KSC

KENNEDY SPACE CENTER, FLORIDA

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

LAUNCH COMPLEX 34 FACILITIES

FACT SHEET 05
FEBRUARY, 1968

SATURN PROGRAM 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. NASA designed the Saturn I, the Saturn IB, and the Saturn V as the launch vehicles for use in the Apollo program.

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.

Saturn launch vehicles are designed at the Marshall Space Flight Center. The Manned Spacecraft Center oversees development of Apollo spacecraft systems and manages 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, preflight testing and launch of Saturn vehicles and Apollo spacecraft.

Aerial view of Launch Complex 34 shows the rail-mounted service structure positioned at launch pad. Igloo-type building at right is the launch control center.

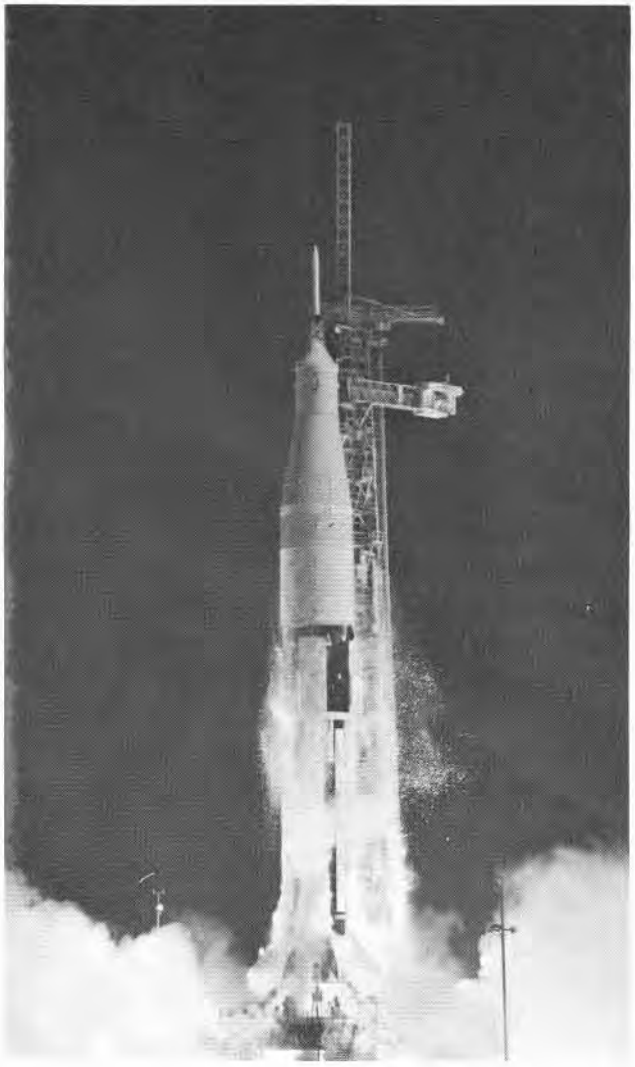
SATURN I TEST FLIGHT PROGRAM

On October 27, 1961, a Saturn I clustered engine booster lifted off the pad from NASA's Launch Complex 34 at Cape Kennedy. At that time, LC–34 was the largest known rocket site in the world, and the first to be built expressly for the peaceful exploration of space.

Four Saturn I vehicles were successfully launched from LC–34. The first flight produced the largest thrust developed by a United States launch vehicle up to that time, carrying a dummy upper stage into space.

The next three Saturn I launches took place on April 25 and November 16, 1962, and March 28, 1963. The Saturn I test flight series was completed with the successful flights of six more Saturn I vehicles launched from Complex 37.

Launch of AS-201, the first Saturn IB space vehicle launched from Complex 34.



