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Press Kit

Project

Wet Countdown Demonstration and Flight Readiness Firing

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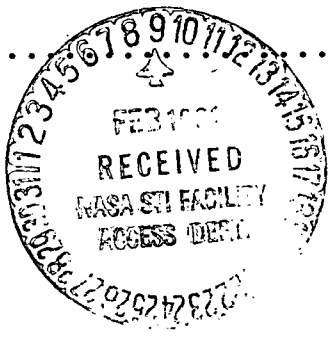

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SPACE SHUTTLE DRESS REHEARSAL SET FOR FEBRUARY

A dress rehearsal of all aspects of the first Space Shuttle mission (STS-1) will be conducted by NASA in February to clear the way for the launch of the Shuttle's first orbital flight, now scheduled for no earlier than March 17, 1981.

The exercise will touch upon all segments of the mission -- including countdown and launch, ascent and orbital operations, and reentry and landing under normal and abort conditions.

The 11-day test series will involve operations at the Kennedy Space Center in Florida, the Johnson Space Center in Houston, the Dryden Flight Research Center in Edwards, Calif., the Marshall Space Flight Center, Huntsville, Ala., and the White Sands Missile Range in New Mexico.

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It will be divided into two major sections: the Wet Countdown Demonstration Test/Flight Readiness Firing, which will include a 20-second test firing of the orbiter's three main engines, and a Mission Verification Test, which will be centered on flight and landing operations.

The first Space Shuttle mission (STS-1) will be 54 hours, 30 minutes in duration with launch from the Kennedy Space Center. Mission operations will be controlled by the Johnson Space Center. The Dryden Flight Research Center is the primary landing site, but provisions exist for a return-to-launch-site abort landing at the Kennedy Space Center and an abort landing after less than a single orbit (abort-once-around) at the Northrop Strip, White Sands Missile Range, N.M.

Astronauts on the prime crew for the STS-1 mission are John Young, commander, and Robert Crippen, pilot. Backup crew members are Joe Engle, commander, and Richard Truly, pilot.

The STS-1 space vehicle, consisting of the orbiter Columbia, the external tank which supplies liquid hydrogen and liquid oxygen propellants to the orbiter's three main engines, and two solid rocket boosters, was moved from Kennedy's Vehicle Assembly Building to Pad A at Launch Complex 39 on Dec. 29.

The space vehicle and mobile launcher platform on which it rests were connected with ground support equipment for the Pad Validation Test which began on Jan. 2.

An extensive series of flight and ground system tests in January and early February set the stage for the 11-day dress rehearsal which must be successfully completed to clear the way for launch.

The Wet Countdown Demonstration Test/Flight Readiness Firing and Mission Verification Test will exercise all elements of the new Space Transportation System, including personnel, facilities, space vehicle and computer programs in a demanding real time environment to demonstrate the proper integration of all elements prior to the STS-1 mission.

The Wet Countdown Demonstration/Flight Readiness Firing at Kennedy will be followed by approximately three weeks by a "dry" launch simulation with the external tank unloaded and the prime crew on board. During this dry countdown test, the space vehicle will be processed through the final five hours of the countdown to a simulated ignition and liftoff.

This test in which the crew will participate is primarily a checkout of flight and ground support systems.

(END OF GENERAL RELEASE)

WET COUNTDOWN DEMONSTRATION TEST/FLIGHT READINESS FIRING

The Wet Countdown Demonstration Test/Flight Readiness Firing is a detailed practice run for the STS-1 launch and is aimed at identifying any failures or weaknesses in spacecraft and ground systems before launch day. Conditions and timelines for the test and firing duplicate as close as practicable those planned for STS-1 launch, and include tanking and detanking of the orbiter Columbia and the external tank (hence "wet") and a complete checkout of Pad A at Complex 39.

Columbia's cabin will be unmanned when propellant loading begins, and orbiter systems will be remotely operated during the test. The six-day demonstration test will culminate in a 20-second firing of Columbia's three main engines at throttle settings ranging from 94 to 100 percent of rated thrust while the engine nozzles are tilted in their gimbals as they would be in flight to control the direction of thrust.

