PROJECT ANNA

Anna 1B

31 Oct 62

Booster: Thor-Able
Sponsor: A Army
N Navy
N NASA
I Air Force

Test # 3723
Pad 17A

Purpose: Placed a Geodetic satellite in earth orbit to make precise optical measurements as an aid to determining the size and shape of the earth. Anna was a 36-inch aluminum sphere girdled by a band of solar cells that gave it a diameter of 48 inches at mid-section. It weighed approximately 350 pounds. It carried a one-million watt blinking strobe light. Each flash was to b photographed from different positions on the earth to determine relative position and compute distance. Anna achieved near circular orbit of about 700 miles altitude.

MT63-13732

AGENA SPACECRAFT (GEMINI TARGET)

TAB B

Date : 25 Oct 65
Payload : Agena Stage
Booster : Atlas
Sponsor : NASA
Test No. : 4994
Launch Pad: 14

The 7200-lb Agena stage of Atlas/Agena booster vehicle was to be placed in orbit for use as a docking vehicle for the GT-6 spacecraft. The Agena stage failed to ignite and was not propelled into orbit. This caused the GT-6 launch to be postponed until a substitute docking vehicle could be selected and launched.

Date : 16 Mar 66
Payload : Agena Stage
Booster : Atlas
Sponsor : NASA
Test No. : 2166
Launch Pad: 14

The Agena, TDA-3, stage of the Atlas/Agena booster vehicle was boosted into earth orbit as the docking vehicle for the Gemini (GT-8) spacecraft. Rendezvous and docking was accomplished but severe yaw and roll of the joined vehicles forced undocking action. Apogee was 161.3 NM; perigee 160.6 NM; and orbital period was 90.4 min. The target vehicle weighed 7,000 lbs.

Date : 17 May 66
Payload : Agena Stage
Booster : Atlas
Sponsor : NASA
Test No. : 2398
Launch Pad: 14

The Agena, TDA-5, stage of the Atlas/Agena booster vehicle was to be boosted into earth orbit as the docking vehicle for Gemini (GT-9) spacecraft. One of the Atlas engines gimballed and locked in an off-center position which prevented the programmed speed and altitude being achieved to boost the Agena stage into orbit. The Agena fell into the Atlantic and the GT-9 launch was scrubbed.

ATDA (AUGMENTED TARGET DOCKING ADAPTER)

TAB C

Date	:	1 Jun 66
Payload	:	ATDA
Booster	:	Atlas D (5304)
Spnnsor	:	NASA
Test No.	:	5060
Launch Pad:		14

The ATDA was boosted into orbit as a rendezvous target docking vehicle for Gemini (GT-9) spacecraft. This replacement was a less sophisticated replacement for the Agena vehicle that failed to achieve orbit on 17 May. It was a modified Agena shell adapted for docking, but without the Agena propulsion system. Human error in installing the lanyards holding the shroud in place prevented it from being jettisoned and docking action by GT-9 could not be accomplished. ATDA apogee was 165.4 NM, perigee 160.9 NM, and orbital period was 90.475 minutes.

ET66-14757

APOLLO PROGRAM

APOLLO — 18 Sep 64

Booster — Saturn SA-7

Sponsor — NASA
Test No. — 4444
Launch Pad — 37B

Boilerplate version of unmanned Apollo spacecraft to test jettisoning of launch escape system and orbital performance of Apollo capsule. The command module was a conical structure 154 inches in diameter at base and 144 inches high. The 120 inch escape tower was mounted above and the 154 inch diameter, 141 inch long service module was mounted below. Boilerplate Apollo weighed 17,200 lbs, the instrumentation unit weighed 5,400 lbs and the spent S-IV stage of the Saturn weighed 14,100 lbs making a total weight of 36,700 lbs placed in orbit. Perigee was 114 mi, apogee 141 mi; and orbital period 88.4 minutes. Decay occurred on 22 Sep 64 after 59 orbits.

ET65-9858

APOLLO

Date	:	26 Feb 66
Payload	:	Unmanned Apollo Spacecraft
Booster	:	Saturn 1B
Sponsor	:	NASA
Test No.	:	0195
Launch Pad	:	34

This was a suborbital test flight of an unmanned Apollo spacecraft to test certain performance features and physical suitability for withstanding re-entry temperatures. The test was a success all the way. Impact was 200 NM east of Station 12.

APOLLO

Date	: 25 Aug 66	This was an unmanned version of the Apollo spacecraft designed to carry three men to the moon. It was boosted two-thirds around the world in a suborbital flight to a landing in the Pacific Ocean as a final test for acceptability as a man-rated space vehicle.
Payload	: Apollo Spacecraft	
Booster	: Saturn IB (AS-202)	
Sponsor	: NASA	
Test No.	: 7879	
Launch Pad	: 34	

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ET67-14767

APOLLO

Date : 9 Nov 67
Payload : S-IVB (Saturn 3rd Stage) Command Module, Service Module, and Boiler plate version of Lunar Module.
Booster : Saturn V
Sponsor : NASA
Test No. : 0072
Launch Pad: 39A

Apollo 4 mission orbited the third stage of the Saturn V booster. It carried into earth orbit the Command Module, the Service Module, and a boiler plate version of the Lunar Module. As the S-IVB/Lunar Module combination passed over north Florida during the second revolution of its parking orbit, it was reignited and boosted to 10,696 mi for separation. The reignition was photographed by the ROTI (Recording Optical Tracking Instrument) located at the Melbourne Beach Site. This was the first time orbital reignition had ever been photographed by a ground station. The remarkable thing was that it was photographed during daylight hours. The S-IVB and modules weighed 278,699 pounds. Recovery was made near Hawaii. Impact was six miles from recovery vessel.

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Date : 22 Jan 68
Payload : Lunar Module (LM-1)
Booster : Saturn 1B
Sponsor : NASA
Test No. : 2320
Launch Pad: 37B

Apollo 5 mission boosted an unmanned Apollo spacecraft, including Service Module and Lunar Module, into earth orbit. This was the first test of the Lunar Module (LM-1) designed to land two men on the moon. It verified ascent and descent stages propulsion systems including restart and throttle operation.

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Date : 4 Apr 68
Payload : Lunar Module Model
Booster : Saturn V
Sponsor : NASA
Test No. : 6343
Launch Pad: 39A

Apollo 6 mission carried unmanned Apollo spacecraft including Service Module and Lunar Module model into earth orbit. A malfunction in two of the second stage booster engines and failure of the third stage booster to reignite prevented accomplishment of all primary mission objectives. Recovery was made in Pacific. Landing was 80 mi from the recovery carrier. The simulated Lunar Module was designated LTA-2R (Lunar Test Article).

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ET68-14761

APOLLO

Date : 11 Oct 68
Payload : Apollo 7
Booster : Saturn IB (AS-205)
Sponsor : NASA
Test No. : 0066
Launch Pad: 34

This was the first manned Apollo mission. The Apollo 7 crew consisted of Walter Schirra (Commander), Donn Eisele, and Walter Cunningham. They completed an 11-day earth orbit mission to prove the performance capability of the spacecraft for a journey to the moon. Blast off occurred at 1102 and 45 seconds EST, 11 October 1968, and splashdown at 0712 EST on 22 October 1968. They were in the air 260 hours 9 minutes 15 seconds, and completed 163 revolutions of the earth at 142 to 177 miles altitude. On splashdown, the Apollo capsule settled in the water apex down and had to be righted by the crew. The recovery area was in the Atlantic Ocean south of Bermuda just 7.5 miles from the recovery carrier USS Essex. The astronauts were transferred to the carrier by helicopter. Cabin atmosphere in the spacecraft prior to and during launch was a mixture of nitrogen and oxygen. After liftoff it was quickly phased down to pure oxygen for the remainder of the flight. Apollo 7 firsts included live television beamed from space, and drinking water produced as a by-product from the fuel cells. The service module's main engine proved itself by performing the longest and shortest reburn periods and the largest number of inflight starts to date.

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Date : 21 Dec 68
Payload : Apollo 8
Booster : Saturn V (AS-503)
Sponsor : NASA
Test No. : 0170
Launch Pad: 39A

This was the second manned Apollo mission. Apollo 8 crew consisted of Frank Borman (Commander), James Lovell, Jr., and William Anders. They blasted off at 0751 EST on a 6-day mission becoming the first men to ride the giant Saturn V and the first to travel to the moon and back. After one and three-fourths revolutions of the earth, the Saturn V upper stage was refired to place spacecraft in a transfer trajectory to the moon. Brief calendar of events: 22 December 1968, first live television program beamed to earth from space. Borman suffered intestinal flu. Lovell and Anders slightly ill. 23 December 1968: crew recovered from illness. Made course corrections. Beamed first deep space photo to earth from 202,000 miles in space. Reached point where moon's gravitational pull was greater than that of earth. 24 December 1968: went into lunar orbit at 1659 hours EST, ranging from 69 to 193 miles above lunar surface. Relayed TV photos of moon surface to earth. Closed telecast by reading first chapter

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Apollo 8 continued,

of Genesis. Orbited the moon ten times. 25 December 1968: ended 20-hour period of moon orbit by blasting out of lunar orbit for return to earth at 0100 hours EST. Reentered earth gravitational control at 1239 hours. 26 December 1968: caught up on sleep in preparation for reentry into earth's atmosphere. Televised pictures to earth from 112,000 miles away. 27 December 1968: Splashed down in the Pacific 930 miles southwest of Hawaii at 1151 hours EST, thus completing a 148-hour flight. Impact was just 5000 yards from the recovery ship USS Yorktown. The Apollo 8 capsule settled in the water in an apex down position and remained so for six minutes before being righted by the spacecrafts upright system. Among the many firsts accomplished by Apollo 8 were: first manned flight on a Saturn V launch vehicle; first time man had traveled at a speed of 24,171 mph; first time man had traveled 223,000 miles from earth; first time man had been under the gravitational influence of another celestial body; first time man had seen the moon close-up with his own eyes; first time a manned reentry of the earth's atmosphere had been made at speeds of almost 25,000 mph.

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Date : 3 Mar 69

Payload : Apollo 9

Booster : Saturn V (AS-504)

Sponsor : NASA

Test No. : 9025

Launch Pad: 39A

This was the third manned Apollo mission. Apollo 9 crew consisted of James McDivitt (Commander), David Scott, and Russell Scheickart. They blasted off at 1100 hours EST on a 10-day mission to prove that LEM was capable of taking the astronauts from the Command Module down to the surface of the moon and returning them to the mother spacecraft. The Saturn V booster with its Apollo 9 payload was the heaviest ever launched by the United States. Launch weight was 6,486,915 pounds. This was 264,000 pounds heavier than Apollo 8. The orbital payload weighed 297,009 pounds, the heaviest ever placed in orbit by the United States. During the 10-day mission, McDivitt and Schweickart separated the LEM from the Apollo capsule, flew it over 100 miles away and returned and docked. While in the LEM they were in a vehicle incapable of returning to the earth alone and unequipped with life support elements. Rendezvous was essential to survival. All test objectives were accomplished. Apollo 9 splashed down in the Atlantic Ocean, 300 miles north of Puerto Rico at 1200 hours 53 seconds EST on 13 March 1969, after 241 hours 53 seconds of flight. It made 151 revolutions of the earth. This was one more than planned. Bad weather conditions and high seas in the initial recovery area 171 miles southwest of Bermuda forced a change in recovery area and caused the flight to be extended one revolution more than planned. Apollo 9 was scheduled for launch on 28 February, but the astronaut crew contracted colds and sore throats on 27 February, causing a three-day postponement of launch.

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APOLLO (cont)

Date	:	18 May 1969
Payload	:	Apollo 10
Booster	:	Saturn V (AS-505)
Sponsor	:	NASA
Test No.	:	0920
Launch Pad:		39B

This was the fourth manned Apollo mission and the second to travel to the vicinity of the moon. Astronauts Thomas P. Stafford (Commander), Eugene A. Cernan, and John W. Young comprised the crew. Liftoff was at 1149 hours EST. After two orbits of the earth, they entered a translunar trajectory. During 19 and 20 May, while on their way to the moon, they televised the earth and the moon for earth viewers. They reached the moon and went into lunar orbit about 1600 hours EST on 21 May 1969. They spent two and one-half days in moon orbit and completed 31 revolutions before returning to earth. On 22 May, Stafford and Cernan entered the LEM, separated it from the Command Module, and dropped down to within 9.4 miles of the moon's surface for a close look at the landing site for Apollo 11 and to check out the LEM. The LEM excursion lasted about 8 hours and ranged 350 miles from Command Module. The lower half (descent portion) of the LEM was jettisoned before return to the Command Module which had maintained an altitude of 69 miles above the surface of the moon. The upper portion of the LEM began a series of wild gyrations when the lower half was dropped. This was caused by a switch to the target seeking radar being in the wrong position. Instructions to recycle it had been omitted in printing the instruction sheet. The astronauts had also encountered difficulty in depressurizing the tunnel connecting the LEM to the Command Module before undocking. The LEM redocked with the Command Module about 2200 hours EST on 22 May. The LEM was then discarded and fired on a course toward the sun. 23 May was spent in moon orbit. On 24 May the Command Module fired its rockets to break out of moon orbit for return to earth. The remainder of that day and 25 May were spent in moon/earth trajectory. Splashdown occurred in the Pacific Ocean at 1152 hours EST on 26 May 1969. Impact was 400 miles east of Pago Pago and about three miles from the recovery ship USS Princeton. Recovery by helicopter was accomplished without incident. The Apollo 10 crew made the fastest reentry in the earth's atmosphere to date at 24,694 mph. The Apollo 10 journey lasted eight days three minutes.

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ATS (APPLICATIONS TECHNOLOGY SATELLITE)

Date : 6 Dec 66
Payload : ATS-I (B)
Booster : Atlas Agena
Sponsor : NASA
Test No. : 8267
Launch Pad: 12

ATS "B" became ATS I when it went into orbit. This was the first of five planned ATS vehicles. It weighed 775 pounds. It was to provide communications, weather photos, and serve as test platform. The satellite was stabilized in near synchronous orbit with apogee of 19,627 nm and perigee of 19,561 nm above the equator and over the Pacific Ocean. From this position it could photograph an area extending roughly from northeast United States to mid-Australia. Orbital period was 660 minutes or 11 hours. ATS I was spin stabilized.

