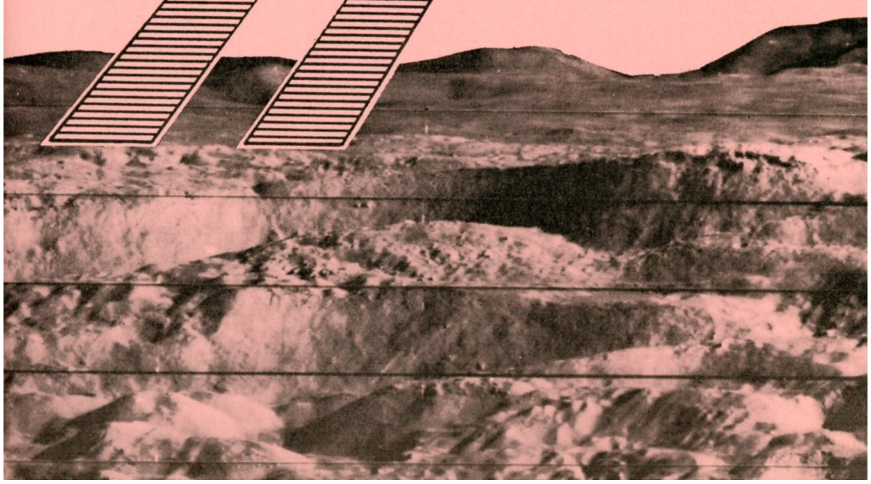
BOEING and APOLLO 11



BOEING
and

APOLLO 11

July, 1969

Members of the Press:

Welcome to Cape Kennedy for the launch of Apollo 11. The Boeing Company is proud to be a part of the great government - industry team working on Project Apollo.

We hope this booklet will help you in knowing more about Boeing's role in the Apollo mission. If we can be of assistance while you are here, please call us at 784-3104; or, drop by the Boeing press suite, room 104 at the Ramada Inn.

THE BOEING COMPANY
Southeast Division

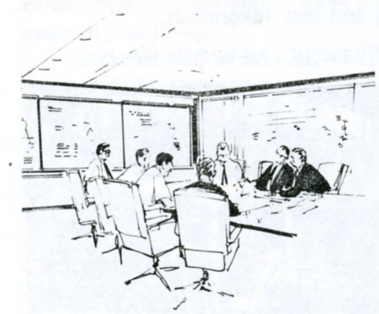
THE APOLLO/SATURN V PROGRAM

The National Aeronautics and Space Administration's Apollo/Saturn V project is the biggest industrial engineering and scientific effort of our time, both in manpower and goals. To put two men on the surface of the moon and return them safely to earth will rank as one of man's greatest achievements.

BOEING ROLE

Boeing's responsibility to NASA is four-fold: detailed design, fabrication, assembly, and test of the first stage (S-IC) of the Saturn V at New Orleans, Louisiana, and at the Mississippi Test Facility at nearby Bay St. Louis; systems engineering, vehicle integration and mission support for the entire Saturn V rocket at Huntsville, Alabama; pre-launch checkout support during final vehicle assembly as well as other launch responsibilities at Cape Kennedy, Florida, and technical integration and evaluation (TIE) of the Apollo command, service and lunar modules. TIE work is divided between four Boeing locations.

TECHNICAL INTEGRATION AND EVALUATION



Apollo 11 -- the nation's first attempt at landing men on the moon -- marks a significant milestone for Boeing in its role as Apollo technical integration and evaluation (TIE) contractor.

Boeing has been assisting NASA as Apollo TIE contractor since May, 1967.

Apollo 11 is the fifth manned Apollo flight in which Boeing's TIE teams have played a part. In addition, Apollo TIE made contributions to three unmanned Apollo missions during the last two years.

Boeing's TIE assignment is one of evaluating for NASA that the Apollo spacecraft -- the service, command and lunar modules -- and its launch vehicle will work together and that the complete "stack" is ready to safely perform the mission it has been assigned.

In the weeks leading up to the Apollo 11 launch, Boeing supported NASA with a series of launch readiness assessment reports. They were aimed at providing Apollo program officials with added assurance for safe Apollo mission success.

The assessments are based on Boeing's participation in all the various reviews leading up to the Apollo 11 flight, and from various technical evaluations in which TIE has been involved.

At times, these evaluations involved identifying and assessing program problems and proposing solutions to NASA. Many of the evaluations are based upon data developed by NASA and its other Apollo contractors.

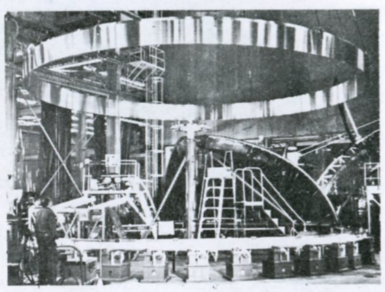
There are four Boeing Apollo TIE teams, each with an area of responsibility corresponding to the NASA organization it supports. At the NASA Manned Space Flight Center level, Boeing-Houston is responsible for TIE activity related to the spacecraft; Boeing-Huntsville, the launch vehicle, and Boeing Atlantic Test Center, launch operations and ground support equipment.

This geographically dispersed TIE activity culminates in Boeing's Washington, D. C., organization, which supports NASA's Apollo Program Office.

A nationwide communication system is used to tie together the four Apollo management and technical teams.

Boeing's Apollo involvement includes such tasks as program control, engineering evaluation, configuration management, logistics, safety and test integration.

ASSEMBLY OF THE FIRST STAGE - NEW ORLEANS

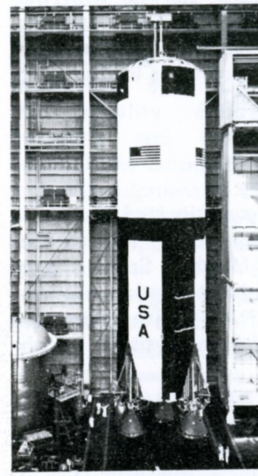


The first stage of the Saturn V, built by Boeing under contract with NASA, is the largest rocket booster in production in the United States.

Parts for the stage are shipped to Michoud for assembly from sub-contractors and from other Boeing locations, notably the company's plant at Wichita, Kansas.

Parts of tank skins--pre-cut, milled and shaped -- are welded together in an environmentally controlled "room within a room" at Michoud. The pieces which are to be assembled into the ends of the tanks -- the bulkheads -- are trimmed by

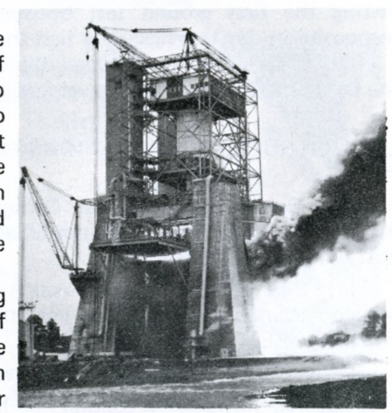
specially designed tools and, after proper preparation of the welding surfaces, are joined by welding.



The skins -- the pieces which make up the sides of the propellant tanks -- are joined into rings in the same room by the same type of welding process. Other components are also assembled in the room, such as the "Y-rings," major structural parts of the tanks. Y-rings are milled from circular billets of aluminum.

