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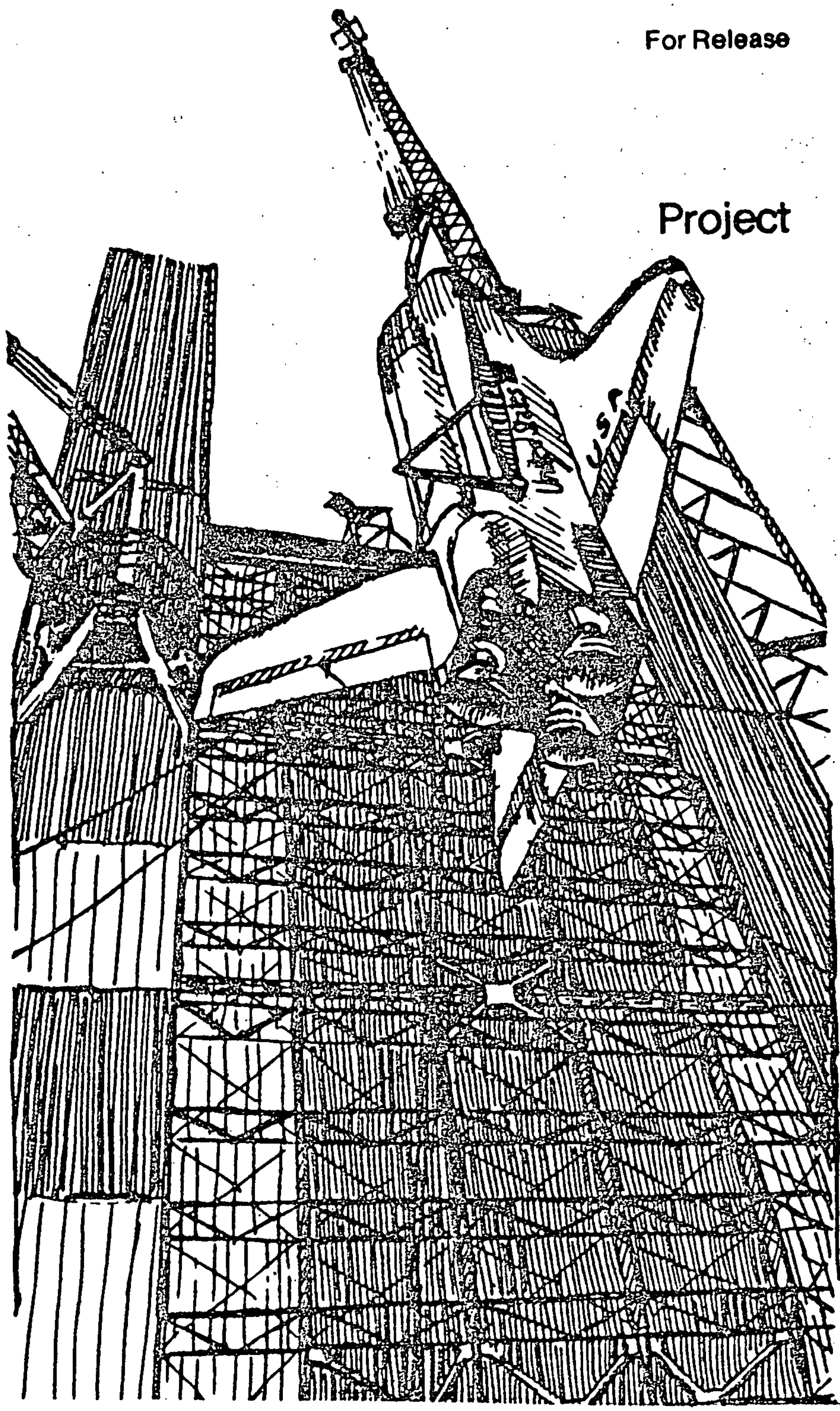

For Release IMMEDIATE

Project Space Shuttle Ground Vibration Tests

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SHUTTLE BEING TESTED AT MARSHALL CENTER

America's spaceship of the future, the Space Shuttle, has arrived in Alabama to be assembled for the first time as a complete vehicle for ground vibration tests at NASA's Marshall Space Flight Center in Huntsville.

In a huge facility originally constructed for testing the Saturn V Moon rocket, engineers will evaluate the structural dynamics and their effect on the control system of the Shuttle.