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Date : 5 Apr 67
Payload : ATS-II (A)
Booster : Atlas Agena
Sponsor : NASA
Test No. : 4570
Launch Pad: 12

ATS II was known as ATS "A" before it went into orbit. It was the second in a series of five planned ATS vehicles. It weighed 782 pounds and was gravity-gradient stabilized. It was designed to provide a stable platform for its many experiments operating from a circular orbit of approximately 6000 miles. Instead it entered a highly elliptical orbit with apogee of 5805 nm and perigee of 108 nm.

* * * * *

ATS (Applications Technology Satellite)

Date	:	5 Nov 67
Payload	:	ATS-C or 3
Booster	:	Atlas/ Agena D
Sponsor	:	NASA
Test No.	:	2800
Launch Pad:		12

ATS-3 was boosted into 22,228 NM synchronous earth orbit stationed over the Atlantic Ocean near the mouth of the Amazon River. The space vehicle carried 18 experiments designed to provide weather, navigation, and communications data. The satellite weighed 805 pounds, and was a 6-ft long cylinder 5-ft in diameter. The sides were covered with solar cells. ATS-3 returned photos of the entire earth's disc.

ET68-14761

ATS (Applications Technology Satellite)

Date	: 10 Aug 68	This was the fourth in a series of seven launchings programmed. The initial launch
Payload	: ATS-4 (ATS-D)	placed ATS-4 in a preliminary elliptical earth orbit with apogee of 640 miles and perigee of 115 miles. This was to have been converted
Booster	: Centaur C-17	into an elliptical transfer orbit extending 22,300 miles out with a final conversion to a stationary 22,300 miles synchronous equatorial
Sponsor	: NASA	earth orbit about 400 miles west of Quito, Equador, over the Pacific. Failure of the
Test No.	: 4089	Centaur stage of the booster to restart in space prevented modification in the initial
Launch Pad:	36A	orbit and rendered the experiments aboard the satellite useless because of its orbital

position and the fact that the satellite remained attached to the Centaur stage. ATS-4 reentered the earth's atmosphere on 17 October 1968 and burned. The mission of ATS-4 was to photograph tropical disturbances. It also carried advanced communication equipment and a mini-jet engine for testing. Configuration: Cylindrical spacecraft 72 inches long and 56 inches in diameter. Stabilized by four giant booms, each 123 feet long, extended to form a giant X. It was the first satellite to carry a new type image-orthicon capable of photographing weather formations both day and night. Weight 864 pounds. Cost $28 million. Decay occurred 17 October 1968.

ATV (AGENA TARGET VEHICLE FOR GEMINI PROGRAM)

Date : 18 Jul 66
Payload : Agena Target Vehicle for GT-10
Booster : Atlas
Sponsor : NASA
Test No. : 5434
Launch Pad: 14

Agena Target Vehicle (ATV) for Gemini 10 was used for rendezvous and docking purposes in space. It was also used to change orbits of the Gemini space vehicle for deeper penetration of space. Reached apogee of 476 statute miles to set manned penetration record. It decayed 29 Dec 66. Vehicle weighed 7184 pounds.

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Date : 12 Sep 66
Payload : Agena Target Vehicle for GT-11
Booster : Atlas
Sponsor : NASA
Test No. : 2429
Launch Pad: 14

Agena Target Vehicle (ATV) for Gemini 11 was used as rendezvous and docking vehicle. It was also used to change orbits of the Gemini space vehicle to set new altitude record of 850 statute miles for manned penetration of space. It was tethered to the GT-11 spacecraft for three hours by a 100-foot nylon rope to become the first tethered flight in space history. Difficulty with checkout of the Atlas booster on 10 Sep forced postponement of GT-11 flight until 12 Sep. The 7199 pound Agena decayed 30 Dec 66

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Date : 11 Nov 66
Payload : Agena Target Vehicle for GT-12
Booster : Atlas
Sponsor : NASA
Test No. : 3678
Launch Pad: 14

Agena Target Vehicle (ATV) for Gemini 12 was used as rendezvous and target vehicle. It weighed 7090 pounds. It positioned Gemini 12 spacecraft for solar eclipse photos. Decayed 23 Dec 66.

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ET67-14767

BIO-SATELLITE

Date : 14 Dec 66

Payload : Bio Sat I

Booster : Delta Thor (TAID)

Sponsor : NASA

Test No. : 7060

Launch Pad: 17A

This was a 940-pound, three-module Bio-satellite, about 7-feet long, referred to by some as "Noah's Ark." It was designed to carry plants and insects into earth orbit for a three day period to determine the effects of space flight on them. A 290-pound speciman capsule held the plants and insects. Recovery was planned after about 47 orbits or three days to observe the effects of space travel on biological processes. The satellite failed to return the biological capsule. Perigee was 191 mi, apogee 197 mi, with orbital period of 91 minutes. Seven of the thirteen biological experiments were carried in duplicate in the BIOS-I. The experiments were:

1. Virus activation in lysogenic bacteria.
2. Genetic effects on orange bread mold.
3. Gene mutations in spiderwort plant.
4. Genetic effect on parasitic wasp.
5. Genetic effect on the fruit fly.
6. Embryo development in Drosophila larvae.
7. Development of a flour beetle.

Half were exposed to gamma rays and zero gravity and half to zero gravity only. Other zero gravity experiments were:

8. Feeding and growth of giant amoeba.
9. Effects on frog egg development.
10-12. Effects on form, tissues and bio-chemistry of wheat seedlings. Three seperate experiments.
13. Leaf angle and biochemistry effects on pepper plants.

Bio-satellite I was programmed to drop to earth on its 1000th orbit and is presumed to have landed in Western Australia on 15 Feb 67, but it could not be located.

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ET67-14767

BIO-SATELLITE

Date : 7 Sep 67

Payload : Bio-Satellite 2

Booster : Delta-Thor (TAID)

Sponsor : NASA

Test No. : 4447

Launch Pad: 17B

Bio-Satellite 2 carried 13 plant and animal experiments into earth orbit on a two-day mission. The experiment included pepper plants, wheat seedlings, frog eggs, amoeba, beetles, bacteria, and wasp nurse cells. The purpose was to study the effects of weightlessness and radiation hazards on living cell structure and growth. Experiments and space vehicle weighed 1120 pounds. Communication difficulties and poor weather conditions in the recovery area caused recovery to be effected after 30 revolutions instead of the 47 planned. Recovery was made by air snatch on 9 Sep 1967. Findings indicated that both plant and animal cells suffer greater damage from irradiation in the weightless state than they would suffer in earth environment. Leaves of the pepper plants twisted and curled downward. Roots of the wheat seedlings grew up and sideways. Primitive egg cells and larva grew more slowly while weightless. Two strains of bacteria grew faster in the weightless state. Mortality rate of the beetles was twice as great as on earth.

Bio-Satellite 2 was a cylinder with a blunt cone end. Overall length of spacecraft was 6 ft 9 inches and weight was 940 pounds.

BIO-SATELLITE

Date : 28 Jun 69

Payload : Bio-Satellite 3

Booster : Delta-Thor (Long Tank)

Sponsor : NASA

Test No. : 0197

Launch Pad: 17A

Bio-Satellite D was the third biological research satellite launched by the United States. It contained a 14-pound pigtail monkey named Bonny on what was to be a 30-day flight in a 220-mile circular orbit. Electrical sensors were connected to various parts of the monkey's body so that scientists could monitor brain wave patterns, heart action, respiration, kidney function, and other bodily functions. A major objective was to determine the effects of long-term weightlessness on the body functions and cell structure on a man-like animal. The flight was terminated on 7 July after only nine days and 130 orbits, when Bonny became sluggish, inactive, and unresponsive. A cloud layer in the recovery area caused the recovery plane to miss its mid-air pick-up and the 315-pound capsule fell into the sea. It was recovered by helicopter and taken to Hickam AFB, Hawaii, for examination. Although Bonny was recovered alive, he did not respond to treatment and died 8 July 1969, just 12 hours after recovery. His death came as a considerable surprise to the examining physicians who planned a complete autopsy to try to determine the exact cause of death. It was speculated that physical deterioration was caused by low temperature, inactivity, and isolation. Final analysis of autopsy results was not expected for several months.

Configuration: Bio-Satellite D was a seven-foot long cylinder that weighed 1536 pounds. It was the first United States orbiting space vehicle to provide a two-gas atmosphere resembling the earth's air. The environment consisted of 20 percent oxygen and 80 percent nitrogen at a sea level pressure of 14.7 pounds per square inch. A temperature of 75 degrees was to be maintained. The capsule containing Bonny weighed 315 pounds.

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CENTAUR SECOND STAGE

TAB D

Date	: 7 Apr 66	Centaur stage of the Atlas/Centaur boosted combination was injected into earth orbit to study the behavior of the liquid hydrogen fuel and test its stability for use as fuel on space missions. The Centaur hydrogen engine failed to restart in space, but it was not the fault of the fuel. A mass model simulated Surveyor spacecraft was attached to the second stage Centaur.
Payload	: Centaur (2nd Stage of Atlas/Centaur Booster)	
Booster	: Atlas	
Sponsor	: NASA	
Test No.	: 6812	
Launch Pad	: 36B	

ET66-14757

CENTAUR SECOND STAGE

Date	:	26 Oct 66
Payload	:	Centaur, 2nd Stage of Atlas/Centaur Booster
Booster	:	Atlas
Sponsor	:	NASA
Test No.	:	1906
Launch Pad:		36B

Centaur, the second stage of the Atlas/Centaur booster combination, was injected into earth orbit carrying a mass model Surveyor type payload. This was the final R&D launch to test the capability of the Centaur stage to restart after a coast phase and place a payload into a lunar transfer trajectory. The Centaur stage was not considered a spacecraft. Second burn was accomplished and Surveyor mass model payload was boosted into lunar transfer trajectory. The Centaur stage decayed on 6 Nov 66.

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ET67-14767

CLASSIFIED OR-3880

Date : 6 Aug 68
Payload : Classified
Booster : Atlas-Agena
Sponsor : Air Force
Test No. : 4920
Launch Pad: 13

Because of the cloak of secrecy surrounding this payload, no official pronouncement concerning its mission, configuration, or parameters was released. It was the first closed launch from the Cape since 1963. The payload was initially boosted into an elliptical earth orbit and then converted into a near circular orbit with perigee of 19,686 miles as part of an experimental satellite program. Launch was conducted in accordance with Operations Requirements Document OR-3880. The only official Air Force announcement was made eight minutes after the launch, to the effect that "an experimental payload had been launched." Approximate weight of payload 500 pounds. TRW Space Log gives perigee as 19,686 miles and apogee of 24,769 miles.

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Date 12 Apr 69
Payload : Classified
Booster : Atlas-Agena
Sponsor : Air Force
Test No. : 1069
Launch Pad: 13

This was the second classified payload launched in accordance with Operations Requirements Document OR-3880. The first was launched 6 August 1968. No official release concerning mission, configuration, or flight parameters was made. It was an experimental payload.

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COMSAT PROGRAM

COMSAT (Early Bird)	6 Apr 65	Communications satellite "Early Bird" was propelled into synchronous earth orbit with apogee of 22,685.8 mi, perigee of 21,711.8 mi, and orbital period of 23 hrs 57 min. Final position was located above the equator at 27.5° west longitude which placed it above the Atlantic Ocean.
Booster	Delta D-30	
Sponsor	NASA Am Tel & Tel	
Test No.	0500	
Launch Pad	17A	

ET65-9858

DATS (Despun Antenna Test Satellite)

Date	:	1 Jul 67
Payload	:	DATS-1
Booster	:	Titan IIIC
Sponsor	:	Air Force
Test No.	:	4029
Launch Pad:		41

DATS-1 was a communication satellite with a despun antenna designed to test methods of electronically despinning an antenna beam on a spinning satellite so that signal strength would always be oriented toward the earth. The satellite was a 26-sided polygon 34 inches in diameter and weighed 150 pounds. It was covered with solar cells. It was injected into circular orbit 20,000 NM above the equator.

DATS-1 was an auxiliary payload. Other payloads were three IDCSPs, a LES-5, and one DODGE satellite.

ET68-14761

DODGE (Department of Defense Gravity-Gradient Experiment)

Date : 1 Jul 67

Payload : DODGE

Booster : Titan IIIC

Sponsor : Navy

Test No. : 4029

Launch Pad: 41

DODGE was a 430-pound gravity-gradient satellite designed to provide high resolution black and white and color TV pictures of the earth, and to expand technology in support of precise and reliable gravity-gradient control systems for earth satellites. DODGE was a 8-sided aluminum shell with a truncated pyramid at top and a 62-inch cylindrical mast extending from the bottom. It carried ten booms, some extending 150 feet, to stabilize the satellite with one face pointing toward the earth. The main body of the satellite was 48-inches wide and 33-inches high. It was placed in a 20,000 NM circular orbit above the earth. The DODGE was an auxiliary payload on this launch. The primary payload was three IDCSPs. Other auxiliary payloads were LES-5 and DATS-1.

ERS (Environmental Research Satellite)

Date	: 13 Dec 67	TTS-1 (Test and Training Satellite) was an adaption from the Environmental Research Satellite (ERS) series. It was octahedral in shape, 12 inches across each side, and weighed 44 lbs. Each of its eight triangular sides was faced with 111 solar cells. Three VHF antennas were deployed from one apex and one S-band antenna was deployed from the opposite apex. TTS-1 was designed to test the worldwide network of Apollo tracking stations. This was NASA's first piggyback payload. It was an auxiliary payload on the Pioneer VIII launch.
Payload	: ERS, TTS-1 (Piggyback on Pioneer VIII)	
Booster	: Delta-Thor (TAD)	
Sponsor	: NASA	
Test No.	: 2898	
Launch Pad:		

ERS (Environmental Research Satellite)
TTS (Test and Training Satellite)

Date : 8 Nov 68

Payload : ERS
TTS-2
(Secondary
Payload)

Booster : Delta/Thor
D-60

Sponsor : NASA

Test No. : 6850

Launch Pad: 17B

This was an auxiliary payload that rode "piggyback" into earth orbit as Pioneer IX was being boosted into solar orbit. It was the second TTS launch, being an adaptation of the ERS series. TTS-2, sometimes referred to as TETR-2 will provide an orbiting target for checking out equipment and training personnel under conditions similar to those provided by an orbiting Apollo spacecraft.

