UNITED STATES AIR FORCE

TITAN III

STANDARD SPACE LAUNCH SYSTEM

THE U. S. AIR FORCE TITAN III
STANDARD SPACE LAUNCH SYSTEM

PREPARED BY
OFFICE OF INFORMATION
HQ AIR FORCE SPACE SYSTEMS DIVISION
AIR FORCE SYSTEMS COMMAND
LOS ANGELES AIR FORCE STATION, CALIF. 90045

2ND EDITION (OCTOBER, 1965)

CONTENTS

(Cover Photo: First Titan III-C launch, Cape Kennedy, Fla., June 18, 1965)

REPORT ON FIRST TITAN III-C FLIGHT TEST
Cape Kennedy, Florida
June 18, 1965

MISSION

- To inject a 21,000-pound payload into a 100-nautical mile circular orbit.
- To evaluate performance of the two 120-inch diameter solid rocket motors in:
  - ---the launch and flight environments.
  - ---maintenance of trajectory through the use of liquid injection thrust vector control.
  - ---the solid stage/liquid stage separation sequence.
- To demonstrate capability for in-flight start of Stage 1 engines.
- To evaluate performance of all airborne and ground systems.

MISSION EVALUATION

- Unqualified success.

SIGNIFICANT ACHIEVEMENTS

- All test objectives were accomplished.
- This flight validated the soundness of the Titan III building block concept.
- This flight proved the feasibility of employing large solid rocket motors as the initial stage in a multi-stage launch vehicle.
- Titan III-C established three notable space records in the course of its first flight:
  - ---Most powerful vehicle launched to date by the United States. The solid motors developed 2,400,000 pounds of thrust at lift-off.
  - ---Most powerful booster stage ever ignited in flight. Stage 1 engines developed 470,000 pounds of thrust when started at altitude.
  - ---Heaviest payload to date orbited by the United States. (Titan III-C's Transtage, which propelled the payload into orbit, is not included as part of the payload weight.)

MISSION ACCURACY (Predicted and Actual Flight Data for the 100-Nautical Mile Circular Orbit)

	PREDICTED	ACTUAL
Apogee(nautical miles)	101	101
Perigee(nautical miles)	98	96
Velocity(feet per second)	25,583	25,584
Eccentricity of orbit	.0004	.0007
Inclination(degrees)	32.179	32.175
Period of orbit(minutes)	88.1	88.1

TITAN III BACKGROUND

Taller than a 12-story building and six times more powerful than the Atlas rocket which carried the Mercury astronauts, the Air Force Titan III-C is the free world's mightiest space booster launched to date.

The 127-foot tall Titan develops nearly $2\frac{1}{2}$ million pounds of lift-off thrust -- enough to orbit up to 12 tons of payload.

The big new space launch vehicle is the first member of the third generation of U.S. military boosters. Its ancestors are the Thor and Atlas, both developed as ballistic missiles, then turned to space use. Then came Titans I and II and the first of a new breed of solid fuel rockets -- the Minuteman ICBM.

From the technology perfected in developing these boosters came Titan III. Combining solid fuel for tremendous lift-off power with sophisticated liquid fuels for in-space "stop-and-startability," Titan III is the Nation's first military booster to be designed from the outset for space missions.

Its solid fuel boosters contain propellant which can be molded in segments of various diameters. These segments can be stacked like building blocks according to the quantity of thrust needed. The Titan III-C uses five-segment, 120-inch diameter boosters. However, future Titan III versions could use up to seven 120-inch diameter segments in each solid booster. Or the 120-inch motors could be replaced with 156-inch diameter solid motors to provide increased capability.

-more-

Titan III's liquid fuel engines are driven by propellants which ignite on contact with each other -- thus eliminating the need for a complex ignition system. And, unlike many other liquid fuel boosters, Titan III's propellants are storable. Besides greater safety, this means time saved on the launch pad. Vehicles can be fueled weeks in advance of lift-off time, and there is no need to drain the tanks should a problem elsewhere delay the launch.

