V11.6.

KSC

KENNEDY SPACE CENTER, FLORIDA

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

LAUNCH COMPLEX 39 FACILITIES

V111.6

FACT SHEET 03
NOVEMBER 1966

APOLLO OBJECTIVES AND RESPONSIBILITIES

A major goal of NASA's Apollo program is a manned space flight to the moon, exploration of the lunar surface, and safe return of the astronauts before the end of this decade.

Under the direction of the Office of Manned Space Flight, NASA, Washington, D. C., the Apollo program is a joint responsibility of Manned Spacecraft Center, Houston, Texas; Marshall Space Flight Center, Huntsville, Alabama; and Kennedy Space Center, Florida.

Development of launch vehicles for the Apollo program is undertaken at the Marshall Space Flight Center, while the Manned Spacecraft Center oversees development of spacecraft systems and astronaut selection and training.

Kennedy Space Center is NASA's manager for launch operations. KSC provides the launch facilities to support the mission, is responsible for receiving, inspection, assembly and preflight testing of launch vehicles and spacecraft, and conducts launch of vehicles employed in the Apollo program.

FACILITIES TO SUPPORT APOLLO PROGRAM

Following President Kennedy's commitment to place American astronauts on the moon before the end of this decade, NASA obtained Congressional approval to create a national spaceport on 88,000 acres of land on Merritt Island, adjacent to existing facilities on Cape Kennedy. In August 1961, this location was officially designated as the launch site for the lunar program.

While KSC developed design criteria for the spaceport, construction was carried out by various contractor organizations under direction of the Army Corps of Engineers.

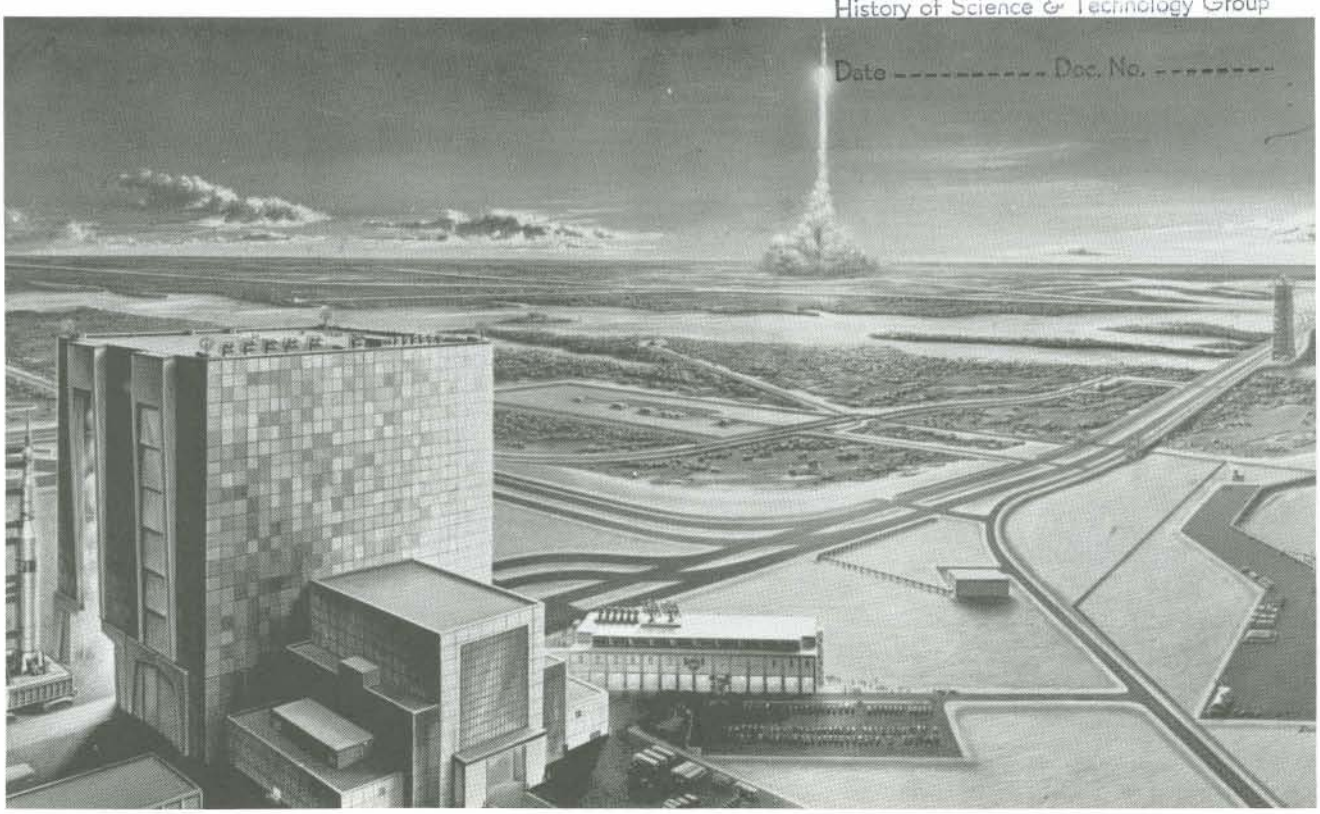
In 1967 the first of the Saturn V configurations (the launch vehicle to be used for the lunar mission) will be launched by KSC.