LC–34 FACILITIES

Facilities at LC-34 were then modified for the assembly, checkout, and launch of the larger and more powerful Saturn IB. The first Saturn IB launched from LC-34 on February 26, 1966 produced 1.6 million pounds of thrust and boosted a 45,900-pound Apollo spacecraft into earth orbit, the heaviest payload launched to that time by NASA. Saturn IB rockets were designed to boost Apollo spacecraft into earth orbit for space vehicle qualification, astronaut training, and rendezvous practice. This is the second phase of the program leading to the Apollo/Saturn V manned lunar landing mission which is scheduled to take place before the end of this decade.

The main features of LC–34 are its single launch pad with launch pedestal, umbilical tower and propellant facilities, a service structure, a launch control center, an automatic ground control station, and an operations support building.

LAUNCH PAD

The launch pad at LC–34 is 430 feet in diameter. Part of the pad is covered with refractory brick that minimizes damage caused by the rocket exhaust. The surface of the pad is 16 feet above sea level.

The reinforced concrete launch pedestal, located in the center of the pad, provides a platform to support the launch vehicle and certain ground support equipment. The pedestal is 27 feet high and 42 feet square. Plate steel covers all pedestal surfaces exposed to rocket flame as it passes through an opening 25 feet in diameter to a flame deflector below. This opening also provides access to the first stage of the vehicle. Eight identical holddown arm assemblies are bolted around this opening to anchor the launch vehicle to the top of the pedestal. The holddown arms are released after ignition of the first stage motors.

Two 150-ton flame deflectors, in the shape of inverted V's are 21 feet high, 43 feet long, and more than 32 feet wide. They are constructed of steel trusses covered with a steel skin 1-inch thick, and are coated with a 4-inch layer of special heat-resistant ceramic.

The umbilical tower at LC–34 is a 240-foot high steel-trussed structure which rises alongside the launch pedestal. Four swing arms are attached to the umbilical tower by hinged joints. Each swing arm carries links between the space vehicle and tower which lead to ground-based power, air conditioning, hydraulic, pneumatic, fuel, measuring, and command systems.

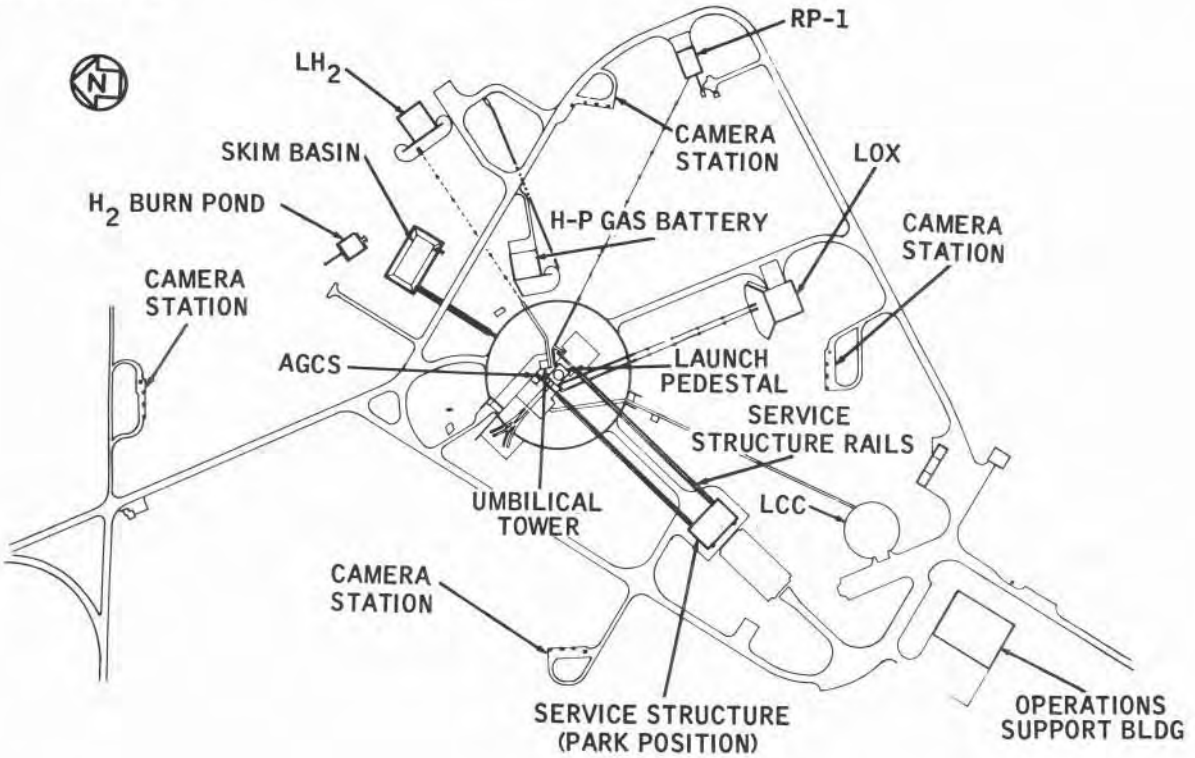
At the 220-foot level is the Apollo spacecraft access arm. Astronauts enter or leave the the Apollo spacecraft by means of this access arm which is connected to the spacecraft environmental chamber, or white room. The umbilical elevator, which can travel at a speed of 450 feet per minute, serves as a means of astronaut egress in an emergency.