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The component parts needed to make the Shuttle complete -- the orbiter, external tank and solid rocket boosters -- will be transported from California, Louisiana, Utah and other locations. Testing is expected to begin in early spring and continue for several months.

The tests are called MVGVT , an acronym which stands for Mated Vertical Ground Vibration Tests. The term vibration may be misleading. This is not a shaking test to learn how strong the vehicle is. Engineers at the Marshall Center will "float" the Shuttle in the center's tall test tower and apply vibrations to its exterior with exciters powered by amplifiers similar to those found on home stereo sets. Sensors placed along the skin at other locations record the characteristics of the vibrations as they pass from one area to another.

Information from these tests will allow the center to verify the system design and mathematical models that predict how the Shuttle's control system will react to the much more severe vibrations expected during launch and flight into orbit.

The ground vibration tests will continue through most of the year with pauses only to change the test configuration of the Space Shuttle vehicle.

The first test article configuration will include the orbiter and external tank to simulate the high altitude portion of a Shuttle mission after the solid rocket boosters have separated. The liquid oxygen tank of the external tank will be filled with smaller and smaller quantities of deionized water to simulate use of propellant by the main engines. The liquid hydrogen tank will be pressurized but empty.

For the second test configuration, solid rocket boosters filled with inert propellants will be stacked in the stand along with the orbiter and tank. This configuration simulates liftoff conditions. This will be the first stacking of all Space Shuttle components as they will appear for launch. Following this test series, all components will again be removed from the stand.

The third test configuration will be the same as the second except that the solid rocket boosters will be empty, simulating the portion of a Shuttle mission just prior to booster separation. Following this final test series, Shuttle components will be removed from the stand and prepared for return to points of origin.

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Shuttle elements for the test will arrive during the next several months. The orbiter is the portion of the Shuttle which carries the crew and payload to Earth orbit and has performed to near perfection in flight tests in California. The same Boeing 747 aircraft which carried the orbiter aloft for the flight tests ferried it piggyback to the Marshall Center.

Arriving in segments by rail from Utah, the West Coast and other locations, the solid rocket boosters will be assembled at Marshall. The booster segments are expected to arrive at the center during the May-July time period. The largest Shuttle element, the external tank, assembled at New Orleans, arrived by barge on the Tennessee River early in March.

For flight, the boosters, external tank and orbiter will be joined to form one unit. The boosters are attached to the sides of the tank and the orbiter is fastened on top of the tank between the boosters. The boosters provide thrusting power during the first two minutes of flight. The main engines, pulling propellants from the external tank, burn for about the first eight minutes of flight.

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The reusable Space Shuttle will become America's work-horse for future space missions. Its payload bay measures 4.57 meters (15 feet) in diameter and 18.28 m (60 ft.) in length and can accommodate payloads up to 29,484 kilograms (65,000 pounds) in low Earth orbit. The Shuttle will be able to take a variety of satellites to orbit, retrieve satellites and return them to the ground, or to repair satellites already in orbit.

The Shuttle will also be the carrier vehicle for Space-lab, which consists of a shirtsleeve laboratory module for scientists to conduct orbital experiments in addition to pallets for experiment hardware which needs to be exposed to the space environment. Spacelab flights are scheduled to begin in 1980.

NASA's Johnson Space Center, Houston, Texas, has responsibility for the orbiter and the integration of all elements into the final vehicle.

The Marshall Center has the responsibility for design and development of the main engines, the external tank and the solid rocket boosters and some major testing of the vehicle and its components.