Configuration: Octahedron shaped (bottom to bottom pyramids) 11 inches on each side. The top apex supports an S-band antenna with mast. Two VHF transmitter antenna sections are located at opposite apexes of the center plane. The VHF command telemetry antenna section is located near the bottom apex. Solar cells provide electric power to recharge the power batteries. Weight 40 pounds. TTS-2 was sometimes referred to as the TETR-2.

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EXPLORER PROGRAM

EXPLORER I Booster: JUPITER-C #27	31 Jan 58	First U.S. earth satellite placed in orbit. Cylinder 80" long, 6" diameter, weight 30.8 lbs. Expected life, 3 to 5 years. Apogee 1,155 mi, perigee 217 mi.
EXPLORER II Booster: JUPITER-C #26	5 Mar 58	Failed to achieve orbit. Size and weight same as EXPLORER I.
EXPLORER III Booster: JUPITER-C #24	26 Mar 58	Placed in earth orbit. Size and weight same as EXPLORER I. Re-entered earth's atmosphere 27-29 Jun 58 after about 1,250 revolutions. Apogee 1,741 mi, perigee 117 mi.
EXPLORER IV Booster: JUPITER-C #44	26 Jul 58	38.64 lb earth satellite to study cosmic ray intensity. Placed in earth orbit. Re-entered earth's atmosphere 23 Oct 59 after about 6,400 revolutions. Apogee 1,388 mi, perigee 157 mi.
EXPLORER V Booster: JUPITER-C #47	24 Aug 58	Failed to achieve orbit. 2nd and 3rd stages fired at incorrect angle for orbital flight. Payload weight 38.4 lbs (25.8 lb satellite and 12.6 lb 4th stage)
EXPLORER (Unnumbered) Booster: JUNO II #16 Sponsor: NASA	16 Jul 59	Purpose to place satellite in orbit to measure earth's radiation balance. Payload weighed 91.5 lbs, was 76" high and 8.75" in diameter. RSO destruct of booster at T+5.5 sec prevented orbit.
EXPLORER VI Booster: #134 THOR-ABLE 3	7 Aug 59	Paddlewheel satellite placed in earth orbit. Life expectancy over 1 year. Purpose to study environment encountered. Apogee 26,357 mi, perigee 156 mi, weight 142 lb.

EXPLORER PROGRAM

EXPLORER VII 13 Oct 59 Booster: JUNO II #19A	Placed in orbit a 91.5 lb earth satellite with a life expectancy of 20 years. Apogee 673 mi, perigee 344 mi. Purpose to study radiation.
EXPLORER (Unnumbered) 23 Mar 60 Booster: JUNO II #19C	Attempt to place radiation measurement package in earth orbit to study Van Allen radiation belt. Payload weight 35.3 lbs (22.8 lb instrument pack and 12.5 lb 4th stage). 4th stage of vehicle did not ignite. Orbital velocity not achieved.
EXPLORER VIII 3 Nov 60 Booster: JUNO II #19D Sponsor: NASA	Placed 90 lb satellite in earth orbit to study radiation. Apogee 1422.6 statute mi, perigee 258.4 statute mi. Orbital period 112.75 min. Life expectancy 10 years. Payload weight 90.14 lbs.
EXPLORER IX	Was launched from Wallops Island, Va., consequently, it is not included in this series.
EXPLORER (Unnumbered) 24 Feb 61 Booster: JUNO II #19F Sponsor: NASA	Attempted placement of 74 lb payload in earth orbit to study shape of ionosphere by analysis of transmitted signals. Payload was 30" diameter, 24" high formed by joining two aluminum truncated cones at their bases. Failure of third and fourth stage boosters to ignite prevented orbit of payload. Test accomplished later as EXPLORER XI.
EXPLORER X 25 Mar 61 Booster: DELTA-THOR #4 Sponsor: NASA	Satellite payload weighed 79 lbs and was 52" high. It consisted of a 13" sphere atop a supporting tube joined to the flat side of a 19" cylinder. Purpose to gather data on earth's magnetic fields. Achieved elliptical orbit with perigee of 100 mi and apogee of 145,000 mi. Estimated lifetime of a few weeks.

EXPLORER PROGRAM

EXPLORER XI 27 Apr 61 Booster: JUNO II #19E Sponsor: NASA	Earth satellite to study gamma rays from cosmic sources and map their distribution in the sky. Payload weighed 82 lbs. Configuration resembled old-time street lamp - 12" diameter, 23.5" long octagonal box mounted on 6" diameter column that was 20.5" long. The 44" long 4th stage booster remained attached to satellite. Elliptical orbit had apogee of 1113.2 mi and perigee of 304 mi. Estimated lifetime, 1 to 3 years.
EXPLORER (Unnumbered) 24 May 61 Booster: JUNO II #19G Sponsor: NASA	Purpose was to place a 75 lb earth satellite in orbit known as "Ionospheric Beacon (S-45)." Electrical power failure in missile prevented orbit of payload. This was the last of the JUNO II boosters.

EXPLORER PROGRAM

EXPLORER XXI	3 Oct 64	This was in Interplanetary Monitoring Platform (IMP-B)
Booster	Delta-Thor D-26	lofted to measure magnetic fields, cosmic rays and solar winds. Apogee was lower than planned giving a highly eccentric earth orbit instead of the planned interplanetary orbit. Apogee was 59,253 mi, perigee 1540, and orbital period 34 hrs, 57 min. Payload weighed 136 lbs.
Sponsor	NASA	
Test No.	0131	
Launch Pad	17A	
EXPLORER XXVI	21 Dec 64	This was a 101-lb Energetic Particles Explorer satellite carrying five experiments to obtain data on how high energy particles are injected, trapped, and lost in earth's magnetosphere. Satellite achieved orbit with apogee of 16,280 mi, perigee of 180 mi, and orbital period of 7 hrs, 36 min. Satellite weighed 101 lbs, was 17 inches high and 27.75 inches in diameter, exclusive of protruding solar panels and magnetometer.
Booster	Delta-Thor D-27	
Sponsor	NASA	
Test No.	2873	
Launch Pad	17A	
EXPLORER XXVIII	29 May 65	This was a 130-lb Interplanetary Monitoring Platform (IMP-C) having the same mission as Explorer XXI. Apogee was 163,833 mi, perigee 121.5 mi, and orbital period of 142 hrs, 38.8 min.
Booster	Delta-Thor D-31	
Sponsor	NASA	
Test No.	1922	
Launch Pad	17B	

EXPLORER PROGRAM

Date : 6 Nov 65

Payload : Explorer XXIX (GEOS-A)

Booster : Delta-Thor TAD

Sponsor : NASA

Test No. : 6400

Launch Pad: 17A

GEOS-A, a geodetic map making satellite in the Explorer series, was placed in elliptical earth orbit with perigee of 691 SMI and apogee of 1411 SMI. Orbital period was 120.3 min. Orbital weight was 380 lbs. Explorer XXIX had an eight sided shell 48 inches across and 32 inches high. It was capped by an eight sided truncated pyramid. A 24-inch diameter hemisphere was attached to the bottom. Most of the exterior surface was covered by solar cells. Purpose of GEOS-A was to provide geodetic measurements on a global scale. It contained 5 geodetic instrumentation systems to provide simultaneous measurements to establish a model of the earth's gravitational fields and to map a system of world coordinates.

Date : 25 May 66

Payload : Explorer XXXII

Booster : Delta-Thor

Sponsor : NASA

Test No. : 0238

Launch Pad: 17B

Explorer XXXII, a 485-lb earth satellite, was boosted into elliptical orbit with perigee of 170 NM, apogee of 750 NM, and orbital period of 116 min. It carried 8 experiments designed to measure temperature, pressure, density, and composition of the upper atmosphere during one of the two years when solar activity climbs in intensity from minimum to maximum level.

EXPLORER

Date	: 1 Jul 66	IMP-4 or D was a 206-pound moon satellite designed to orbit the moon and explore the space around it. The Delta booster imparted too much push to its six million dollar payload for the moon's gravitational force to pull it into orbit around moon. Perigee was 9880 statute miles and perogee 270,560 miles.* Orbital period was 8540 minutes.
Payload	: Explorer XXXIII IMP-4 (Interplanetary Monitoring Platform)	
Booster	: Delta Thor (TAID)	
Sponsor	: NASA	
Test No.	: 3329	
Launch Pad	: 17A	

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* Parameters fluctuate as a result of perturbations caused by near passes to the moon.

EXPLORER

Date	:	19 Jul 67
Payload	:	Explorer XXXV (IMP-E)
Booster	:	Delta-Thor (TAD)
Sponsor	:	NASA
Test No.	:	1073
Launch Pad:		17B

Explorer XXXV (IMP-E) was launched to study solar winds and magnetic fields from the vicinity of the moon. The purpose was to discover possible hazards to astronauts journeying to the moon. The 230-pound spacecraft went into lunar orbit, and measures the earth's magnetic tail every 29.5 days. The main body of Explorer XXXV was an octagon, 28-inches across and 8-inches high. Four whip antennas projected from the top. Two 6-foot magnetometer booms and four solar panels extended from the main body.

ET68-14761

GEMINI PROGRAM

GEMINI GT-2	19 Jan 65	Gemini capsule GT-2 was second and final unmanned Gemini Flight. This was a suborbital flight to test the capsule. Capsule recovery was made by USS Lake Champlain 2127 mi down range.
Booster	Titan II	
Sponsor	NASA	
Test No.	4466	
Launch Pad	19	
GEMINI GT-3	23 Mar 65	Gemini capsule GT-3 (Molly Brown) was the first 2-man flight by the U.S. Astronauts Gus Grissom and John Young. They orbited the earth three times and landed near Station 7, Grand Turk. They were picked up by helicopter and placed aboard the USS Aircraft Carrier Intrepid. Duration of flight was 4 hrs, 53 min. Highlight of the flight was the first attempt at manned orbital maneuvering. Orbital altitude was changed over Texas during first orbital pass. Weight 7000 lbs.
Booster	Titan II	
Sponsor	NASA	
Test No.	0475	
Launch Pad	19	
GEMINI GT-4	3 Jun 65	Gemini GT-4 capsule carried Astronauts Edward White and James McDivitt on a 62-orbit flight around the earth. Splashdown was in the Atlantic Ocean about 400 mi east of Cape Kennedy. They were picked up by helicopter and put aboard the Aircraft Carrier Wasp. Duration of the flight was 97 hrs, 56.5 min. An attempt to rendezvous within contact vicinity of Titan II second stage had to be abandoned to conserve thruster fuel. Highlight of the flight was when White left the capsule for a 20-minute space walk during the third orbital pass over the United States. Weight 7000 lbs. After launch, flight control was transferred to the Flight Control Center, Houston, Texas. This was the first time control of a space mission was not conducted from the Cape.
Booster	Titan II	
Sponsor	NASA	
Test No.	1777	
Launch Pad	19	

ET65-9858

UNCLASSIFIED

GEMINI PROGRAM

Date : 21 Aug 65
Payload : Gemini (GT-5) (Radiation REP)
Booster : Titan II
Sponsor : NASA
Test No. : 2315
Launch Pad: 19

GT-5 was a bell-shaped spacecraft 18 ft 5 in. high, with a base diameter of 10 ft. It weighed 7,879 lbs. Boosted into earth orbit with initial perigee of 100 SMI and apogee of 216 SMI, later corrected to 124.7 SMI perigee and 192.7 SMI apogee. Orbital period was 89.5 min. Astronauts Gordon Cooper and Charles Conrad, Jr. remained in orbit 190 hrs, 56 min (7 days, 22 hrs, 56 min), and completed 120 revolutions of the earth. This was the longest manned mission to date. They terminated their flight on 29 August with splash-down in the Atlantic approximately 325 mi SW of Bermuda. They were recovered by helicopter and placed aboard the carrier Lake Champlain. Flight was cut short one orbit because of hurricane Betsy disturbance in the landing area. Ejected a 104 lb Radar Evaluation Pod (REP) into orbit. It decayed 27 Aug 65.

Recurring problems with power supply in the spacecraft hampered the performance of some mission objectives. An attempted launch on 19 August 1965 was scrubbed because of weather and technical problems after the astronauts had entered the capsule.

Date : 4 Dec 65
Payload : Gemini (GT-7)
Booster : Titan II
Sponsor : NASA
Test No. : 6145
Launch Pad: 19

GT-7 was boosted into orbit carrying astronauts Frank Borman and James Lovell. They completed the longest space ride on record by remaining aloft 14 days and completing 206 orbits. Rendezvous between GT-7 and GT-6 was accomplished on 15 December when the spacecrafts were brought within 6 to 10 feet of one another and flew formation for about 4 hrs. Splashdown was made on 18 December, only 6.6 NM from selected impact point, after 330 hrs, 30 min, 4 sec in the air. Impact was in the vicinity of Grand Turk, at 0905 hours. Astronauts were picked up by helicopter at 0920 hours and landed on the deck of aircraft carrier Wasp at 0937 hours. Live TV coverage of recovery operations was relayed via Early Bird satellite. Payload weight of GT-7 was 8,000 lbs.

ET66-14757

GEMINI PROGRAM (Cont)

Date : 15 Dec 65

Payload : Gemini (GT-6

Booster : Titan II

Sponsor : NASA

Test No. : 7100

Launch Pad 19

GT-6 was boosted into orbit carrying astronauts Walter Schirra and Thomas Stafford. They completed 16 revolutions, accomplished rendezvous with GT-7 in a fine display of spacemanship that brought the two crafts within 6 to 10 ft of each other, then splashed down in the vicinity of Grand Turk on 16 December 1965. Touchdown was just 13.4 NM from expected impact point. Recovery was accomplished by aircraft carrier Wasp. The astronauts were returned to Cape Kennedy on 17 December 1965. GT-6 spacecraft weighed 7,000 lbs. Duration of flight 25 hrs, 51 min.