In appearance, the Titan III-C resembles its Roman numeral designation -- except that the center "I" is 41 feet taller (depending on payload height) than the two beside it.

In the center is the liquid fuel core vehicle. Attached to either side are the 85-foot tall solid fuel boosters. Each of the three steel-skinned cylinders is 10 feet in diameter.

The solid boosters are ignited for lift-off and burn out after two minutes. Then they are jettisoned and fall back into the sea about 135 miles down the Air Force Eastern Test Range.

The three-stage core vehicle, which can be launched without the solid boosters (then it is known as the Titan III-A) continues on its programmed flight path. The first two stages fall away in turn as their fuel is consumed. Finally, the versatile third stage -- or Transtage -- continues on, bearing one or more of many possible payloads.

-more-

Among the maneuvers the acrobatic Transtage can perform in space are:

-- injection of a payload directly into a 100 nautical mile circular orbit,

-- injection of a payload into a synchronous orbit (one which allows the payload to "hover" above a point on the earth revolving below),

-- transfer from a circular to an elliptical orbit,

-- transfer from a low circular to a deep circular orbit,

-- change the angle (plane) of its orbit to the Earth's equator,

-- transfer from a circular orbit to a flight path which penetrates deep into space,

-- lift into a deep space trajectory.

Complementing Titan III's powerful lower stages and its versatile Transtage is the unique Integrate-Transfer-Launch Facility (ITL).

The ITL blends railroad roundhouse with aerospace factory -- all on man-made islands in the Banana River at Cape Kennedy.

The main buildings are called VIB (for Vertical Integration Building), and SMAB (for Solid Motor Assembly Building.) Both are linked to the two launch pads, 40 and 41, by a dual-track railway. In addition there are warehouses for component storage, and a series of smaller facilities buildings.

Within the ITL, Titan III components -- solid motor segments, liquid stages, payloads -- can be assembled and completely checked out in a controlled atmosphere which is virtually an extension of the factories in which they were built.

The ITL is constructed so that a Titan III-A, which does not use solid boosters, bypasses the SMAB. When it has been assembled and mated with its payload in the VIB, it is pushed by twin diesel electric locomotives out to one of two launch pads which lie at the ends of long narrow spits.

When the booster, with its payload, arrives at the launch pad, a giant Mobile Service Tower (MST) is trundled toward it from the opposite direction. Final pre-launch procedures are conducted and the vehicle is sent on its way in space.

Titan III-Cs follow the same routine, except for a stop in the SMAB where they are fitted with their dual solid boosters.

The two-pad ITL will make it possible to launch Titan IIIs at the rate of five per month, according to Maj. Gen. Ben I. Funk, Commander of the Air Force Systems Command's Space Systems Division, Los Angeles.

"The ITL concept will end the need to assemble the vehicle right on the pad as we have been doing. This ties up a pad for weeks, even months. With the ITL, we can assemble Titan IIIs indoors, roll them out and fire them off with time-table frequency and reliability," he says.

The ITL will not be fully completed and ready for use until late 1965. For this reason, the first two Titan III-C vehicles were "built-up" on one of the ITL launch pads -- Pad 40 -- and traditional pre-launch procedures were followed.

Assembly of the second Titan III-C flight test vehicle was conducted in the SMAB and VIB -- but pre-launch check-out was conducted on the pad.

Titan III is being developed under the executive management of the Space Systems Division. Col. David V. Miller is Titan III System Program Office Director. His development team includes both military and civilian systems management experts. The Aerospace Corporation provides highly-specialized systems engineering and technical direction.

Titan III's test record thus far has been impressive. Four Titan III-As have been successfully test flown. A fifth III-A may be launched later in the development program, or it may be converted and flown as a Titan III-C, according to Colonel Miller.

The first Titan III-C vehicle was given a highly successful flight test on June 18, 1965. Nine more Titan III-Cs are scheduled for launch through June, 1967. Two more III-Cs are being held for launch after that time.

The Titan III mission is to provide a powerful, reliable, economical and versatile system with which to launch a variety of both unmanned and manned payloads.