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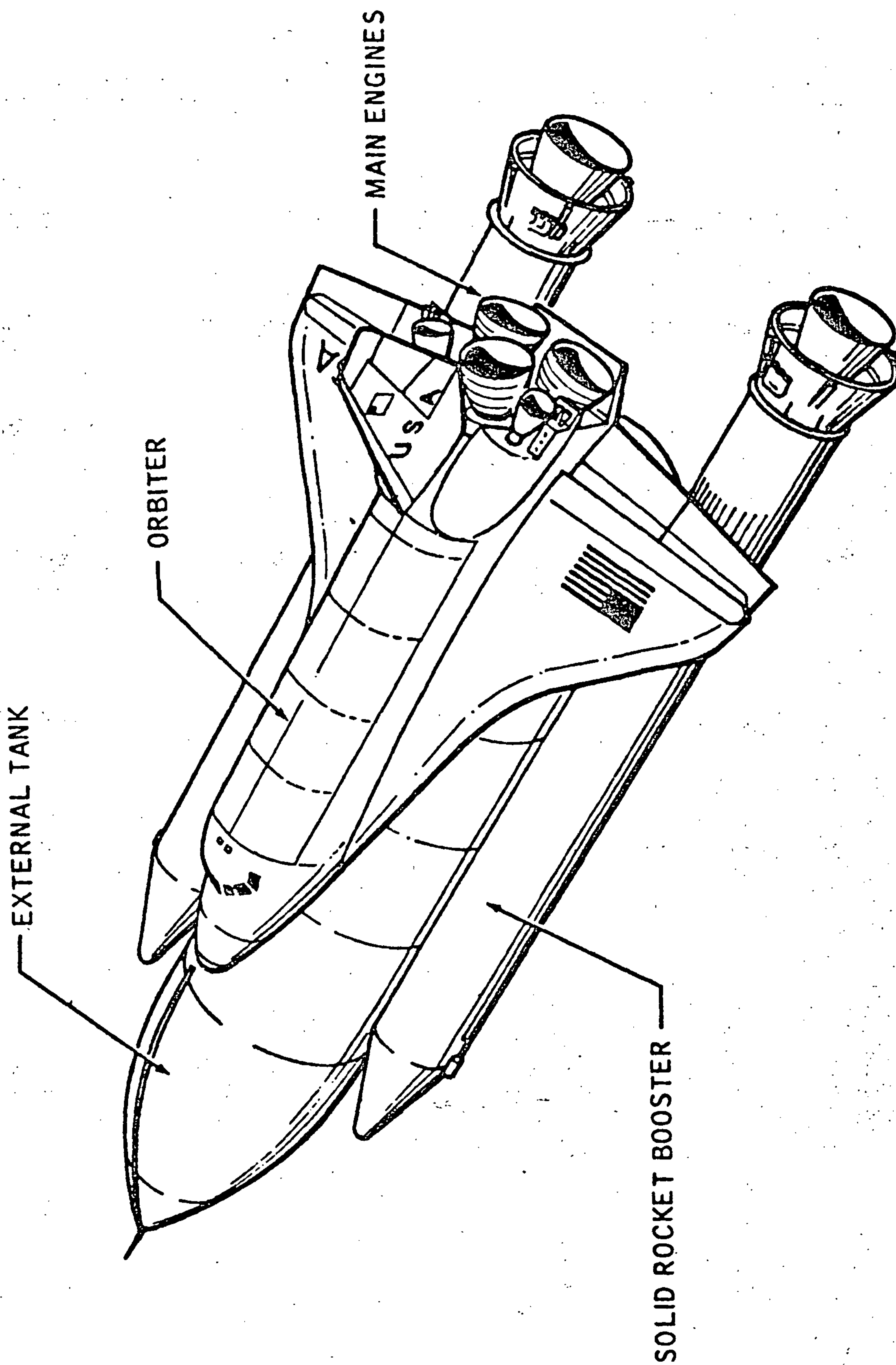
NASA's Kennedy Space Center, Fla., and Vandenberg Air Force Base, Calif., have been selected as the Shuttle launch and landing areas.

(END OF GENERAL RELEASE. BACKGROUND INFORMATION FOLLOWS.)


MAIN ENGINES
ORBITER
EXTERNAL TANK
SOLID ROCKET BOOSTER

MATED VERTICAL GROUND VIBRATION TEST MILESTONES -- 1978

Start test -- Orbiter and External Tank	April
Complete test -- Orbiter and External Tank	June
Start test -- Orbiter, External Tank and Solid Rocket Boosters Full	September
Complete test -- Orbiter, External Tank and Solid Rocket Boosters Full	September
Start test -- Orbiter, External Tank and Solid Rocket Boosters Empty	October
Complete testing	November

