORNIA
GWM = GUAM ISLAND
HAW = KAUAI, HAWAII
IOS = INDIAN OCEAN STATION
MAD = MADRID, SPAIN
MIL = MERRITT ISLE, FLORIDA
ORR = ORRORAL VALLEY, AUSTRALIA
QUI = QUITO, ECUADOR
TUL = TULA PEAK, NEW MEXICO
YAR = YARAGADEE, AUSTRALIA
DAY 000
-00:30
-00:20
-00:10
000:00:00
00:10
00:20
00:30
00:40
00:50
01:00
ORBITAL MANEUVERING SYSTEM (OMS) NITROGEN TANK PRESSURIZATION
AIR-TO-GROUND VOICE COMMUNICATION CHECK
NOTE
AT T-20 A 20 MINUTE HOLD IS PLANNED
NOTE
AT T-9 A 10 MINUTE HOLD IS PLANNED
MAIN PROPULSION SYSTEM (MPS) HELIUM PRESSURIZATION SYSTEM RECONFIGURATION
"GO FOR LAUNCH"
HEATER RECONFIGURATION
AUXILIARY POWER UNIT (APU) START
LIFT-OFF CONFIGURATION
LIFT-OFF
SOLID ROCKET BOOSTER (SRB) SEPARATION (ALTITUDE = 140,000 FT): 00:02:00
MAIN ENGINE CUTOFF (MECO): 00:08:32
EXTERNAL TANK (ET) SEPARATION: 00:08:50
ORBITAL MANEUVERING ENGINE FIRING #1 (OMS-1): 00:10:32
NOTE
POST OMS-1 ALTITUDE = 130 X 55 NM
AUXILIARY POWER UNIT/HYDRAULIC SHUTDOWN
MAIN PROPULSION SYSTEM VACUUM INERTING ACTIVATION: 00:17:00
ORBITER EXTERNAL TANK UMBILICAL DOOR CLOSURE
EJECTION SEAT SAFING & ADJUSTMENT: 00:25:00
MAIN PROPULSION SYSTEM VACUUM INERTING TERMINATION : 00:40:00
ORBITAL MANEUVERING ENGINE FIRING #2 (OMS-2): 00:44:00
NOTE
POST OMS-2 ALTITUDE = 130 X 130 NM
DATA PROCESSING SYSTEM CONFIGURATION
SEAT EGRESS
YAR

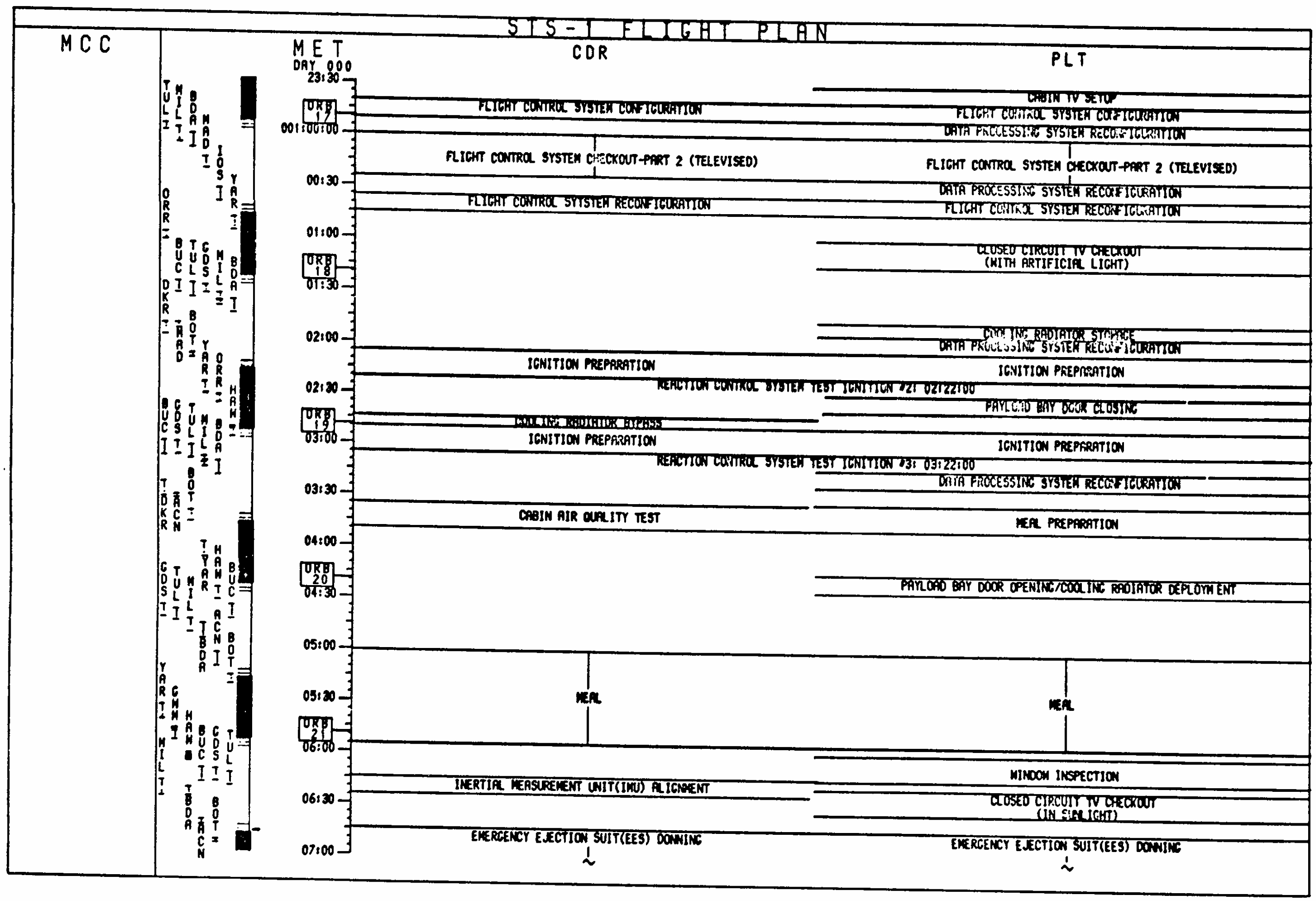
STS-1 FLIGHT PLAN

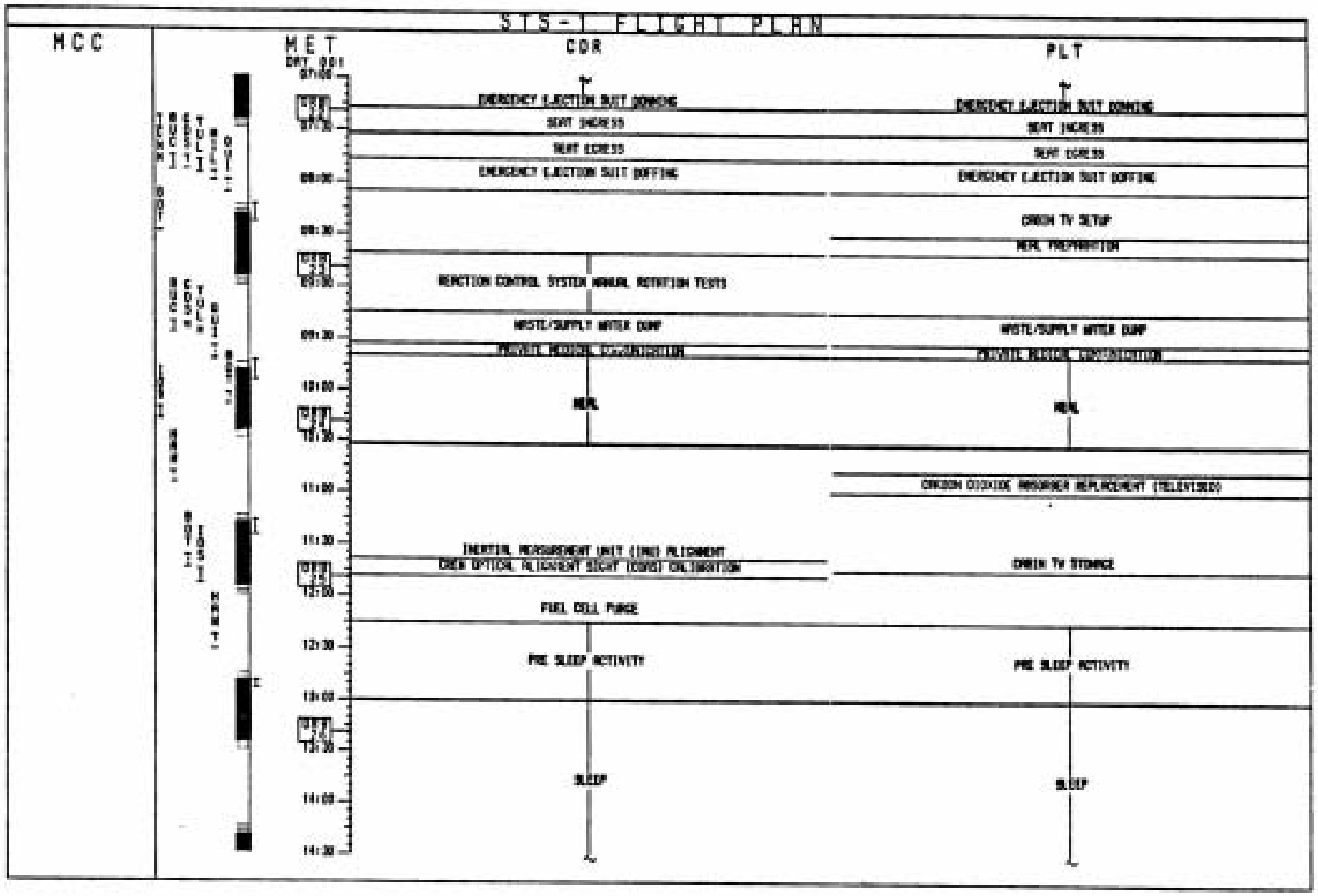
MCC	MET DAY 000	CDR	PLT
	01:00	SEAT EGRESS	DATA PROCESSING SYSTEM CONFIGURATION
	ORB 2		SEAT EGRESS
	01:30 – 02:00	PAYLOAD BAY DOOR MONITORING	PAYLOAD BAY LATCH/ DOOR TEST
	02:30	CREW OPTICAL ALIGNMENT SIGHT(COAS) CALIBRATION	RADIATOR DEPLOYMENT
	ORB 3 / 03:00	INERTIAL MEASUREMENT UNIT/STAR TRACKER TESTS	INERTIAL MEASUREMENT UNIT/ STAR TRACKER TESTS
	03:30		FUEL CELL PURGE
		EMERGENCY EJECTION SUIT(EES) DOFFING	EMERGENCY EJECTION SUIT DOFFING
	04:00 / ORB 4	ORBITER SYSTEMS ACTIVATION	ORBITER SYSTEMS ACTIVATION
	04:30	WASTE WATER TANK DUMP	WASTE WATER TANK DUMP
	05:00 – 05:30	MEAL	MEAL
	ORB 5	CABIN AIR QUALITY TEST	
	06:00	IGNITION PREPARATION	IGNITION PREPARATION
	06:30	ORBITAL MANEUVERING ENGINE FIRING # 3 (OMS-3) : 06:21:41 NOTE POST OMS-3 ALTITUDE = 150 X 130 NM	
	07:00	IGNITION PREPARATION	IGNITION PREPARATION
	ORB 6	ORBITAL MANEUVERING ENGINE FIRING # 4 (OMS-4) : 07:05:31 NOTE POST OMS-4 ALTITUDE = 150 X 150 NM	CABIN NOISE LEVEL SURVEY
	07:30	FLIGHT CONTROL SYSTEM CHECKOUT-PART 1	FLIGHT CONTROL SYSTEM CHECKOUT-PART 1
	08:00		GENERAL PURPOSE COMPUTER MEMORY DUMP TO RECORDER
	08:30	REACTION CONTROL SYSTEM(RCS) JET TEST	CABIN TV SETUP