The three other major parts of each stage are assembled from preformed parts in the open areas of the plant. They are the thrust structure, to which the engines are attached; the intertank section, which is used to attach the two tanks together, and the forward skirt, which is used to attach the S-IC to the next stage of the Saturn V rocket.

Final assembly -- bringing together the two tanks and the other three components -- takes place in a 215-foot-tall vertical assembly building.



Final welding of the tanks and the stacking of the stage, one piece atop another, are also accomplished at Michoud. So are hydrostatic tests, in which fuel and liquid oxygen tanks are pressure tested with water.

At Michoud, Boeing conducts a variety of testing programs. The major check on each completed stage, after actual static firing, is done in the stage test building. There, thousands of pressure, mechanical, electrical, electronic and other checks of flight systems are made on each booster. A digital-analog-hybrid computer system monitors and automatically checks the 138-foot-high stage in a specially designed building at Michoud where two stages can be checked out at one time.

Test firing of completed first stages, starting with the fourth flight stage, is at the Mississippi Test Facility, approximately 35 miles north-east of New Orleans, where a double stand for the stages is located. Boeing is in charge of static firing of the first stage boosters at MTF.

SE&I/MISSION SUPPORT -- HUNTSVILLE

Boeing/Huntsville has worked over every inch of the moon rocket in carrying out its systems engineering and vehicle integration (SE&I) tasks for NASA's Marshall Space Flight Center. In addition Boeing in performing a mission support assignment which includes providing NASA with trajectory requirements for launches and post flight analysis of launch vehicle performance.

Boeing also operates and maintains a systems development ("breadboard") facility to support the automatic checkout and launch control equipment at Cape Kennedy. The system of electronic and mechanical equipment functionally simulates in real time the entire Apollo/Saturn launch sequence to verify launch procedures.

Early in the program Boeing/Huntsville assisted NASA in testing the first ground test booster (S-IC-T) and assumed responsibility for test firing the first three flight boosters.

Other early testing included the dynamic (shake) tests of the complete Saturn V launch vehicle.

LAUNCH SUPPORT OPERATIONS - CAPE KENNEDY

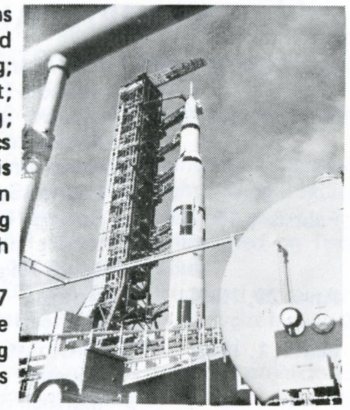
The Boeing Atlantic Test Center has four broad basic support functions on the Apollo/Saturn V program at the NASA/Kennedy Space Center:

(1) S-IC first stage pre-launch preparations including related ground support equipment and part of the Saturn V common GSE;

(2) Managing and accomplishing launch support equipment engineering, development and testing functions;

(3) Test integration functions including site activation and launch vehicle operations;

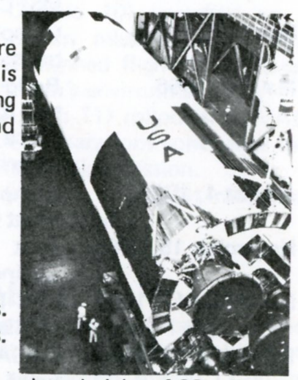
(4) Technical integration and evaluation of the total program.



BATC provides systems engineering; design and development engineering; configuration management; reliability engineering; refurbishment and logistics engineering; systems analysis and quality control in managing and maintaining most of the Saturn V launch support equipment at KSC.

Specifically, there are 17 launch support hardware systems on which Boeing provides design and logistics engineering at KSC.

1. Gaseous Hydrogen
2. Gaseous Helium
3. Gaseous Nitrogen
4. Gaseous Oxygen
5. Liquid Hydrogen
6. Liquid Oyxgen
7. RP-1
8. Environmental Control System
9. Tail Service Masts
10. Service Arms
11. Mobile Launch Tower
12. Crawler Transporter
13. Spacecraft Support
14. Flame Deflector
15. Holddown Arms
16. Vehicle Auxiliary Support Equipment
17. Handling and Access Equipment



There also are three software systems for which BATC is responsible: Propellant Tanking Computer, Data Transmission, and Digital Events Evaluator.

S-IC CHARACTERISTICS

Height:	138 feet
Diameter:	33 feet
Thrust:	7.5 million lbs.
Weight:	5,028,071 lbs.
Weight (empty):	288,750 lbs.
S-IC Requirements:	1.5 million pounds to height of 38 miles at 6,100 miles an hour
Material:	Aluminum alloy
Fuel:	RP-1, a refined kerosene, (212,940 gallons)
Oxidizer:	Liquid oxygen (348,600 gallons)

SATURN MILESTONES

December 15, 1961	NASA announces that Boeing has been named S-IC contractor.
February 14, 1962	Interim contract with NASA enables Boeing to begin design and development work on the Saturn V first stage. Launch Systems Branch organized.
February 15, 1963	Boeing begins manufacture of first rocket parts for delivery to Marshall Space Flight Center, Alabama
April 29, 1964	Boeing begins work on first Michoud-assembled booster.
March 1, 1965	S-IC test vehicle, first complete S-IC booster, placed in ground test stand at Marshall Space Flight Center.
April 16, 1965	First full-thrust, one-engine firing of S-IC-T at MSFC.
June 27, 1965	First Boeing-built ground test booster (S-IC-D) rolled out of vertical assembly building at Michoud.
August 5, 1965	First full-duration (2 1/2 minutes), full thrust firing of S-IC-T at MSFC.
October 15, 1965	Turnover of first Boeing-built, Michoud assembled booster (S-IC-D) to NASA at MSFC.
March 15, 1966	Completion of first Boeing-built flight booster (S-IC-3).
May 25, 1966	Rollout of the first Apollo/Saturn V test rocket at Kennedy Space Center, to check out ground support equipment at launch pad 39A.
August 4, 1966	Completion of second Boeing-built flight booster (S-IC-4).
November 15, 1966	First test firing (127 seconds) of a Boeing-built stage (S-IC-3) in Huntsville.
December 17, 1966	S-IC-T test vehicle lifted into test stand at Mississippi Test Facility.
February, 1967	NASA announces Boeing contract to build five additional Saturn V first stages at Michoud.
March 3, 1967	First firing (15 seconds) of a Saturn V first stage (S-IC-T) in the test stand at Mississippi Test Facility.
March 15, 1967	Second firing (60 seconds) of S-IC-T in the MTF test stand, completing the stand's certification tests.
August 26, 1967	Apollo/Saturn 501 rollout from VAB to Pad 39A at KSC.
November 9, 1967	A/S 501 (Apollo 4) launched on historic all-up systems first flight lasting 8 hours 38 minutes.
January 22, 1968	A/S 204 (Apollo 5) launched on first flight test of lunar module.
April 4, 1968	A/S 502 (Apollo 6) launched on second unmanned all-up systems flight lasting 9 hours and 57 minutes.
October 11, 1968	A/S 205 (Apollo 7) launched on historic first three-man flight lasting 10 days 20 hours 8 minutes and 164 revolutions.
December 21, 1968	A/S 503 (Apollo 8) launched on three-man moon mission lasting 147 hours. Second manned flight in Apollo program and the first manned flight of the Saturn V rocket.
March 3, 1969	A/S 504 (Apollo 9) launched on a three-man earth orbital mission lasting 241 hours. First manned flight of the lunar module.
May 18, 1969	A/S 505 (Apollo 10) launched on a three-man moon mission lasting 192 hours. First manned flight of the lunar module in moon's environment.
May 20, 1969	A/S 506 (Apollo 11) rollout from VAB to Pad 39A. Preparations commence for historic lunar landing mission.
June 6, 1969	A/S 506 (Apollo 11) flight readiness test (FRT) completed.