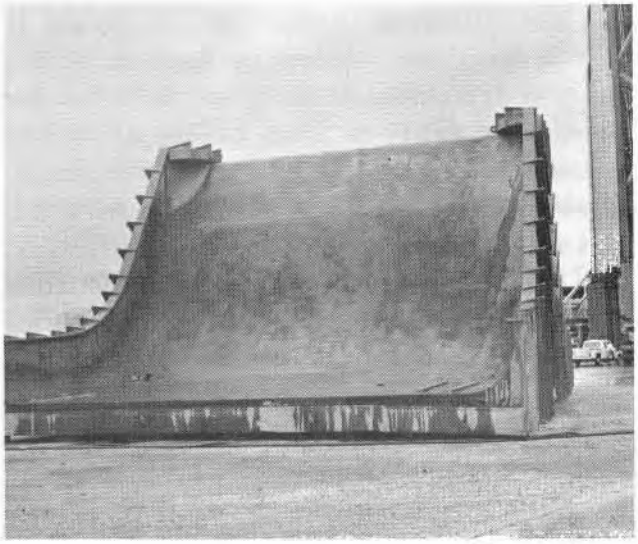
Mounted on the tower is a 5,000-pound capacity boom hoist which is equipped with a trolley that extends the hook 27 feet from the boom pivot point. The boom can be pivoted 360 degrees.

RP-1 service facilities store and transfer fuel to the launch vehicle's first stage. The automatic/semiautomatic system is remotely controlled. It consists of equipment located in the storage area, automatic ground control station, launch pedestal, and launch control center. The two cylindrical storage tanks, which are 41 feet in length and 11 feet in diameter, have a capacity of 60,000 gallons. They have a fast-fill transfer capability of 2,000 gallons per minute and a slow-fill rate of 200 gallons per minute. Included in the system are facilities for filtration and water separation.

Liquid hydrogen is stored and transferred at -423°F. The liquid hydrogen system supplies fuel to the second stage of the uprated Saturn I vehicle. The remotely-controlled facility is an automatic/semiautomatic system consisting of equipment located at the storage area, automatic ground control station, electrical equipment house, umbilical tower, and launch control center. The 125,000-gallon capacity storage tank is a double-walled, vacuum-insulated sphere 38 feet in diameter. Insulation is also provided by perlite, a glassy volcanic rock. It was designed with a transfer capability of 3,000 gallons per minute, a replenish rate of 0 to 200 gallons per minute, and a fine-fill rate of 500 gallons per minute. One hydrogen burn pond, located near the storage area, disposes of vented gas from the storage tank and part of the transfer line system. A second burn pond, located adjacent to the launch pad, is used to dispose of gas

Site Plan Complex 34.