-more-

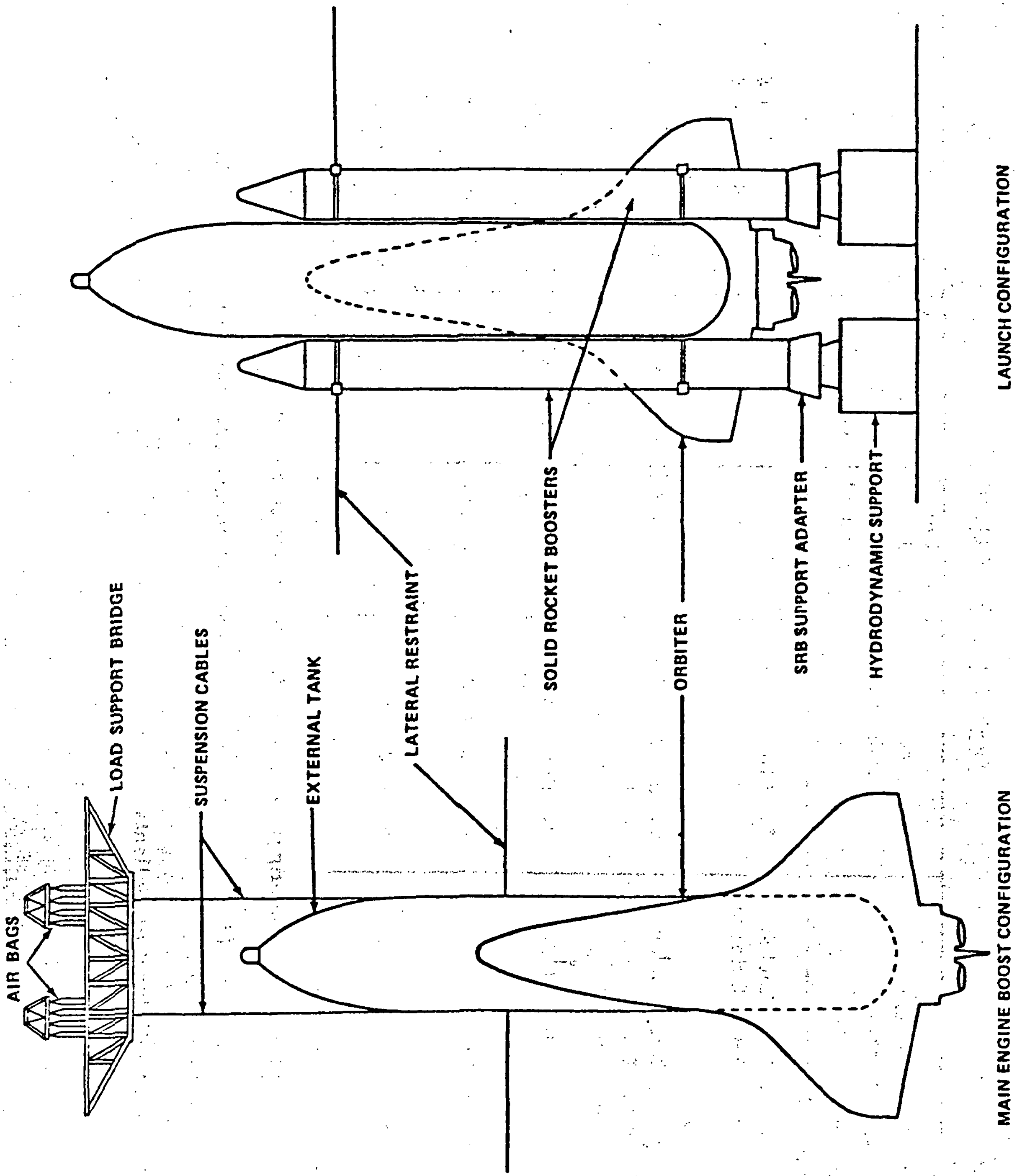
TEST CONFIGURATIONS

Test Article Configuration [1]	Test Condition	Time in Mission (Seconds)	Simulated LOX Level (Gallons) [2]	
1. Orbiter, Solid Rocket Boosters Full, External Tank [3]	1. Liftoff	T + 0	140,600	Shuttle Vehicle stacked and mated to simulate liftoff
2. Orbiter, Solid Rocket Boosters Empty, External Tank	2. Solid Rocket Booster Burnout	T + 125	101,000	Empty SRM segments simulate pre-SRB separation
3. Orbiter, External Tank	3. Boost (Main Engines only)	T + 125	101,000	Mated to simulate post SRB jettison
Orbiter, External Tank	4. Mid Boost	T + 301	45,750	Simulate conditions at main engines mid-burn
Orbiter, External Tank	5. End Boost	T + 477	3,450	Simulate conditions at main engines near burnout