THE S-IC-6
A PREFLIGHT PROFILE

On January 4, 1966, The Boeing Company, prime contractor for the Saturn V first stage, began assembling at Michoud the actual vehicle that will launch Apollo 11 on its lunar landing journey.

On that date, the company began welding the first parts for the vehicle's giant propellant tanks at the NASA's Michoud Assembly Facility in New Orleans, Louisiana.

January 4, 1966, generally is considered to mark the start of manufacture of the S-IC-6 -- the technical name for Apollo 11's first stage. But two-and-a-half years of preliminary fabrication work by subcontractors and by workers at other Boeing plants had preceded that. The first contract on the S-IC-6 was awarded by Boeing in March 1963 for a liquid oxygen relief valve.

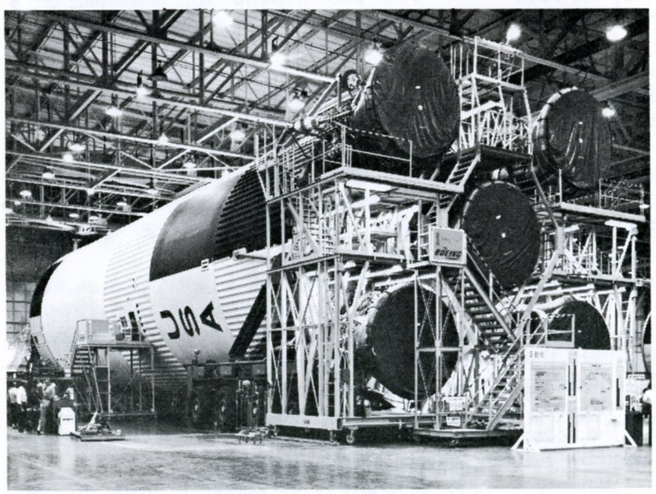
The major parts job for the S-IC-6 vehicle -- its base, its kerosene and liquid oxygen tanks, and its forward and center sections -- were completed in September 1966, 10 months after start of assembly.

Vertical assembly of the 12-story vehicle began September 30, 1966. This is the process where the major parts are stacked one on the other and joined together. It was completed January 4, 1967.

The vehicle was lifted from its assembly tower in the vertical assembly building at Michoud and returned to the adjoining factory building, where its engines, electronic equipment and other internal systems were installed. The stage was completed May 8, 1967 and rolled out June 1, 1967.

Computer simulations of flight and other post-manufacturing tests of the stage's completeness began next. These were handled in the stage checkout building at Michoud. These tests were completed July 26, 1967.

From Michoud, the stage was barged to Mississippi Test Facility in Hancock County, Miss., March 1, 1968, where it was successfully test fired for 125.1 seconds August 13, 1968.



Following static firing, the stage was returned to Michoud by barge August 29, 1968, where it underwent refurbishment and check after firing. This was completed December 9, 1968. The vehicle was placed in storage for a brief period before leaving Michoud for the last time February 16, 1969, bound for Cape Kennedy by barge.

During the past three months, the stage has been in the vehicle assembly building at NASA's Kennedy Space Center, where it was mated with the upper stages of the Saturn V rocket and the Apollo 11 capsule.

On May 20, 1969, the 36-story tall rocket, and its 12-story tall first stage, were rolled out to Pad A at Launch Complex 39. The intensive final preparations for one of man's greatest adventures -- preparations in the making for the past six years -- had begun.

APOLLO 11 SPECIFICATIONS

	Diameter	Height
Apollo 9 (with interstages)	33 feet*	363 feet
First Stage (S-IC)	33 feet	138 feet
Second Stage (S-II)	33 feet	81 feet 6 in.
Third Stage (S-IVB)	21 feet 8 in.	58 feet 8 in.
Instrument Unit (IU)	21 feet 8 in.	3 feet
Apollo Spacecraft	12 feet 10 in.	81 feet 10 in.

	Dry Weight	Fueled Weight
Apollo 9 (complete vehicle)	496,648 lb.**	6,493,035***
First Stage (S-IC)	289,150 lb.	5,037,500 lb.
Second Stage (S-II)	90,470 lb.****	1,060,000 lb.****
Third Stage (S-IVB)	26,107 lb.	262,080 lb.
Instrument Unit (IU)	4,306 lb.	
Lunar Module (LTA-13)		33,190 lb.
Service Module (SM)	10,508 lb.	51,099 lb.
Command Module (CM)		12,363 lb.
Lunar Module Adapter		4,058 lb.
Injection Payload to Lunar Orbit		100,710 lb.
Launch Escape System (LES)		8,900 lb.

The weights for the various assemblies of the Apollo spacecraft are figures for a typical Apollo/Saturn V mission. To make up the liftoff weight of the entire vehicle at 6,493,035 lb., there must be included ullage rockets, various adapters, ice coatings, pyrotechnic and other devices, assemblies, and fluids.

* Tank diameter. S-IC fin diameter is 64 feet
** Includes LM propellants.
*** Liftoff weight.
**** With aft interstage included. (With aft interstage included S-IVB dry-weight is 34,177 lb., fueled weight is 271,150lb.)

S-IC stages have lifted five Apollo spacecraft (Apollos 4,6,8,9 and 10) on the first leg of their flights into space. In doing their work these first stage boosters have fired a total of 777 seconds.

However, these stages and six others have been fired an additional 31 times during static tests for a total of 2,209.998 seconds, or more than 36 minutes.

APOLLO 11 COUNTDOWN

Following are some of the highlights of the final count:

T-28 hours	Final countdown starts
T-27 hours 30 minutes	Install launch vehicle flight batteries
	LM stowage and cabin closeout
T-24 hours 30 minutes	Launch vehicle systems checks
T-21 hours	Top off LM super critical helium
T-16 hours	Launch vehicle range safety checks
T-11 hours 30 minutes	Install launch vehicle destruct devices
	Command/service module pre-ingress operations.
T-10 hours 20 minutes	Start mobile service structure move to park site
T-9 hours	Start six hour built-in-hold
T-9 hours counting	Clear blast area for propellant loading
T-8 hours 30 minutes	Launch vehicle propellant loading, three stages (liquid oxygen in first stage; liquid oxygen and liquid hydrogen in second, third stages). Continues thru T-3 hours 30 minutes.
T-3 hours 10 minutes	Spacecraft closeout crew on station
T-2 hours 40 minutes	Start flight crew ingress
T-1 hour 50 minutes	Abort advisory system checks
T-1 hour 46 minutes	Space vehicle Emergency Detection System (EDS) test
T-1 hour 15 minutes	Mission Control Center-Houston/spacecraft command checks
T-43 minutes	Retract Apollo acess arm to standby position (12 degrees)
T-42 minutes	Arm launch escape system
T-40 minutes	Final launch vehicle range safety checks
T-30 minutes	Launch vehicle power transfer test
T-20 minutes	LM switch over to internal power
T-15 minutes	Spacecraft to internal power
T-6 minutes	Space vehicle final status checks
T-5 minutes 30 seconds	Arm destruct system
T-5 minutes	Apollo access arm fully retracted
T-3 minutes 10 seconds	Initiate firing command (Automatic sequencer)
T-50 seconds	Launch vehicle transfer to internal power
T-8.9 seconds	Ignition sequence start
T-2 seconds	All engines running
T-0	Liftoff

NOTE: Some changes in the above countdown are possible as a result of experience gained in the Countdown Demonstration Test (CDDT) which occurs about two weeks before launch.