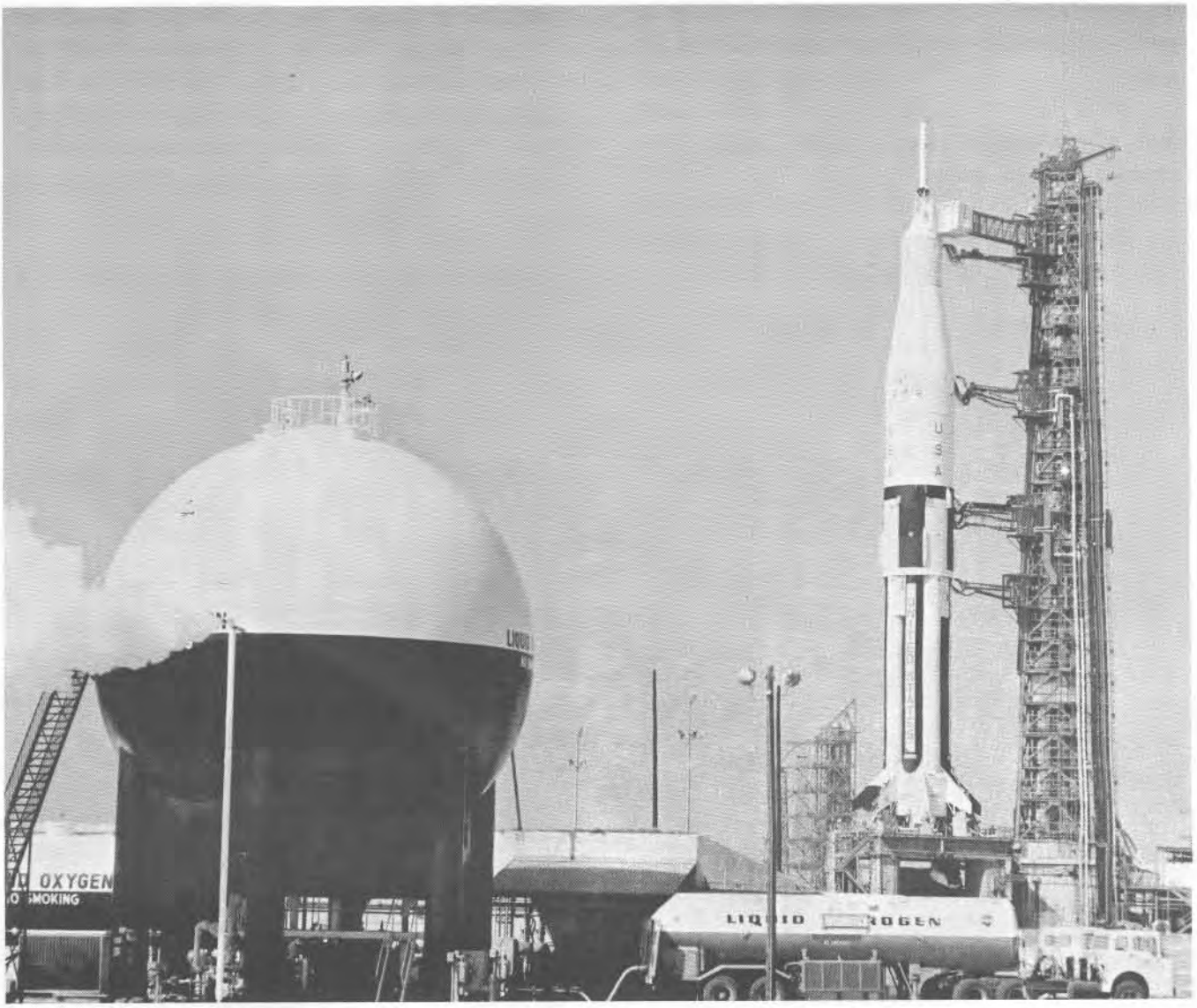


Flame deflector.

vented from the vehicle, the helium heat exchange, and the remainder of the transfer line.