The facilities at Kennedy Space Center are located in two basic areas:

1. The Industrial Area which houses administrative and engineering personnel, and provides test facilities for Apollo spacecraft.
2. Launch Complex 39, located approximately five miles north of the Industrial Area, where facilities have been constructed to implement the assembly, checkout and launch of Apollo/Saturn V space vehicles.

SATURN HISTORY DOCUMENT
University of Alabama Research Institute
History of Science & Technology Group
Date ---------- Doc. No. ---------

Artist's concept of Launch Complex 39 shows Vehicle Assembly Building at lower left. Next to the VAB is Launch Control Center. The Crawlerway over which the Transporter carries the Mobile Launcher and space vehicle terminates at the launch pads in the distance.



THE NEED FOR NEW CONCEPTS

Since the United States' first satellite was launched in 1958, the fixed launch concept has been employed exclusively in all major NASA programs.

Under the fixed launch concept the space vehicle undergoes assembly and integration at the launch pad, and at that location simulated flight tests and final checkout of the vehicle takes place. This method has proved entirely satisfactory in programs to date; however, the size and complexity of the Apollo/Saturn V vehicles and the frequency of scheduled flight tests dictated requirements that have evolved in the new "mobile launch concept."

The mobile launch concept consists of assembly, integration and checkout of space vehicles in a protected environment, with the flight ready vehicle then transported to the launch site. There, following final servicing and propellant loading, the launch is effected.

One of the major benefits realized in the mobile launch concept is the reduction in "pad time" (the time a launch site and support elements are tied up in preparation for a mission). As a comparison, manned Mercury missions normally required pad times of several months. In Apollo missions, the mobile launch concept can eventually reduce pad time to about 13 days.

Kennedy Space Center's Launch Complex 39 provides the capability to carry out launch operations under the requirements of the mobile launch concept.

VEHICLE ASSEMBLY BUILDING

The hub of operations at Launch Complex 39 is the Vehicle Assembly Building (VAB). The VAB consists of a high bay area 525 feet high, and a low bay area 210 feet high. With a length of 716 feet and width of 518 feet, the VAB covers 343,500 square feet of floor space. It is the world's largest building by volume, containing 129,482,000 cubic feet of space. Assembly of Apollo/Saturn V space vehicles takes place inside the VAB.

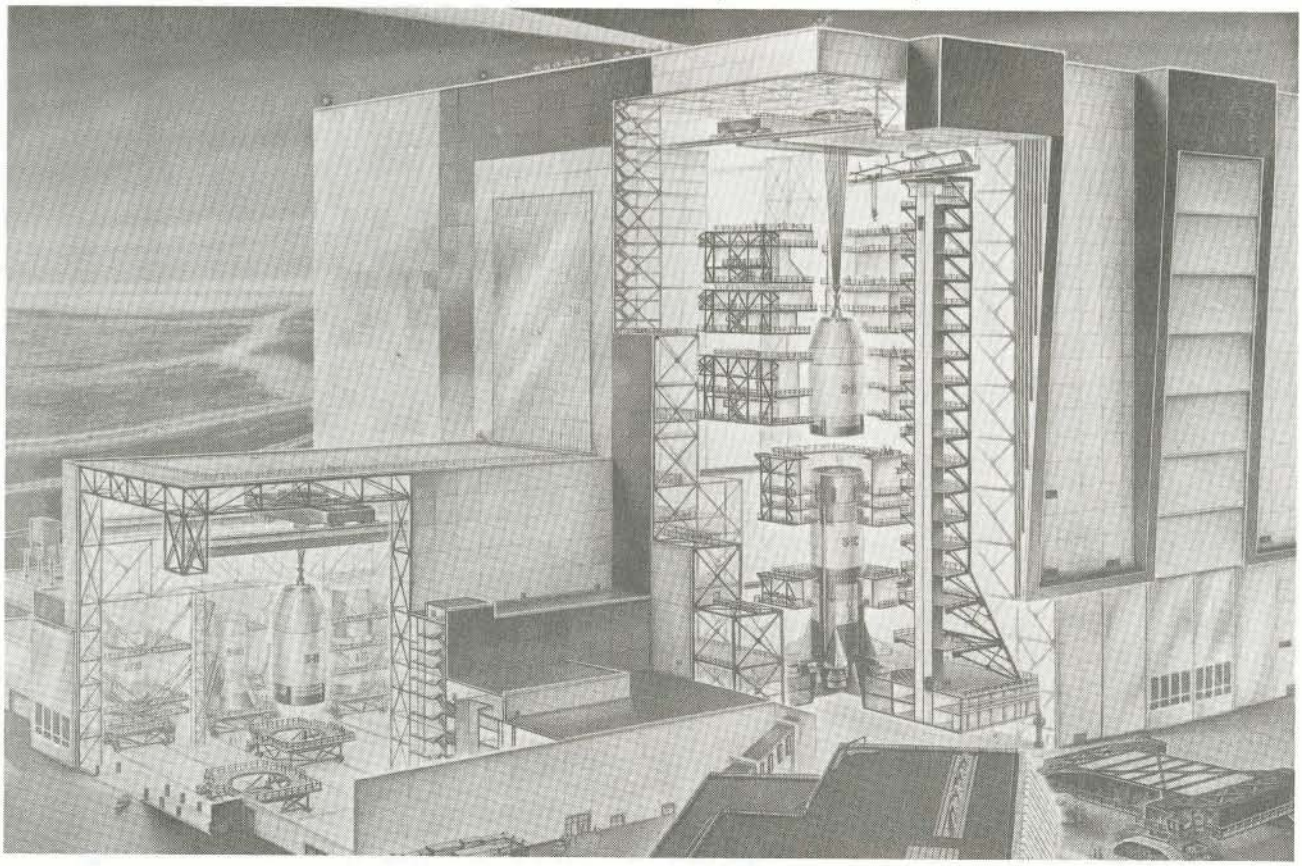
The high and low bay areas, serviced by a transfer aisle for movement of vehicle stages, form two distinct operational elements of the building.