Extra experience and training will be gained from the test and readiness firing by other NASA facilities involved in Shuttle operations. Flight controllers in the Mission Control Center at the Johnson Space Center in Houston will monitor Columbia's systems during the tests, as will personnel at the Huntsville Operations Support Center, Marshall Space Flight Center, Huntsville, Ala.

While the main engines, orbiter, external tank, solid rocket boosters and ground support systems have been tested individually, the demonstration test and readiness firing will be the only chance to test the full vehicle "stack" in launch conditions without proceeding to an actual launch.

A successful test will provide confidence that the Space Shuttle is ready for flight.

Both wet and dry launch rehearsals were conducted prior to all 13 Saturn V and four Saturn 1B launches from Complex 39, but those tests did not include the on-pad rocket engine firing which will be such a significant part of this exercise.

Among the purposes of the test and firing are:

- To test all elements of the Space Transportation System in a real time launch countdown which will culminate in the firing of the orbiter's three main engines and a simulated launch to insure their proper integration prior to the STS-1 flight.

- To verify the capability of the launch facility to provide propellants to the Shuttle under launch conditions. The external tank and orbiter systems will be exposed to the same thermal environment they will experience during STS-1 launch preparations.

The main propulsion system control elements also will be required to maintain pressure in the external tank and in the main engines during the test firing as they would during an actual launch.

- To verify the ability of the orbiter's auxiliary power units and hydraulic system, and the flight control system to throttle and gimbal the main engines.

- To evaluate the performance of avionics and computer programs in controlling and monitoring the interaction of the external tank and main engines under the vibration and sound conditions they will experience during ignition and the pre-liftoff phase.

- To verify that Kennedy's Launch Processing System and Columbia's bank of general purpose computers can work together in controlling the launch countdown sequence.

- To verify compatibility of the Space Shuttle's onboard avionics equipment with the radio frequencies used by ground support elements during the launch phase.

- To assess the "twang" effects of the orbiter's three main engines. At main engine ignition, a bending movement is created, causing the upper extremities of the entire Space Shuttle "stack" to bend toward the external tank side of the stack and to twang back as the spring action of the hold down mechanisms react against the main propulsion system bending forces. The twang effect occurs over a period of a few seconds (approximately 5 seconds) at the end of which the solid rocket boosters would be fired for liftoff. This test will certify the time phasing of the orbiters main engines and solid rocket booster ignition.

- To exercise the ground data processing system and methods and make any needed fixes before the STS-1 launch.

- To compare earlier dynamic and vibroacoustic testing data to actual conditions during launch.

COUNTDOWN AND FLIGHT READINESS FIRING

The Wet Countdown Demonstration Test/Flight Readiness Firing preparation phase begins on the first day of the 11-day STS-1 simulation and ends of the sixth day. The schedule includes a number of built-in holds. All operational elements supporting the STS-1 mission will participate and demonstrate their readiness by exercising all countdown functions and interfaces. T-0 will be planned to occur at the opening of the launch window, which is approximately five hours in duration.

As for the STS-1 launch, the window will open at sunrise plus 45 minutes. The Flight Readiness Firing is scheduled for no earlier than Feb. 10. Window opening times for that date and the six subsequent days are as follows:

Feb. 10	-	7:50 a.m. EST
Feb. 11	-	7:49 a.m. EST
Feb. 12	-	7:48 a.m. EST
Feb. 13	-	7:47 a.m. EST
Feb. 14	-	7:46 a.m. EST
Feb. 15	-	7:45 a.m. EST
Feb. 16	-	7:44 a.m. EST

The firing pre-count will be picked up at T-53 hours with the powering up of the solid rocket boosters, orbiter and ground support equipment. The STS-1 launch pre-countdown begins at T-68 hours. However, for the Flight Readiness Firing, a number of events which would normally occur between T-68 hours and T-53 hours (such as loading hypergolic propellants for the orbiter's auxiliary power units and the boosters' hydraulic power units) will have already been accomplished as a part of earlier tests. Hypergolic propellants for the orbiter's orbital maneuvering system and reaction control system were to be loaded in late January.