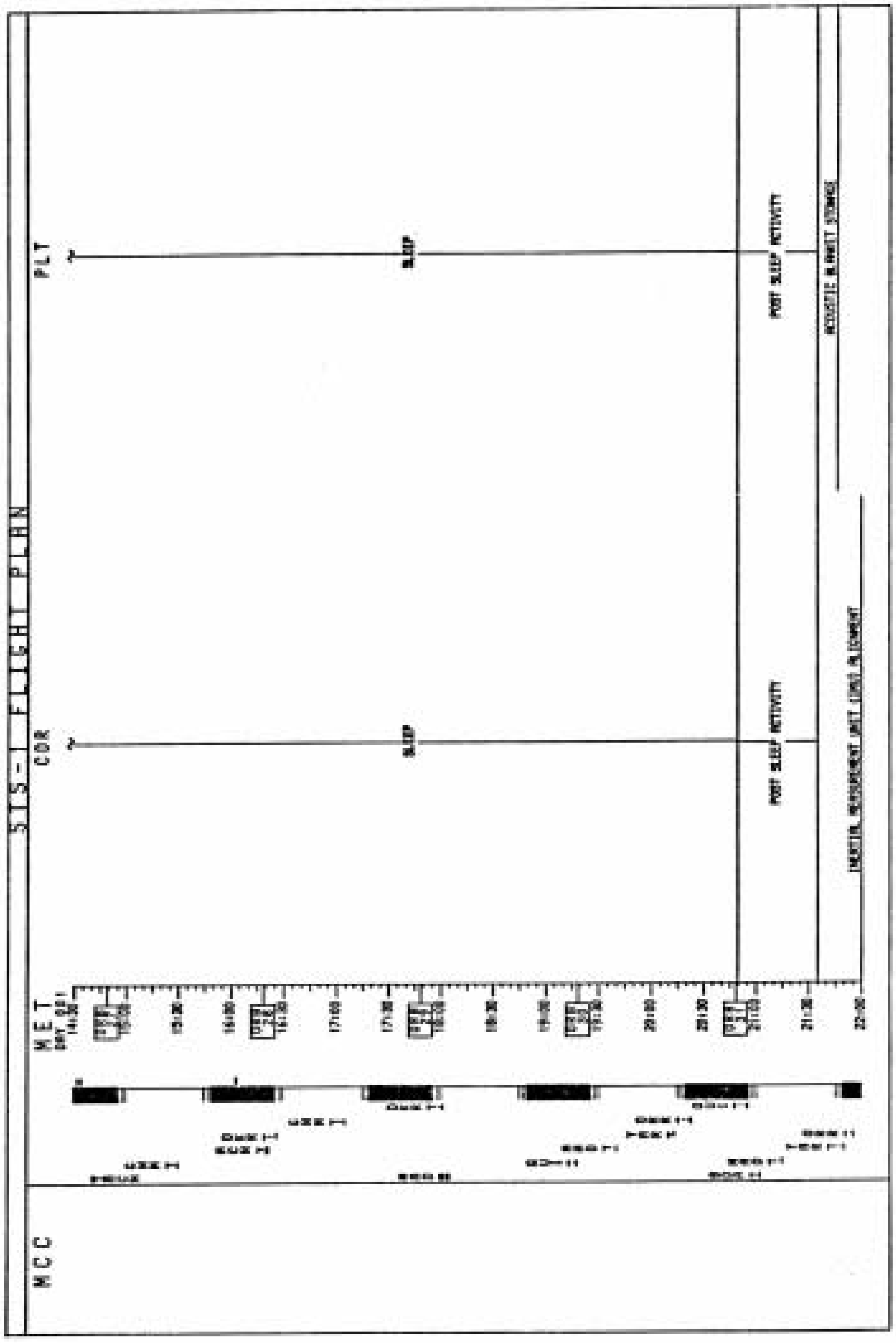

STS-1 FLIGHT PLAN
MCC
MET
DAY 000
08:30
09:00
09:30
10:00
10:30
11:00
11:30
12:00
12:30
13:00
13:30
14:00
14:30
15:00
15:30
16:00
ORB 7
ORB 8
ORB 9
ORB 10
ORB 11
CDR
REACTION CONTROL SYSTEM(RCS) JET TEST
INERTIAL MEASUREMENT UNIT (IMU)/IMU ALIGNMENT
CABIN TV ACTIVATION
FLIGHT STATUS REPORT (TELEVISED)
INERTIAL MEASUREMENT UNIT (IMU) ACCELEROMETER CALIBRATION
MEAL
PRIVATE MEDICAL COMMUNICATION
INERTIAL MEASUREMENT UNIT (IMU) ALIGNMENT
CREW OPTICAL ALIGNMENT SIGHT CALIBRATION & ALIGNMENT VERIFICATION
FUEL CELL PURGE
PRE SLEEP ACTIVITY
SLEEP
PLT
CABIN TV SETUP
MEAL PREPARATION
INERTIAL MEASUREMENT UNIT(IMU) ACCELEROMETER CALIBRATION
MEAL
PRIVATE MEDICAL COMMUNICATION
WINDOW INSPECTION
16 MM CAMERA SETUP
CARBON DIOXIDE ABSORBER REPLACEMENT
(PHOTOGRAPHED - 16MM CAMERA)
PRE SLEEP ACTIVITY
SLEEP



STS-1 FLIGHT PLAN
MCC
MET
DAY 000
CDR
PLT
16:00
ORB 12
16:30
17:00
17:30
ORB 13
18:00
18:30
19:00
ORB 14
19:30
20:00
20:30
ORB 15
21:00
21:30
22:00
ORB 16
22:30
23:00
23:30
SLEEP
SLEEP
POST SLEEP ACTIVITY
POST SLEEP ACTIVITY
INERTIAL MEASUREMENT UNIT(IMU) ALIGNMENT
HEATER RECONFIGURATION
FUEL CELL PURGE
IGNITION PREPARATION
REACTION CONTROL SYSTEM TEST
GENERAL PURPOSE COMPUTER RECONFIGURATION
MEAL
MEAL

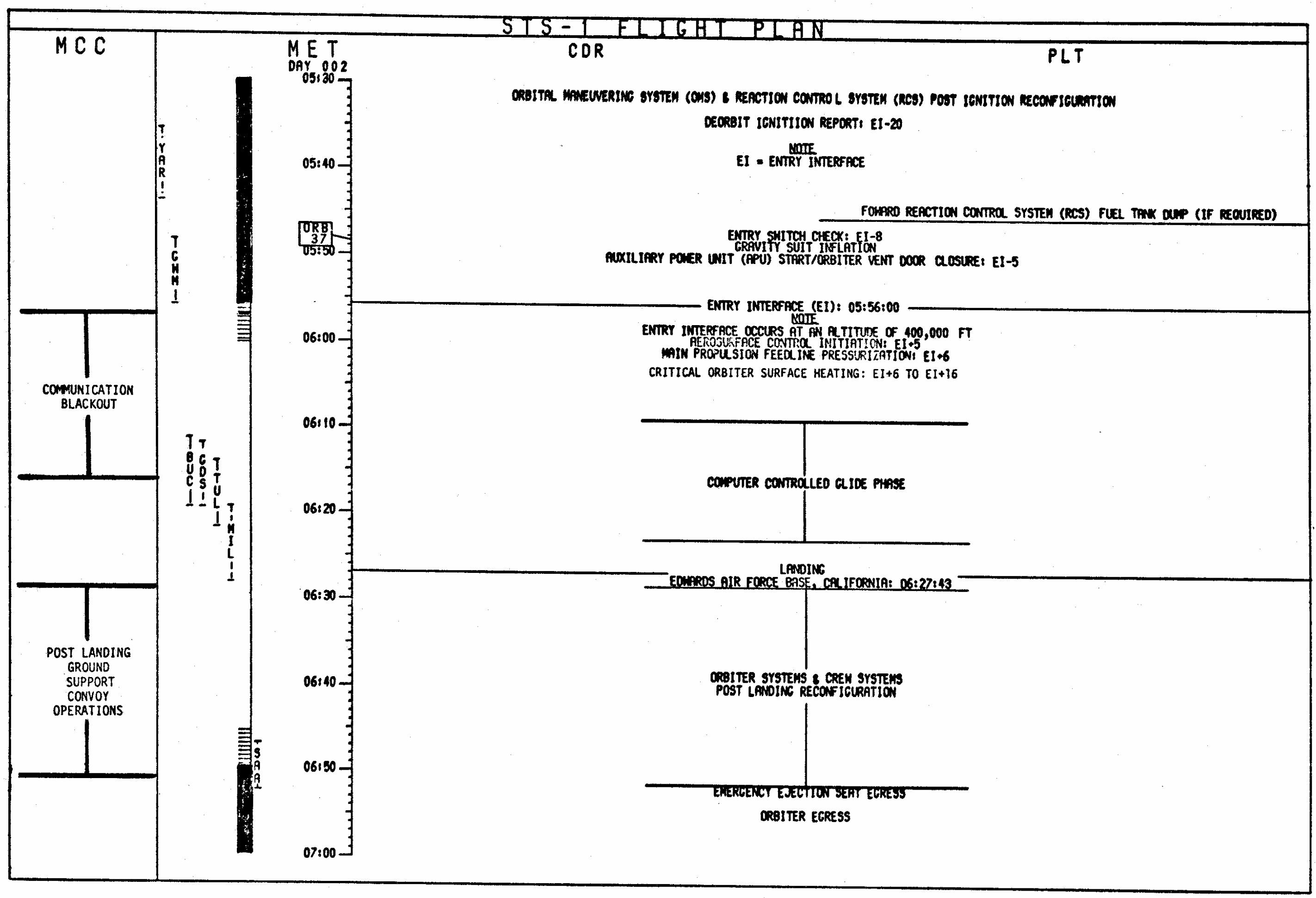

STS-1 FLIGHT PLAN
MCC
MET
DAY 000
CDR
PLT
23:30
ORB 17
001:00:00
00:30
01:00
ORB 18
01:30
02:00
02:30
ORB 19
03:00
03:30
04:00
ORB 20
04:30
05:00
05:30
ORB 21
06:00
06:30
07:00
FLIGHT CONTROL SYSTEM CONFIGURATION
FLIGHT CONTROL SYSTEM CHECKOUT-PART 2 (TELEVISED)
FLIGHT CONTROL SYSTEM RECONFIGURATION
IGNITION PREPARATION
REACTION CONTROL SYSTEM TEST IGNITION #2: 02:22:00
COOLING RADIATOR BYPASS
IGNITION PREPARATION
REACTION CONTROL SYSTEM TEST IGNITION #3: 03:22:00
CABIN AIR QUALITY TEST
MEAL
INERTIAL MEASUREMENT UNIT(IMU) ALIGNMENT
EMERGENCY EJECTION SUIT(EES) DONNING
CABIN TV SETUP
FLIGHT CONTROL SYSTEM CONFIGURATION
DATA PROCESSING SYSTEM RECONFIGURATION
FLIGHT CONTROL SYSTEM CHECKOUT-PART 2 (TELEVISED)
DATA PROCESSING SYSTEM RECONFIGURATION
FLIGHT CONTROL SYSTEM RECONFIGURATION
CLOSED CIRCUIT TV CHECKOUT (WITH ARTIFICIAL LIGHT)
COOLING RADIATOR STORAGE
DATA PROCESSING SYSTEM RECONFIGURATION
IGNITION PREPARATION
PAYLOAD BAY DOOR CLOSING
IGNITION PREPARATION
DATA PROCESSING SYSTEM RECONFIGURATION
MEAL PREPARATION
PAYLOAD BAY DOOR OPENING/COOLING RADIATOR DEPLOYMENT
MEAL
WINDOW INSPECTION
CLOSED CIRCUIT TV CHECKOUT (IN SUNLIGHT)
EMERGENCY EJECTION SUIT(EES) DONNING