"Although the first Titan III-C payload was ballast for flight test purposes, the other flights in the 17-launch test series will carry primary and bonus payloads," according to Colonel Miller.

Two experimental communications satellites and a radar calibration sphere, all built by the Lincoln Laboratory of the Massachusetts Institute of Technology, have already been launched aboard Titan III-As.

- more -

Three more Lincoln Laboratory communications satellites are scheduled for launch aboard Titan IIIs. One of these will be placed in near-synchronous equatorial orbit, and the other two will be put into synchronous equatorial orbits.

Three payloads developed by the Air Force Office of Aerospace Research (OAR) will be launched aboard Titan IIIs. "Each of these payloads actually consists of many experiments," according to Colonel Miller. "One payload will be placed in a medium-altitude elliptical orbit, one in a near-synchronous and the third in a synchronous orbit."

"In addition, Titan III-Cs will carry future Vela Nuclear Detection Satellites into orbit," he said.

Six Vela satellites have already been launched from Cape Kennedy aboard Atlas-Agena launch vehicle combinations.

Titan III has also been selected as the launch vehicle for the Air Force Manned Orbiting Laboratory (MOL) which is now under development. Flight test of an unmanned MOL is scheduled for late 1967 or early 1968. The first of five manned MOL flights is scheduled for late 1968.

TITAN III DEVELOPMENT HISTORY

By 1961, the United States had developed and put into operation the Thor and Atlas -- first as ballistic missiles and then as space boosters. Then came Titans I and II, and the first of the solid fuel missiles, the Minuteman.

Development of these vehicles had been keyed to a major scientific breakthrough by U.S. scientists: the capability to build low-weight, high-yield nuclear warheads. A boon as far as fast development of a powerful nuclear defense force was concerned, this capability became a handicap when the U.S. turned to space.

To carry unmanned satellites large enough to be useful in space, and to orbit manned vehicles, the U.S. needed more powerful boosters. The need became even more critical when the Soviet Union became the first nation to orbit a satellite -- Sputnik I -- which they placed in space in October, 1957.

With the Soviet space success as an additional spur, a U.S. Large Launch Vehicle Planning Group (LLVPG) was formed. Made up of Department of Defense and National Aeronautics and Space Administration experts, its purpose was to study the Nation's space booster needs for the late 1960s and early 1970s.

The Planning Group reached several major conclusions. One, that the U.S. needed a military booster powerful enough to place at least ten tons into orbit. Another, that such a booster should be easily adaptable to a wide variety of payload requirements.

-more-

In November, 1961, The Planning Group recommended that a program to develop the vehicle found to be the most satisfactory for the Nation's post-1963 requirements be started immediately.

That vehicle was Titan III.

In December, 1961, funds were released to the Air Force with which to begin Phase One studies of the new booster system. By November, 1962, studies were completed and on December 1, 1962, a 45-month hardware development program was begun.

The development job was given to the Air Force Systems Command's Space Systems Division commanded by Maj. Gen. Ben I. Funk in Los Angeles. Brig. Gen. (then Colonel) Joseph S. Bleymaier was named System Program Director. In 1964, he became Space Systems Division's Deputy Commander for Manned Systems. And, effective Oct. 1, 1965, he became commander of the Air Force Western Test Range at Vandenberg AFB, Calif.

Colonel David V. Miller took over the job of Titan III System Program Director in August, 1964.

Appointed partner in the development project was the Aerospace Corporation, the non-profit corporation which had been chartered to provide systems engineering and technical direction for Air Force missile and space programs.

-more-

Backbone of the Titan III program was a development philosophy dependent on high contractor performance and minimum technical risk, as well as skills already perfected.

"We had been given a job to do and a schedule to stick to," recalls General Bleymaier, "and we couldn't risk using materials or procedures still undeveloped."

Under a sliding scale of profits and losses -- called the Cost-Plus-Incentive-Fee contract system -- firms were rewarded for good work completed on time within cost estimates. And, they suffered profit penalties for inferior or late work and cost overruns.