GT-6 was scrubbed twice before being accomplished. First scrub was 25 October when the Agena rendezvous vehicle failed to achieve orbit and the second was 12 December when the Titan booster experienced automatic shutdown just 1.6 sec after ignition. Astronauts had entered the spacecraft in both instances before scrub was announced. First live TV coverage of recovery activities broadcast by Early Bird satellite. The 12 Dec scrub was caused by failure of check-out crews to discover and remove a plastic dust cap from the ga generator system of the Titan II booster.

Date : 16 Mar 66

Payload : Gemini (GT-8)

Booster : Titan II

Sponsor : NASA

Test No. : 1503

Launch Pad: 19

Gemini GT-8 spacecraft was manned by astronauts Neil Armstrong and David Scott. Their mission was to rendezvous and practice docking with the Agena target vehicle launched on the same day. Rendezvous and docking was accomplished, but the docking action resulted in such severe yaw and roll maneuvers that the combination could not be stabilized and the two vehicles were disengaged. So much re-entry control fuel was expended in an effort to maintain attitude control of the docked vehicles that early termination of the flight was necessary. Splashdown occurred in the 3rd recovery zone in the Western Pacific 500 mi east of Okinawa during the 7th orbit. Pararescue men from Naha Air Base, Okinawa arrived at the scene by helicopter within 20 min after splashdown. Recovery was by USS destroyer Mason, 10 hrs, 40 min, after launch. Perigee of the spacecraft during

ARS Kaul helicopter,

GEMINI PROGRAM (Cont)

Payload: Gemini GT-8 (cont)

initial orbital flight was 86.2 NM and apogee was 148 NM. Orbital parameters were adjusted to accomplish docking. The spacecraft weighed 7,800 lbs.

Date : 3 Jun 66
Payload : Gemini (GT-9)
Booster : Titan II
Sponsor : NASA
Test No. : 2433
Launch Pad: 19

Gemini, GT-9, spacecraft was manned by astronauts Thomas Stafford and Eugene Cernan. It was suppose to rendezvous and dock with the ATDA vehicle launched two days earlier. Improper installation of protective shroud on the ATDA kept it from being jettisoned so docking could not be accomplished. Cernan was to test a back pack, Astronaut Maneuvering Unit (AMU), during an around the world space walk. He left the spacecraft on 5 June for a period of 2 hrs, 10 min, but did not test the AMU because his face plate fogged up from internal moisture. Thus, two major objectives of the flight were not accomplished. GT-9 spacecraft weighed 8,268 lbs.

Flight lasted 72 hrs, 20 min, and made 45 orbits of the earth. Splashdown was 380 mi east of Cape Kennedy on 6 June just 3.2 mi from aircraft carrier Wasp which made the recovery.

GT-9 flight was scrubbed twice after astronauts had entered the capsule for launch. First scrub was on 17 May when Agena target vehicle failed to orbit, and second was on 1 June because of improper recording of guidance data by computer. This scrub occurred after the target vehicle had been launched.

Stafford and Cernan carried aboard their spacecraft the U S Flag that Adm Richard E Byrd carried over the North and South Poles on his early expeditions.

WPW

ET66-14757

GEMINI

Date : 18 Jul 66
Payload : GT-10
Booster : Titan II
Sponsor : NASA
Test No. : 6833
Launch Pad: 19

Gemini space vehicle GT-10 weighed 8294 pounds. It carried Comdr John W. Young (USN), and Maj Michael Collins (USAF) into orbit. They stayed aloft 2 days, 22 hours, 47 minutes, and completed 43 revolutions of the earth. They made rendezvous and docked with the Agena target vehicle. Used its power to ascend to a record altitude for manned flight of 476 statute miles and returned to lower orbit. During the 30th orbit they made rendezvous with the Agena target vehicle for GT-8 which had been in orbit since 16 Mar 66. Collins conducted two extra vehicular activity (EVA) periods. During a 30-minute space walk, Collins went over to the GT-8 Agena target vehicle and recovered a micrometeoroid box from its side. Splashdown took place on 21 Jul 66, about 500 mi east of Cape Kennedy. Landing was within 4 mi of the carrier Guadacanal. The flight accomplished three space firsts: (1) Double rendezvous with two different space vehicles in two different orbits; (2) EVA contact with another space vehicle; and (3) Made deepest manned penetration in space (476 statute miles) up to that time.

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Date : 12 Sep 66
Payload : GT-11
Sponsor : NASA
Test No. : 3287
Launch Pad: 19

Gemini space vehicle GT-11 weighed 8374 pounds. It carried Comdr Charles P. Conrad, Jr. (USN), and Lt Comdr Richard F. Gordon, Jr. (USN) into orbit. They stayed aloft 2 days,23 hours, 17 minutes, and completed 44 revolutions of the earth. They made rendezvous and docked with their Agena target vehicle over Hawaii before completing first orbit. Agena was ignited and boosted them to a new record height of 853.4 statute miles above the earth. Gordon made the longest space walk on record. Splashdown occurred 700 mi east of Cape Kennedy on 15 Sep 66. Astronauts were picked up by helicopter and placed on carrier Guam. The GT-11 flight was postponed twice, once when a minute leak in Titan II was discovered and once when difficulty was encountered with the Atlas booster. Both postponements occurred before the astronauts entered the space vehicle. GT-11 set seven records: (1) Fastest rendezvous and docking, accomplished during first orbit; (2) First multiple docking in space, each astronaut docked twice; (3) Deepest space penetration by manned vehicle, 853.4 miles; (4) First space flight of tethered vehicle. GT-11 and Agena target vehicle flew 3 hours tied together by 100-ft nylon rope.; (5) Longest EVA period, Gordon was out of vehicle 2 hours 52 minutes.; (6) First space rendezvous conducted solely with use of on-board equipment; (7) First completely automatic reentry.

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ET67-14767

GEMINI (Cont)

Date	:	11 Nov 66
Payload	:	GT-12
Booster	:	Titan II
Sponsor	:	NASA
Test No.	:	2742
Launch Pad:		19

Gemini space vehicle GT-12 carried astronauts Capt James A. Lovell, Jr. (USN), and Maj Edwin E. Aldrin, Jr. (USAF) into earth orbit. They stayed aloft 3 days, 22 hours, 34 minutes, and completed 59 revolutions of the earth. Aldrin made the longest space-walk on record, staying outside his space vehicle 5 hours 36 minutes. They simulated an Apollo program rendezvous. Four of their attitude control rockets failed so they let their spacecraft drift in orbit near the close of the mission to conserve water and fuel. Splashdown was in the Sargasso Sea about 700 mi southeast of Cape Kennedy and only 2.5 mi from target point. They were picked up by helicopter and placed on the carrier Wasp. Flight ended 15 Nov 66. The GT-12 spacecraft weighed 8294 pounds. This was the last launch in the Gemini Program.

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GRAVITY-GRADIENT PROJECT

TAB G

Date : 16 Jun 66

Payload : Gravity-Gradient

Booster : Titan IIIC

Sponsor : Air Force and Navy

Test No. : 7379

Launch Pad: 41

A gravity-gradient satellite was boosted into earth orbit in conjunction with 7 Initial Defense Communication Satellite Program (IDCSP). It was injected into near synchronous equitorial orbit approximately 18,200 NM above the earth.

ET66-14757

HEOS (Highly Eccentric Orbit Satellite)

Date : 5 Dec 68
Payload : HEOS-A
Booster : Delta-Thor (TAID) D-61
Sponsor : NASA
Test No. : 8560
Launch Pad: 17B

HEOS-A was launched by NASA for the European Space Research Organization. It was the first launch service purchased from NASA by a foreign power. HEOS-A was placed in a highly elliptical earth orbit with apogee of 138,000 miles and perigee of 274 miles. Orbital period was five days.

The purpose of HEOS-A was to investigate interplanetary space during a period of maximum solar activity the latter part of 1968 and the first part of 1969. It will study ion clouds, magnetic fields, cosmic radiation, and solar winds outside the magnetosphere and the earth's shock waves. It carried eight experiments prepared by University Labs in Belgium, West Germany, France, Italy, and the United Kingdom.

Configuration: Sixteen-sided cylindrical structure, 100 inches high and 51 inches in diameter. It was spin stabilized at 10 rpm. Four 63-inch booms were extended perpendicular to the spin axis. Estimated life one year. Weight 238 pounds. Cost $16 million including $3.75 million reimbursement to NASA for launch services.

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INITIAL DEFENSE COMMUNICATION SATELLITE PROGRAM (IDCSP) TAB H

Date	:	16 Jun 66
Payload	:	7 IDCSPs & 1 Gravity-Gradient
Booster	:	Titan IIIC
Sponsor	:	Air Force and Navy
Test No.	:	7379
Launch Pad	:	41

Eight satellites consisting of 7 IDCSPs and 1 gravity-gradient were boosted into earth orbit. They were injected into random, near synchronous equatorial, orbit with apogee of 18,287 to 18,546 NM and perigee from 18,183 to 18,204 NM. They initiated the first global, military, long-range telecommunications system employing satellite relay. Within four days after launch, voice communications had been established between Camp Roberts, California, and Fort Dix, New Jersey, and between Fort Dix and West Germany. Each satellite weighed about 100 lbs.

ET66-14757

IDCSP (Initial Defense Communications Satellite Program)

Date : 26 Aug 66
Payload : IDCSP
Booster : Titan IIIC
Sponsor : Air Force and OAR
Test No. : 2631
Launch Pad: 41

Purpose of flight, part of Air Force IDCSP, was to place eight Initial Defense Communication Satellites in earth orbit. The booster vehicle exploded at T+80 seconds and aborted the mission. Payload weight was 800 pounds.

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Date : 18 Jan 67
Payload : IDCSP, #8 through #15
Booster : Titan IIIC
Sponsor : Air Force and OAR
Test No. : 5870
Launch Pad: 41

Boosted the second group of eight IDCSPs into 21,000 mi synchronous earth orbit to comprise a global defense communication network. Each IDCSP weighed 100 pounds, had 26 sides, and was 36-inches in diameter. Orbital period was 22.7 hours. All satellites successfully injected into orbit in the planned sequence.

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IDCSP (Initial Defense Communications Satellite Program)

Date	: 1 July 67	Purpose was to place three IDCSP satellites (No. 16, 17, & 18) in synchronous earth orbit between 20,000 and 21,000 miles above the earth to augment the Defense Communications network. Each IDCSP was a 24-sided polygon, 36 inches in diameter, 32 inches high, and weighed 100 pounds. The faces were covered with solar cells. Communication antenna extended from the top and telemetry antenna from the bottom. All IDCSPs achieved proper orbit. The LES-5 continued tests to improve communications between aircraft. It weighed 225 pounds. DATS-1 was a 150-pound mechanically despun antenna test satellite to test methods of directing antenna beams toward earth. DODGE was a Navy sponsored DOD gravity-gradient experimental satellite. It weighed 430 pounds. See separate listings for LES-5, DATS, and DODGE.
Payload	: IDCSP 16, 17, and 18	
Auxiliary Payloads	: DATS-1, LES-5, & DODGE (Navy).	
Booster	: Titan IIIC	
Sponsor	: Air Force	
Test No.	: 4029	
Launch Pad:	41	

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Date	: 13 Jun 68	Purpose was to place eight IDCSP satellites in synchronous earth orbit 18,200 NM above the equator to augment the DOD communications network by filling the gaps among the 18 IDCSPs already in orbit. The eight were properly injected in an 18,200 NM circular orbit above the equator. Configuration and weight of these satellites were as described for the 1 Jul 67 IDCSP launch.
Payload	: IDCSP 19-26	
Booster	: Titan IIIC	
Sponsor	: Air Force	
Test No.	: 2035	
Launch Pad:	41	

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INTEL SATELLITE

Date	: 26 Oct 66	Intel Satellite II (F-1) (Blue Bird) was to have initiated the first operational commercial satellite system. It was twice as large as Intel Satellite I (Early Bird), launched as a developmental satellite in April 1965, and weighed 192 pounds. It was to have been placed in 24-hour synchronous earth orbit over the Pacific Ocean. Instead, it went into a 12-hour elliptical orbit, which meant it could not fulfill its intended mission.
Payload	: Intel Satellite II (F-1) (Blue Bird)	
Booster	: Delta Thor (TAD)	
Sponsor	: NASA and Comsat Corp.	
Test No.	: 5123	
Launch Pad:	17B	

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Date	: 11 Jan 67	Intel Satellite II (F-2) (Lani Bird) was the second operational commercial satellite. It was placed in synchronous earth orbit over the Pacific Ocean to provide transpacific communication service. Intel Satellite II weighed 192 pounds. Orbital period was 24 hours. This satellite was officially known as Pacific 1. It was to be augmented by launch of Intelsat II (F-4) Pacific 2 before the end of the year.
Payload	: Intel Satellite II (F-2) (Lani Bird) (Pacific 1)	
Booster	: Delta Thor (TAD)	
Sponsor	: NASA and Comsat Corp.	
Test No.	: 7367	
Launch Pad:	17B	

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Date	: 22 Mar 67	Intel Satellite II (F-3), the third operational commercial satellite, was boosted into 22,250 mi stationary earth orbit over the Atlantic Ocean to relay TV and teletype messages between North America and Europe. This completed the initial Intel Satellite II communications system. Weight was 192 pounds. Orbital period was 24 hours. System to be augmented at a later date by an Intelsat II (F-4) (Pacific 2).
Payload	: Intel Satellite II (F-3) (Atlantic 2)	
Booster	: Delta Thor (TAD)	
Sponsor	: NASA and Comsat Corp.	
Test No.	: 5191	
Launch Pad:	17B	

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ET67-14767

Intel Sat II

Date	:	27 Sep 67
Payload	:	Intel Sat 2D (F-4) Pacific 2
Booster	:	Delta/ Thor (TAD)
Sponsor	:	NASA
Test No.	:	6988
Launch Pad	:	17B

Intel Sat 2D (F-4) Pacific 2 was a 192 pound commercial communications satellite placed in 22,220 NM high synchronous earth orbit, positioned over the Pacific Ocean. It was to augment the worldwide commercial Comsat network already in being. It would serve as a backup facility for Pacific 1 to relay communications between the United States, Hawaii, and the Far East. Pacific 2 was a cylinder 56 inches in diameter and 25.5 inches high. Antennas were mounted on both top and bottom. Its aluminum honeycomb sides were faced with solar cells.