STS-1 FLIGHT PLAN
MCC
MET
CDR
PLT
EMERGENCY EJECTION SUIT DONNING
SEAT INGRESS
SEAT EGRESS
EMERGENCY EJECTION SUIT DOFFING
CABIN TV SETUP
MEAL PREPARATION
REACTION CONTROL SYSTEM MANUAL ROTATION TESTS
WASTE/SUPPLY WATER DUMP
PRIVATE MEDICAL COMMUNICATION
MEAL
CARBON DIOXIDE ABSORBER REPLACEMENT (TELEVISED)
INERTIAL MEASUREMENT UNIT (IMU) ALIGNMENT
CREW OPTICAL ALIGNMENT SIGHT (COAS) CALIBRATION
CABIN TV STOWAGE
FUEL CELL PURGE
PRE SLEEP ACTIVITY
SLEEP
08:00
08:30
09:30
10:00
11:00
11:30
12:30
13:00
14:00
14:30


STS-1 FLIGHT PLAN
MCC
MET
CDR
PLT
14:30
15:00
15:30
16:00
16:30
17:00
17:30
18:00
18:30
19:00
19:30
20:00
20:30
21:00
21:30
22:00
SLEEP
SLEEP
POST SLEEP ACTIVITY
POST SLEEP ACTIVITY
INERTIAL MEASUREMENT UNIT (IMU) ALIGNMENT
ACOUSTIC BLANKET STOWAGE

STS-1 FLIGHT PLAN

MCC	MET DAY 001	CDR	PLT
	22:00	REACTION CONTROL SYSTEM (RCS) JET TEST	
	ORB 32		FUEL CELL PURGE
	22:30 – 23:00	MEAL	MEAL
	23:30	ENTRY STOWAGE	ENTRY STOWAGE
	ORB 33	FLIGHT CONTROL SYSTEM (FCS) RECONFIGURATION	FLIGHT CONTROL SYSTEM (FCS) RECONFIGURATION
			DATA PROCESSING SYSTEM RECONFIGURATION
	002:00:00	FLIGHT CONTROL SYSTEM CHECKOUT	FLIGHT CONTROL SYSTEM CHECKOUT
	00:30	INERTIAL MEASUREMENT UNIT (IMU) ACCELEROMETER CALIBRATION	INERTIAL MEASUREMENT UNIT (IMU) ACCELEROMETER CALIBRATION
	01:00		
	ORB 34	CREW SYSTEMS DEACTIVATION	CREW SYSTEMS DEACTIVATION
	01:30	EMERGENCY EJECTION SUIT DONNING	EMERGENCY EJECTION SUIT DONNING
	02:00		
	02:30		DATA PROCESSING SYSTEM RECONFIGURATION
	ORB 35	PAYLOAD BAY DOOR CLOSING	PAYLOAD BAY DOOR CLOSING
	03:00		
	03:30	SNACK	SNACK
	04:00	INERTIAL MEASUREMENT UNIT ALIGNMENT/ VERIFICATION	
	ORB 36	FORWARD & AFT CABIN SWITCH POSITION VERIFICATI ON	FORWARD & AFT SWITCH POSITION VERIFICATION
	04:30	SEAT INGRESS	SEAT INGRESS
	05:00	DEORBIT IGNITION PREPARATION	DEORBIT IGNITION PREPARATION
	05:30	DEORBIT IGNITION: 05:27:52	DEORBIT IGNITION: 05:27:52


STS-1 FLIGHT PLAN
MCC
MET
DAY 002
CDR
PLT
05:30
05:40
ORB 37
05:50
06:00
06:10
06:20
06:30
06:40
06:50
07:00
ORBITAL MANEUVERING SYSTEM (OMS) & REACTION CONTROL SYSTEM (RCS) POST IGNITION RECONFIGURATION
DEORBIT IGNITION REPORT: EI-20
NOTE
EI = ENTRY INTERFACE
FORWARD REACTION CONTROL SYSTEM (RCS) FUEL TANK DUMP (IF REQUIRED)
ENTRY SWITCH CHECK: EI-8
GRAVITY SUIT INFLATION
AUXILIARY POWER UNIT (APU) START/ORBITER VENT DOOR CLOSURE: EI-5
ENTRY INTERFACE (EI): 05:56:00
NOTE
ENTRY INTERFACE OCCURS AT AN ALTITUDE OF 400,000 FT
AEROSURFACE CONTROL INITIATION: EI+5
MAIN PROPULSION FEEDLINE PRESSURIZATION: EI+6
CRITICAL ORBITER SURFACE HEATING: EI+6 TO EI+16
COMMUNICATION BLACKOUT
COMPUTER CONTROLLED GLIDE PHASE
LANDING
EDWARDS AIR FORCE BASE, CALIFORNIA: 06:27:43
POST LANDING GROUND SUPPORT CONVOY OPERATIONS
ORBITER SYSTEMS & CREW SYSTEMS POST LANDING RECONFIGURATION
EMERGENCY EJECTION SEAT EGRESS
ORBITER EGRESS

LANDING AND POSTLANDING OPERATIONS

Ground operations to prepare the Columbia for a ferry flight to Kennedy Space Center and launch on subsequent missions will begin immediately upon the spacecraft's rollout on the dry lake bed at Edwards Air Force Base, Calif. The Kennedy Space Center is responsible for ground operations and a recovery convoy will move in to begin preliminary securing and safing operations as soon as Columbia has come to a stop. Early tasks consist of establishment of ground communications, the connection and initiation of ground cooling and purge air flow, a post-landing inspection and safety verification and the connection of the ground tow vehicle to the orbiter. The flight crew will leave the vehicle and be replaced by a ground crew approximately 45 minutes after landing.

The 18-unit ground convoy consists of the elements required to detect and disperse hazardous vapors, service Columbia's systems, transport and support ground personnel wearing protective garments, provide access to the crew compartment and transport the flight crew and ground crew which will replace them, and fire-fighting equipment.

Post-landing operations will be performed in the following sequence:

On the conclusion of orbiter rollout, the flight crew will safe the Columbia's orbital maneuvering and reaction control system prior to ground crew access.

After this has been done, ground personnel wearing protective garments will move in next to the orbiter and use sensitive "sniffer" devices to verify the absence of explosive or toxic gases such as ammonia, hydrazine, monomethyl hydrazine or gaseous hydrogen. A mobile wind machine will be used to reduce the possibility that explosive or toxic gases exist in dangerous concentrations.

Then access vehicles will be placed adjacent to the liquid oxygen and liquid hydrogen T-zero umbilicals on the aft end of the orbiter approximately 7 minutes after landing.

Large transporters bearing purge and cooling ground support units will then be moved into place behind the orbiter and their lines connected with the appropriate T-zero umbilicals.

The lines from the coolant transporter will be connected with the liquid hydrogen T-zero umbilical on the left side of the orbiter. once the connection has been made, Freon from this ground unit will begin flowing through the orbiter's cooling systems.

The lines from the purge transporter will be connected with the liquid oxygen T-zero umbilical on the right side of the orbiter. This unit will supply air conditioning for temperature and humidity to the orbiter's payload bay and other cavities to remove any residual explosive or toxic fumes and provide a safe, clean and cool environment inside the vehicle.

After a further assessment by a safety assessment team, the protective suit requirement will be removed and tow preparations and crew exchange activities will be initiated. The crew module hatch access vehicle will be then positioned adjacent to the crew hatch on the left side of the vehicle.

Following the opening of the hatch, an activity expected to require 18 minutes, the flight and ground crews will be exchanged and the hatch will then be closed. After removing the hatch access vehicle, the tow of the orbiter to the NASA area at the Dryden Flight Research Center will begin.

The elapsed time from the end of the rollout to the beginning of the tow is approximately one hour.

The orbiter will be in the Dryden Center's facilities for a week to 10 days undergoing further system deservicing and ferry flight preparations for the journey back to the Kennedy Space Center.

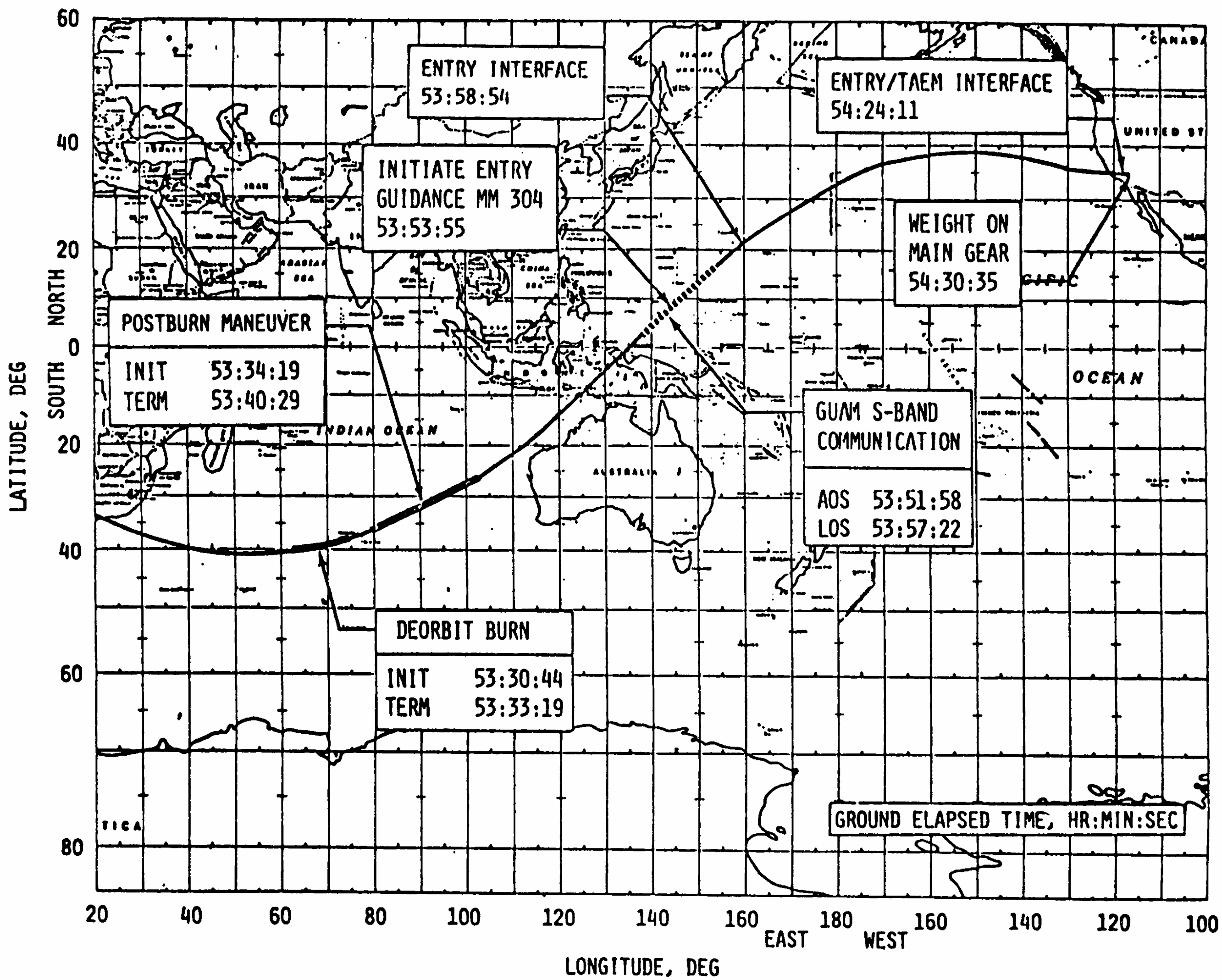
Nominal flight time for the Columbia aboard the 747 Shuttle Carrier Aircraft is two days.