The new, intense management philosophy bore fruit quickly. On February 23rd, 1963, the first Titan III solid motor segment was successfully test-fired at the Coyote Canyon test facility of United Technology Center, near Sunnyvale, Calif. On June 13th that year, the contract for construction of Integrate-Transfer-Launch (ITL) installations was awarded.

The first full scale, five-segment firing of a 120-inch diameter solid propellant motor was conducted by UTC on July 20th. And, on July 23rd, the Aerojet-General Corporation of Sacramento, Calif., successfully conducted a Titan III Transtage test in which its liquid propellant engine was shut down and restarted twice.

Also, on July 23rd, construction of a special concrete-and-steel Titan III Solid Motor Test Complex was completed at Edwards AFB in Southern California.

-more-

By the 25th, preparation of the ITL site -- which involved dredging enough sand to form a one-foot square pillar to the Moon -- was completed in the Banana River at Cape Kennedy. (In September that year, modification of Pad 20 at the Cape was completed to accommodate the first Titan III-A Launches.)

On December 10th Dyna Soar, long planned as a manned space glider and slated to be the first payload for the Titan III launch system, was cancelled. In its place, plans were announced for a Manned Orbiting Laboratory (MOL) which would combine a modified Gemini "B" capsule with a "small house-trailer size" space laboratory.

In the MOL, two space pilots would be able to live and work in a shirt-sleeve environment while orbiting the earth for periods of up to 30 days. MOL's purpose was described as "To test the utility of man in space." Full-scale development of MOL was ordered by President Lyndon B. Johnson on August 25, 1965.

Delayed three days by Hurricane Cleo, the first launch of Titan III-A occurred on September 1, 1964, from Pad 20 at Cape Kennedy -- still within one day of the month established over two years earlier. Described as, "95 percent successful," because the Transtage shut down too early to orbit its 3,750 pound ballast payload, the first launch was followed by a completely successful flight on December 10th that year.

A third successful flight test was conducted on February 11, 1965. In this test, Titan III's versatile Transtage proved itself by switching into three separate orbits -- in addition to sending a "bonus" communications satellite built by Massachusetts Institute of Technology's Lincoln Laboratory into its own orbit.

- more -

In the fourth test of Titan III-A on May 6, 1965, the Transtage topped its previous world record-setting performance by switching into four separate orbits. The Transtage once again bore a Lincoln Laboratory communications satellite and radar calibration sphere.

Afterward, General Bleymaier qualified his earlier description of Titan III. "That performance was by no workhorse," he said. "That was done by a pedigreed stallion."

The first flight test for the Titan III-C occurred on June 18, 1965, and was a complete success. On this launch a 21,000 pound dummy payload was placed into a 100-nautical mile circular orbit. Evaluation of flight data showed that the nation's most powerful space launch vehicle could have placed a payload weighing nearly 27,000 pounds into the 100 mile orbit. This flight proved the feasibility of employing large solid rocket motors as the initial stage in a multi-stage vehicle.

By summer, 1965, Titan III had leaped from the drawing board into factories across the Nation and on to Cape Kennedy. Program Director Miller found the future bright for Titan III: "We think we've built a good tool with which to explore space. Now we mean to prove it."

WHAT TITAN III CAN DO

The Air Force Titan III-C, developing nearly 2.5 million pounds of thrust at lift-off, can place:

-- over 25,000 pounds in a 100 nautical mile equatorial orbit, or

-- 2,100 pounds in a 19,300 nautical mile synchronous orbit, or

-- 5,000 pounds in a deep space trajectory to escape from the earth's gravitational pull.

For comparison 25,000 pounds is roughly equal in weight to three Project Gemini spacecraft; 2,100 pounds is about 14 times the weight of the Early Bird satellite; and 5,000 pounds is heavier than the Project Mercury spacecraft, roughly twice the weight of the Surveyor spacecraft. Titan III-C could place payloads weighing up to 5,000 pounds on either Mars or the Moon.

Payloads can be injected directly into a low altitude circular or elliptical orbit. And, once in a circular orbit, they can be transferred into another orbital path, either circular or elliptical, with or without a plane change.