The low bay area is approximately 442 feet deep and 274 feet wide. It contains eight stage preparation and checkout cells equipped with systems to simulate stage interface and operation with other stages and the instrument unit. A 175-ton bridge crane services the transfer aisle from the low bay to the high bay area.

The high bay area provides the facilities for assembly and checkout of Saturn V stages, instrument unit and Apollo Spacecraft. The high bay area is approximately 525 feet high, and covers an area 518 feet by 442 feet. It contains four separate bays for vertical assembly and integrated vehicle checkout.

Access to the space vehicle is provided by work platforms in each high bay which completely surround the vehicle at varying levels. Each platform is composed of two bi-parting sections that move in and mate, affording

Artist's cutaway view of Vehicle Assembly Building shows the assembly and checkout of Apollo/Saturn V



360-degree access to the section being worked on.

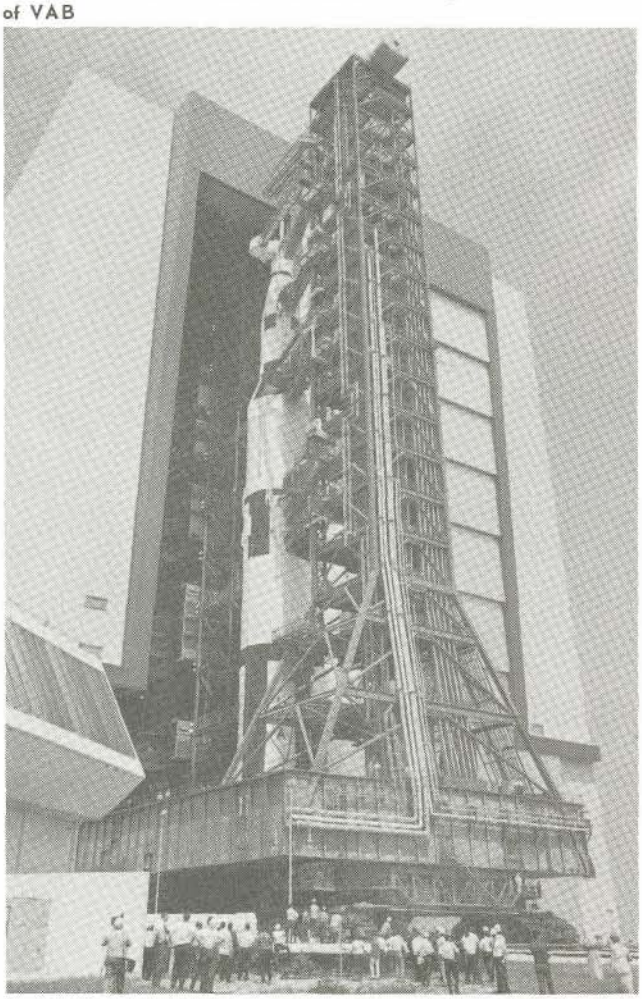
There are 141 lifting devices in the VAB, ranging from one ton hoists to two 250-ton high-lift bridge cranes with hook heights of 456 feet. The close tolerance cranes provide the precision capability for proper mating of the vehicle stages.

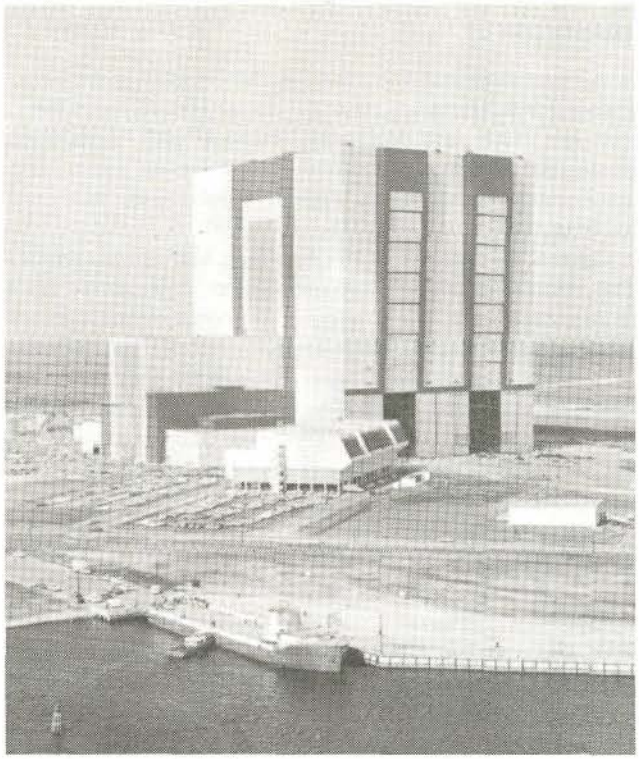
Office and storage areas are available inside the VAB. The low bay area contains quarters for flight crews and support personnel who must maintain close proximity to operations during critical periods of assembly and checkout. In the high bay area, 16 elevators operate from the ground level to the 420-foot level. A single elevator from the 420-foot level provides access to the roof. Four elevators service the low bay area.