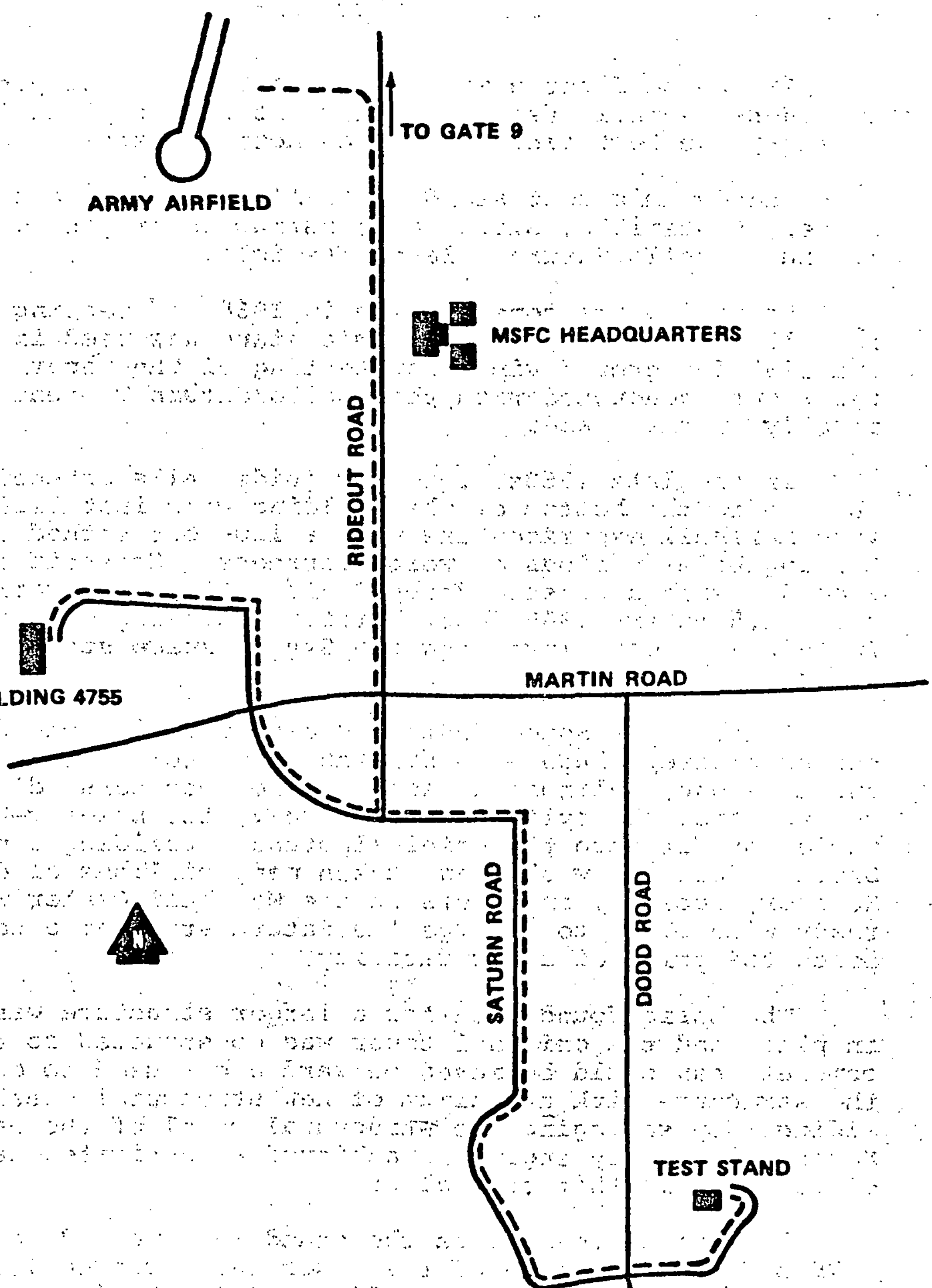
[1] Three basic test article configurations used to create five test conditions

[2] Deionized corrosion inhibited water used to simulate liquid oxygen. Liquid hydrogen tank will be pressurized but empty

[3] SRB's filled with inert propellants



MATED VERTICAL GROUND VIBRATION TEST



DASH LINES SHOW ROUTES THE ORBITER VEHICLE WILL TAKE BETWEEN THE ASSEMBLY BUILDING 4755, THE TEST STAND AND THE AIRFIELD.

THE TEST FACILITY

The Space Shuttle will not be the first occupant of the 36-story-tall test tower where it will be installed. In fact, the test facility has an active history.