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INTEL SAT III

Date : 18 Sep 68

Payload : Intel Sat III-A (F-1)

Booster: : Delta-Thor D-59 Long Tank Delta

Sponsor : NASA for INTELSAT

Test No. : 7970

Launch Pad: 17A

Intel Sat III was a third generation commercial communications satellite launched by NASA for COMSAT Corporation on behalf of INTELSAT. It was the largest commercial communications satellite ever built, the first of four planned for launch. Intel Sat III-A (F-1) was programmed for launch into a 22,300 mile synchronous earth orbit stationed above the Atlantic Ocean off the coast of Brazil. It was designed to carry up to 1200 two-way voice circuits or four color TV channels simultaneously to provide telephone, TV, teletype, facsimile, and digital data transmission throughout the world.

About 68 seconds after launch, the long-tank Delta booster began pitching off course as the result of a malfunction in the pitch-rate auto-pilot system. The missile began breaking up and exploded at T+102 seconds. RSO destruct was signaled at T+108 seconds. Missile debris fell into the ocean about 12 miles off shore.

Configuration: Cylinder 41 inches long and 56 inches in diameter, capped by an antenna system 37 inches high giving it an overall length of 78 inches. Weight 632 pounds. Cost of satellite $55 million. Fee for launching including booster $4.5 million.

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Date : 18 Dec 68

Payload : Intel Sat III-B (F-2)

Booster : Delta-Thor D-63 Long Tank Delta

Sponsor : NASA for INTELSAT

Test No. : 1380

Launch Pad: 17A

This was the second INTELSAT III launch for the COMSAT Corporation on behalf of INTELSAT. Intel Sat III (F-2) was a duplicate of Intel Sat IIIA (F-1). It was placed in synchronous, equatorial, earth orbit over the Atlantic off the coast of Brazil. Each Intel Sat III is designed for a minimum life expectancy of five years. Electric power is provided by 10,720 solar cells mounted on the outside of the satellite. Intel Sat III-B (F-2) had the same configuration and weight as its ill-fated sister satellite Intel Sat III-A (F-1). It was placed in commercial operation on 24 December 1968.

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INTEL SAT III (cont)

Date : 5 Feb 69

Payload : Intel Sat III-C (F-3)

Booster : Delta-Thor D-66 Long Tank Delta

Sponsor : NASA for INTELSAT

Test No. : 3320

Launch Pad: 17A

Intel Sat III-C (F-3) was boosted into synchronous, equatorial, earth orbit over the Gilbert Islands in the Pacific Ocean. It became the second operational Intel Sat III. Two more were programmed for launch to complete the commercial satellite system.

Configuration, weight, and cost were the same as for Intel Sat III-A and B.

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Date : 21 May 69

Payload : Intel Sat III-D (F-4)

Booster : Delta-Thor D-68 Long Tank Delta

Sponsor : NASA for INTELSAT

Test No. : 4501

Launch Pad: 17A

Intel Sat III-D (F-4) was the fourth launched in the series and the third successfully placed in synchronous earth orbit. It was positioned above the Gilbert Islands in the Pacific to replace Intel Sat III-C (F-3) which was to be repositioned above the Indian Ocean. The reason for the switch was that electrical difficulties with F-3 caused some ground stations to use up to ten times the normal power output to relay signals through the satellite. Since there would be less traffic via the Indian Ocean satellite than the Pacific satellite, the decision was made to reposition F-3.

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LINCOLN CALIBRATION SPHERE

TAB I

Date : 15 Oct 65

Payload : LCS-2 (Lincoln Calibration Sphere); also OAR OV2-1 & Transtage

Booster : Titan IIIC

Sponsor : Air Force Space Systems Division

Test No. : 3656

Launch Pad: 40

The Lincoln Calibration Sphere (LCS) was a precisely machined and carefully polished spherical surface to produce steady radar echoes of uniform strength. The LCS was exactly spherical, about 44 inches in diameter with a surface area of exactly one square meter, the unit of measurement commonly used to express the reflecting strength of radar targets. The vehicle weighed 75 lbs. The transtage failed to restart after its second space firing and there was no evidence to indicate that it ejected its payloads. This was the second launch of an LCS. The first was launched on 6 May 1965 by Titan IIIA in conjunction with LES-2 satellite.

ET66-14757

LES PROGRAM

LES-1 (Lincoln Experimental Satellite)	11 Feb 65	LES-1, a 69-lb radio laboratory, was placed in earth orbit along with a 1070-lb dummy payload and the booster transtage which weighed 5930 lbs. Apogee was
Booster	Titan IIIA (SSLV-3)	1737.2 mi and perigee 1721.1 mi. Orbital period was 145.6 min.
Sponsor	MIT and Air Force	The LES-1 was expected to serve as a test bed for devices for
Test No.	0051	possible future use in Defense
Launch Pad	20	Department communications satellites. It contained its own small rocket motor to kick it into separate orbit after separation from the transtage.
LES-2 & RCS (Lincoln Experimental Satellite)	6 May 65	Two satellites and the transtage of the booster were injected into orbit. LES-2 was an 80-lb radio laboratory payload that differed from LES-1 only in that it had a
Booster	Titan IIIA-6	sun-sensing system. Apogee was
Sponsor	MIT and Air Force	2322.5 mi and perigee 1721.7 mi, orbital period was 157 minutes.
Test No.	0130	The second satellite was a 75-lb
Launch Pad	20	radar calibration sphere, 44.5 in. in diameter. It was the first perfectly round satellite sent aloft by the United States. It provided a reflective area of exactly one square meter and produced steady radar echoes of uniform strength. This permitted radar tracking systems to be accurately calibrated.

LES PROGRAM

TAB J

Date	:	21 Dec 65
Payload	:	LES 3 & 4 (Lincoln Experimental Satellite)
Booster	:	Titan IIIC
Sponsor	:	Air Force and MIT
Test No.	:	6020
Launch Pad	:	41

The two Lincoln Experimental Satellites LES 3 and 4 were forerunners of the Initial Defense Communication Satellite Project. They were to have been placed in near synchronous orbit above the equator. The transtage vehicle failed to execute its third restart which would have placed it in circular orbit. As a result it ejected its payloads in highly elliptical orbits. LES-3 was a polyhedron 2 ft across. It had 18 square and triangular faces, and weighed 35 lbs. LES-4 was a 10-sided polyhedron, 36 inches high, and 33.5 inches in diameter. It weighed 115 lbs. Two other satellites OV2-3 and Oscar were also carried as payloads by the transtage. One of them, Oscar, was spring-ejected into an elliptical orbit. There was no evidence to indicate that OV2-3 separated from the transtage.

LES (Lincoln Experimental Satellite)

Date	:	1 Jul 67
Payload	:	LES-5
Booster	:	Titan IIIC
Sponsor	:	Air Force
Test No.	:	4029
Launch Pad:		41

The LES-5 was an auxiliary payload on the IDCSP launch. It was to lay the groundwork for improved communication between aircraft up to 8,000 miles apart. From its 20,000 mile high orbit, the LES-5 allows a line-of-sight reaching halfway around the earth. LES-5 was cylindrical in shape, 5.5-feet long, 4 feet in diameter, and weighed 225 pounds. It accomplished the first tri-service communications by satellite on 3 and 4 July 1967. Other payloads on this launch were three IDCSPs, one DODGE, and one DATS.

ET68-14761

LES (Lincoln Experimental Satellite)

Date	:	26 Sep 68
Payload	:	LES-6 (Primary) (OVs Secondary)
Booster	:	Titan IIIC No. 5
Sponsor	:	Air Force (AFCRL)
Test No.	:	3105
Launch Pad:		41

LES-6 was the primary payload on this launch which also carried three OV satellites (OV2-5, OV5-2, and OV5-4) as secondary payloads. (See page 41.) LES-6, an MIT built satellite, was placed in 19,306 by 19,163 nautical mile near synchronous, equitorial, earth orbit. It was a radio relay station designed to evaluate communication performance, test jam resistant voice and teletype communications to soldiers in the field, air planes in flight, and ships at sea.

Configuration: Drum-shaped tube 68 inches long and 48 inches in diameter. Weight 360 pounds.

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LUNAR ORBITER.

Date : 10 Aug 66
Payload : Lunar Orbiter "A"
Booster : Atlas Agena
Sponsor : NASA
Test No. : 4003
Launch Pad: 13

Lunar Orbiter I was an 850-pound space vehicle designed to orbit the moon in search of possible landing site for manned flight. Provided photographs of moon until 29 Aug 66. Impacted on moon 29 Oct 66. Payload was referred to as Lunar Orbiter A until it entered orbit.

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Date : 6 Nov 66
Payload : Lunar Orbiter "B"
Booster : Atlas Agena
Sponsor : NASA
Test No. : 1469
Launch Pad: 13

Lunar Orbiter II was an 861-pound space vehicle placed in lunar orbit to select a landing site for manned flights. It returned 206 medium and 205 high resolution frames of photography of the lunar surface. Payload was referred to as Lunar Orbiter B until it entered orbit.

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Date : 4 Feb 67
Payload : Lunar Orbiter "C"
Booster : Atlas Agena D
Sponsor : NASA
Test No. : 3424
Launch Pad: 13

Lunar Orbiter III was an 850-pound vehicle launched for the purpose of investigating possible landing sites on the moon. It returned 153 medium and 144 high resolution frames of lunar photography. Payload was referred to as Lunar Orbiter C until it entered orbit.

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Date : 4 May 67
Payload : Lunar Orbiter "D"
Booster : Atlas Agena
Sponsor : NASA
Test No: : 2935
Launch Pad: 13

Lunar orbiter IV was an 860-pound space vehicle placed in lunar orbit to obtain a broad photographic survey of the front side of the moon and additional photographic coverage of its hidden side. The spacecraft was injected into a near polar orbit of the moon to enhance the broad coverage of the moon's face. The twelve-hour orbital period made possible a read back of photographs

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LUNAR ORBITER (Cont)

Continued:
Lunar Orbiter "D"

taken on each orbital pass as they were processed. Lunar Orbiter IV was a truncated cone, 5-ft in diameter and 5 1/2-ft high, with four solar panels projecting from its base. Two antennas extended from each side of the spacecraft. When deployed in space, the antenna booms were 18 1/2-ft across and the solar panels had a span of 12 ft 2 in. Wide angle and telephoto lens cameras were located in the lower section of the spacecraft.

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Lunar Orbiter

Date	:	1 Aug 67
Payload	:	Lunar Orbiter 5
Booster	:	Atlas/ Agena D
Sponsor	:	NASA
Test No.	:	6622
Launch Pad:		13

Lunar Orbiter 5 was an 860-pound spacecraft used to survey and photograph five prospective landing sites on the lunar surface. The spacecraft was injected into lunar orbit and completed the photographic mapping of the lunar surface. LO-5 was a truncated cone structure, 5 feet in diameter and 5.5 feet high. Low-gain and parabolic high-gain antennas and four solar panels extended from the base. Deployed, the solar panels measure 12 feet 2 inches across and the antenna booms measured 18.5 feet across. This was the final launch in the Lunar Orbiter program.

ET68-14761

MARINER PROGRAM

Mariner I — 22 Jul 62

Booster: Atlas 145D/Agena
Sponsor: NASA

Test # 2900
Pad 12

Purpose: To place Mariner I, a 447 pound spacecraft in the vicinity of planet Venus. To gain knowledge of planet Venus and its environment, and to investigate solar phenomena throughout the Earth-Venus interplanetary space. The omission of a hyphen in the guidance tape caused the space vehicle to deviate from planned trajectory resulting in RSO destruct after about T + 293 seconds of flight.

Mariner II — 27 Aug 62

Booster: Atlas 179D/Agena
Sponsor: NASA

Test # 3731
Pad 12

Purpose: To place Mariner II, a 447 pound spacecraft in the vicinity of planet Venus to gather information on its environment. This was accomplished on 14 Dec 62 when Mariner II passed within 20,000 miles of Venus on its way to solar orbit.

MARINER PROGRAM

MARINER III	5 Nov 64	Mariner III was launched as a Mars fly-by to investigate interplanetary space between the orbits of Earth and Mars. The payload was 9.5 ft high and 22 ft 7.5 inches wide with solar panels and pressure vanes deployed. It weighed 575 lbs. The protective shroud failed to jettison properly after launch. This failure was believed to have been caused by delamination of the fiberglass honeycomb shroud. Repeated efforts to jettison the shroud and extend solar panels failed.
Booster	Atlas/ Agena D	
Sponsor	NASA	
Test No.	5800	
Launch Pad	13	
MARINER IV	28 Nov 64	Mariner IV was encased in a redesigned metal shroud as protection against the fate that befell Mariner III with the laminated fiberglass honeycomb shroud. Excellent injection for Mars fly-by was achieved. Midcourse maneuvers were conducted to correct the original miss distance from 151,000 miles to approximately 5,000 miles at closest approach. The 228-day journey was expected to bring Mariner IV to its nearest approach to Mars on 14 July 1965. Payload weighed 525 lbs.
Booster	Atlas/ Agena D	
Sponsor	NASA	
Test No.	5049	
Launch Pad	12	

MARINER

Date	:	14 Jun 67
Payload	:	Mariner V Venus Fly-By
Booster	:	Atlas Agana
Sponsor	:	NASA
Test No.	:	4102
Launch Pad	:	12

Mariner V, Venus Fly-By space probe, was designed to obtain scientific information on the origin and nature of Venus and its environment. Mariner's trajectory was expected to take it within 2,000 miles of Venus about 19 Oct 67. Scientific instruments will report on solar, plasma, radiation, magnetic fields, and other properties of the atmosphere. Mariner V was 9 1/2-ft high and had a span of 18-ft with solar panels extended. It had four solar panels with 43.5 sq ft of solar panel surface area. Basic structure was a 32-pound, 8-sided, magnesium frame with seven electronic compartments.