Four doors in the high bay area, one each in the individual bays, provide for the entrance and exit of Mobile Launchers. Each door is in the form of an inverted T, 152 feet wide and 113 feet high at the base, then narrowing to 76 feet in width. Total door height is 456 feet.

The foundation of the VAB rests on 4,225 steel pilings, each sixteen inches in diameter, driven from 150 to 170 feet to bedrock. The skeletal structure of the building contains approximately 57,000 tons of structural steel. The exterior is covered by more than a million square feet of insulated aluminum siding.

Transporter carries Mobile Launcher and Apollo/Saturn V out of VAB





Vehicle Assembly Building

MOBILE LAUNCHERS

For each space vehicle undergoing assembly inside the VAB, a Mobile Launcher, comprised of a launch platform base and an umbilical tower, provides the physical support for the vertically integrated vehicle. The 18,000 square foot base of the Mobile Launcher, upon which the Apollo/Saturn V is assembled, will later serve as the launch platform at the pad. The umbilical tower provides access platforms and support for propellant, electrical and communication lines.

The base of the Mobile Launcher contains holddown arms and the tail service masts for servicing the S-1C stage of the space vehicle. The launcher base houses equipment including computer systems, digitally controlled equipment for propellant loading, hydraulic test sets, propellant and pneumatic lines, electrical power systems, and water systems. There is a 45 foot square opening through the base for rocket exhaust at liftoff.

The umbilical tower, permanently positioned on the base platform, is a 380 foot high open steel structure. Mounted at the top of the tower is a 25-ton hammerhead crane, which extends the total height to 399 feet.

The umbilical tower provides support for the nine swing arms (for direct access to the space vehicle), 17 work platforms, and distribution equipment for propellant, pneumatic, electrical, and instrumentation systems. Two high speed elevators, centrally located within the umbilical tower, afford service to the work platforms.

Each Mobile Launcher stands 445 feet nine inches tall when standing on its mount mechanisms at pad, VAB, or parking area, and weighs about 10.5-million pounds.

TRANSPORTER

Transportation is afforded by two Transporters. These 5.5-million pound units transfer Mobile Launchers into the VAB and Mobile Launchers with assembled Apollo/Saturn V space vehicles to the launch pad. They also transport the Mobile Service Structure to and from the launch pad.

Each Transporter is 131 feet long and 114 feet wide. The vehicle moves on four double-tracked crawlers, each 10 feet high and 40 feet long. Each shoe on the crawler tracks weighs about 2,000 pounds.

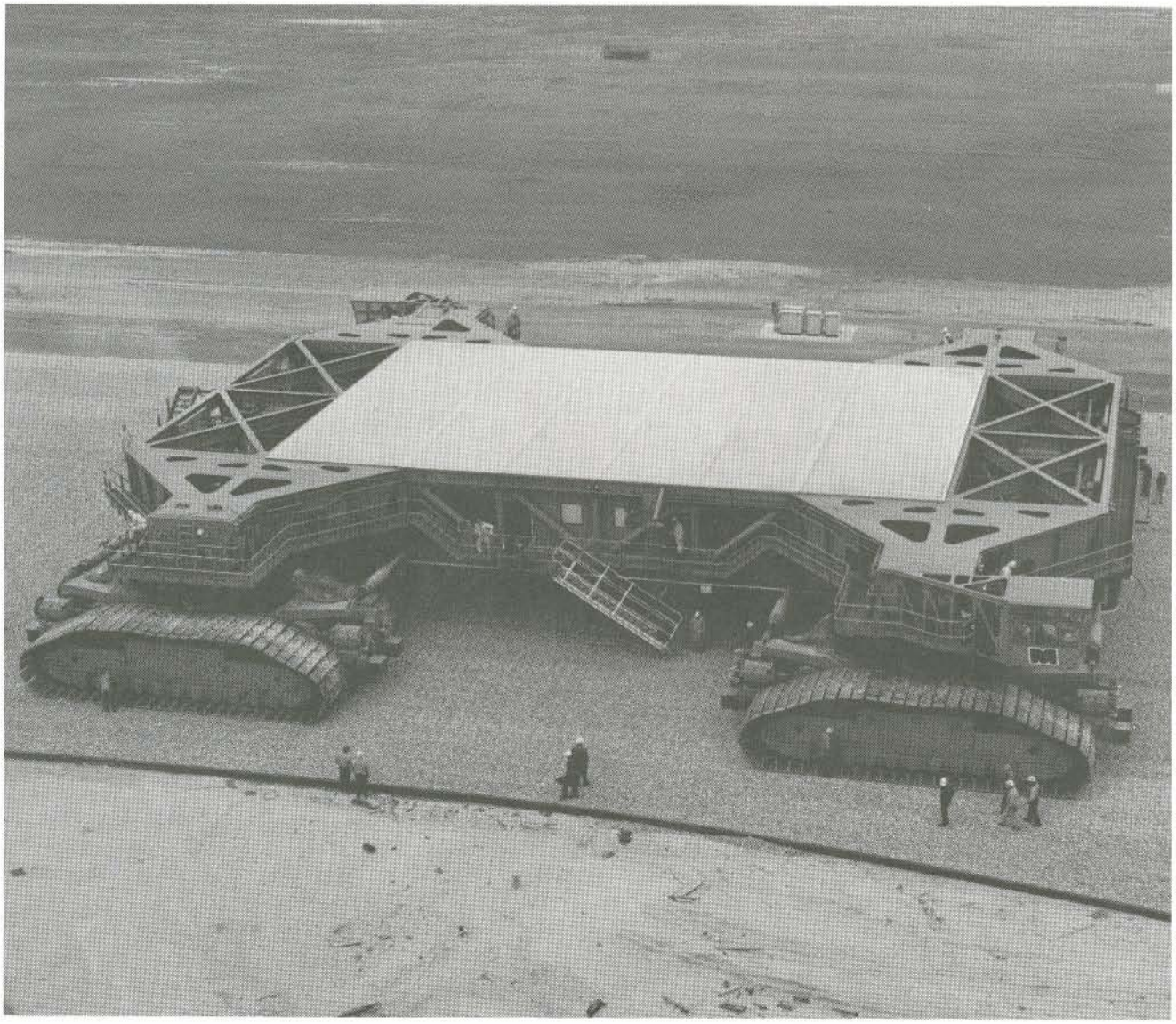
Sixteen traction motors powered by four 1000 kw generators, which are driven by two 2750 horsepower diesel engines, provide the motive power for the Transporter. Two 750 kw generators, driven by two 1065 horsepower diesel engines, power the jacking, steering, lighting, ventilating and electronic systems.