FACTS ON THE S-1C FIRST STAGE

Fully loaded, just prior to ignition, the S-IC stage of the Saturn V booster vehicle, including fuel, fin assemblies, pressurization equipment, fuel for pumps and other systems, ullage rockets and other devices, weighs approximately 5,030,000 pounds. This figure increases slightly from the weight of ice that coats the cryogenic tank. At launch, the S-IC stages of AS-501 and AS-502 were each coated with approximately 650 pounds of ice. Depending upon temperature and humidity, and time fueled on the pad, the weight of S-IC stage ice will vary for the AS-506/Apollo 11 mission.

The major structural components of the S-IC include the (1) thrust structure, (2) fuel tank, (3) intertank, (4) liquid-oxygen tank, (5) forward skirt.

The propulsion system of the S-IC stage is made up of five bipropellant F-I engines that burn RP-1 fuel and liquid-oxygen. The liftoff thrust for each F-1 engine is 1,514,000 pounds, or a total of 7,570,000 pounds as the vehicle begins its first movement.

The S-IC stage increases its power output during flight. Rocket engines increase power within diminishing ambient pressure. At launch the S-IC produces a total thrust of 7,570,000 pounds. By the time the engines are ready to shut down at a height of approximately 205,000 feet, S-IC stage thrust has increased to a total of 8,500,000 pounds.

The S-IC stage tanks contain 212,940 gallons of RP-1 (kerosene) fuel and 348,600 gallons of liquid-oxygen -- an approximate total of 4,734,000 pounds. The normal propellant flow rate to the five F-1 engines is 30,000 pounds per second. During its two and a half minutes of operation, the S-IC propulsion system consumes 2,250 tons of propellants.

Just before burnout the S-IC's five engines produce a combined thrust roughly equivalent to 180,000,000 horsepower. Hoover Dam can generate approximately 1,345 megawatts of power. At "full bore" the S-IC stage produces energy equal in wattage to approximately 85 Hoover Dams.

The liquid-oxygen of the S-IC stage -- 348,600 gallons, or enough to fill about 54 tank cars -- is a supercold liquid that boils at 297 degrees F. below zero.

Each F-1 engine of the S-IC stage is 19 feet long and 12 feet 4 inches in diameter. The maximum nozzle exit diameter is 11 feet 7 inches. Each engine has a maximum weight in flight configuration of 18,500 pounds. It takes muscle to keep the F-1 engines operating; each engine has a direct-drive turbopump that can move 9,000 pounds of propellant per second. To do this job, each pump develops 60,000 horsepower -- more energy than is developed by 15 diesel locomotives. Or, if you ever have a flood in your back yard, one F-1 turbopump can empty a pool of 20,000 gallons of water in just about 30 seconds.

Thrust of the S-IC stage at liftoff is equal to the combined thrust of 100 Mercury-Redstone boosters. That's equal to the combined thrust of 20 Mercury-Atlas boosters.

When the 5.5 million pounds (approximate) of propellants are loaded above the Saturn V booster, the entire vehicle "settles" and contracts 10 inches. Ground support equipment is built to compensate for this "shrinkage." An accumulation of the many manufacturing tolerances built into the Saturn V accounts for some of the drop in height. Hundreds of small rivet holes in the thrust structure also "give" beneath the propellant weight to bring on the 10-inch reduction in height.

At liftoff the S-IC stage produces a power output that's equal to nearly 3,000 of the largest diesel locomotives in the United States.

Boeing builds the S-IC stage of aluminum in the biggest cylinder ever machined in this country. To put together a single

S-IC stage, Boeing uses more than 250,000 different nuts, bolts, rivets and special fasteners that come in more than 2,000 different sizes and shapes. To help everything fit there are also nearly 8,000 feet of welding seams in the S-IC.

The liquid-oxygen tank of the S-IC stage is fueled at the rate of 10,000 gallons per minute.

Mission profile for the Saturn V calls for the booster to reach "max q" -- the region of maximum aerodynamic pressure -- at 78 seconds after liftoff. At this point in the flight the restraining air drag on the entire booster is equal to approximately 460,000 pounds.

The vehicle for the Apollo 4 mission carried an extra 1,400 pounds of ice -- coated around the cryogenic tanks of the three stages -- at liftoff. Engineers estimated that the first stage (S-IC) carried 650 pounds, the second stage (S-II) about 450 pounds, and the third stage (S-IVB) about 300 pounds. The ice doesn't stick around too long. It begins to break away at a height of 4.6 miles, which is approximately one minute after liftoff, with climbing speed at Mach 1 -- the speed of sound. About 22 seconds later the S-IC has boosted the speed to Mach 2. The bird is about 9.5 miles high and all the frost is gone.

The Apollo 4 mission on November 9, 1967 called for the Saturn V booster on its first flight to put a greater payload into orbit, in one shot, than all the payloads fired by the United States since our first satellite was orbited on January 31, 1958. The requirement was for a payload of 278,699 pounds to be rifled into an orbit 117 statute miles high. According to Major General Samuel C. Phillips of Project Apollo, Saturn AS-501 outdid itself and the payload was "something over 285,000 pounds." A fully-loaded Boeing 727-120 airliner at takeoff, with all fuel, passengers and baggage aboard, weighs 248,000 pounds.

The S-IC stage burns for approximately 150 seconds in flight -- at which point it is intended to be 38.5 miles high and nearly 55 miles downrange, pushing the upper stages and payload toward space with a velocity of more than 6,100 miles per hour.

The four outer F-1 engines of the S-IC stage are mounted on a ring, each 90 degrees from its neighbor. These four are gimballed to control the direction of flight of the Saturn V. The fifth (center) engine is mounted rigidly.

Just before shutdown of its five engines the S-IC booster generates a 4.15-g load.

The S-IC stage 13 powerplants -- the five F-1 rocket engines and eight rocket motors. The latter are the solid-fuel retrorockets which decelerate the stage and "back it away" from the second stage to avoid a possible collison when the two stages separate. The retrorockets are mounted in pairs, two motors in each of the four engine shrouds. Each retrorocket burns for .6 seconds and delivers a thrust of 87,900 pounds.