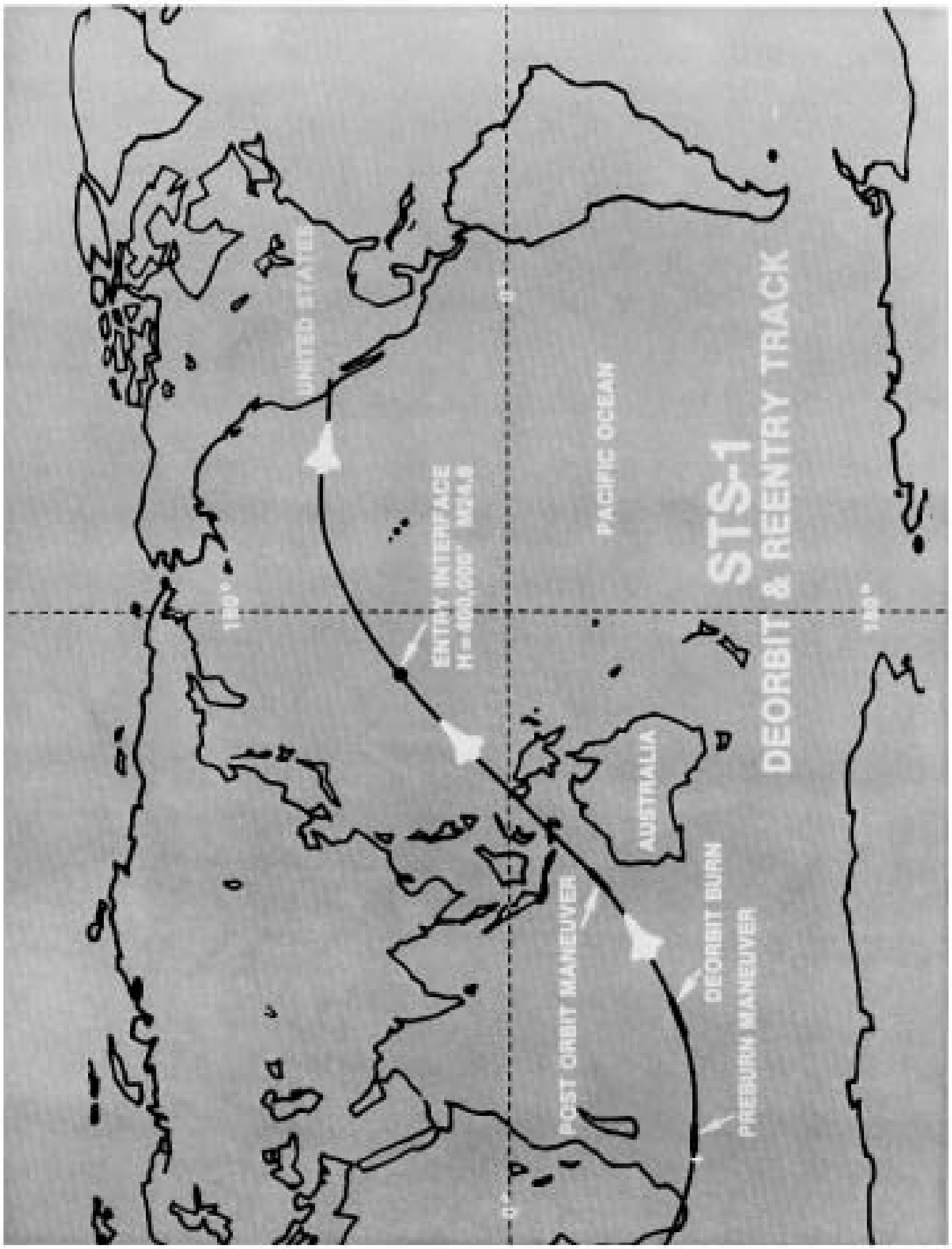
Columbia is due to arrive back at Kennedy from 10 days to two weeks after its touchdown in California from its first orbital mission.

SHUTTLE TRAJECTORY (FINAL)

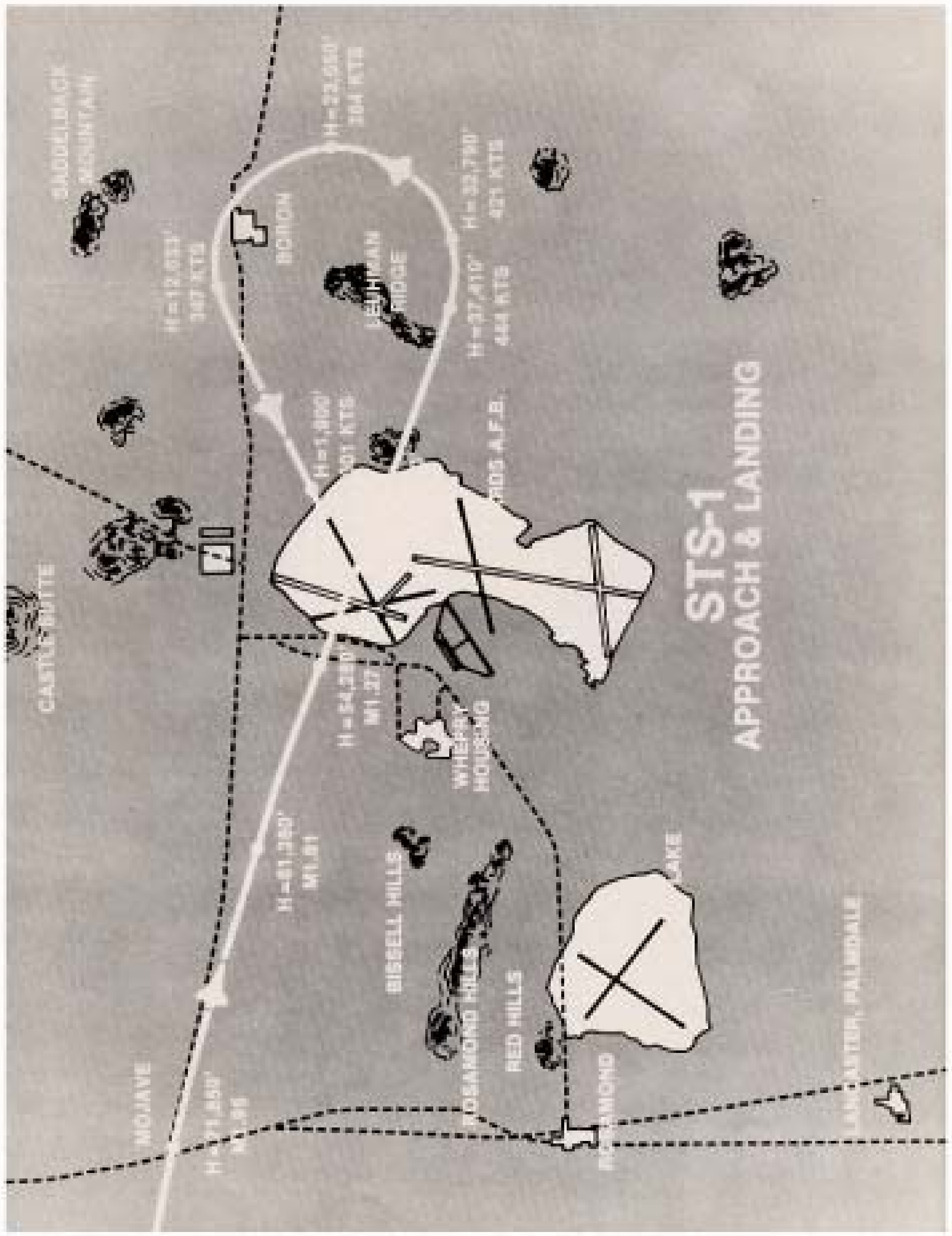
Location/Event	Speed	Altitude (feet)	Time To Touchdown
West edge of lake bed	M1.2	53,000	270 sec
East edge of lake bed	M0.88	44,000	230 sec
Abeam Boron, heading 330 degrees (turn final)	270 KEAS 13,000 fpm descent rate 20 degrees glide path	18,500	110 sec
Coming across U.S. 58 5-1/2 n mi on final	20 degrees glide path	10,000	76 sec
Initiate preflare 1/3 n mi from edge of lake bed	280 KEAS	2,000	36 sec
Gear Down command	270 KEAS 5 degrees glide path	250	19 sec
Gear locked	230 KEAS	100	11 sec
Touchdown	180 KEAS	0	0 sec

M =Mach
KEAS = Knots Equivalent Air Speed

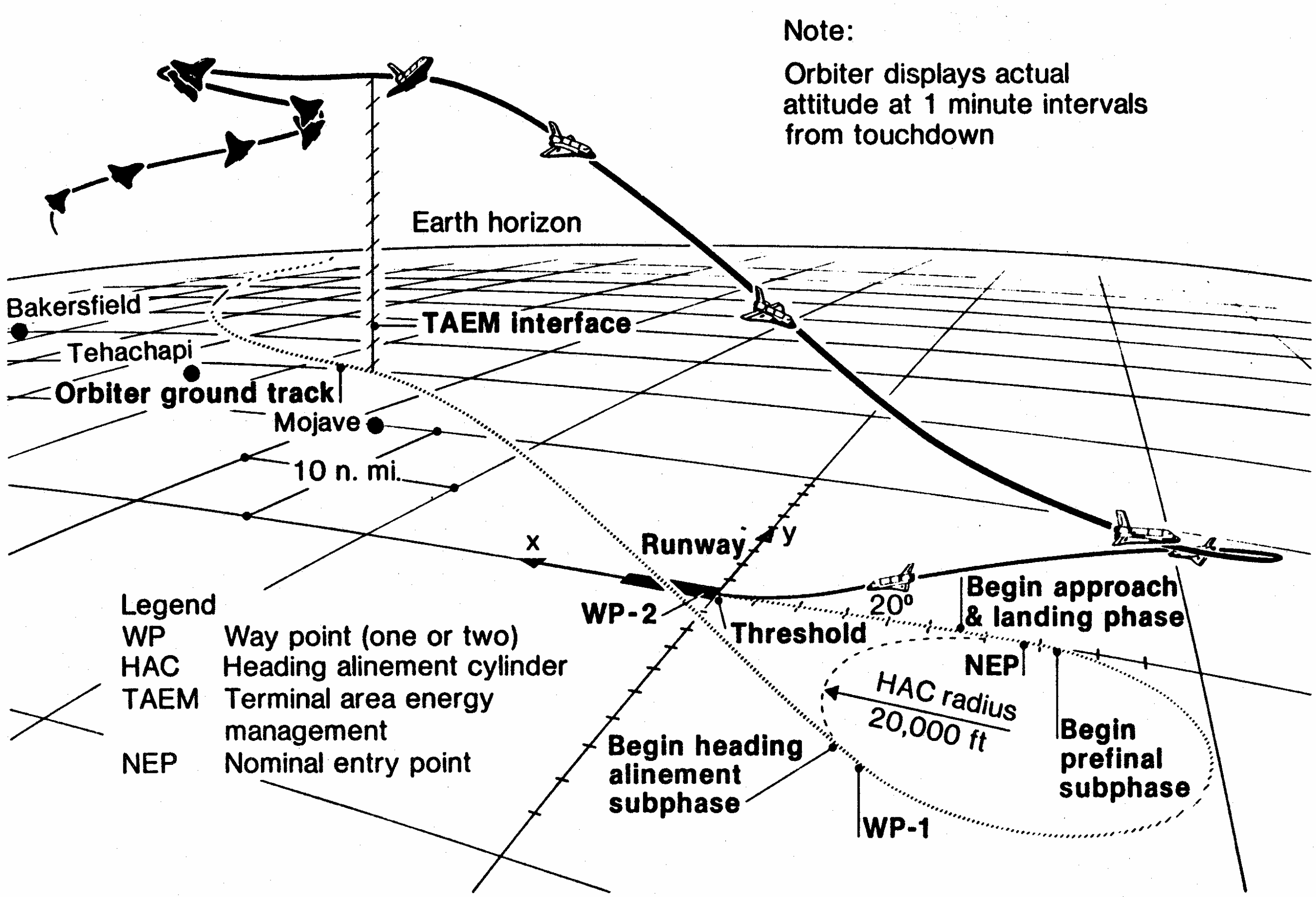

ENTRY INTERFACE
53:58:54
ENTRY/TAEM INTERFACE
54:24:11
INITIATE ENTRY
GUIDANCE MM 304
53:53:55
WEIGHT ON
MAIN GEAR
54:30:35
POSTBURN MANEUVER
INIT 53:34:19
TERM 53:40:29
GUAM S-BAND
COMMUNICATION
AOS 53:51:58
LOS 53:57:22
DEORBIT BURN
INIT 53:30:44
TERM 53:33:19
GROUND ELAPSED TIME, HR:MIN:SEC
INDIAN OCEAN
OCEAN
AUSTRALIA
CANADA
LATITUDE, DEG
NORTH
SOUTH
LONGITUDE, DEG
EAST
WEST
60
40
20
0
20
40
60
80
20
40
60
80
100
120
140
160
180
160
140
120
100


STS-1
DEORBIT & REENTRY TRACK
UNITED STATES
PACIFIC OCEAN
ENTRY INTERFACE
AUSTRALIA
DEORBIT BURN
POST ORBIT MANEUVER
PREBURN MANEUVER


STS-1
DESCENT OVER CALIFORNIA
CALIFORNIA
CHINA LAKE
EDWARDS A.F.B.
BAKERSFIELD
PALMDALE
H=107,100'
M3.97
SANTA BARBARA
SAN LUIS OBISPO
PACIFIC OCEAN


STS-1
APPROACH & LANDING
MOJAVE
CASTLE BUTTE
BORON
BISSELL HILLS
RED HILLS
WHERRY HOUSING

STS-1 Entry Flight Profile



IF THINGS DON'T GO RIGHT
(Contingencies)

STS-1 flight planners have attempted to anticipate any possible contingency that could happen during the flight -- from premature main engine shutdown to a sudden desert cloudburst making a wet lake of Rogers Dry Lake.