In operation, a Transporter slips under the Mobile Launcher and raises the launcher and space vehicle. The Transporter moves out of the VAB, transferring the more than 11-million pound load approximately 3.5 miles to the launch site. During the trip, which includes a climb up a 5-percent grade to the pad, the Transporter must carry its load in a vertical position within 10 minutes of arc. In order to accomplish this the Transporter is equipped with both automatic and manual leveling devices. It is also equipped with a hydraulic jacking system for raising and lowering the Mobile Launchers.

The Transporter travels over a specially constructed Crawlerway, 130 feet wide, divided by a median strip. The roadbed is approximately eight feet thick and is composed of layers of hydraulic fill, selected fill, graded lime rock, and asphalt sealer coat. It is then topped with eight inches of graded river rock.

The Transporter, which has a maximum loaded speed of one mile an hour, is designed for a 12-million pound load capacity. Depending on direction of movement, operators can occupy cabs at either end of the Transporter. Minimum turning radius for the vehicle is 500 feet.

Transporter



Apollo/Saturn V and Mobile Launcher are moved to launch pad by Transporter.

LAUNCH SITES

Two launch pads have been constructed at Launch Complex 39, and land is available for two more if future schedules require additional sites.

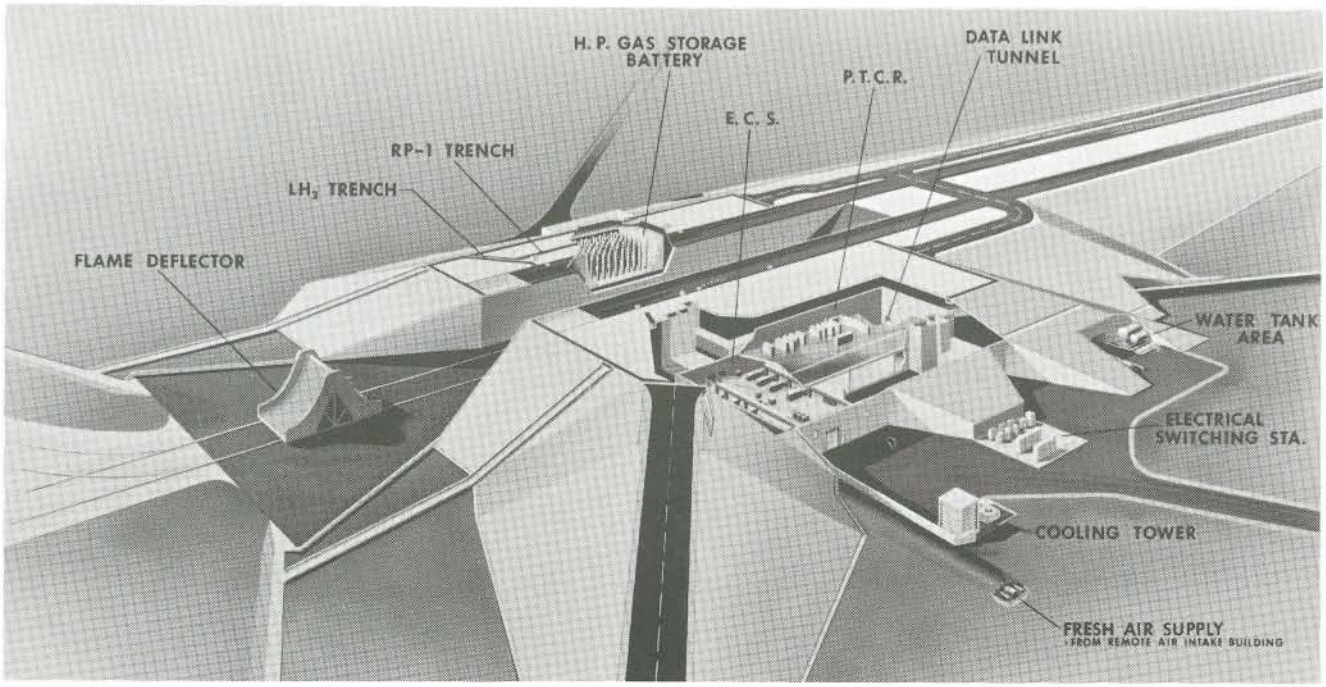
Each launch site is in the shape of an irregular eight sided polygon, approximately 3,000 feet across. A deep flame trench partially bisects each pad. Prior to launch a 350-ton wedge shaped flame deflector, 41 feet six inches high, is moved by rail into the flame trench. Positioned directly beneath the space vehicle, it deflects the flames and channels the exhaust along the flame trench. To dissipate flames and minimize damage at the pad, a water deluge system is available which can pump 40,000 gallons of water a minute into the flame trench.