- more -

THE TITAN III TRANSTAGE

Star performer on the Titan III team is a 15-foot long space acrobat called Transtage.

It is the third stage of the Titan III core vehicle and it has already set world records for maneuverability and guidance life.

With a total thrust capability of only 16,000 pounds, it is no heavy-weight. But its pressure-fed engine, built by the Aerojet-General Corporation of Sacramento, Calif., can be repeatedly stopped and then started again in space.

This "re-start capability" made it possible for the Transtage to switch into three separate orbits during the third Titan III-A flight test on February 11, 1965 -- a world first. And in the fourth III-A flight on May 6, 1965, the versatile upper stage bettered that performance by switching into four separate orbits.

Not to be outdone by an engine the Titan III's guidance and control systems -- which are contained in the control module in the Transtage -- set records of their own.

The guidance life -- that is, the time its guidance and control equipment can function normally -- of a ballistic missile is measured in minutes.

Titan III's remarkable guidance and attitude control system can operate for hours.

-more-

This makes it world champion among all missile and space vehicles.

Built by the AC Electronics Division of General Motors Corporation, Milwaukee, Wis., the system supplies all guidance signals required by the Titan III vehicle and Transtage during boost and coast phases of the flight and for injection of the payload into orbit or into an escape trajectory.

The steel-skinned Transtage is 10 feet in diameter, the same as the lower Titan III stages. When empty of its liquid propellants, it weighs only 4,000 pounds -- about the same as two small automobiles. But fueled, its weight goes up to 28,000 pounds.

The propellants used in the Transtage, like those used throughout the Titan III's liquid propulsion system, are both hypergolic and storable. A 50/50 mixture of hydrazine and UDMH (unsymmetrical dimethyl hydrazine) with nitrogen tetroxide as the oxidizer, they burn spontaneously when mixed. And, unlike cryogenic fuels, which require delicate handling and refrigeration until use, the Titan III propellants can be pumped into the vehicle early -- and left there even if trouble elsewhere should temporarily delay the launch.

TITAN III: HOW MUCH IT COSTS

The overall research and development cost of the Titan III Standard Space Launch System, including 17 flight test vehicles, will be $800 million, spent approximately as follows:

-- Development of solid motors, including both test and flight motors	$200,000,000
-- Airframe	300,000,000
-- Propulsion systems, including necessary Aerospace Ground Equipment (AGE)	60,000,000
-- Guidance systems, including AGE	40,000,000
-- Other costs, including:	200,000,000
a. Transportation	
b. Propellants	
c. Housekeeping support at Eastern Test Range	
d. Phase I (Definition) Studies	
e. Test facilities	
Total	$800,000,000

Construction of the Integrate-Transfer-Launch (ITL) facility at Cape Kennedy cost an additional $50 million.

TITAN III's NEW MANAGEMENT PHILOSOPHY

Titan III could never have been developed like a World War II bomber.

In those days a plane could be designed, fabricated, and assembled in quantity in a single plant and rolled from its doors right to the flight line.

But a missile or a space booster system is different.

Where the bomber was built by a single prime contractor, an engine subcontractor, and their suppliers, Titan III has six associate prime contractors and dozens of sub-contractors, plus the suppliers.

Titan III's airframe was built in Colorado, its propulsion systems in California, and its guidance system in Wisconsin. There is no "rolling Titan IIIs to the flight line." The system components must be transported by rail, highway and air to reach the launch area at Cape Kennedy.

In short, judicious and simultaneous development of an $800 million dollar system which has the entire Nation for its factory poses management challenges never before encountered.

To surmount these obstacles, the Air Force devised a new management philosophy. Its three main precepts are called PDP, PERT, and CPIF.

PDP stands for Program Definition Phase and is called, simply, "Phase One." It is a management approach which specifies that a contractor produce a complete design of the system he proposes to build. The design must be in sufficient detail to forecast costs and prevent late changes. This procedure assures that the best of all proposed ideas and techniques will be given trial -- but on paper, not in the factory.