"What ifs" have been a central part of each mission design from the outset of Project Mercury 20 years ago and continuing through Gemini, Apollo and Skylab. While there were no launch phase aborts in any of these programs, the cryogenic oxygen tank explosion aboard Apollo 13 and the ensuing use of the lunar module as a lifeboat, proved that contingency planning and training do pay off.

The preferred type of launch abort for Shuttle launches is the abort-to-orbit (ATO) in which enough main engine and orbital maneuvering system engine energy is available to reach a 194-km (105-nm) orbit, but not enough to get the nominal 278-km (150-nm) orbit. An abort-to-orbit would be called for if one main engine should shut down before enough velocity is reached to yield a 278-km (150-nm) orbit.

Slightly less available energy for orbit insertion because of an earlier failure of a single main engine would force an abort-once-around (AOA) situation in which Columbia would land near the end of one orbit at Northrup Strip on the U.S. Army White Sands Missile Range, N.M. Abort-once-around would also be used for any time-critical orbiter systems failures requiring immediate deorbit and landing. Northrup Strip is also the backup landing site in case Rogers Dry Lake at Edwards is wet.

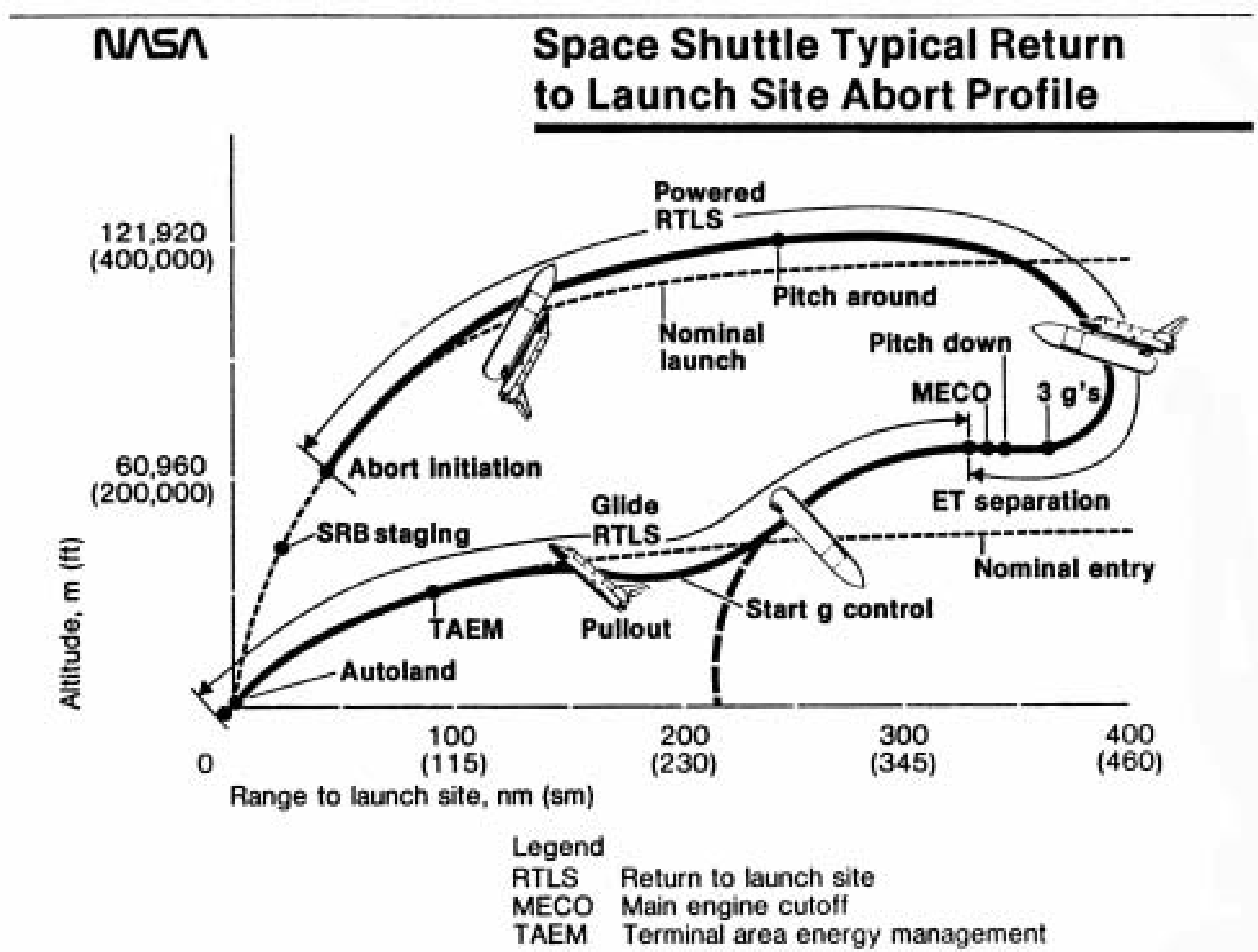
Still earlier shutdown of a single main engine brings about the more critical return-to-launch-site (RTLS) abort. The vehicle would be turned around while thrusting and then glide back toward the Shuttle Landing Facility at Kennedy Space Center.

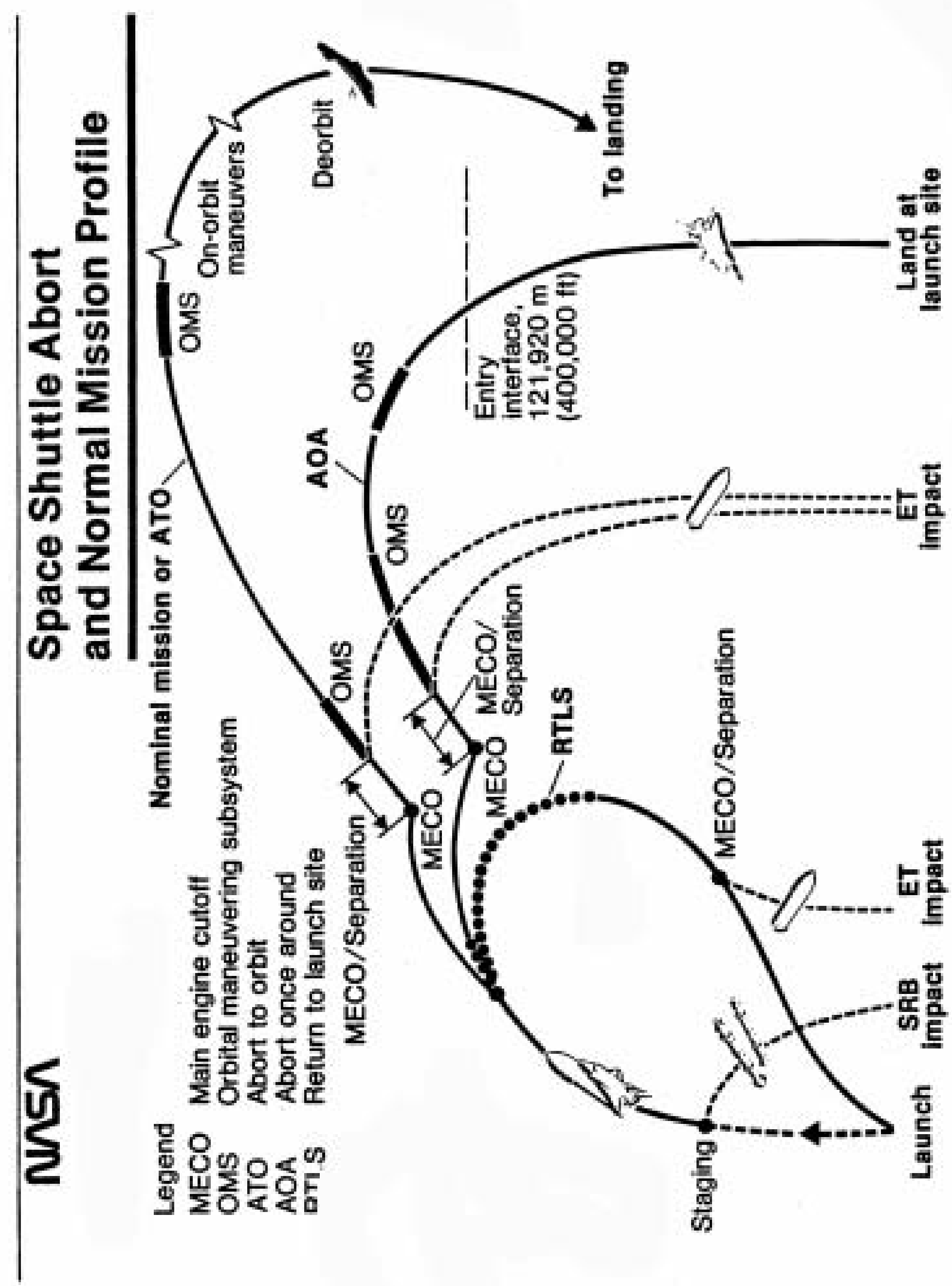
Once the decision to abort had been made, Columbia and the external tank would be flown in a pitch-around maneuver to heads-up and pointed back along the ground track to Cape Canaveral. The remaining two functioning main engines would cancel out the eastward velocity and accelerate the vehicle in a westward direction until enough velocity and distance is reached to glide along a normal entry trajectory to the Kennedy runway. orbiter systems failures during ascent could also force a return-to-launch-site abort.

Loss of control or impending catastrophic failure during ascent, from clearing the launch pad service structure up to an altitude of 30,480 m (100,000 ft.), calls for crew ejection. Loss of two main engines prior to seven minutes of flight would also require crew ejection.

Shuttle abort philosophy emphasizes safe return of the flight crew, the orbiter and its payloads to an intact landing at either the prime landing site at Edwards, the backup site at White Sands, or the contingency landing sites at Hickam Air Force Base, Hawaii; Rota, Spain; and Kadena Air Base, Ryukyu Islands.

A situation such as a systems failure forcing landing on the first day of flight would mean landing at Edwards at the end of the fifth orbit


NASA
Space Shuttle Typical Return
to Launch Site Abort Profile
Altitude, m (ft)
121,920
(400,000)
60,960
(200,000)
0
Powered
RTLS
Pitch around
Nominal
launch
Pitch down
MECO
3 g's
Abort initiation
SRB staging
Glide
RTLS
ET separation
Nominal entry
Start g control
TAEM
Pullout
Autoland
100
(115)
200
(230)
300
(345)
400
(460)
Range to launch site, nm (sm)
Legend
RTLS Return to launch site
MECO Main engine cutoff
TAEM Terminal area energy management


NASA
Space Shuttle Abort
and Normal Mission Profile
Legend
MECO Main engine cutoff
OMS Orbital maneuvering subsystem
ATO Abort to orbit
AOA Abort once around
RTLS Return to launch site
Nominal mission or ATO
OMS
On-orbit maneuvers
Deorbit
To landing
AOA
OMS
OMS
Entry interface, 121,920 m (400,000 ft)
MECO/Separation
MECO
MECO/Separation
MECO
RTLS
MECO/Separation
ET Impact
ET Impact
Land at launch site
SRB Impact
Launch
Staging

ORBITER COLUMBIA'S MAIDEN FLIGHT
(Configuration)

When fully fitted out for operational flights (STS-5 and on), Columbia's middeck will house more creature comforts for the crew than the somewhat spartan accommodations of the first orbital test flight. For example, no sleeping bags have been stowed nor bunks installed aboard Columbia. Young and Crippen will sleep strapped into the flight deck ejection seats in their flight overalls. Sleep kits, with ear plugs and eye covers, have been provided for making the two sleep periods more comfortable.