The dynamic test stand at NASA's Marshall Space Flight Center, Huntsville, Ala., was constructed originally for the huge Apollo/Saturn V launch vehicle.

Following its construction in 1964 and testing system installation in 1965, the dynamic stand was used in 1966 and 1967 for ground vibration testing of the Saturn V. The tests were conducted with the Apollo/Saturn V mounted vertically in the stand.

In the late 1960s, interior guide rails extending from the top to the bottom of the building were installed to provide Marshall experimenters with a low-cost method of obtaining brief periods of weightlessness. Scientific packages placed inside a capsule dropped along the guide rails for over 91.5 meters (300 feet) briefly achieving weightlessness. In 1972-73, tests involving the Skylab space station were conducted in the stand.

Because the Space Shuttle's configuration, an airplane-shaped orbiter, huge external tank for engine propellants and the long, cylindrical solid rocket boosters, differed so much from the cylindrical Saturn V, the newer vehicle would not fit into the original stand. Building a new Shuttle facility would have taken many millions of dollars. However, facility engineers at the Marshall Center were ready with plans to enlarge the Saturn stand at a cost far below the price of a new facility.

The basic foundation for a larger structure was already in place and the original tower was constructed so that a complete bay could be moved outward and reused to enlarge the structure with a minimum of new structural steel and siding. By salvaging the structural steel of the east bay, Marshall facility engineers achieved an estimated savings of $300,000 in that area alone.

A contract to enlarge the stand was awarded in late 1975 and the east side of the tower was extended 7.3 meters (24 feet) to provide a 7.3 x 29.9 m (24 x 98 ft.) addition so that the test bay would be large enough for the Space Shuttle.

During 1977, new work platforms to fit the Shuttle were added in addition to other support equipment for the tests.

Original dimensions of the stand were 29.9 x 29.9 m (98 x 98 ft.). As it now stands, it is 29.9 x 37.2 m (98 x 122 ft.) at the base and remains 109.7 m (360 ft.) high. In its extended position, a 181,440-kilogram (200-ton) derrick atop the facility reaches about 131 m (430 ft.) high. A 158,760-kg (175-ton) derrick is mounted on one side of the stand.

Modifications inside the stand include work platforms on eight levels shaped for access to the Space Shuttle configuration and two large hydrodynamic support stands for the solid rocket boosters.

Cost of facility modifications necessary to prepare the stand for Space Shuttle testing is estimated at about $2,880,000.

DYNAMIC TEST SUSPENSION SYSTEM

A unique suspension system with air bags and cables will be used to suspend the Space Shuttle's Orbiter Enterprise and external tank in the test tower for the first phase of the Shuttle ground tests at the Marshall Center during 1978.

The suspension system includes a large overhead truss which will be installed like a crossbeam between two test stand walls at the 65.8-m (216-ft.) level. The air bags and cables will be attached to the truss.

Although the Orbiter Enterprise and external tank will weigh about 544,320 kg (1.2 million pounds), this suspension system will allow the freedom of movement necessary for the acquisition of test data.

Suspending the orbiter and tank, which is the first phase of testing and scheduled to begin in April, duplicates as nearly as possible the flight conditions of the Space Shuttle from the time the solid rocket boosters drop off, two minutes into the flight, until the main engines shut off six minutes later. Following tests involving the entire Space Shuttle assembly will use a different suspension system.

Preparation for the first Shuttle test phase will begin with installation of the external tank in the stand. The tank will be temporarily affixed to the stand with knee braces. Then the Orbiter Enterprise will be lowered into place and mated to the external tank as it would be in an actual flight.

After the Enterprise is in place, engineers will install the suspension system overhead and attach the cables to the external tank. The upper ends of the cables are attached to the air bags. Air bags will be pressurized, and the knee braces removed. At this point, the Enterprise and the external tank will be suspended by the cables. Lateral restraints will prevent sideways movements of the configuration.

The suspension system is not needed for the second and third phases of the test, which use the solid rocket boosters, and will be removed.

Sperry Support Services, Huntsville, a division of Sperry Rand Corp., was responsible for development, design and manufacturing of the complete suspension system under contract to the Marshall Center. It was delivered to the Marshall Center Jan. 3, 1978.

The test support division of the Marshall Center's Test Laboratory was responsible for technical review of the suspension system development.