The Mobile Launcher, with flight-ready space vehicle on board, is secured to six mount mechanisms located on the concrete surface of the pad. Other fixed components on the launch pad include a hydrogen service tower, fuel system service tower, electrical power pedestal, and other facilities to service and effect launch of the space vehicle.

The Pad Terminal Connection Room is located underground and to one side of the flame trench. The steel-reinforced concrete, earth revetted, enclosure houses electronic equipment which is part of the communication link between a Mobile Launcher and the Launch Control Center. Other similarly placed enclosures are the Environmental Control Systems Room, High Pressure Gas Storage Room and Emergency Egress Room.

Located near the perimeter of the pads are RP-1, Liquid Oxygen and Liquid Hydrogen storage facilities, and a Remote Air Intake Facility. Within the launch site area are holding ponds used for retention of fuel spill and waste water. There is also a burn pond for disposal of hydrogen gas boil off.

Cutaway view of Launch Pad "A"



MOBILE SERVICE STRUCTURE

In an actual launch operation, the Transporter, after depositing the Mobile Launcher and space vehicle on the pad, returns to the service structure parking area 7,000 feet from the pad. There it picks up the Mobile Service Structure and carries it to the pad.

The Mobile Service Structure is a 402-foot tall derrick type, steel trussed tower, which weighs 9,300,000 pounds. At the launch pad it is lowered and secured to four mount mechanisms.

The Mobile Service Structure provides access for final connection of certain ordnance items, checkout functions, and related equipment for servicing systems components of the Apollo spacecraft, and provides access for hypergolic fueling of the service, command and lunar modules.

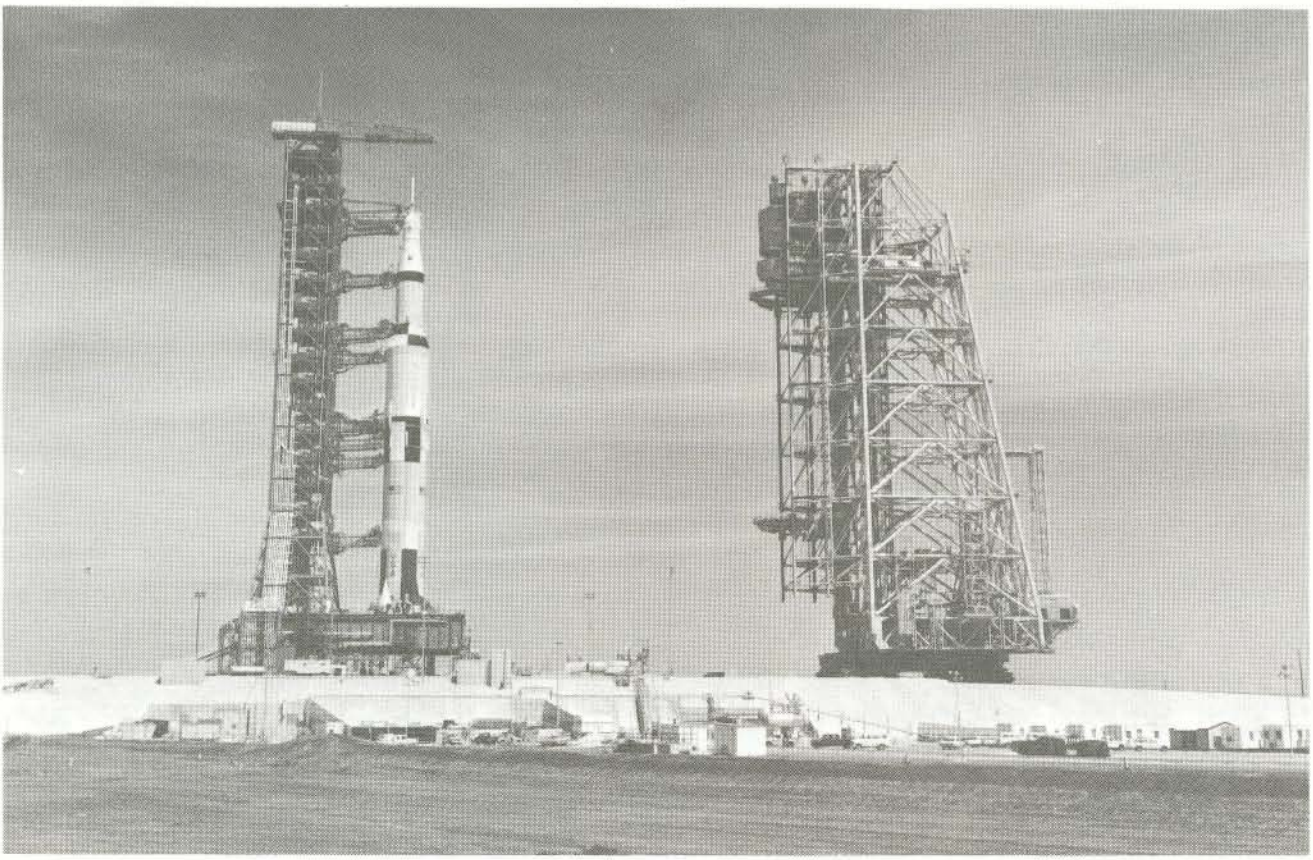
The Mobile Service Structure has five work platforms which close around the space vehicle. Two platforms are powered to move up and down. The remaining three can be repositioned, but are not self powered. Two high rise elevators provide service to the work platforms.