The Flight Readiness Firing pre-count includes the capability for three built-in holds. These could include one of 12 hours duration at T-24 hours and two of six hours duration, occuring at T-15 hours, 30 minutes and at T-5 hours, 30 minutes.

Additional holds are planned during the countdown which begins at T-5 hours. These are indicated at the appropriate places in the Flight Readiness Firing Countdown Sequence which follows.

Countdown Sequence - Flight Readiness Firing

Count Time	Function
T-53 hours	Start of FRF call to stations.
T-11 hours	Extend fixed service structure external tank gaseous oxygen vent arm/start retraction of rotating service structure.
T-9 hours, 30 minutes	Retract external tank intertank access arm on fixed service structure.
T-5 hours, 30 minutes	Clear launch pad to begin countdown.
T-5 hours	Start countdown. Chilldown liquid oxygen/liquid hydrogen transfer system.
T-4 hours, 30 minutes	Begin liquid oxygen fill of external tank and LH_2. MPS facility/orbiter chilldown.
T-4 hours, 15 minutes	Begin liquid hydrogen fill of external tank.
T-2 hours, 4 minutes	One-hour built-in hold. ET cryo loading complete. Start ET pressurization tests. No activities planned. (During STS-1 countdown, crew entry will begin following this hold and be completed by T-1 hour, 5 minutes.)
T-1 hour, 50 minutes	External tank ice/frost evaluation.
T-20 minutes	20-minute built-in hold.
T-9 minutes	10 minute built-in hold.
T-9 minutes	Go for launch/start launch processing system ground launch sequencer (automatic sequence).
T-7 minutes	Start crew access arm retraction (fixed service structure).
T-5 minutes	Start orbiter auxiliary power units.
T-3 minutes, 45 seconds	Run orbiter aero surfaces profile.

T-3 minutes, 30 seconds	Orbiter placed on internal power.
T-3 minutes, 10 seconds	Run gimbal slew profile, Space Shuttle main engine.
T-2 minutes, 55 seconds	External tank oxygen to flight pressure.
T-2 minutes, 50 seconds	External tank gaseous oxygen vent arm retracted.
T-1 minute, 57 seconds	External tank hydrogen to flight pressure.
T-25 seconds	Solid rocket booster hydraulic power units activated/orbiter onboard general purpose computer assumes control of terminal countdown/ground launch sequencer remains on line supporting.
T-18 seconds	Verify solid rocket booster nozzle position.
T-11 seconds	Initiate pre-liftoff sound suppression system water (post-liftoff system - "rainbirds" - inhibited for Flight Readiness Firing).
T-3.8 seconds	Main engine start sequence begins.
T+.24 second	All engines at 90 percent thrust.
T+2.88 seconds	Simulated external tank umbilical retract/simulated solid rocket booster ignition and holddown post release.
T+3 seconds	Simulated liftoff.
T+18.2 to 20 seconds	Main engine shutdown commands issued.
T+22 seconds	Solid rocket booster hydraulic power units shut down.
T+22.7 to 25.9 seconds	Main engine LOX/LH_2 prevalves closed.

Flight Readiness Firing

The Flight Readiness Firing operation is limited to approximately 20 seconds of main stage operation with the start identical to that planned for the STS-1 launch. The engines will be tested at 94 percent and 100 percent rated power level with shutdown occurring from 100 percent. Gimbaling of the main engine will be performed at both power levels.

The three engines are not ignited simultaneously but start commands are issued at intervals of about 120 milliseconds. The start command for engine 3 is issued at T-3.8 seconds, that for engine 2 at T-3.68 seconds, followed by the start command for engine 1 at T-3.56 seconds. The engines are throttled to 100 percent at approximately T-0. Part way through the burn, the engines are throttled back to 94 percent of rated thrust. Near the burn's end, they are throttled up to 100 percent of rated thrust. The engine nozzles are gimbaled during both peak and reduced thrust.

The Wet Countdown Demonstration Test/Flight Readiness Firing will end when all propellants and cyrogenics have been removed from the vehicle after engine firing.