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ET67-14767

MARINER

Date : 24 Feb 69

Payload : Mariner 6

Booster : Centaur C-20

Sponsor : NASA

Test No. : 0183

Launch Pad: 36B

Mariner 6 was boosted on a five-month journey that would take it within 2000 miles of Mars for fly-by mission on 31 July 1969. Its mission was to measure atmospheric density and components surrounding Mars and obtain high resolution photographs to ascertain the possibility of life being sustained on Mars. The space vehicle contained six experiments to gather data on physical, chemical, and thermal properties of the Mars atmosphere and to refine astronomical data. Mariner 6 was to cover the equatorial region of Mars.

Configuration: Shaped like octagonal hat box, 18 inches high and 54 1/2 inches across. Four solar cell paddles deployed from the sides to form a span 19 feet. The antenna gave the vehicle an overall height of 11 feet. Weight 910 pounds. Cost $128 million. The booster and launching costs added another $20 million. On 14 February 1969, the Atlas first stage of the booster suffered slight buckling of the outer surface as a result of underpressurization while undergoing prelaunch tests on Pad 36A. On 15 February, the payload was transferred to another booster on Pad 36B so the wrinkled Atlas could be returned to the factory for repair.

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Date : 27 Mar 69

Payload : Mariner 7

Booster : Centaur C-19

Sponsor : NASA

Test No. : 6891

Launch Pad: 36A

Mariner 7 was a twin of Mariner 6. It was launched on the same mission as Mariner 6, except that it was to cover the southern polar region of the planet Mars. Mariner 7 was programmed to arrive in the vicinity of Mars on 5 August 1969.

Configuration: Same as Mariner 6.

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MOL (MANNED ORBITAL LABORATORY)

Date	3 Nov 66	A simulated MOL, consisting of a refurbished Gemini capsule and a Titan II tank, was boosted into space in a heat shield qualification (HSQ) test. The capsule was released on an accelerated ballistic trajectory for reentry into earth atmosphere to test its abillty to withstand the intense heat generated. The Titan II tank was injected into elliptical earth orbit as OV4-3 test satellite. The combination weighed 21,300 pounds. Three other OV satellites were placed in orbit. They were OAR's OV1-6 and AF's OV4-1R and OV4-1T. For data on them see OAR OV Program.
Payload	Simulated MOL (OV4-3) and OV Satellites for OAR and Air Force	
Booster	Titan IIIC	
Sponsor	Air Force and OAR	
Test No.	0855	
Launch Pad	40	

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ET67-14767

OAO (ORBITING ASTRONOMICAL OBSERVATORY)

TAB K

Date : 8 Apr 66

Payload : OAO-1

Booster : Atlas/Agena

Sponsor : NASA

Test No. : 0050

Launch Pad: 12

The Orbiting Astronomical Observatory 1 was boosted into earth orbit. Perigee 491 miles, apogee 498.4 miles, and orbital period 100.9 minutes. Battery failure in the OAO caused the mission to be aborted two days after launch.

OAO (Orbiting Astronomical Observatory)

Date	:	7 Dec 68
Payload	:	OAO-II (A2)
Booster	:	Centaur C-16
Sponsor	:	NASA
Test No.	:	1979
Launch Pad	:	36B

OAO-A2 was the second in a series of four programmed for a 469 to 490 nautical mile, near circular orbit of the earth to give a clear look at the universe from above the earth's atmosphere. Its mission was to measure the brightness of 50,000 stars in ultraviolet spectrum, gather spectral energy distribution information on stars and nebulae in the ultrviolet range, and measure time varying spectral intensity of particular stars. Eleven telescopes provided the primary equipment, seven from the University of Wisconsin and four from Smithsonian Observatory. The Wisconsin experiment was designed to study one star at a time for up to several hours, or about 15 stars a day. Smithsonian was designed to concentrate on young stars, many of which cannot be seen from the earth's surface.

Configuration: Main body an octagonal alumnium cylinder 10 feet long, 7 feet diameter. Solar cell paddles extended on either side gave an overall span of 21 feet. Weight 4376 pounds. Cost $75 million. It was the most sophisticated unmanned satellite developed by the United States.

A previous OAO launch (8 April 1966) achieved almost perfect orbit, but failure in its power supply rendered it inoperative.

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OAR (OV) ORBITAL SUPPORT PROGRAM

TAB L

Date	15 Oct 65	This was the first launch of a scheduled three OV2s. OV = Orbiting Vehicle, and 2 = model normally placed in orbit by Titan III booster. Numbered suffixes denote the different payload configurations in the series. OV2-1 was to measure energetic particles, electromagnetic field strength, very low frequencies, and radiation effects on tissue equivalents. Main body of the OV2-1 was 23 inches square and 24 inches long. A solar panel extended from each of its four upper corners. The 360-lb vehicle carried 14 separate experiments prepared by AFWL (Air Force Weapons Laboratory) and AFCRL (Air Force Cambridge Research Laboratories). In addition to the OV2-1, the transtage carried a 75-lb Lincoln Calibration Sphere for injection into orbit. The transtage achieved orbit but failed to restart after its second space firing and no evidence was obtained that the satellites it carried were ejected.
Payload	OV2-1 (Orbiting Vehicle, Model 2)	
Booster	Titan IIIC	
Sponsor	Air Force & Office of Aerospace Research	
Test No.	3656	
Launch Pad	40	
Date	21 Dec 65	This was the second OV2 launching. OV2-2 was eliminated from the series. OV2-3 was similar in configuration and mission to OV2-1 discussed above except that it weighed 427 lbs and carried 15 experiments instead of 14. It was one of four satellites carried on this launch to be ejected into circular orbits after the second restart of the transtage engine had placed the transtage vehicle in synchronous orbit. The transtage failed to restart the second time, and remained in elliptical orbit. The three other satellites were apparently ejected into elliptical orbit, but all indications were that the OV2-3 remained locked in the transtage. Since it was to have been the last payload to eject, it could have remained affixed even though the other three ejected. The other three satellites were LES 3 and 4, and OSCAR.
Payload	OV2-3 (Orbiting Vehicle, Model 2)	
Booster	Titan IIIC	
Sponsor	Air Force & Office of Aerospace Research	
Test No.	6020	
Launch Pad	41	

ET66-14757

OAR (OV) ORBITAL SUPPORT PROGRAM

Date : 3 Nov 66

Payload : OV1-6, OV4-1R, OV4-1T, & OV4-3 MOL

Booster : Titan IIIC

Sponsor : OAR and Air Force

Test No. : 0855

Launch Pad: 40

Orbiting vehicles OV1-6, OV4-1R, and OV4-1T were part of OAR's orbital support program. OV4-3 was part of the USAF MOL program. See MOL launchings. OV1-6 weighed 445 pounds, contained classified payload and decayed 31 Dec 66. OV4-1R and OV4-1T were launched for Air Force Avionics Laboratory. They were Receivers and Transmitters, respectively, in the "Whispering Gallery" test. OV4-1R weighed 300 pounds, OV4-1T weighed 240 pounds.

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Date : 28 Apr 67

Payload : 2 - OAR OV
2 - Vela (#7 & #8)
1 - SSD ERS-18

Booster : Titan IIIC

Sponsor : Air Force, ARPA, & OAR

Test No. : 8275

Launch Pad: 41

Three ERS (Environmental Research Satellites), two OVs, and one SSD (ERS), were launched in conjunction with Vela 7 and 8. ERS-27 (OV5-1) was designed to look for x-rays and other types of radiation generated by the sun during solar storms. The second, ERS-20 (OV5-3) carried samples of several different metals including silver, gold, stainless steel, and teflon to determine changes in their characteristics caused by friction and space radiation. These OVs were octagonal with 11-inch sides and weighed 20 pounds each. ERS-18 was the third ERS portion of the payload. It was designed to measure and map "trapped radiation" in the Van Allen belt. ERS-18 was sponsored by the Space Systems Division (SSD) of the Air Force Systems Command.

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OV (Orbiting Vehicles)

Date : 26 Sep 68

Payload : OV2-5
OV5-2 (ERS-28)
OV5-4 (ERS-21)
(LES-6 was Primary)

Booster : Titan IIIC No. 5

Sponsor : Air Force and OAR

Test No. : 3105

Launch Pad: 41

These OV satellites were secondary payloads to the primary payload LES-6. (See page 37.) OV5-2 was the first one of the payloads to be released. It was an OAR radiation detection satellite designed to monitor radiation around the world. It was released in the highly elliptical orbit of 16,337 nautical mile by 90 nautical mile. OV5-2 consisted of eight 9-inch triangular solar cell panels mounted on a gold plated alumnium structure. Weight 21.5 pounds.

The other three satellites were released in a near synchronous orbit of 19,306 nautical mile by 19,193 nautical mile. OV5-4 was the second satellite released. It was a heat transfer experiment to study transfer of heat to a liquid under zero gravity conditions. The purpose was to increase confidence in the design of propellant systems for operation in space environments. OV5-4 was an octahedral satellite. Weight 27.9 pounds. OV2-5 was the fourth satellite released. It was a space physics research laboratory designed to obtain data in an earth equatorial belt at near synchronous altitude. It carried eleven separate experiments to accomplish its mission. OV2-5 had a 7.6 foot span across its solar paddles and a span of 52 feet across its antennas. Weight 450 pounds.

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Date : 23 May 69

Payload : Three OV5s as Secondary Payload to two Vela satellites

Booster : Titan IIIC No. 15

Sponsor : Air Force and OAR

Test No. : 3013

Launch Pad: 41

Three OAR OV5s were launched as secondary payloads in conjunction with twin Vela primary payload. Each OV5 weighed 25 pounds. They were released in an elliptical earth orbit with perigee of 9,154 nautical mile and apogee of 60,326 nautical mile.

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O-G-O PROGRAM

O-G-O-1 (Orbiting Geophysical Observatory)

Booster	Atlas/Agena
Sponsor	NASA
Test No.	4307
Launch Pad	12

4 Sep 64

OGO-1 was placed in orbit to acquire data on Sun's effects on earth environment. It carried 20 experiments, more than any previous U.S. satellite. An elliptical orbit with perigee of 175 mi and apogee of 92,827 mi was achieved. Two of its booms failed to deploy properly and one obscured the horizon scanners view of the earth. This prevented proper earth orientation of the spacecraft. All 20 experiments provided valuable data. The satellite was 6 ft long, 3 ft wide, and 3 ft deep excluding protrusions. It weighed 1073 lbs including 190 lbs of scientific instruments. Orbital period was 64 hrs. Estimated lifetime was 1 year. SATAR satellite rode piggy-back into earth orbit.

ET65-9858

OGO (ORBITING GEOPHYSICAL OBSERVATORY)

TAB M

Date: : 6 Jun 66

Payload : OGO-B

Booster : Atlas/ Agena D

Sponsor : NASA

Test No. : 6423

Launch Pad: 12

OGO-B or 3 was boosted into earth orbit. It carried 21 experiments to study space environment and investigate such areas as cosmic rays, energetic particles, magnetic fields, solar radiation, solar plasma, micrometeoroids, atmospheric composition, and solar flares. The main body of the OGO space vehicle was made of aluminum, 68 inches long and 33 inches square. Two solar panels were attached to the body and solar experiment packages were mounted to each panel. Two 22-ft booms and four 6-ft booms extended from the spacecraft to meet viewing requirements and minimize interference between experiments. Some of the experiments were within and on the main body of the spacecraft. A high-gain antenna and two attitude control jets were boom mounted. OGO weighed 1,100 lbs and carried 200 lbs of experiments. 560 watts of power were provided by nickel-cadmium batteries and more than 32,000 solar cells.

ET66-14757

OGO (Orbiting Geophysical Observatory)

Date	:	4 Mar 68
Payload	:	OGO-E
Booster	:	Atlas/Agena
Sponsor	:	NASA
Test No.	:	3366
Launch Pad:		13

OGO-E became OGO-5 when it achieved earth orbit. It carried 24 experiments all of which provided usable data. This was more experiments than carried by any previous satellite. Experiments from England, France, and the Netherlands were included in the payload, in addition tc experiments provided by six U.S. Universities, four U.S. Government departments, and two private companies. The OGO series of satellites were to provide a better understanding of the complex interplanetary relationship between earth and sun. OGO-5 weighed 1,347 pounds and, with booms, solar panels, and antenna deployed, it measured 57-feet long and 20-feet across. This was the last of the OGO series programmed for launch from the Eastern Test Range.

ET68-14761

ORS (OCTAHEDRAL RESEARCH SATELLITE)

TAB N

Date	: 20 Jul 65	This 12-lb Octahedral Research Satellite rode piggyback into a wide-ranging elliptical orbit to monitor background radiation in the Van Allen Belt that surrounds the earth. Perigee was 94.86 SMI and apogee was 69,870.28 SMI. Twin satellites, Vela 5 and 6, were the major payloads on this launch. This was the first ORS flight. It was part of the Environment Research Satellite (ERS-17) series. ORS was an octahedron, Mark III configuration, 11 inches on a side. The sides were faced with solar cells. A dipole antenna extended 13 inches from opposite corners.
Payload	: ORS (ERS-17)	
Booster	: Atlas/ Agena	
Sponsor	: ARPA (Advanced Research Projects Agency)	
Test No.	: 1496	
Launch Pad	: 13	

OSCAR PROJECT

TAB P

Date : 21 Dec 65

Payload : OSCAR IV (Orbiting Satellite Carrying Amateur Radio)

Booster : Titan IIIC

Sponsor : American Radio Relay League

Test No. : 6020

Launch Pad: 41

OSCAR IV was a 42-lb satellite, built by the American Radio Relay League, a group of space scientists whose hobby is amateur radio. It cost about $200. It might be termed a "poor man's telstar." It was a free-access satellite for world-wide use by amateur radio operators. This was one of four satellite payloads carried by this launch. The others were LES 3 and 4, and OV2-3 an OAR experiment. OSCAR 4 was a 19-inch cube with truncated corners. All four faces were covered with solar cells and a 19-inch antenna extended from each corner.