-more-

"Pencils and paper," as one Defense Department official put it, "are a lot cheaper than cancelled programs."

Twelve months were spent developing the management organization, the procedures, and selecting superior designs before industry turned the first wheel. Every area of technical risk was identified and the best balance was achieved between cost, performance, standardization, reliability, and maintainability. Contractors were chosen and the contracts were negotiated.

According to Brig. Gen. Joseph S. Bleymaier, director of Titan III development, "We entered the active development phase of the Titan III system on December 1, 1962, with a greater degree of confidence that we could meet our cost, performance and schedule goals than ever before at the beginning of a military program of this magnitude."

PERT, short for Program Evaluation and Review Techniques, was born as a result of the challenges presented by Polaris missile development. The idea was evolved as a method to prepare realistic contract bids, schedule efficient use of manpower and other resources, locate trouble areas, and suggest revisions to meet program deadlines.

In the Titan III program, all the jobs that made up the project were identified, then charted and a relationship was established between them. The estimated time each task would require and its cost were recorded. This data was then fed into computers to obtain the cost and optimum time sequence of each program step. Based on the computer information, managers were able to maintain, simultaneously, on-schedule development of all components.

-more-

CPIF, the third major Titan III management tool, stands for Cost-Plus-Incentive-Fee. It is a contracting system which provides profit rewards for contractors who do good work on time, and penalties for inferior or late work. All major Titan III contracts were negotiated under the CPIF system.

Explaining the rationale for CPIF, General Bleymaier said, "The days of success at any price are long gone. Unlike dollars for scientific research, the defense dollar must be split many ways. Missiles and rifles and shoes and barracks are needed as well as new space launch systems. We must get the most and the best for every penney we spend."

The CPIF system insures maximum return for each tax dollar. It also assures industry that a reasonable fee will be paid for adequate performance -- and a bigger fee for outstanding performance. No contractor stands to lose his entire fee under CPIF. Each contract is negotiated differently, but as a rule, the contractor is assured of making a minimum one to two and a half percent over his cost. Contracting experts quickly point out, however, that no company can afford to stay in business very long with that kind of profit margin.

The history of the Titan III development program reflects the success of this new management philosophy. On September 1, 1964, within one day of the month established over two years earlier, the first Titan III-A was launched from Cape Kennedy.

Three other flight tests followed. In the third test, the amazing Titan III Transtage switched into three separate orbits -- a world first. And in the fourth flight, the Transtage broke its own record by transferring into four orbits.

-more-

Praise of Titan III came around the Nation. But the highest came from Washington.

After a thorough evaluation of the Titan III development program, Secretary of Defense Robert S. McNamara called it, "The best managed program we have."

THE TITAN III DEVELOPMENT TEAM

The Titan III Standard Space Launch System is being developed by a nation-wide military and industrial team. Among its members:

-- Martin Company, Denver Division, Denver Colo. (Airframe, assembly, test and system integration).

-- Aerojet-General Corporation, Sacramento, Calif. (Liquid propulsion systems).

-- United Technology Center, Sunnyvale, Calif. (120-inch diameter solid motors).

-- AC Electronics Division, General Motors Corporation, Milwaukee, Wis. (Inertial guidance system).

-- Ralph M. Parsons Company, Los Angeles, Calif. (Architectural engineering and design of the Integrate-Transfer-Launch Facility at Cape Kennedy).

-- Aerospace Corporation, El Segundo, Calif. (Systems engineering and technical evaluation).

-- U. S. Army Corps of Engineers, (Construction supervision - Integrate-Transfer-Launch Facility).

-- Space Systems Division of Air Force Systems Command, Los Angeles AFS, Calif. (Overall executive management of the Titan III research and development program).

AIR FORCE SPACE SYSTEMS DIVISION

The Space Systems Division of the Air Force Systems Command manages the development, production, delivery, and test of military space systems.

Commander of the Division is Maj. Gen. Ben I. Funk.

Systems under the Division's management include space launch vehicles, and both manned and unmanned spacecraft and satellites. The Division's FY 65 budget amounted to $1.3 billion.