During a mission of nominal performance, the S-IC stage shuts down after approximately 150 seconds of powered flight -- at which time the booster will be about 205,000 feet high and moving with a velocity of 6,025 miles per hour. After separation and retrofire of the S-IC stage, it continues coasting on its momentum along a ballistic trajectory peaking at approximately 366,000 feet. Nine minutes after liftoff the S-IC stage impacts approximately 390 miles down range of the launch pad. On all of the prior missions the S-IC stages broke up during reentry.

The Saturn V uses a total of 41 rocket engines in performing its function as the boost vehicle for the Apollo spacecraft. These engines range in power from 72 pounds thrust to the 1,514,000 pounds thrust of each F-1 engine.

WHERE ARE THEY NOW?

Boeing presently is under contract to build 13 flight stages, starting with the S-IC-3, at the company's Launch Vehicle Branch in New Orleans. Two additional vehicles, the S-IC-1 and S-IC-2, were assembled by NASA at Huntsville, Ala., bringing the total to 15 flight vehicles.

Five of these vehicles already have been launched. The remaining ten stages, as of Apollo 11's launch day, are located as follows:

S-IC-6 Apollo 11, on Pad 39A at Kennedy Space Center.
S-IC-7 Apollo 12, on LUT 2 in the Vehicle Assembly Building, KSC.
S-IC-8 Apollo 13, on LUT 3 in the VAB at KSC.
S-IC-9 In storage at New Orleans, awaiting shipment to the Cape.
S-IC-10 Just completing checkout following static firing, Stage Test Building, Michoud.
S-IC-11 Undergoing refurbishment and checkout following static firing, Stage Test Building, Michoud.
S-IC-12 In static firing stand, Mississippi Test Facility, awaiting firing test.
S-IC-13 Nearing completion of manufacture, Factory Building, Michoud.
S-IC-14 Major parts assembled, Factory Building, Michoud.
S-IC-15 Major parts assembled, Factory Building, Michoud.

Contracts held by Boeing for construction of the first stage slightly exceed $1 billion.

BOEING -25 YEARS OF AEROSPACE LEADERSHIP

Boeing's role in the missile and rocket industry began in 1943, when Boeing and Army Air Forces engineers performed a series of combat simulation tests of GB-1 glide bomb missiles released from B-17 Flying Fortress bombers. On May 25, 1944, B-17s carrying glide bombs made the first mass missile attack in history on Cologne, Germany. During 1944 and in the years following B-17s and B-29s were used as carrier aircraft for many other types of missiles, including visual, television and radar-controlled weapons.

GAPA

In June of 1945 Boeing received an AAF contract to develop a series of anti-aircraft missiles known as GAPA – Ground-to-Air Pilotless Aircraft.

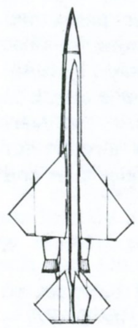
To achieve goals of GAPA, propulsion systems using different rocket motors and engines, and ramjet engines were investigated. The basic requirement for the GAPA series was to produce the technology - in the form of experimental missiles – that would permit swift interception of enemy aircraft flying with speeds up to 700 miles per hour from 8,000 to 60,000 feet. The more advanced versions of GAPA (the first missile was fired on June 13, 1946) used a solid- propellant booster for "crash acceleration" and a ramjet engine for sustained power. On November 15, 1949, a GAPA missile achieved an intercept altitude of 59,000 feet - the highest flight altitude achieved up to that time with supersonic ramjet propulsion. The last of more than 100 GAPA missiles was fired in August of 1950.

BOMARC

The GAPA program laid the foundation for future missile technology and in January of 1951 the U.S. Air Force ordered Boeing to develop the advanced high-altitude, long-range bomber-intercept missile known as Bomarc. During the next decade two versions of the long-range interceptor missile were developed to operational status.

The first rake-winged prototype, ushering in a new era of rocket/ramjet propulsion systems, was test fired on September 10, 1952. Less than 30 months later the Boeing launch crew fired - on February 24, 1955 - the first completely instrumented test version with operational capability. It flew at supersonic speeds to more than 70,000 feet and had a range of 200 miles.

On December 30, 1957 the first combat - production model - IM-99 Bomarc was delivered to the Air Force. Within three years five east-coast missile bases with Bomarcs were operational, manned with crews of the Air Defense Command.



Long before the IM-99 went operational, Boeing was well into development of an improved interceptor, the IM-99B which weighed 1,000 pounds more than its predecessor, performed at higher altitudes, improved speed and increased range. Boeing fired the first IM-99B on May 27, 1959. In the two-year program Bomarcs intercepted jet bombers, target drones, supersonic fighters and missiles. In 1961 an IM-99B exceeded 100,000 feet in a test intercept flight.

The Boeing IM-99B Bomarc remains on operational status with the Air Defense Command and serves also with the Royal Canadian Air Force.

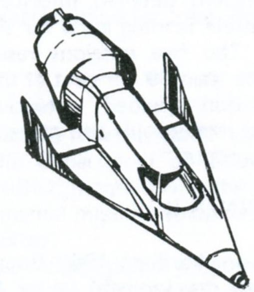
MINUTEMAN

The "instant reaction" Minuteman ICBM was developed by the United States Air Force Systems Command for deployment and control by the Strategic Air Command. Boeing is weapons system integrator for the nation's most advanced ICBM, has responsibility for assembly, test, launch control and ground support systems.

Designed for the highest possible reliability, minimum reaction time, and greatly reduced unit cost, Minuteman missiles currently are deployed in underground launching sites (silos) dispersed over a wide geographical area. Today more than 1,000 Minuteman ICBMs are on operational alert at six SAC wings. Minuteman 1, the mainstay since 1962 of the defensive force is being replaced by Minuteman II, a slightly larger and more advanced missile.

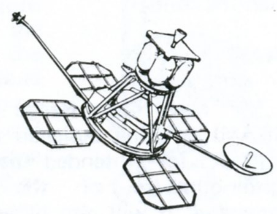
There have been five Minuteman III launches from Cape Kennedy down the Eastern Test Range with the first being fired in August of last year. Two test launches have been fired from Vandenberg Air Force Base, California.

DYNA - SOAR



The Dyna-Soar aerospace vehicle was a highly advanced Air Force program to develop a manned winged vehicle capable of rocket-boosted flight into orbit, where it would perform its military mission, and, be capable of winged reentry and flight through the atmosphere. The delta-winged Dyna-Soar (named for Dynamic Soaring) was to be boosted into orbit by the Titan IIIC launch vehicle system. A trans-stage engine orbited with the Dyna-Soar gave the aerospace vehicle the capability of orbital and plane-change maneuvers. Several versions were under development, including multi-manned designs. The winged configuration permitted reentry and recovery without elaborate recovery task forces; Dyna-Soar would land on a wheel-and-skid system like that of the X-15. The project was cancelled December 10, 1963, after initial models had been built but before a test launching could be made.

LUNAR ORBITER



Two weeks after the Dyna-Soar project cancellation, Boeing was awarded the NASA contract to develop and build the advanced Lunar Orbiter, an unmanned camera-carrying spacecraft intended to take extensive sharp closeup photographs of the lunar surface. Five scheduled flights to the moon were completed by August of 1967, just one decade after the first lunar probe attempt by this country.