OSO PROGRAM

OSO-B2 (Orbiting Solar Observatory)	3 Feb 65	OSO B2 was placed in 300 mile high earth orbit to study X-ray, Gamma rays, and the ultra violet radiation of the sun. Payload weight was 545 lbs. Apogee was 391.2 miles and perigee 337.3 miles. Orbital period was 96.5 minutes.
Booster	Delta-Thor (D-29)	
Sponsor	NASA	
Test No.	0304	
Launch Pad	17B	

ET65-9858

OSO PROGRAM

TAB O

Date	:	25 Aug 65
Payload	:	OSO-C (Orbiting Solar Observatory)
Booster	:	Delta-Thor
Sponsor	:	NASA
Test No.	:	0466
Launch Pad:		17B

This was the third launch of an OSO satellite to obtain data on the sun's gamma, ultraviolet, and x-ray electromagnetic radiations. Booster third stage ignited prematurely and impacted in the Atlantic Ocean. Payload orbit was not achieved. OSO-C was a 9-sided polygon, 44 inches diameter, with a fan shaped sail. Overall height was 37 inches and total weight was 620 lbs with experiment payloads of about 200 lbs.

OSO (ORBITING SOLAR OBSERVATORY)

Date	: 8 Mar 67	OSO-3, a 627-pound satellite, was boosted into 350-mile circular orbit to study effects of solar radiation. It contained nine separate experiments. Perigee was 336 statute miles, apogee 354 statute miles, and orbital period 95.9 minutes. The OSO program is designed to study solar activity during the sun's full 11-year cycle.
Payload	: OSO-3	
Booster	: Delta Thor	
Sponsor	: NASA	
Test No.	: 6936	
Launch Pad:	17A	

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OSO (Orbiting Solar Observatory)

Date	: 18 Oct 67	OSO-4 was placed in near circular earth orbit at an altitude of between 334 and 354 NM. The spacecraft weighed 597 pounds including 235 pounds of experiments. It was designed to study the influence of the sun on interplanetary space near the earth.
Payload	: OSO-D or 4	
Booster	: Delta-Thor	
Sponsor	: NASA	
Test No.	: 0153	
Launch Pad:	17B	

ET68-14761

OSO (Orbiting Solar Observatory)

Date : 22 Jan 69

Payload : OSO-5 or (OSO-F)

Booster : Delta-Thor D-64

Sponsor : NASA

Test No. : 5960

Launch Pad: 17B

OSO-5 was placed in 350 statute mile circular orbit to gather data on the sun and its influence on interplanetary space near earth. Mission was to pinpoint temperature at various locations on the surface of the sun by studying solar X-rays; and measure atomic particles streaming from the sun's surface to determine their effect on the earth's weather and on radio communications. Measurements will be taken during periods of near maximum solar activity. OSO-5 carried eight experiments weighing 265 pounds. They were provided by University College, London, and University of Leicester, jointly; University of Colorado; University of Minnesota; Goddard Spaceflight Center; and Naval Research Laboratory. They were designed for a life of six months.

Configuration: Nine-sided base section, called the wheel, with three arms containing spin-control gas supply. The wheel diameter was 44 inches with the arms giving it a span of 92 inches. The upper section was fan-shaped structure with pointing instruments that made the satellite 38 inches high. Weight 641 pounds. Cost $12 million. NASA expects to launch two more OSO satellites.

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PEGASUS PROGRAM

PEGASUS I	16 Feb 65	Pegasus I was a 3200-lb micrometeoroid detection satellite. It was the first operational payload lofted by the Saturn missile. Apogee was 731 mi and perigee 497 mi. Orbital period was 97.6 minutes. Pegasus I was a wing-like structure 96 ft long and 14 ft wide which offered 2300 sq ft of area instrumentation to detect collision with meteoroid particles. It had three sensor panels of different thicknesses to permit analysis of the various size meteoroids encountered.
Booster	Saturn SA-9	
Sponsor	NASA	
Test No.	0143	
Launch Pad	37B	
PEGASUS II	25 May 65	Pegasus II was of the same configuration and dimensions as Pegasus I. It weighed 1.5 tons and achieved an apogee of 733 mi and perigee of 510 mi. Orbital period was 97.2 minutes. Two meteoroid punctures were incurred during its first 24 hours in orbit.
Booster	Saturn SA-8	
Sponsor	NASA	
Test No.	2222	
Launch Pad	37B	

ET65-9858

PEGASUS SATELLITES

TAB Q

Date	:	30 Jul 65
Payload	:	Pegasus III
Booster	:	Saturn I
Sponsor	:	NASA
Test No.	:	3530
Launch Pad		37B

Pegasus III, referred to as Pegasus C before going into orbit, was orbited to obtain data on near-earth meteoroid hazards in space by use of recoverable meteoroid puncture panels. Payload was a rectangular spacecraft 96-ft long and 14-ft high. It weighed 3,200 lbs. Achieved orbit with perigee of 323 SMI, apogee of 336 SMI, inclination of 28.9 degrees, and orbital period of 95.25 minutes. This was the final scheduled launch in the Pegasus series.

ET66-14757

PIONEER PROGRAM

TAB R

Date	:	16 Dec 65
Payload	:	Pioneer VI
Booster	:	Delta-Thor (TAID)
Sponsor	:	NASA
Test No.	:	4867
Launch Pad	:	17A

Pioneer VI was a cylindrical interplanetary spacecraft 35-inches long and 37-inches in diameter. It weighed 140 lbs including 35 lbs of experiments. It was designed to orbit the sun between the orbits of earth and Venus. It carried 6 experiments to return data on turbulent solar winds, the magnetic fields of the sun, the boundary region between solar atmosphere and interstellar space, the physics of the sun itself, the basic interaction of high-energy charged particles and magnetic fields. The orbital period around the sun was expected to be 310 days. Successful orbit was achieved.

ET66-14757

PIONEER

Date	:	17 Aug 66
Payload	:	Pioneer VII
Booster	:	Delta Thor (TAD)
Sponsor	:	NASA
Test No.	:	3633
Launch Pad	:	17A

Pioneer VII was a 140-pound space vehicle that carried six solar and interplanetary experiments. It was injected into solar orbit. The space vehicle was shaped like a tom-tom with arms. It was the second in a series of five Pioneer satellites designed to probe outer space from solar orbit to examine space particles, and gravity, and investigate earth's magnetic tail.

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ET67-14767

PIONEER

Date	:	13 Dec 67
Payload	:	Pioneer 8
Auxiliary Payload	:	Piggyback TTS-1
Booster	:	Delta-Thor (TAD)
Sponsor	:	NASA
Test No.	:	2898
Launch Pad	:	17B

Pioneer VIII was a 145-pound interplanetary weather robot boosted into solar orbit to monitor solar events as the sun reaches the climax of its 11-year cycle in 1969. The spacecraft was a cylinder 37 inches in diameter and 35 inches high. High-gain, low-gain, and dual-frequency antennas projected from the ends of the cylinder. Seven experiments were aboard the spacecraft, two of which were new. They covered such fields as solar winds, cosmic rays, and magnetic fields. A 44-pound Test and Training Satellite (TTS-1) rode piggyback into earth orbit. It was an adaptation from the ERS (Experimental Research Satellite) series.

ET68-14761

PIONEER

Date	:	8 Nov 68
Payload	:	Pioneer IX and TTS-2
Booster	:	Delta-Thor D-60 TAD
Sponsor	:	NASA
Test No.	:	6850
Launch Pad	:	17B

Payload Pioneer D which became Pioneer IX was boosted into solar orbit to study solar plasma, energetic particles, and magnetic fields propogated by the sun toward the earth. Data will be used to understand solar processes and their effects on earth environment. Eight scientific experiments were carried. They included a new improved magnetometer and instruments to measure solar wind, cosmic ray particles, electron density, electric fields, and cosmic dust. Pioneer IX will orbit the sun every 297.5 days at a distance of 70 to 93 million miles from the solar surface. This is the closest approach of any solar satellite to the searing surface of the sun.

Configuration: Drum-shaped container, 35 inches high and 37 inches in diameter. Sides were covered with solar cells. A narrow circular band around the cylinder contained apertures for four experiments and for four orientation sun sensors. A fifth sun sensor recorded directional references to the sun's position. Three 5 feet 4 inch booms extended from the sides at 120 degree intervals. Weight 148 pounds including 39.5 pounds of scientific experiments.

A secondary payload, TTS-2, was dropped off in earth orbit. (See page 33.)

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RANGER PROGRAM

Ranger V — 18 Oct 62

Booster: Atlas 215D/Agena
Sponsor: NASA

Test # 5050
Pad 12

Purpose: Provide information on origin, constitution, and surface characteristics of the moon. Obtain data and operating experience to speed progress toward manned lunar flights. Ranger V was a 755 pound gold and chrome plated spacecraft designed to televise close-up pictures of the moon's surface and place an instrumented package on the surface of the moon to transmit data on moon quakes and other structural characteristics of the moon. The solar panels of Ranger V failed to provide electrical power required for its TV camera and fire the guidance rockets that would enable it to land its instrumented package on the moon. Radiation damage was believed to have caused failure. Missed moon by about 300 miles.

RANGER PROGRAM

RANGER VII — 28 Jul 64

Booster: Atlas 205D/ Agena
Sponsor: NASA
Test No.: 448
Launch Pad: 12

Ranger VII was the second in a series of four spacecraft designed to intercept and photograph the moon. It was launched into a parking orbit, then on a lunar trajectory by the second Agena ignition. Moon impact occurred at 8:25 a.m. EST, 31 Jul 64. Before impact Ranger VII transmitted 4316 moon photographs of excellent quality back to earth. Configuration: Truncated cone attached to a hexagonal base. Diameter 5 ft, height 8.24 ft, weight 806 lbs. Deployment of panels gave spacecraft a diameter of 15 ft. Extension of antenna increased height to 10.25 ft. Flight time was 68.6 hrs.

RANGER VIII — 17 Feb 65

Booster: Atlas/ Agena
Sponsor: NASA
Test No: 235
Launch Pad: 12

Ranger VIII was an 808-lb spacecraft containing six TV cameras designed to photograph the moon's surface in preparation of the Surveyor and Apollo moon landing programs. Ranger VIII transmitted 7000 excellent close-up photographs of the moon before crashing just 15 miles from the preselected target point about 4:57 a.m., 20 Feb 65.

RANGER IX — 21 Mar 65

Booster: Atlas/ Agena
Sponsor: NASA
Test No.: 300
Launch Pad: 12

Ranger IX was an 800-lb spacecraft designed to photograph and land on the moon. It carried six cameras and a small steering rocket to guide it to the moon crater Alphonsus for landing. The extreme accuracy of the launch made only a 400-mile course correction necessary. 5814 photographs were transmitted to earth. During the last few minutes of flight, Ranger IX provided live televised photographs of the moon's surface and the crater Alphonsus. The crater is 60-miles wide, surrounded by 10,000-ft cliffs with a 3000-ft peak in the center. A large crack, or rill traversed the relatively level crater floor. Moon impact occurred at 9:08 a.m. EST on 24 Mar 65 after a flight of 64 hrs, 31 min, 12 sec.

ET65-9858

SATURN S-IV B

Date	:	5 Jul 66
Payload	:	2nd Stage S-IV B Saturn
Booster	:	Saturn 1B (AS-203)
Sponsor	:	NASA
Test No.	:	7207
Launch Pad	:	37B

This was the first orbital mission of the Saturn second stage S-IV B. The 29-ton, 92-ft lcng S-IV B was placed in earth orbit 101.8 nautical miles high to test suitability of liquid hydrogen for use as a space fuel. It was the heaviest load launched to date by the United States. It was blown up to end test and decayed 5 Jul 66. It was not considered a spacecraft.

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ET67-14767

SURVEYOR PROGRAM

SURVEYOR	11 Dec 64	Surveyor, mass model moonship, and Centaur stage of the booster combination placed in earth orbit to test the Centaur system's structural and thermal integrity. Elliptical earth orbit with apogee of 106 mi and perigee of 100 mi was achieved. Orbital period was 87 min. The inert Surveyor mass model weighed 2100 lbs, was 94 inches long and 44 inches in diameter. Combined weight of Surveyor model and spent Centaur stage was 6500 lbs. Decay occurred during early morning hours of 12 Dec 64.
Booster	Atlas/ Centaur	
Sponsor	NASA	
Test No.	4373	
Launch Pad	36A	

ET65-9858

SURVEYOR PROGRAM TAB S

Date	: 11 Aug 65	Simulated Surveyor spacecraft was placed in lunar transfer trajectory. The Surveyor model was 94-inches long and 44-inches in diameter. It weighed 2,100 lbs. It achieved orbit with perigee of 105 SMI, apogee of 509,829 SMI, inclination of 28.55 degrees, and orbital period of 31 days.
Payload	: Surveyor (Dymanic Model)	
Booster	: Atlas/ Centaur	
Sponsor	: NASA	
Test No.	: 1920	
Launch Pad:	36B	

Date	: 7 Apr 66	Mass Model, spacecraft dummy simulating Surveyor vehicle and second stage Centaur were boosted into earth orbit in connection with performance test of Centaur hydrogen engine in space. Orbit was achieved with perigee of 108.5 SMI, apogee of 197.8 SMI, and orbital period of 89.6 minutes, but Centaur hydrogen engine failed to restart in space. Surveyor vehicle weighed 1,730 lbs.
Payload	: Surveyor (Mass Model Dummy)	
Booster	: Atlas/ Centaur	
Sponsor	: NASA	
Test No.	: 6812	
Launch Pad:	36B	

Date	: 30 May 66	Surveyor (SC-1), a 2250-lb spacecraft, was boosted on a lunar trajectory for an attempted soft landing on the moon. The purpose was to study composition of the lunar surface and determine suitability for human landing. Basic structure of Surveyor SC-1 was of tubular aluminum alloy 8-ft high with three landing legs tipped with crushable polystyrene pads. A solar panel and high-gain planor antenna were mounted on top. Soft lunar landing was accomplished on 2 June 1966 and excellent photographs were obtained of the moon's surface. 11150 photos returned
Payload	: Surveyor (SC-1)	
Booster	: Atlas/ Centaur	
Sponsor	: NASA	
Test No.	: 0184	
Launch Pad:	36A	

ET66-14757

SURVEYOR

Date : 20 Sep 66
Payload : Surveyor II
Booster : Centaur
Sponsor : NASA
Test No. : 5739
Launch Pad: 36A

Surveyor II spacecraft weighed 644 pounds. It was launched for an attempted soft landing on the moon to take pictures of the moon's surface. The vehicle tumbled out of control on 21 Sep 66 when a directional rocket failed to fire. All contact with Surveyor II was lost on 22 Sep when it supposedly crashed into the moon's surface at about 6000 mph. Time and place of impact, calculated on the basis of flight path data prior to loss of radio contact, was southeast of Copernicus about 63 hours after launch.