The seventh day of the overall 11-day dress rehearsal will be reserved for securing pad operations and will not include any flight simulation test activity.

MISSION VERIFICATION TEST

A series of four coordinated tests and simulations will follow the Countdown Demonstration Test/Flight Readiness Firing at the Kennedy Space Center. The simulations begin on the eighth day of the 11-day series.

They include a return-to-launch-site abort simulation at the Kennedy Space Center's Shuttle Landing Facility; an abort-once-around landing simulation at the White Sands Missile Range; a 56-hour-long duration mission simulation at the Johnson Space Center of the flight phase of the mission from solid rocket booster ignition to a routine landing at the end of the flight; and an end-of-mission landing exercise at the Dryden Flight Research Center in California.

Return-to-Launch-Site Abort Exercise

This will involve a series of four activities at Kennedy's Shuttle Landing Facility to demonstrate the ground team's readiness to support various situations following a return-to-launch-site abort. The exercise is a simulation of the orbiter approach and landing from approximately 12,200 meters (40,000 feet) after a return-to-launch-site abort and runs through landing and post-landing activities and orbiter safing.

The major differences between this abort exercise and such an actual abort will be related to using a T-38 jet aircraft instead of an orbiter for the approach and landing and a simulated orbiter aircraft with simulated interfaces for ground connections.

The T-38 landing will be planned to occur at a time of day compatible with a liftoff at the opening of the launch window. The purpose of the simulated return-to-launch-site abort is to exercise the flight control team, post-landing operations team, crash and rescue team, and airspace and chase aircraft control organizations.

Abort-Once-Around Exercise

A similar series of four activities will also be conducted on the eighth day at the Northrop Strip, White Sands Missile Range, in parallel with the return-to-launch-site abort exercise at Kennedy. This exercise is a simulation of approach, landing and post-landing activities following an abort-once-around from approximately 12,200 m (40,000 ft.) through orbiter safing. As at Kennedy, a T-38 aircraft will be used to simulate the orbiter's approach and landing and the post-landing activities on the ground.

The purpose of the simulated approach and landing and subsequent activities is to exercise the flight control team, post-landing operations team, crash and rescue team, and airspace and chase aircraft control organizations.

Mission Simulation

A Shuttle mission simulator and the Mission Control Center at the Johnson Space Center will be electronically linked to provide a realistic, 56-hour simulation of the STS-1 mission from solid rocket booster ignition and liftoff to a landing at the primary landing site, the Dryden Flight Research Center at Edwards Air Force Base, Calif. This exercise will be conducted on days 9, 10 and 11 with the simulated liftoff to occur at the opening of the launch window. This will be the seventh and final long-duration mission simulation for the STS-1 flight crews.

During the months of training leading up to the Mission Verification Test, prime and backup flight crews and flight control teams have routinely run mission phase simulations (launch, entry, aborts, on-orbit operations) on a Tuesday and Thursday schedule, with long-duration simulations spaced a month to six weeks part.

This full-duration mission simulation during the Mission Verification Test will be the final "walk-through" of the STS-1 flight profile and timeline before the actual flight begins.

End-of-Mission Exercise

This is a series of four activities at Dryden Flight Research Center to demonstrate the ground team's readiness to support various situations following the end-of-mission landing at the primary landing site. They will be conducted on the 11th day of the test series and wrap up the combined Countdown Demonstration Test/Flight Readiness Firing and Mission Verification Test.

A T-38 jet aircraft will be used to simulate the orbiter approach and landing phase beginning at an altitude of approximately 12,200 m (40,000 ft.). The landing will be timed so that touchdown coincides with that of the long-duration mission simulation underway at the Johnson Space Center in Texas. After landing, the T-38 will taxi past an orbiter mockup which will be placed at the nominal wheels stop point. The orbiter mockup has the appropriate interfaces for ground connections to enable ground crews in the recovery convoy to simulate post-landing safing operations and turnaround initiation. Both on-runway and off-runway contingency situations will also be simulated as they were during the return-to-launch-site abort exercise at Kennedy and the abort-once-around abort exercise at White Sands.

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