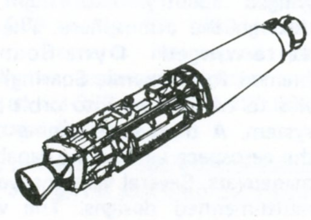
The scheduled Lunar Orbiter flights to the moon were the most successful NASA program and the only lunar program to ring up a perfect success.

Lunar Orbiter's mission was to provide advance detailed information about the surface of the moon to allow selection of potential landing sites for astronauts of Project Apollo.

Photographs taken during the first three missions provided sufficient detailed information for scientists to select eight possible landing areas for the lunar module of Project Apollo.

The five missions resulted in photographic coverage of more than 99 per cent of the entire surface of the moon and in addition yielded extensive information about radiation, micrometeoroids and other space phenomena in the vicinity of the moon.

BURNER II



In April of 1965 Boeing began development under Air Force contract of a highly reliable, low-cost upper-stage booster vehicle for the injection into orbit of small-and medium-weight payloads. The solid-fuel stage, known as Burner II, is mounted atop Thor standard launch vehicles and is adaptable to specialized missions with Atlas and Titan booster variants.

The first flight of Burner II was made on September 15, 1966, when the stage was mounted atop a Thor booster launched at Vandenberg Air Force Base. Thor-Burner II missions include classified flights for the Air Force as well as scientific shots.

SRAM

A new Short-Range Attack Missile (SRAM) is being designed under Air Force contract for intended use on advanced fighter-bombers of the Strategic Air Command. It will also be adaptable to some models of the Boeing B-52 Stratofortress strategic bomber. The primary mission capability of SRAM will be to penetrate deep and intricate enemy defenses after launch from the carrier aircraft.

The new strategic air-to-ground missile will fly at supersonic speeds, will be nuclear-armed, and will have a multi-pulse, restartable rocket motor that may be fired on command in order to provide the attack missile with a high degree of maneuvering and extended-glide capability.

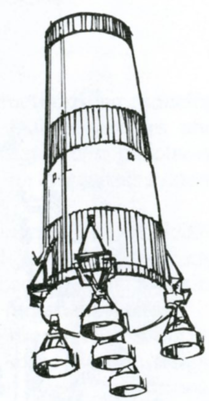
Boeing was named prime contractor for SRAM in the fall of 1966. The program calls for design, development, testing and evaluation of SRAM. Boeing is responsible for total SRAM system performance.

HIBEX

On January 13, 1966, the Advanced Research and Projects Agency (ARPA), an agency of the Department of Defense, announced the conclusion of the HiBEX program with the test firing of a high-acceleration experimental missile booster at the White Sands Missile Range, New Mexico.

ARPA has identified HiBEX as an experimental program to study the problems connected with the boost of a high-acceleration interceptor missile. No final weapon system was planned in the program for which Boeing was the prime contractor.

AND FOR TOMORROW. . . .



Boeing participation in Project Apollo is well known, and yet it is only the most obvious element of Boeing's participation in the aerospace sciences and industry. Extensive studies are under way with NASA and selected contractor personnel to extend the capabilities of the Saturn V booster system by uprating the engines now in use, decreasing the structural and non-payload weights of the vehicle, and using strap-on boosters of different dimensions and thrust ratings. Future upper-stage nuclear systems based on the S-IC as the primary lifting vehicle are underway.

In addition to these booster program studies, Boeing is involved in advanced proposals for planetary surveillance and photographic spacecraft, extending from modifications of the spectacularly successful Lunar Orbiter vehicle to studies of manned expeditionary flights to Mars. Advanced propulsion systems, spaceborne optical telescope systems, electric propulsion for deep-space missions are only a few of the extensive programs and studies under way at Boeing.

INTERMEDIATE 20

NASA has issued a $230,000 contract to The Boeing Company for a ten-month study defining a two-stage derivative of the Saturn V launch vehicle called "Intermediate 20."

Title of the study is "Saturn V Derivative Launch Vehicle System." The vehicle to be studied consists of the first (S-IC) and third (S-IVB) stages and the instrument unit (IU) of the Saturn V, plus payload.

A number of configurations are possible using the S-IC and S-IVB as the basic vehicle. By varying the number of F-1

engines in the S-IC stage from two to five the vehicle can be tailored for missions to low earth orbit with payloads ranging up to 158,000 pounds. The first phase of the study will result in selection of a single baseline launch vehicle for further study.

The use of a two-stage Saturn V for missions not requiring the full three-stage vehicle would result in major savings. One-time costs of vehicle modifications and changes to ground support equipment and launch facilities would cancel about 50 per cent of the savings for the first vehicle. Full savings would be realized on all subsequent launches.

The second phase of the study will be the preliminary design of the selected vehicle and development of an implementation plan. Modification kits to convert the standard Saturn V equipment will be designed, interface matching of several possible third stages with the baseline vehicle will be investigated, and normal IU separation plane location and IU performance capabilities for third stage and payload will be identified.

Research, development, test and engineering program development will be the third phase of the study.

EARTH ORBITAL SYSTEMS

For several years, NASA has studied methods for reducing the costs of manned entry spacecraft, launch vehicles and operations. These studies have revealed isolated cost problems, but have not dealt specifically with a fully integrated system from an economic standpoint.

The Boeing Company has been awarded a $173,000 contract by the NASA-Marshall Space Flight Center to study ways of reducing the costs of future space vehicle logistics systems, considering both expendable and reusable systems.

The work will be done at Boeing facilities in Huntsville by a team that will investigate the effect of space system design, development, manufacture, qualification and operational practices. The study will consider past and present design work and the experience gained in manned space flight.

Titled "Low Cost Earth Orbital Transportation System Synthesis by Economic Analysis," the current study will identify the features of several systems that can lead to reducing recurrent costs as much as possible. Through the methodology of synthesis, these features will be combined as much as is feasible to determine the most economical transportation system for the future.

The major emphasis of the economic study will be on space station logistics missions in 100 to 300 nautical mile orbits, with payload ranges between 5,000 and 50,000 pounds (not counting the spacecraft weight), and capable of holding 12 passengers plus return cargo weighing from 3,000 to 12,000 pounds.

The contract's period of performances will run approximately eleven months, including a nine-month study period and a two-month reporting period.

SPACE LOG

PROJECT MERCURY

Alan B. Shepard, Jr. May 5, 1961 *Freedom 7*	America's first manned space flight; suborbital; 15 min. 22 sec. duration.
Virgil I. Grissom July 21, 1961 *Liberty Bell 7*	Evaluated spacecraft functions. Suborbital; 15 min. 37 sec. duration.
John H. Glenn, Jr. February 20, 1962 *Friendship 7*	America's first manned orbital space flight; three revolutions; duration 4 hrs. 55 min. 23 sec.
M. Scott Carpenter May 24, 1962 *Aurora 7*	Initiated research experiments to further future space efforts. Three revolutions; duration 4 hours 56 min. 05 sec.
Walter M. Schirra, Jr. October 3, 1962 *Sigma 7*	Developed techniques and procedures applicable to extended time in space. Six revolutions; duration 9 hrs. 13 min. 11 sec.
L. Gordon Cooper, Jr. May 15–16, 1963 *Faith 7*	Met the final objective of the Mercury program–spending one day in space; 22 revolutions; duration 34 hrs.19 min.49 sec.