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Date : 26 Oct 66
Payload : Surveyor Type Mass Model
Booster : Centaur
Sponsor : NASA
Test No. : 1906
Launch Pad: 36B

Mass model Surveyor type payload consisted of ballast and weighted material to simulate the size, weight, and configuration of Surveyor spacecraft. Mass model payload was boosted into lunar transfer trajectory during second burn of Centaur stage booster.

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Date : 17 Apr 67
Payload : Surveyor SC-3
Booster : Centaur
Sponsor : NASA
Test No. : 6950
Launch Pad: 36B

Surveyor spacecraft, SC-3, soft landed on the moon in the Ocean of Storms on 19 Apr, just 66 hours after launch. Touchdown was within 4 seconds and 1 mile of predicted target. It landed 15 or 20 feet down the inside slope of a 50-ft diameter crater. On 21 Apr it extended its steel-tipped aluminum scoop, soil sampler about 42 inches and scooped a trench in the moon's surface. Surface proved to be dry and granular but with the cohesiveness of wet sand. Bearing weight estimated at six pounds per square inch, sufficient to support weight of astronauts.

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ET67-14767

SURVEYOR

Date : 14 Jul 67
Payload : Surveyor 4
Booster : Centaur
Sponsor : NASA
Test No. : 4213
Launch Pad: 36A

Surveyor 4 was to make soft landing on the moon, photograph and sample the moon's surface and relay the data back to earth. All communications with Surveyor 4 were lost 2.5 minutes before it impacted on the lunar surface. No data was returned. The spacecraft weighed 625 pounds. Surveyor 4 consisted of a triangular aluminum frame with mounting surfaces for landing gear, retrorocket engine, vernier engine, fuel tanks, thermal compartments, etc.

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Date : 8 Sep 67
Payload : Surveyor 5
Booster : Centaur
Sponsor : NASA
Test No. : 7231
Launch Pad: 36B

Surveyor 5 soft landed on the moon in the Sea of Tranquility, 10 Sep 1967. It provided the first successful chemical analysis of the composition of the lunar surface. It also returned 19,000 photographs to earth. Surveyor 5 weighed 616 pounds. Flight time to the moon was 64.8 hours. Structure of the spacecraft was same as Surveyor 4.

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Date : 7 Nov 67
Payload : Surveyor 6
Booster : Centaur
Sponsor : NASA
Test No. : 2020
Launch Pad: 36B

Surveyor 6 soft landed on the moon in the Sinus Medii area, near the center of the moon's visible surface, on 9 Nov 1967. Flight time to the moon was 65.4 hours. It became the first spacecraft to be moved from one lunar location to another. This was done by rocket takeoff from the lunar surface. It returned photographs of its rugged boulder strewn landing area. Surveyor 6 weighed 617 pounds. Its structure was same as Surveyor 4.

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SURVEYOR (Cont)

Date : 7 Jan 68
Payload : Surveyor 7
Booster : Centaur
Sponsor : NASA
Test No. : 1384
Launch Pad: 36A

Surveyor 7 soft landed on the moon near the crater Tycho on 9 Jan 1968. The spacecraft was equipped with a camera, an earth claw, a chemistry laboratory, and magnets. Desired objectives were attained. This was the final launch in the Surveyor program. Surveyor 7 weighed 639-pounds. Its structure was the same as Surveyor 4.

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ET68-14761

SYNCOM PROGRAM

SYNCOM III	19 Aug 64	Syncom III was placed in synchronous equatorial orbit over the Pacific Ocean for communication purposes. It was the first truly synchronous Comsat stationed above the equator at 180° west longitude. This placed it between Baker and Gilbert Island Groups. Perigee was 22,164 mi and apogee 22,312 mi. Orbital period was 23 hrs, 56 min. Configuration: Cylinder 15 1/2 inches long, 28 inches diameter. Weight 145 lbs before firing apogee kick rocket for position, 83 lbs after firing kick rocket. Estimated life 1 year.
Booster	Delta-Thor	
Sponsor	NASA	
Test No.	136	
Launch Pad	17A	

ET65-9858

TAC COM SAT (Tactical Communications Satellite)

Date	:	9 Feb 69
Payload	:	TAC CON SAT I
Booster	:	Titan IIIC No. 17
Sponsor	:	Air Force
Test No.	:	1188
Launch Pad	:	41

TAC COM SAT I was a military communications satellite developed by Hughes Aircraft for the Air Force Space Systems Division (SSD) under a $23.5 million contract. It was designed for use as an R&D tactical satellite communications system for all three services. It had a capacity comparable to 10,000 two-way telephone channels and was tall as a two story building. TAC COM SAT I was placed in 22,300 nautical mile synchronous earth orbit stationed above the equator just off the western coast of South America.

Configuration: A cylinder covered with solar panels with five element antenna array of UHF antennas, each 8 feet long; two microwave horns; and a bi-conical telemetry horn. Weight 1,600 pounds. It was the biggest and most powerful communications satellite ever built.

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TIROS PROGRAM

TIROS IX	22 Jan 65	The ninth in a series of weather satellites to observe and photograph the earth cloud cover. Tiros IX was placed in a north-south orbit, the first such attempted from the Eastern Test Range. Excessive burning time of booster second stage resulted in an elliptical orbit instead of the planned circular orbit. Apogee was 1590 mi and perigee 448.9 miles. Orbital period was 119.2 minutes. The drum-shaped satellite was maneuvered to a side position where it appeared to roll like a huge cartwheel. The two cameras pointed out opposite ends of the drum heads and continuously photographed areas of the earth beneath its orbital path.
Booster	Delta-Thor	
Sponsor	NASA	
Test No	0285	
Launch Pad	17A	

ET65-9858

TIROS PROGRAM

TAB T

Date	: 1 Jul 65	The tenth in a series of satellites to photograph earth cloud cover in storm breeding areas. Tiros X was placed in north-south orbit. This was the second near-polar orbit from the Eastern Test Range. Sun-synchronous orbit achieved with perigee of 458 SMI, apogee of 517 SMI, inclination of 81.4 degrees, and orbital period of 100.6 minutes. Tiros X was an 18-sided polygon with cylindrical diameter of 42 inches and height of 22 inches. Payload weight was 280 lbs.
Payload	: Tiros X	
Booster	: Delta-Thor	
Sponsor	: NASA	
Test No.	: 2756	
Launch Pad	: 17B	

Date	: 3 Feb 66	Tiros XI weather satellite ESSA-1 (Environmental Science Service Administration) was injected into earth orbit. Perigee was 379 NM, apogee was 450 NM, and orbital period was 100.3 minutes. Payload weight was 305 lbs. This was the first ESSA operational meteorological satellite.
Payload	: Tiros XI (ESSA-1)	
Booster	: Delta-Thor	
Sponsor	: NASA	
Test No.	: 0200	
Launch Pad	: 17A	

Date	: 28 Feb 66	Tiros XII, weather satellite, was boosted into earth orbit. It was the second ESSA vehicle known as ESSA-2 (Environmental Science Service Administration). Perigee was 731 NM, apogee was 476 NM, and orbital period was 113.5 minutes. Payload weight was 290 lbs. Launch of ESSA-2 completed the initial ESSA global system.
Payload	: Tiros XII (ESSA-2)	
Booster	: Delta-Thor	
Sponsor	: NASA	
Test No.	: 0405	
Launch Pad	: 17B	

TIROS

Date	: 26 Feb 69	Tiros 19 (TOS-G) or ESSA-9 as it was sometimes called was a weather satellite operated by the Experimental Science Services Administration (ESSA). It was boosted into a near polar sun-synchronous earth orbit about 887 statute miles above the earth. The Tiros Operational Satellite TOS rolls through space like a giant wheel taking pictures as each camera is pointed toward the earth. It has two cameras which cover the entire surface of the earth once every 24 hours, and photographs a given area at the same local time each dav. This was the ninth and last mission of TOS series.
Payload	: Tiros 19 (TOS-G) or (ESSA-9)	
Booster	: Delta-Thor D-67	
Sponsor	: NASA	
Test No.	: 3163	
Launch Pad:	17B	

Configuration: Hat box shaped, 18-sided polygon, 22 inches high and 42 inches in diameter. Weight 347 pounds.

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VELA PROGRAM

VELA PROGRAM		16 Oct 63	Twin satellites weighing 493 lbs each, and containing radiation sensing equipment were placed in earth orbit to detect nuclear test detonations in space. A 4.5 lb hitchhiker satellite was injected into orbit by the same vehicle.
Booster:	Atlas 197D/ Agena B		
Sponsor:	ARPA		
Test No:	5145		
Launch Pad 13			

ET64-15759

VELA PROGRAM

VELA 3 and 4 — 17 July 64

Booster — Atlas 216D/ Agena D
Sponsor — ARPA/Air Force
Test No. — 2925
Launch Pad — 13

This was a triple satellite operation. Twin Vela, nuclear detection satellites and a Tetrahedral Research Satellite (TRS-5), NDS-13, were placed in different orbits by one booster. Vela NDS-3 was injected into near circular orbit with perigee of 63,639 mi and apogee of 65,024 miles. NDS-4 was kicked into tandem orbit on the opposite side of the earth with perigee of 58,766 mi and apogee of 64,886 miles. Orbital period was 101 hours. Vela satellites were 20-sided polyhedrons, 54 inches in diameter, each weighing 493 lbs. The TRS-5 weighed 4.5 lbs. It was carried on the Agena aft rack and injected into eleptical orbit of 120 to 64,886 miles to gather radiation data.

ET65-9858

VELA PROGRAM

TAB U

Date	:	20 Jul 65
Payload	:	Vela 5 & 6
Booster	:	Atlas/ Agena D
Sponsor	:	ARPA
Test No.	:	1496
Launch Pad:		13

Twin nuclear detection satellites, Vela 5 and 6, were placed in earth orbit. This was the third set of Vela satellites placed in tandem earth orbit 180 degrees apart, which placed them on opposite sides of the earth. They carried improved sensors to distinguish between nuclear explosion and sun radiation. They were injected into near circular orbits. The mean distance from earth of Vela 5 was 57,279 miles and Vela 6 69,225 miles. Orbital period of one was 111.53 hours, the other 112.08 hours Each spacecraft was a 20-sided polyhedron, 54-inches in diameter and weighed 524 lbs.

A 12-lb Octahedral Research Satellite, ERS-17, rode piggyback into a wide-ranging elliptical orbit to monitor background radiation in the Van Allen Belt that surrounds the earth. Perigee was 94.86 miles and apogee 69.870.28 miles.

VELA SATELLITES

Date	:	28 Apr 67
Payload	:	Vela 7 & 8 2 - OAR OV 1 - SSD ERS-18
Booster	:	Titan IIIC
Sponsor	:	Air Force and OAR
Test No.	:	8275
Launch Pad	:	41

Vela nuclear detection satellites 7 and 8 were boosted into a 60,000-mile circular orbit spaced approximately 180 degrees apart. They were shaped like Chinese lanterns, 54-inches in diameter, with 26 sides. Solar cells covered 24 of the sides. The extra weight of these Velas caused the Titan IIIC to be selected as booster instead of the usual Atlas-Agena combination. One Vela was equipped with a Lithium Drift package consisting of a cluster of solar power conversion cells. The purpose was to test their self-sealing capabilities after bombardment by solar particles.

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VELA

Date	:	23 May 69
Payload	:	Vela 9 and 10 (Primary) (Secondary Payload of OV5s)
Booster	:	Titan IIIC No. 15
Sponsor	:	Air Force
Test No.	:	3013
Launch Pad:		41

Twin Vela nuclear detection satellites 9 and 10 were placed in elliptical earth orbit with perigee of 9,154 nautical miles and apogee of 60,326 nautical miles. Each Vela weighed 765 pounds. Secondary payload consisted of three 25-pound OV5s and a 45-pound spin interstage.

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DUMMY PAYLOAD PROGRAMS

Dummy Payload (Lead) 1 Sep 64

Booster	Titan IIIA
Sponsor	Air Force
Test No.	4751
Launch Pad	20

On its first space mission the Titan IIIA carried a 3750 lb dummy payload of lead. Third stage malfunction prevented injection of payload into earth orbit.

Dummy Payload (Lead) 10 Dec 64

Booster	Titan IIIA/ SLV-1
Sponsor	Air Force
Test No.	6505
Launch Pad	20

A dummy payload of lead weighing 3750 lbs was placed in 100 NM earth orbit along with the final stage of its booster by Titan IIIA. Total weight orbited was 9000 lbs. Purpose was to test booster performance.

Dummy Payload (Lead) 18 Jun 65

Booster	Titan IIIC
Sponsor	Air Force
Test No.	0449
Launch Pad	40

A dummy payload of lead ballast weighing 21,000 lbs was placed in earth orbit by the Titan IIIC on its first launch.