Liquid oxygen is stored and transferred at -297° F. The liquid oxygen service facilities store and transfer liquid oxygen to the launch vehicle's first and second stages during fill and replenish operations. The main tank is a 125,000 gallon capacity, double-walled sphere with an outside diameter of 41¼ feet. A 4-foot separation between the inner and outer tanks is filled with expanded perlite and is also pressurized with gaseous nitrogen to further insulate the liquid oxygen supply. The 11-foot diameter replenishing tank is cylindrical and perlite-insulated and has a capacity of 13,000 gallons. Dur-

AS-201 during countdown demonstration test shows the four swing arms and Apollo spacecraft access arm leading from the umbilical tower to the vehicle.



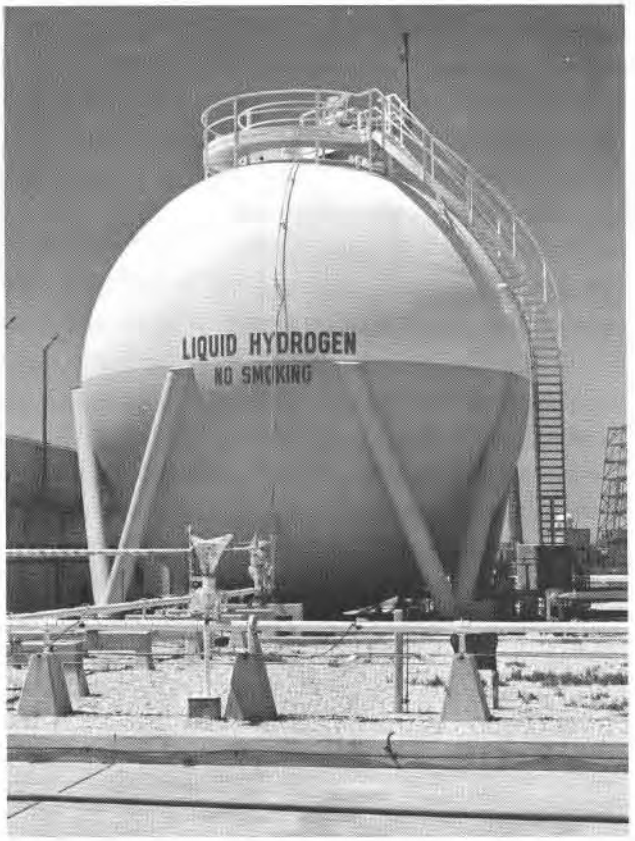
ing tanking operations, liquid oxygen is pumped through transfer lines to the vehicle. A pressure feed system provides liquid oxygen replenishing. Pressure for the replenishing system is maintained by means of a vaporizer unit. Liquid oxygen is transferred by three pumps: a 2,500 gallon per minute pump for filling the first stage, a 1,000 gallon per minute pump for filling the second stage, and a 1,000 gallon per minute pump for transferring liquid oxygen from the main tank into the replenish tank. The fast-fill, slow-fill, and replenish rates for servicing the first stage are 2,500, 500, and 0 to 50 gallons per minute respectively. For the second stage, the fast-fill, slow-fill rates are 1,000, 300, and 0 to 10 gallons per minute respectively. Initiation and control of the tanking and replenishing operations are accomplished and monitored from the launch control center during launch operations.

The converter-compressor facility serves both Launch Complex 34 and 37 as the source of all gaseous nitrogen and helium required to check out, service and launch uprated Saturn I vehicles.