PROJECT GEMINI

Virgil I. Grissom John W. Young March 23, 1965 *Gemini–III*	America's first two-man space flight; three revolutions; 4 hrs. 52 min. 31 sec.
James A. McDivitt Edward H. White, II June 3–7, 1965 *Gemini–IV*	First "walk in space" by an American astronaut. First extensive maneuver of spacecraft by pilot; 62 revolutions; 97 hrs. 56 min. 12 sec.
L. Gordon Cooper, Jr. Charles Conrad, Jr. August 21–29, 1965 *Gemini–V*	Eight day flight proved man's capacity for sustained functioning in space environment; 120 revolutions; duration 190 hrs. 55 min. 14 sec.
Walter M. Schirra, Jr. Thomas P. Stafford December 15–16, 1965 *Gemini–VI-A*	World's first successful space rendezvous. 16 revolutions; duration 25 hrs. 51 min. 24 sec.
Frank Borman James A. Lovell, Jr. December 4–18, 1965 *Gemini–VII*	World's longest manned orbital flight; 206 revolutions; duration 330 hrs. 35 min. 01 sec.
Neil A. Armstrong David R. Scott March 16–17, 1966 *Gemini–VIII*	First docking of two vehicles in space; 6.5 revolutions; duration 10 hrs.41 min.26 sec.
Thomas P. Stafford Eugene A. Cernan June 3–6, 1966 *Gemini–IX–A*	Three rendezvous of a spacecraft and a target vehicle. Extravehicular exercise–2 hrs. 7 min; 45 revolutions; duration 72 hrs. 20 min. 50 sec.
John W. Young Michael Collins July 18–21, 1966 *Gemini–X*	First use of target vehicle as source of propellant power after docking. New altitude record–475 miles; 43 revolutions; duration 70 hrs. 46 min. 39 sec.

Charles Conrad, Jr. Richard F. Gordon, Jr. September 12–15,1966 *Gemini–XI*	First rendezvous and docking in initial orbit. First multiple docking in space. First formation flight of two space vehicles joined by a tether. Highest manned orbit–apogee about 853 miles; 44 revolutions; duration 71 hrs. 17 min. 08 sec.
James A. Lovell, Jr. Edwin E. Aldrin, Jr. November 11–15, 1966 *Gemini–XIII*	Astronaut walked and worked outside of orbiting spacecraft for more than 5½ hrs–a record proving that a properly equipped and prepared man can function effectively outside of his space vehicle. First photograph of a solar eclipse from space; 59 revolutions; duration 94 hrs. 34 min. 31 sec.

PROJECT APOLLO

Walter M. Shirra, Jr. R. Walter Cunningham Donn F. Eisele October 11 - 22, 1968 *Apollo 7*	First manned Apollo flight. First live television from space. Schirra became first man to pilot Mercury, Gemini and Apollo spacecraft; 164 revolutions; duration 260 hrs. 08 min. 45 sec.
Frank Borman James A. Lovell, Jr. William Anders December 21 - 27, 1968 *Apollo 8*	First manned flight of the Saturn V rocket. Achieved first manned lunar orbit; greatest speed by humans (nearly 25,000 mph); and longest distance from earth for a manned flight (approx. 233,000 miles).
James A. McDivitt David R. Scott Russell L. Schweickart March 3-13, 1969 *Apollo 9*	First earth orbital flight of the lunar module in which rendezvous and docking procedures were verified. Schweickart became first man to pilot the LM; Apollo duration 241 hrs. 53 sec.
Thomas P. Stafford John W. Young Eugene A. Cernan May 18 - 26, 1969 *Apollo 10*	First flight of the lunar module in lunar orbit. Color views of the moon's surface were sent back to earth via television. LM came within 10 miles of the lunar surface. Spacecraft was in lunar orbit 61 hours; Apollo duration 192 hrs. 03 min. 25 sec.

BOEING SUBCONTRACTORS ON PROJECT APOLLO

The following companies are supporting Boeing in its Apollo/Saturn program commitments.

AEROQUIP CORP.
Jackson, Mich.
Couplings, pneumatic, and hydraulic hoses
$833,000

AIRCRAFT PRODUCTS
Dallas, Tex.
Machined parts
$149,000

AIRESEARCH MANUFACTURING CO.
Phoenix, Ariz.
Valves
$3,630,000

APPLIED DYNAMICS, INC.
Ann Arbor, Mich.
Analog Computers
$726,000

ARROWHEAD PRODUCTS, DIV. of FEDERAL-MOGUL CORP.
Los Alamitos, Calif.
Ducts
$19,540,000

THE BENDIX CORP., INSTRUMENTS & LIFE SUPPORT DIV.
Davenport, Iowa
Loading systems and cutoff sensors
$4,220,000

BOURNS, INC. INSTRUMENT DIV.
Riverside, Calif.
Pressure transducers
$930,000

BROWN ENGINEERING CO., INC.
Lewisburg, Tenn.
Multiplexer equipment
$2,622,000

THE J. C. CARTER CO.
Costa Mesa, Calif.
Solenoid valves
$254,000

CONSOLIDATED CONTROLS CORP.
Bethel, Conn.
Los Angeles, Calif.
Pressure switches, transducers, and valves
$1,000,000

THE EAGLE-PICHER CO., CHEMICAL AND METALS DIV.
Joplin, Mo.
Batteries
$240,000

ELECTRO DEVELOPMENT CORP.
Seattle, Wash.
AC and DC amplifiers
$2,305,000

FLEXIBLE TUBING CORP.
Anaheim, Calif.
Ducts
$95,000

FLEXONICS, DIV. of CALUMET AND HECLA, INC.
Bartlett, Ill.
Ducts
$9,660,000

GENERAL PRECISION, INC. LINK ORDNANCE DIV.
Sunnyvale, Calif.
Propellant dispersion systems
$460,000

GULTON INDUSTRIES, C. G. ELECTRONICS DIV.
Albuquerque, N.M.
Wiring boards
$987,000

HAYES INTERNATIONAL CORP.
Birmingham, Ala.
Auxiliary nitrogen supply units
$2,205,000

HYDRAULIC RESEARCH AND MANUFACTURING CO.
Burbank, Calif.
Servoactuators and filter manifolds
$1,800,000

JOHNS-MANVILLE SALES CORP.
Manville, N.J.
Insulation
$821,000

KINETICS CORPORATION OF CALIFORNIA
Solano Beach, Calif.
Power transfer switches
$476,000

LING-TEMCO-VOUGHT, INC.
Dallas, Tex.
Skins, emergency drains, and heat shield curtains
$1,220,000

MAROTTA VALVE CORP.
Boonton, N.J.
Valves
$456,000

MARTIN MARIETTA CORP.
Baltimore, Md.
Helium bottles
$1,563,000

MOOG, INC.
East Aurora, N.Y.
Servoactuators
$1,469,000

NAVAN PRODUCTS, INC.
El Segundo, Calif.
Seals
$1,263,000

PARKER AIRCRAFT CO.
Los Angeles, Calif.
Valves
$2,689,000

PARKER SEAL CO.
Culver City, Calif.
Seals
$200,000

PARSONS CORP.
Traverse City, Mich.
Tunnel assemblies
$2,707,000

PRECISION SHEET METAL, INC.
Los Angeles, Calif.
Filter screens, anti-vortex, and adapter assemblies
$365,000