Columbia and the other orbiters joining the fleet will be fitted with airliner-type galleys for meal preparation. on this first flight, however, a carry-on electrical food warmer will heat meals stowed in middeck lockers. orbiters will not have freezers or refrigerators.

Until ejection seats are removed from Columbia after STS-4, crews will wear modified USAF high-altitude pressure suits during launch and entry. Two-piece treated-cotton inflight coveralls will be worn during orbital flight. Shuttle spacesuits, or extravehicular mobility units (EMU), are aboard STS-1 for a contingency spacewalk.

Should the need for a contingency spacewalk arise, such as failure of the mechanical actuators to close the payload bay doors, cabin pressure would be reduced from 14.5 pounds per square inch (21/79-percent oxygen/nitrogen mix) to 9 psi (28/72 percent oxygen/nitrogen).

Crippen would go out through the airlock to manually close the payload bay doors after some 14 hours of pre-breathing at the reduced pressure and at the higher oxygen level to purge suspended nitrogen from the blood stream. Lowering orbiter cabin pressure to 9 psi eliminates the need for Crippen to pre-breathe on an umbilical or on a portable oxygen system and thereby shortens an EVA "work day" by two hours. Moreover, the procedure also prebreathes Young, should he have to suit up and give Crippen a hand with the payload bay doors.

As a hedge against the payload doors failure to open after Columbia is in orbit, additional potable water tanks have been loaded for the flash evaporators-. The flash evaporators transfer metabolic and systems heat from Freon loops to water when the payload doors are closed. Space radiators are attached to the inside of the payload bay doors for heat rejection when the doors are open. (See page 4-21 of the Space Shuttle News Reference.)

If the payload bay doors fail to open during the second orbit, Columbia would be brought down to a landing at Edwards at the end of the fifth orbit. Failure of the payload bay doors to close would call for cabin depressurization to 9 psi and Crippen's spacewalk 14 hours later to unjam the doors.

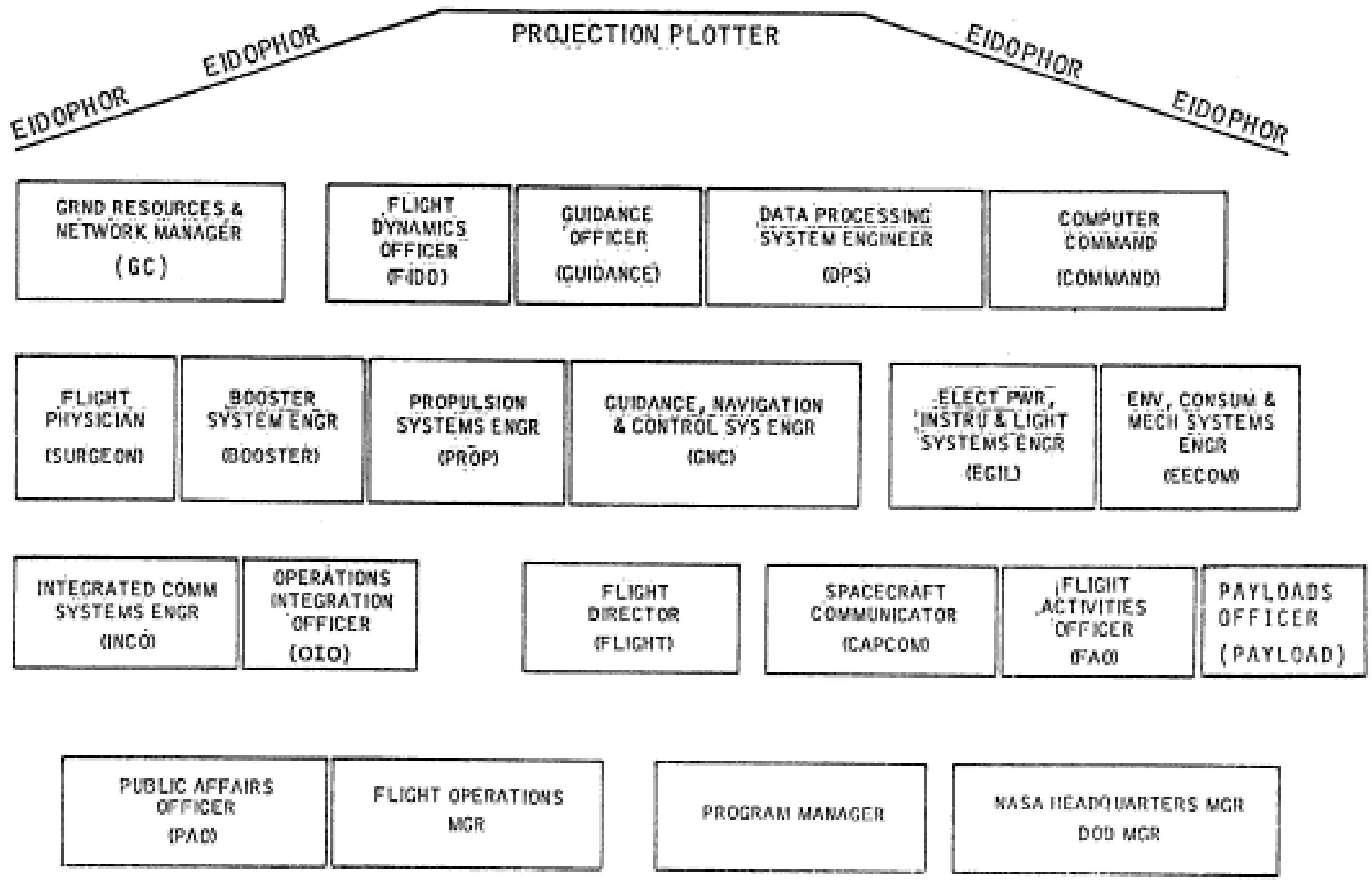
Except for developmental flight instrumentation and the aerodynamic coefficient identification package, Columbia's payload bay will be bare.

Although Mission Control Center-Houston is described in the News Reference as it will be for STS mature operations, for orbital flight tests MCC-H will appear much the same as it did for Apollo and Skylab. The second-floor Mission operations Control Room (MOCR) has been modified for early Space Shuttle flights.

Huntsville Operations Support Center

During the STS-1 countdown, launch and powered flight toward orbit, design experts at the Marshall Space Flight Center, Huntsville, Ala., will monitor real-time data from the vehicle to provide a trouble shooting capability on Marshall-developed Shuttle hardware. Their purpose will be to assist in the early detection of potential problems and to help evaluate and solve them. This pool of propulsion system design experts, consisting of Marshall engineers, project management officials and contractor personnel, will be assembled at the Marshall Center's Huntsville operations Support Center. Marshall is responsible for development of the Space Shuttle main engines, external tank and solid rocket boosters.

MCC MISSIONS OPERATIONS CONTROL ROOM (MOCR) POSITIONS
ROOM 231



SHUTTLE - STANDARD OFT MENU

Meal	Day 1[1], 5		Day 2, 6		Day 3,7		Day 4,8	
A	Peaches	(T)	Applesauce	(T)	Dried Peaches	(IM)	Dried Apricots	(IM)
	Beef Pattie	(R)	Dried Beef	(NF)	Sausage	(R)	Breakfast Roll	(1)(NF)
	Scrambled Eggs	(R)	Granola	(R)	Scrambled Eggs	(R)	Granola w/Blueberries	(R)
	Bran Flakes	(R)	Breakfast Roll	(I)(NF)	Cornflakes	(R)	Vanilla Inst. Breakfast	(B)
	Cocoa	(B)	Chocolate. Instant. Breakfast	(B)	Cocoa	(B)	Grapefruit Drink	(B)
	Orange Drink	(B)	Orange-Grapefruit Drink	(B)	Orange--Pineapple Drink	(B)		
B	Frankfurters	(T)	Corned Beef	(T)(I)	Ham	(T)	Ground Beef w/Pickle Sauce	(T)
	Turkey Tetrazzini	(R)	Asparagus	(R)	Cheese Spread	(T)	Noodles & Chicken	---
	Bread (2X)	(I)(NF)	Bread (2X)	(I)(NF)	Bread (2X)	(I)(NF)	Stewed Tomatoes	(T)
	Bananas	(FD)	Pears	(T)	Green Beans & Broccoli	(R)	Pears	(FD)
	Almond Crunch Bar	(NF)	Peanuts	(NF)	Crushed Pineapple	(T)	Almonds	(NF)
	Apple Drink (2X)	(B)	Lemonade (2X)	(B)	Shortbread Cookies	(NF)	Strawberry Drink	(B)
					Cashews	(NF)		
					Tea w/Lemon & Sugar (2X)	(B)		
C	Shrimp Cocktail	(R)	Beef w/BBQ Sauce	(T)	Cream of Mushroom Soup	(R)	Tuna	(T)
	Beef Steak	(T)(I)	Cauliflower w/ Cheese	(R)	Smoked Turkey	(T)(IM)	Macaroni & Cheese	(R)
	Rice Pilaf	(R)	Green Beans w/ Mushrooms	(R)	Mixed Italian Vegetables	(R)	Peas w/Butter Sauce	(R)
	Broccoli au Gratin	(R)	Lemon Pudding	(T)	Vanilla Pudding	(T)	Peach Ambrosia	(R)
	Fruit Cocktail	(T)	Pecan Cookies	(NF)	Strawberries	(R)	Chocolate Pudding	(T)
	Butterscotch Pudding	(T)	Cocoa	(B)	Tropical Punch	(B)	Lemonade	(B)
	Grape Drink	(B)						

Abbreviations

T = Thermostabilized I = Irradiated R= Rehydratable IM = Intermediate Moisture FD = Freeze-Dried NF = Natural Form B = Beverage (Rehydratable)

[1] NOTE: Day 1 (launch day) consists of Meal B and C only.

SPACEFLIGHT TRACKING AND DATA NETWORK (STDN)

The Spaceflight Tracking and Data Network (STDN) is a highly complex NASA worldwide system that provides reliable, continuous and instantaneous communications with the Space Shuttle orbiter and crew. The network is maintained and operated by NASA Goddard Space Flight Center, Greenbelt, Md.

The network for the Shuttle orbital Flight Test Program consists of 18 ground stations equipped with 4.26-, 9.14-, 12.19 and 25.9-m (14-, 30-, 40- and 85-ft.) S-band antenna systems and C-band radar systems, the NASA Communications System (NASCoM) augmented by 15 Department of Defense geographical locations providing C-band support and one Defense 18.3 m (60-ft.) S-band antenna system. In addition, there are six major computing interfaces located at the Goddard Space Flight Center: Network Operations Control Center (NOCC at Goddard; Western Space and Missile Center, Vandenberg Air Force Base; Air Force Satellite Control Facility, Sunnyvale, Calif.; White Sands Missile Range, N.M.; and Eastern Space and Missile Center, Fla., providing real-time network computational support.

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

Should the Johnson Space Center Mission Control Center be seriously impaired for an extended time, the Network operations Control Center at Goddard becomes an emergency mission control center.

The Merritt Island Florida S-band station provides the appropriate data to the Launch Control Center at Kennedy and the Mission Control Center at Johnson during prelaunch testing and the terminal countdown. During the first minutes of launch and during the ascent phase, the Merritt Island and Ponce de Leon, Fla., S-band and Bermuda S-band stations, as well as the C-band stations located at Bermuda; Wallops Island, Va.; Grand Bahamas; Grand Turk; Antigua; Cape Canaveral; and Patrick Air Force Base, Fla., will provide tracking data, both high speed and low speed, to the Kennedy and Johnson Control Centers.