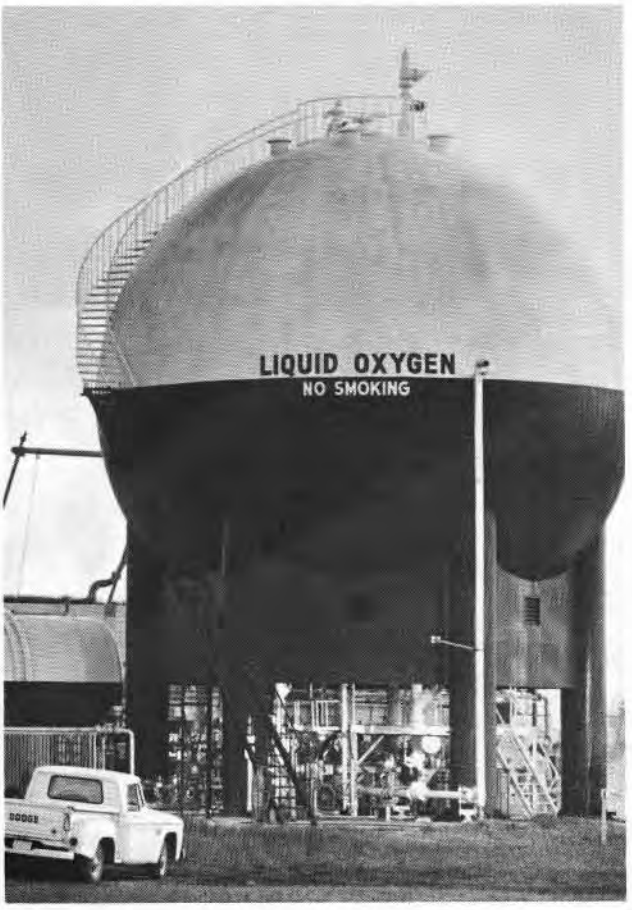
Storage for liquid nitrogen is provided by a 125,000 gallon, double-walled, spherical tank, and a 35,000 gallon tank. Liquid nitrogen is converted to gaseous nitrogen by means of four high-pressure vaporizers and two low-pressure vaporizers. It is then transferred to gaseous nitrogen storage cylinders (batteries). Four 200-cubic foot vessels and six clusters of nine vessels each (200 cubic feet per cluster) are manifolded together to form the nitrogen battery.

Helium is compressed by means of three separate, four-stage compressors, and is stored in the helium storage battery which consists of six clusters of nine vessels each (200 cubic feet per cluster) manifolded together. Both the nitrogen and helium batteries supply gas at a pressure of 6,000 pounds per square inch and contain filters, dryers, relief valves and shutoff valves.

A high-pressure gaseous hydrogen battery supplies cold hydrogen gas for the second stage of the launch vehicle. The battery consists of two 200-cubic foot cylindrical gaseous hydrogen vessels capable of delivering a maximum pressure of 6,000 pounds per square inch.



(Below) Liquid oxygen service facilities.



SERVICE STRUCTURE

The service structure is a movable steel framework used during erection, assembly, and checkout of the Saturn IB space vehicle. It provides work platforms for personnel, cranes for lifting rocket stages and spacecraft into place on the launch pedestal, and protection from the weather for both the space vehicle and personnel.

Overall dimensions of the service structure base are 130 feet by 70 feet. The inverted U-shaped structure rises 310 feet above the launch pad.

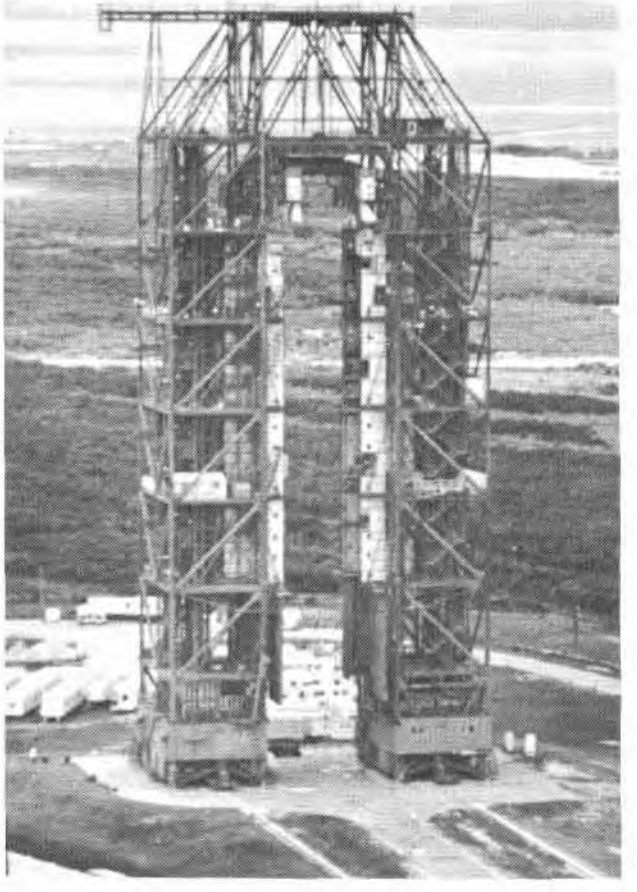
There are four elevators and seven fixed work platforms at various levels within the structure legs. Eight enclosed platforms can be extended to the vehicle from the tower. The launch escape system for the Apollo spacecraft is reached from two additional work platforms located near the top of the service structure. There is a traveling hoist for the launch escape system and a traveling bridge crane for the rocket stages and spacecraft. The bridge crane has a main hoist of 60-ton capacity and an auxiliary hoist of 40-ton capacity.