Located at the base portion of the structure is a mechanical equipment room, operations support room, communication and TV room, and other compartments for equipment storage.

Before launch, the Mobile Service Structure is removed from the launch site and returned to the parking area.

Mobile Service Structure at its parking area

After space vehicle and Mobile Launcher are secured on pad, Transporter moves Mobile Service Structure into position.



LAUNCH CONTROL CENTER

Located just east of the VAB is the Launch Control Center (LCC). This four-story building, where final countdown and launch of Apollo/Saturn V's will be conducted, is the electronic brain of Launch Complex 39. The LCC is also the facility from which a multitude of checkout and test operations will be conducted while space vehicle assembly is taking place inside the VAB.

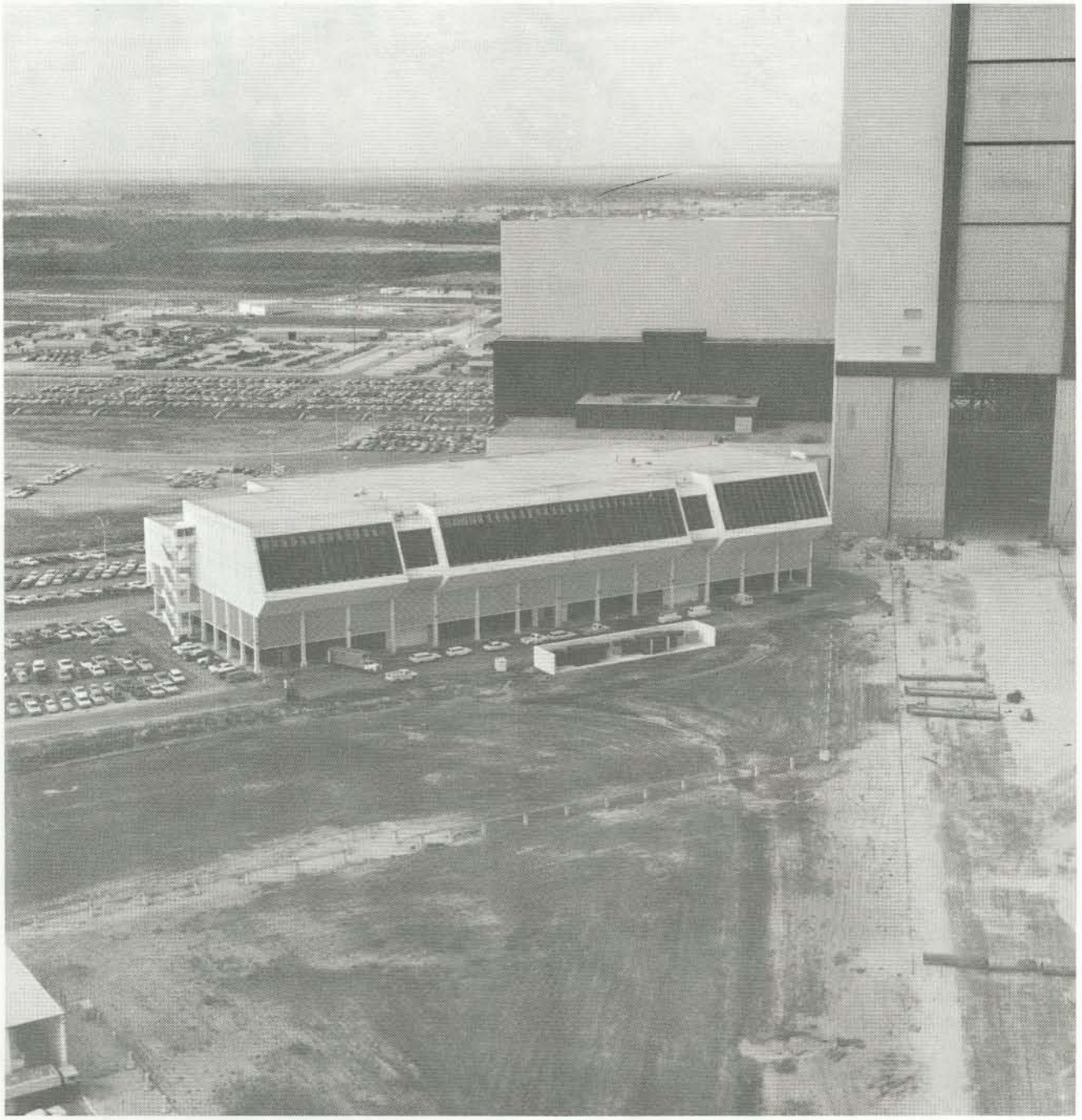
The ground floor of the structure is devoted to service and support functions such as medical facilities, office space, shops, laboratories and cafeteria.