The Madrid, Spain; Indian Ocean Station Seychelles; Orroral and Yarragadee, Australia; and Guam stations provide critical support to the orbital maneuvering systems burns. During the orbital phase all the S-band and C-band stations that see the Space Shuttle orbiter at 30 degrees above the horizon will support and provide appropriate tracking, telemetry, air-ground and command support to the Johnson Mission Control Center though Goddard.

During the nominal reentry and landing phase planned for Edwards Air Force Base, Calif., the Goldstone and Buckhorn, Calif., S-band stations and C-band stations at the Pacific Missile Test Center, Vandenberg Air Force Base, Edwards Air Force Base and Dryden Flight Research Center will provide tracking, telemetry, command and air-ground support to the orbiter and send appropriate data to the Johnson and Kennedy Control Centers.

NASA Communications Network (NASCOM)

The tracking network is linked together by the NASA Communications Network from which all information flows to and from Mission Control Center, Johnson.

The communications network consists of more than 2 million circuit miles of diversely routed communications channels. It uses domestic and international communications satellites, submarine cable and terrestrial landlines and microwave radio systems to interconnect the myriad of tracking stations, launch and orbital control centers and other supporting locations.

The hub of the communications network is the main switching center at Goddard. From Goddard, personnel direct overall network operation including those at supporting NASCOM switching centers in Madrid, Spain; Canberra, Australia; and Jet Propulsion Laboratory, Pasadena, Calif. Additionally, support activities are provided by Air Force communications centers at Cape Canaveral, Fla., and Vandenberg Air Force Base, Calif.

A key change in the communications network has been implementation of two simultaneous air-ground S-band voice circuits in addition to UHF radio capability. In previous Apollo missions only one S-band circuit was provided. Telemetry data circuitry from tracking stations was increased in size to handle 128,000 bits per second (128 kilobits per second) in real time versus the 14-21 kbps in previous programs. Correspondingly, the command data circuit to a station was increased from 7.2 kbps to a 56 kbps capability.

During previous manned program support, use of communications satellites was limited to those connecting the United States with foreign locations (Intelsat system). Since then, domestic communications satellites have become available and they now play a key role in extending voice, data and television signals from key locations and stations in the United States. Additionally, they provide for extending data between Goddard and foreign locations as well as between Goddard and Johnson.

Network Systems Support

At fraction-of-a-second intervals, the network's data processing systems, with Johnson's Mission Control Center as the focal point, "talk" to each other or to the spacecraft.

High-speed computers at the remote site relay commands at a 56-kilobit data rate on such matters as control of cabin pressure, orbital guidance commands or "go/no-go" indications to perform certain functions. In addition, they provide digital voice uplink and downlink from the stations to the orbiter.

The command and air-ground voice is mixed together at the remote station and uplinked to the orbiter at a 72- or 32-kilobit rate.

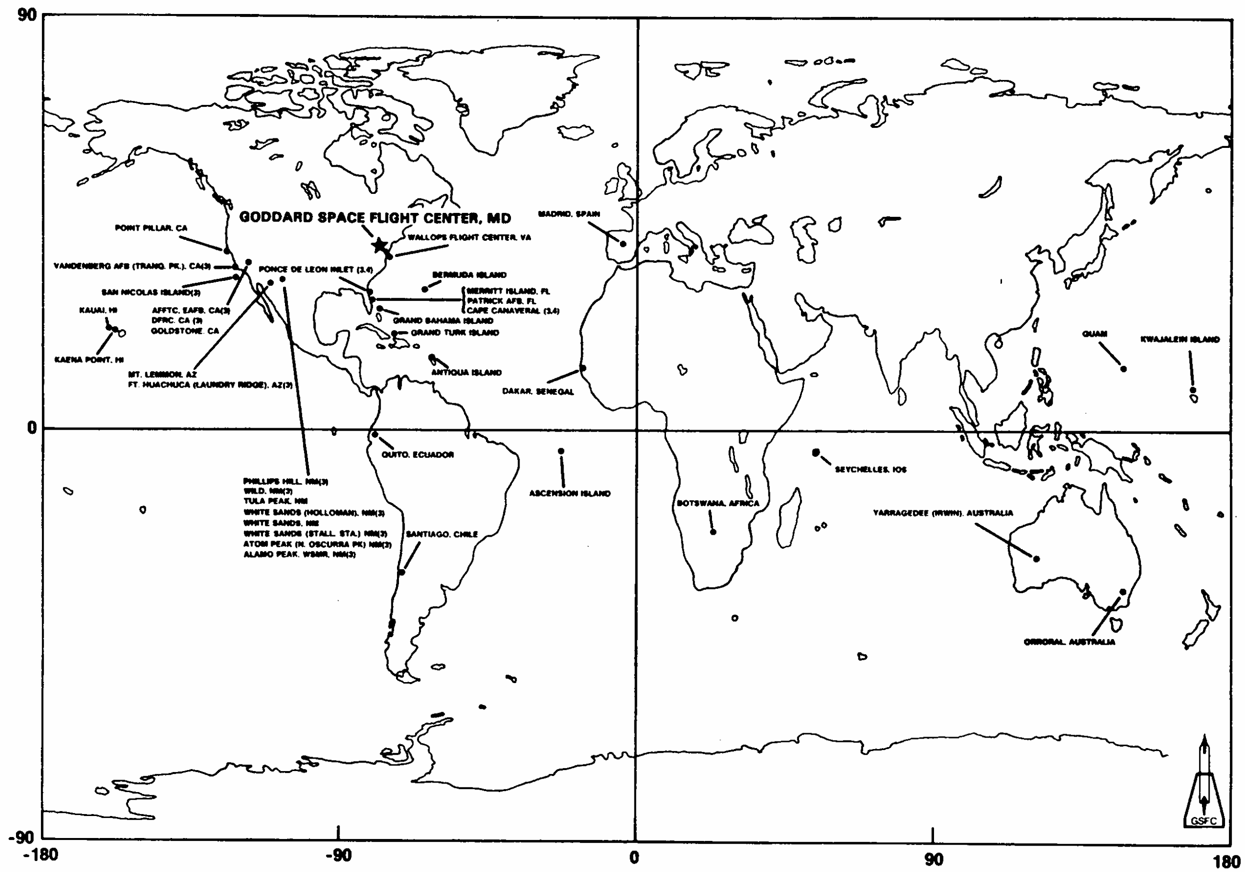
Such uplink information is communicated at a rate of about 4,800 bps. Communication between remote ground sites, via high-speed communications links, occurs at the same rate on a 56-kilobit line. Houston reads information, two channels at a time, from these ground sites at 1,544,000 bps.

For downlink data, sensors built into the spacecraft continually sample cabin temperature, pressure and physical information on the astronauts such as heartbeat and respiration. These data are transmitted to the ground stations at 96, 128 or 192 kilobits.

At Mission Control Center, the computers:

- Detect and select changes or deviations, compare with their stored programs and indicate the problem areas or pertinent data to the flight controllers;
- Provide displays to mission personnel;
- Assemble output data in proper formats;
- Log data on magnetic tape for reply for the flight controllers.

Real time orbital television will be received by the Merritt Island, Fla.; Madrid, Spain; Orroral, Australia; and Goldstone, Calif., stations and transmitted to the Mission Control Center, Houston via the Goddard Space Flight Center.



SPACE FLIGHT TRACKING AND DATA NETWORK (S TDN)

PHOTOGRAPHY AND TELEVISION SCHEDULES

Except where noted as VTR (video tape recorder), television from Columbia during STS-1 will be fed live to the tracking stations being overflown at the time. Two closed-circuit color television cameras in the spacecraft cabin will be managed from Mission Control by ground commands once the cameras are activated by the crew. There are no plans to "dump" scenes from 30-minute VTR cassettes recorded when Columbia is not in view of a tracking station.

STS-1 Television Schedule

Mission Elapsed Time Day/Hours:Minutes	Subject
00/01:25 - 02:25	Payload bay door latch tests, door tests and radiator deploy tests during first payload bay door operations (VTR)
00/01:36 - 01:56	Payload bay door opening and closing
00/09:20 - 09:25	Young reports status of flight
01/01:00 - 01:20	Checkout television system with artificial lighting (VTR)
01/00:01 - 00:23	Flight control system checkout, forward flight deck
01/ 01:29 - 01:41	MCC remotely operates payload bay television
01/10:49 - 10:54	Crippen replaces carbon dioxide absorber on middeck
02/01:31 - 01:41	MCC remotely operates payload bay television
02/02:32 - 03:03	Payload bay door closed for deorbit

Young and Crippen will document the flight in 16 mm motion picture, and 35 mm and 70 mm still picture formats. In addition to photo targets of opportunity, the crew will photograph the following subjects during the flight:

Photography Schedule

Day/Hr:Min	Camera	Subject
00/00:00:30	16 mm	Launch
00/01:45	70 mm	Payload bay
00/12:05	16 mm	Replacement of carbon dioxide absorber on middeck
01/08:31	35 mm	Food warmer activation and food preparation on middeck
01/09:00	16 mm	Out-the-window view of Earth limb while Young checks out reaction control thrusters
01/09:00	70 mm	Out-the-window view of Earth limb
01/09:08	35 mm	Cockpit operations during reaction control system tests
01/11:18	35 mm	Forward flight deck during automatic maneuver for inertial measurement unit alignment
01/12:30	16 mm	Personal hygiene on middeck
25,900 m (85,000 ft.)	16 mm	Landing

National Aeronautics and
Space Administration

S80-40384

Lyndon B. Johnson Space Center
Houston, Texas 77058

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STS-1 CREWMEMBERS

S79-31775 -- Official portrait of STS-1 crewmembers John W. Young (commander), left, and Robert L. Crippen (pilot) posing in ejection escape suits (EES) with a model of the space shuttle.

PHOTO CREDIT: NASA or National Aeronautics and Space Administration.

BIOGRAPHICAL DATA

NAME: John W. Young, STS-1 Commander

BIRTHPLACE AND DATE: Born in San Francisco, Calif., on Sept. 24, 1930. His parents, Mr. and Mrs. William H. Young, reside in Orlando, Fla.

PHYSICAL DESCRIPTION: Brown hair; green eyes; height: 5 ft., 9 in.: weight: 165 lb.

EDUCATION: Graduated from Orlando High School, Fla.; received a bachelor's 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.

RECREATIONAL INTERESTS: Running.

ORGANIZATIONS: Fellow of the American Astronautical Society (AAS) and the Society of Experimental Test Pilots (SETP); and associate fellow of the American Institute of Aeronautics and Astronautics (AIAA).

SPECIAL HONORS: Awarded two NASA Distinguished Service Medals, two NASA Exceptional Service Medals, the Johnson Space Center Certificate of Commendation (1970) and Special Achievement Award (1978), the Navy Astronaut Wings, the SETP Iven C. Kincheloe Award (1972), the AAS Flight Achievement Award (1972), the AIAA Haley Astronautics Award (1973).

EXPERIENCE: Upon graduation from Georgia Tech, Young entered the U.S. Navy. After serving on a West Coast destroyer for one year, he was sent to flight training in props, jets and helicopters. He was then assigned to Fighter Squadron 103 for four years flying "Cougars" and "Crusaders."

After test pilot training at the U.S. Navy Test Pilot School in 1959, he was assigned to the Naval Air Test Center for three years. His-test projects included evaluations of the Crusader and "Phantom” fighter weapons systems. In 1962, he set world time-to-climb records to 3,000- and 25,000-meter altitudes in the Phantom. Prior to reporting to NASA, he was maintenance officer of Phantom Fighter Squadron 143. Young retired from the Navy in September 1976, after completing almost 25 years of active military service, at the rank of Captain.

He has logged more than 8,000 hours flying time, including 533 hours and 33 minutes in four space flights.

NASA EXPERIENCE: Young was selected as an astronaut by NASA in September 1962.

He served as pilot with command pilot Gus Grissom on the first manned Gemini flight on March 23, 1965, a three-orbit mission, during which the crew accomplished the first manned spacecraft orbital trajectory modifications and lifting reentry.