PUROLATOR PRODUCTS, INC., WESTERN DIVISION
Newbury Park, Calif.
Umbilical couplings
$770,000

RANDALL ENGINEERING CO.
Los Angeles, Calif.
Valves
$94,000

RAYTHEON CO.
Waltham, Mass.
Cathode ray tube display system
$2,460,000

ROHR CORP.
Chula Vista, Calif.
Heat Shields
$2,365,000

SERVONIC INSTRUMENTS, INC.
Costa Mesa, Calif.
Pressure transducers
$393,000

SOLAR, DIVISION OF INTERNATIONAL HARVESTER
San Diego, Calif.
Ducts
$8,650,000

SOUTHWESTERN INDUSTRIES, INC.
Los Angeles, Calif.
Calips pressure switches
$540,000

SPACE CRAFT, INC.
Huntsville, Ala.
Converters
$1,376,000

STAINLESS STEEL PRODUCTS, INC.
Burbank, Calif.
Ducts
$2,722,000

STANDARD CONTROLS, INC.
Seattle, Washington
Pressure transducers
$157,000

STRATHAM INSTRUMENTS, INC.
Los Angeles, Calif.
Pressure transducers
$253,000

STERER ENGINEERING AND MANUFACTURING CO.
Los Angeles, Calif.
Valves
$333,000

STRESSKIN PRODUCTS CO.
Costa Mesa, Calif.
Insulation
$244,000

SYSTRON-DONNER CORP.
Concord, Calif.
Servo accelerometers
$744,000

THIOKOL CHEMICAL CORP. ELKTON DIVISION
Elkton, Md.
Retrorockets
$4,500,000

TRANS-SONICS, INC.
Burlington, Mass.
Measuring systems and thermometers
$4,800,000

UNIDYNAMICS/ST. LOUIS, A DIVISION OF UMC INDUSTRIES, INC.
St. Louis, Mo.
Spools, harnesses and ducts
$4,000,000

UNITED CONTROL CORP.
Redmond, Wash.
Ordnance devices and control assemblies
$117,000

VACCO INDUSTRIES
South El Monte, Calif.
Filters, relief valves, and regulators
$937,000

WHITTAKER CORP.
Chatsworth, Calif.
Valves and gyros
$5,557,000

FRED D. WRIGHT CO., INC.
Nashville, Tenn.
Support assemblies and measuring racks
$2,827,000

TELEPHONE INDEX

CAPE KENNEDY

Boeing Public Relations (Press Suite)	784-3104
Apollo Contractors Information Center	784-1260
Air Force Eastern Test Range	494-7731
NASA News Center	783-7781
NASA Recorded Daily Status Reports	784-2380

CAR RENTALS

Avis	783-3643
Budget	783-1641
Cape Car	783-2226
Continental	784-1884
Hertz	783-7771
King Car	783-4090
National	783-7007

MOTELS

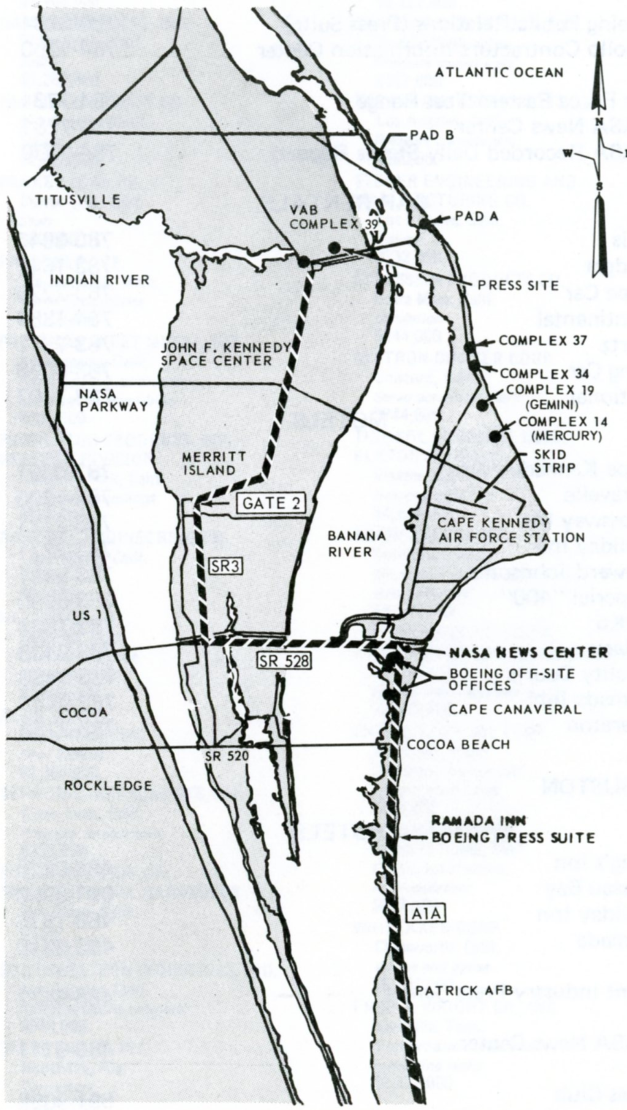
Cape Kennedy Hilton	783-0361
Caravelle	783-1300
Crossway Inn	783-2221
Holiday Inn	783-2271
Howard Johnson's	783-9481
Imperial "400"	783-0980
KoKo	783-7621
Polaris	783-9430
Quality Courts	783-9430
Ramada Inn	783-9441
Sheraton	783-2252

HOUSTON

HOTELS

King's Inn	488-0220
Nassau Bay	591-3000
Holiday Inn	488-1518
Ramada	488-2216
Joint Industry Press Center	488-5472
NASA News Center	483-5111
Press Club	591-9098

GENERAL AREA



BOEING PUBLIC RELATIONS OFFICES

SEATTLE	R. William Jury Aerospace Group P. O. Box 3999 Seattle, Washington 98124	206-773-2816
NEW YORK	Mark E. Nevils 45 Rockefeller Plaza Suite 3562 International Building New York, N. Y. 10020	212-586-8980
WASHINGTON, D. C.	William J. McGinty 1625 K Street N. W. Washington, D. C. 20006	202-484-2273
PHILADELPHIA	John R. Musgrave Vertol Division P. O. Box 16858 Philadelphia, Pa. 19142	215-522-2700
WICHITA	Herbert D. Hollinger Wichita Division 3801 S. Oliver Wichita, Kansas 67210	316-687-3153
HOUSTON	Harold E. Carr P. O. Box 58747 Houston, Texas 77058	713-488-0910
NEW ORLEANS	Milton L. Alberstadt P. O. Box 29100 New Orleans, Louisiana 70129	504-255-2996
HUNTSVILLE	Roger J. Koch Research Park Center P. O Box 1470 Huntsville, Alabama 35807	205-895-0320
CAPE KENNEDY	John T. Payton P. O. Box 1698 Cocoa Beach, Florida 32931	305-784-3122
	Boeing Press Suite Room 104 - Ramada Inn Cocoa Beach, Florida 32931	305-784-3104

THE BOEING COMPANY