Weather protection for the space vehicle is provided by four hurricane doors which extend from the launch pedestal to the 80-foot level and two retractable silo sections which extend from the 80-foot level to the 224-foot level.

The 3,552-ton service structure moves on four 12-wheel trucks along a special dual track railway within the complex. At the launch pad, support points remove the service structure from the trucks and anchor it to the ground. Before the vehicle is launched, the service structure is moved to its parking position some 600 feet away from the pedestal. A 500–kva diesel-electric generator, enclosed in the base of the service structure, supplies power to drive the 100-horsepower traction motors in each truck.

Service structure cranes hoist Saturn IB first stage during erection of space vehicle at pad.

Service structure in park position.



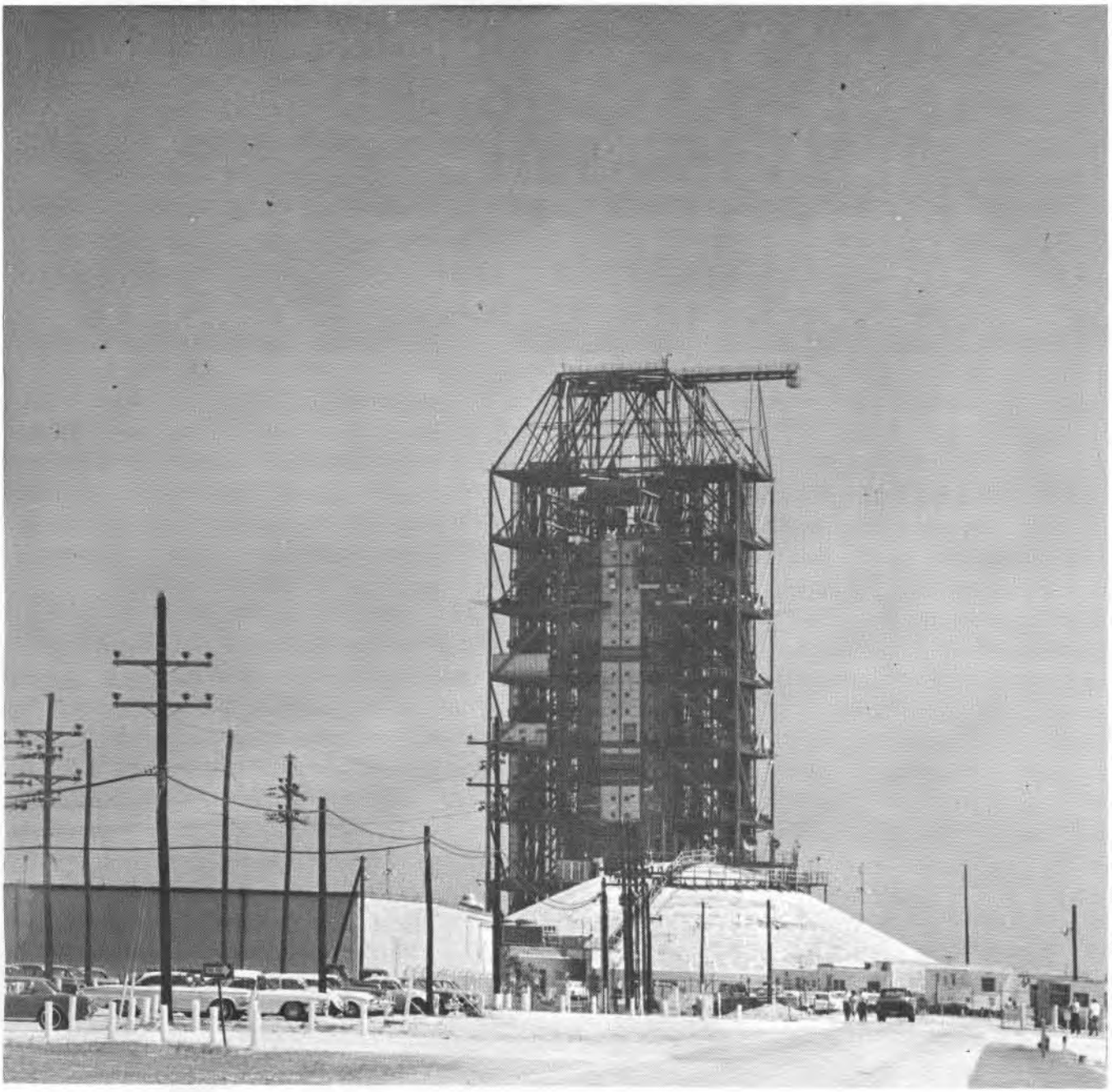
LAUNCH CONTROL CENTER

Personnel, instrumentation, and control equipment connected with launch activities are housed in the launch control center, which also provides blast protection in the event of a launch vehicle explosion.

The launch control center is a two-story, igloo-type building located approximately 1,000 feet from the launch pad. The dome, constructed of 5 feet of reinforced concrete, varies in thickness from 7 feet at the top of the dome to 30 feet at the base. The interior of the dome is sprayed with a 2-inch coat of acoustical material. The building contains 11,650 square feet of space and is designed to withstand blast pressures of 2,188 pounds per square inch.

The first floor is used by personnel involved in tracking, telemetry, closed-circuit television, communication, etc. Launch control and various monitoring and recording consoles are located on the second floor.

Launch control center with service structure in background.