On July 18, 1966, Young was the command pilot on the Gemini 10 mission, with Michael Collins as pilot. They rendezvoused and docked with the Agena target vehicle, then, by igniting the Agena main engine, propelled the docked combination to a record-setting altitude of 475 miles. Then a second rendezvous was performed on another Agena which had been placed in orbit three months earlier, and while Young flew formation beside the Agena, Collins did an extravehicular activity to recover a micrometeorite detector from the Agena.

He was the command module pilot for Apollo 10, May 18-26, 1969, the lunar orbital qualification test of the Apollo lunar module with Thomas P. Stafford, spacecraft commander, and Eugene Cernan, lunar module pilot. Apollo 10 verified the performance of the docked spacecraft configuration during translunar coast and lunar orbit insertion, and verified lunar orbital performance during lunar module separation and descent to within 8 nautical miles of the lunar surface, and lunar rendezvous.

His fourth space flight was as spacecraft commander of Apollo 16, April 16-27, 1972, with Thomas K. Mattingly II, command module pilot, and Charles M. Duke Jr., lunar module pilot. The Apollo 16 lunar mission inspected, surveyed and sampled materials and investigated surface features in the lunar highlands. Young and Duke spent over 71 hours on the Cayley Plains at Descartes. They logged 20 hours in extravehicular activities activating scientific equipment, collecting about 200 pounds of rock and soil samples and driving the lunar rover for 27 km on the rugged lunar terrain. on the way back to Earth, Apollo 16 accomplished an Apollo transearth coast extravehicular activity of more than one hour duration when Mattingly retrieved the scientific film cassettes from the scientific instruments compartment of the command and service module.

Young was also backup pilot of Gemini 6, backup command module pilot of Apollo 7 and backup spacecraft commander for Apollo 13 and 17.

In January 1973, he was assigned responsibility for the Space Shuttle Branch of the Astronaut office which provided operational and engineering astronaut support for the Space Shuttle Program.

CURRENT ASSIGNMENT: Young was named Chief of the Astronaut office in January 1975. In this assignment, he is responsible for the coordination, scheduling and control of astronaut activities. In March 1978, he was assigned as spacecraft commander of the Space Shuttle's first orbital flight test with Robert L. Crippen as Pilot.

BIOGRAPHICAL DATA

NAME: Robert L. Crippen (Captain, USN), pilot.

BIRTHPLACE AND DATE: Born in Beaumont, Texas, on Sept. 11, 1937. He grew up in Porter, Texas, where his mother, Mrs. Herbert W. Crippen, now resides.

PHYSICAL DESCRIPTION: Brown hair; brown eyes; height: 5 ft. 10 in.: weight: 160 lb.

EDUCATION: Graduated from New Caney High School, Texas; received a bachelor's degree in aerospace engineering from the University of Texas in 1960.

MARITAL STATUS: Married to the former Virginia E. Hill. Her parents, Mr. and Mrs. James D. Hill, reside in Corpus Christi, Texas.

CHILDREN: Ellen Marie, June 14, 1962; Susan Lynn, Dec. 24, 1964; Linda Ruth, May 10, 1967.

SPECIAL HONORS: Awarded the NASA Exceptional Service Medal and the Johnson Space Center Group Achievement Award (1972).

EXPERIENCE: Crippen received his commission through the Navy's Aviation officer Program at Pensacola, Fla., which he entered after graduation from the University of Texas. He continued his flight training at Whiting Field, Fla., and went from there to Chase Field in Beeville, Texas, where he received his wings.

From June 1962 to November 1964, he was assigned to Fleet Squadron VA-72 -- completing two-and-one-half years of duty as an attack pilot aboard the aircraft carrier USS INDEPENDENCE. He later attended the U.S. Air Force Aerospace Research Pilot School at Edwards Air Force Base, Calif., and, upon graduation, remained there as an instructor until his selection in October 1966 to the USAF Manned orbiting Laboratory Program. Crippen was among the second group of aerospace research pilots to be assigned to the MOL Program.

He has logged more than 4,275 hours flying time, which include more than 4,090 hours in jet aircraft.

NASA EXPERIENCE: Crippen became a NASA astronaut in September 1969. He was a crew member on the highly successful Skylab Medical Experiments Altitude Test (SMEAT) -- a 56-day simulation of the Skylab mission, enabling crewmen to collect medical experiments baseline data and evaluate equipment, operations and procedures.

Crippen was a member of the astronaut support crew for the Skylab 2, 3 and 4 missions, and he served in this same capacity for the Apollo Soyuz Test Project (ASTP) mission which was completed successfully in July 1975.

CURRENT ASSIGNMENT: Crippen has been designated pilot for one of the four two-man crews selected to fly Space Shuttle orbital flight tests and, with John W. Young, will fly STS-1 in 1981.

SPACE SHUTTLE PROGRAM MANAGEMENT

NASA Headquarters

Dr. Alan Lovelace	Acting Administrator
John F. Yardley	Associate Administrator for Space Transportation Systems
L. Michael Weeks	Associate Administrator for Space Transportation Systems
David R. Braunstein	Deputy Associate Administrator for Space Transportation Systems (Management)
Daniel M. Germany	Director, Orbiter Programs
Walter F. Dankoff	Director, Engine Programs
Edward P. Andrews	Director, Ground Systems and Flight Test
LeRoy E. Day	Director, Systems Engineering and Integration
Frank Van Rensselear	Director, Expendable Equipment

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Robert F. Thompson	Manager, Space Shuttle Program
Donald K. "Deke" Slayton	Manager, Orbital Flight Test
Aaron Cohen	Manager, Space Shuttle Orbiter Project Office
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Maxime A. Faget	Director of Engineering and Development
Lynwood C. Dunseith	Director of Data Systems and Analysis

Kennedy Space Center

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Gerald D. Griffin	Deputy Director
Raymond L. Clark	Associate Director for STS Development
Dr. Robert H. Gray	Manager, Shuttle Projects Office
George F. Page	Director, Shuttle Operations

Marshall Space Flight Center

Dr. William R. Lucas	Director
Thomas J. Lee	Deputy Director
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James E. Kingsbury	Director, Science and Engineering Directorate
James B. Odom	Manager, External Tank Project
George B. Hardy	Manager, Solid Rocket Booster Project
James R. Thompson Jr.	Manager, Space Shuttle Main Engine Project
James M. Sisson	Manager, Engineering and Major Test Management office

Dryden Flight Research Center

Isaac T. Gillam IV	Director
Robert F. Johannes	Deputy Director
John A. Manke	Chief of Flight Operations
Mel Burke	Shuttle Project Manager

Goddard Space Flight Center

A. Thomas Young	Director
Dr. John H. McElroy	Deputy Director
Richard S. Sade	Director of Networks Directorate Space Tracking and Data Network
Walter LaFleur	Deputy Director of Networks Directorate (STDN)
William B. Dickinson	Division Chief, NASA Communications Network
Donald D. Wilson	Assistant Chief, NASA Communications Network
Daniel Spintman	Chief, Network Operations

ABBREVIATIONS/ACRONYMS

AA	Accelerometer Assembly, Angular Accelerometer
A/A	Air-to-Air
ACCEL	Accelerometer
ACCU	Audio Center Control Unit
ACIP	Aerodynamic Coefficients Identification Package
ACN	Ascension Island (STDN site)
ADI	Attitude Directional Indicator
AGO	Santiago, Chile (STDN site)
ANG	Angle
ANT	Antenna
AOA	Abort Once Around
AOS	Acquisition of Signal
APU	Auxiliary Power Unit
ATO	Abort to orbit
AUD	Audio
AUTO	Automatic
BDA	Bermuda Island (STDN site)
BOT	Botswana (STDN site)
BRT	Bright
BUC	Buckhorn, Calif. (STDN site)
CAL	Calibration
CAMR	Camera
CCTV	Close Circuit Television
CCU	Crewman Communications Umbilical
CDR	Commander
CNSL	Console
CNTLR	Controller
C/O	Checkout
COAS	Crewman optical Alignment Sight
CONT	Continuous
CRT	Cathode Ray Tube
CRT	Center
C/W	Caution and Warning
DAP	Digital Auto Pilot
DB	Deadband
DFI	Development Flight Instrumentation
DISC	Discrete
DKR	Dakar, Senegal (STDN site)
DTO	Detailed Test objective
ECLS	Environmental Control Life Support
ESW	Edwards AFB, Calif. (Deorbit optional site)
EES	Emergency Ejection Suits
EET	Entry Elapsed Time
EI	Entry/Interface
ET	External Tank
FCS	Flight Control System
FDF	Flight Data File
FM	Frequency Modulation
FRD	Flight Requirements Document
FSO	Functional Supplementary Objective
FTO	Functional Test Objective

ABBREVIATIONS/ACRONYMS (continued)

GDS	Goldstone, Calif. (STDN site, 1st antenna)
GDX	Goldstone, Calif. (STDN site, 2nd antenna)
GLRS	Glareshield
GMT	Greenwich Mean Time
GNC	Guidance Navigation and Control
GPC	General Purpose Computer
GWM	Guam Island, U.S. (STDN site)
HAW	Hawaii (Kauai, STDN site)
HIC	Hickam AFB, Hawaii (Deorbit optional site)
HTR	Heater
IECM	Induced Environmental Contamination Monitor
IMU	Inertial Measurement Unit
INRTL	Inertial
IOS	Indian Ocean Station (STDN site)
ITS	Interim Teleprinter System
KAD	Kadena AB, Ryukyu Islands (Deorbit optional site)
KSC	Kennedy Space Center, Fla. (Deorbit optional site)
L	Left
LH2	Liquid Hydrogen
LON	Longitude
LOS	Loss of Signal
LOX	Liquid Oxygen
LTG	Lighting
LVLH	Local Vertical Local Horizontal
MAD	Madrid, Spain (STDN site, 1st antenna)
MAN	Manual
MAX	Madrid, Spain (STDN site, 2nd antenna)
MECO	Main Engine Cutoff
MET	Mission Elapsed Time
MIL	Merritt Island, Fla. (STDN site, 1st antenna)
MLX	Merritt Island, Fla. (STDN site, 2nd antenna)
MNVR	Maneuver
NOR	Northrup FLT Strip, N.M. (Deorbit optional site)
NOZ	Nozzle
O2	Oxygen
OF	Operational Flight Instrumentation
OI	Operational Instrumentation
OMS	Orbital Maneuvering System
OPR	Operator
OPS	Operations, Operational Sequence
ORB	Orbiter
ORR	Orroral Valley, Australia (STDN site)
OVHD	Overhead
PA	Power Amplifier
PCM	Pulse-Code Modulation
PL	Payload
PLBD	Payload Bay Doors
PLT	Pilot
PM	Phase Modulation
PMC	Private Medical Communication
PRO	Proceed

ABBREVIATIONS/ACRONYMS (continued)

PNL	Panel
POS	Position
PTC	Passive Thermal Control
PWR	Power
QTY	Quantity
QUI	Quito, Ecuador (STDN site)
R	Right
RCDR	Recorder
RCS	Reaction Control System
REF	Reference
REFSMMAT	Reference Stable Member Matrix
RELMAT	Relative Matrix
RGA	Rate Gyro Assembly
ROS	Regulated Oxygen System
ROT	Rota, Spain (Deorbit optional site); Rotation
RT	Rotation Discrete Rate
SA	South Atlantic Anomaly
SEL	Select
SEP	Separation
SGLS	Space Ground Link System
SPKR	Speaker
SPLY	Supply
SV	State Vector
SYS	Systems
TB	Talkback
TDRS	Tracking and Data Relay Satellite
TK	Tank
T/L	Timeline
TRKR	Tracker
TUL	Tula Peak, N.M. (STDN site)
TV	Television
UHF	Ultra High Frequency
VAC	Vacuum
VLV	Valve
VTR	Video Tape Recorder
WCS	Waste Collection System
WIN	Yarragadee, Australia (STDN site)
WMC	Waste Management Compartment
XFER	Transfer
X-POP	X Body Axis Perpendicular to orbit Plane
Y-POP	Y Body Axis Perpendicular to orbit Plane
-ZLV	-Z Local Vertical (-Z body axis towards Earth)