SHUTTLE TO BE STACKED ON HYDRODYNAMIC STANDS

Hydrodynamic stands which allow vertical, lateral and rotational movement will be used when the entire Space Shuttle is installed in a huge dynamic test stand for the second and third phases of the Shuttle ground tests at the Marshall Center during 1978.

Four stands will be used, two under each solid rocket booster. Each stand contains a cylinder and piston, with bearings installed on top of each piston. Together, this hardware provides for freedom of movement of the Space Shuttle Orbiter, external tank and solid rocket boosters. The stands will support a total weight of about 1.89 million kg (4 million lb.) when the solid rocket boosters are loaded with inert propellants. When the boosters are empty, the total weight on the stands is reduced to about 623,700 kg (1.5 million lb.).

Under test conditions, the cylinders will be pressurized to about 105,450 grams/sq cm (1,500 psi) and charged with about 3,785 liters (1,000 gallons) of a special type of oil. The bearings atop the pistons create the "floating" characteristics desired for the tests.

During the first phase of the test, the hydrodynamic stands will not be used. Only the orbiter and external tank will be installed in the test tower and suspended from a large air bag system located inside a crossbeam.

For the second test phase, the solid rocket boosters, filled with inert propellants, will be stacked inside the test facility on top of the hydrodynamic stands. Then the external tank will be attached to the boosters, and the orbiter will be mated to the external tank.

The third test phase will be the same as Test Phase Two except that the solid rocket booster will be empty.

The hydrodynamic stands, originally used in dynamic testing the Apollo Saturn V vehicle, have been refurbished and modified for the Shuttle tests. Marshall Center engineers estimate that the refurbishment and modification costs were about one-fourth the cost of a new system. Martin Marietta Aerospace, Denver Division, prepared the stands for the Shuttle tests, under contract to the Marshall Center.

HOW SHUTTLE IS VIBRATED

A key element in Space Shuttle ground vibration testing at the Marshall Center during 1978 will be the system that applies vibrations to the Shuttle while it sits vertically in a 109.7-m (360-ft.) tall dynamic test stand. Called the Shuttle Modal Test and Analysis System (SMTAS), this system can provide the required vibrational cycle and force inputs as well as acquire the response data from the vehicle.

The SMTAS will provide automatic control of up to 24 preselected shaker channels from the available 36 68-kg (150-lb.) shakers and 20 953.5-kg (1,000-lb.) shakers which are used to apply simultaneously precise excitation forces at preselected points on the Space Shuttle.

The shakers will be affixed by soft mounts to the test facility structure. Shaker rods will extend to the Space Shuttle and be attached to it at hard points over spars, ribs or other structural elements but not over unsupported skin surfaces. To protect the Shuttle hardware, the SMTAS is capable of manual or automatic cutoff.

The shakers are electrodynamic. The SMTAS will provide the drive amplifiers to control the force -- how hard the rods push and pull -- and the frequency, or rate of vibration.

While the major part of the data will be acquired by the SMTAS, data will also be recorded through test facility channels.

Data acquisition will be the responsibility of the Space Division, Rockwell International, under contract to NASA's Johnson Space Center, Houston.

TEST SUPPORT RESPONSIBILITIES

Test Hardware	
Orbiter	Rockwell International Space Division
External Tank	Martin Marietta Corp.
Solid Rocket Boosters	Marshall Space Flight Center
Solid Rocket Motors	Thiokol Chemical Corp.
Orbiter Support	
Ferry Flight to Marshall Center	Johnson Space Center
Mate-Demate	Kennedy Space Center
Ground Transportation	Marshall Center/Contractor's Cargo
Preparation for Test	Rockwell International
External Tank Support	
Ground Transportation	Marshall Space Flight Center/ Martin Marietta Corp.
Preparation for Test	Martin Marietta Corp.
Solid Rocket Booster Support	
Ground Transportation	Marshall Space Flight Center
Preparation for Test	United Space Boosters, Inc.

Installation in Test Stand (overall responsibility Marshall Space Flight Center)

Hoisting Operations	Bendix Corp.
Stacking of SRBs	United Space Boosters, Inc./ Thiokol Chemical Corp.
Mating of External Tank	Martin Marietta Corp.
Mating of Orbiter	Rockwell International

Mated Vertical Ground Vibration Tests

Test Direction	Marshall Space Flight Center
Vibration and Data Acquistion	Marshall Space Flight Center/ Rockwell International/ Johnson Space Center

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