Telemetry, RF, Tracking Equipment, Instrumentation, Data Reduction and Evaluation occupy the second floor.

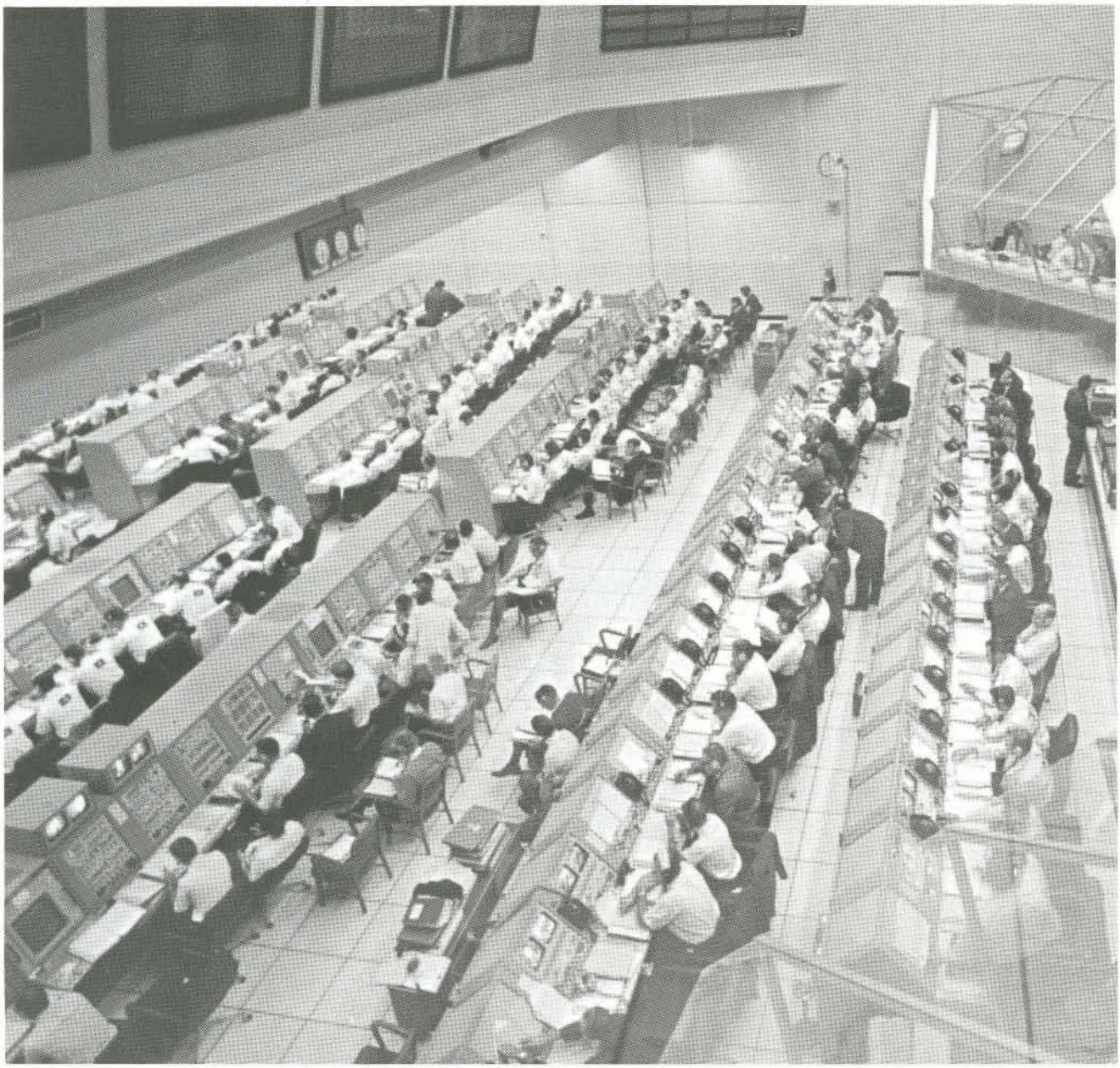
The third floor is divided into four separate control areas that contain firing rooms, computer room, mission control room, test conductor platform areas, visitors' gallery and offices.

The fourth floor level looks down on the third floor firing rooms and presents each firing room with four rear projection screens that provide different views of the launch site during launch operations. The fourth floor also contains conference room areas.

Launch Control Center



One of four firing rooms in Launch Control Center



BARGE TERMINAL

The Barge Terminal facilities consist of an access canal, a barge turning basin, dock, barge slips and a materials handling area adjoining the dock.

The access canal is provided for marine barge vessels which deliver launch vehicle stages and related components as well as other types of heavy equipment. The canal runs generally eastward to the Banana River, which in turn leads to the Atlantic Ocean via Port Canaveral.

The turning basin is the terminal point for the barge vessels. It is 1,200 feet across and 10 feet deep, and is south of the VAB.

Saturn barge at barge terminal