Engineers and technicians at consoles of launch control center conduct test and checkout operations prior to launch of Saturn IB.

OPERATIONS SUPPORT BUILDING

The operations support building, which is located adjacent to the launch control center, provides approximately 30,000 square feet of floor space for measuring and calibrating telemetry and ground support equipment, for electrical networks, and for checkout and evaluation of components. In addition, space is provided for critical parts storage, mechanical equipment, and personnel work areas.

AUTOMATIC GROUND CONTROL STATION

The checkout of launch vehicle systems is fully automated. The control computers for the Automatic Checkout System are located inside an 8,170-square foot concrete structure situated beneath the umbilical tower. The same structure also serves as a distribution point for all high-pressure gas lines and electrical cables servicing the launch complex.

COMMUNICATIONS SYSTEM

Completely flexible intercommunications, closed-circuit television, timing distribution, and paging systems are provided between all operational areas.

The operational intercom system is a two-wire system compatible with other on-site systems. Various control station panels are tied in with the Eastern Test Range; and external tie-in is also provided with associated areas, including the Mission Control Center, Houston; the worldwide tracking network, Goddard Space Flight Center, Greenbelt; and Washington, D. C.

The closed-circuit television system contains monitors and cameras which have a complete mass switching capability from the launch control center. Numerous views of prelaunch activities in the vicinity of the complex can be selected. Distribution of launch countdown timing information is accomplished from the launch control center after generation by range support operations. A paging system is provided and integrated with other systems by means of a switching system.