Members of the Space Systems Division family of space launch vehicles (SLVs) include:

-- Scout, officially known as the SLV I

-- Thor, the SLV II

-- Atlas, the SLV III

-- Gemini-Titan II, the Gemini Launch Vehicle (GLV)

-- Titan III, the SLV V

Spacecraft managed by Space Systems Division include the Agena, an all-purpose space vehicle which can serve as an instrumented satellite itself -- or as an upper stage on which is carried another satellite.

The Division also manages the Vela Nuclear Detection Spacecraft which orbit the earth providing a means of detecting secret nuclear testing in space.

Space Systems Division will also participate in management of the Air Force Manned Orbiting Laboratory (MOL) which will serve as chamber for conducting experiments to learn more about man's ability to perform military tasks in space.

- more -

Space Systems Division's Aerospace Test Wings, the 6595th at Vandenberg AFB, Calif., and the 6555th at Patrick AFB, Fla., launch over 75 percent of all United States space vehicles.

Besides launching strictly military payloads, Space Systems Division provides support to the National Aeronautics and Space Administration (NASA). The Division has played a key role in such projects as Telstar, Mariner, Ranger, Echo -- and the Nation's two civilian manned spaceflight programs, Mercury and Gemini.

Headquarters of Space Systems Division is at Los Angeles Air Force Station, El Segundo, Calif., located in metropolitan Los Angeles County. The Division's principal sub-organizations include its two test wings and the Air Force Satellite Control Facility at Sunnyvale, Calif., the nerve center for a world wide network of satellite tracking stations, ships, and aircraft.

More than 5,000 military and civilian Air Force personnel make up Space Systems Division. These include approximately 1500 officers, 2750 enlisted personnel, and 1100 civil service employees.

The educational level of Space Systems Division personnel is high: 86 percent of its officers have at least a bachelor's degree. Over 500 have master's degrees, and 16 have their doctorate.

AIR FORCE CONTRACT MANAGEMENT DIVISION

Supervision of the Titan III-C production and test phases is a responsibility of the Air Force Contract Management Division (AFCMD).

This Division, newest and--geographically--largest in the Air Force Systems Command, is devoted exclusively to management of defense and aerospace contracts. It typifies application of sound business principles to acquisition of hardware by the Air Force.

The $800 million Titan III program is one of many contracts -- valued at nearly $50 billion -- currently being managed by the AFCMD. Direct support to the Titan III-C program is provided through Air Force Plant Representative offices at Aerojet-General Corp., Sacramento, Calif.; United Technology Center, Sunnyvale, Calif.; AC Electronics Division of General Motors Corp., Milwaukee, Wisc.; and the Martin Company's Denver (Colo.) Division. In addition, the AFCMD Test Site Office at Patrick AFB monitors adequacy of test procedures and results.

When Defense Secretary MacNamara recently described Titan III as the "best managed program we have", 4000 military and civilian members of the nation-wide contract management division accepted the remark as a tribute to their individual and collective performance. Their efforts assured that the product met contract specifications established by the Titan III Systems Program Office.

These professional contract managers perform 64 vital functions for each of their "customers" who include procurement agencies of the Air Force, Department of Defense and the National Aeronautics and Space Administration.

- more -

Establishment of a division dedicated entirely to contract management has been described as a tribute to the foresight and business acumen of the AFSC Commander, Gen. B. A. Schriever, who foresaw the need for such a specialized and impartial organization. It has saved the American taxpayer many millions of dollars without compromising the defense or aerospace programs involved.

6555th AEROSPACE TEST WING TO LAUNCH AIR FORCE TITAN III

Responsibility for erection, checkout, countdown, and launch of the Titan III belongs to Air Force Space Systems Division's 6555th Aerospace Test Wing at Cape Kennedy, Fla.

The Wing is responsible for the test and evaluation of all Air Force ballistic missile and space vehicles launched at the Eastern Test Range.

Commanded by Colonel Otto C. Ledford, Smackover, Ark., the Wing also conducts tests for the National Aeronautics and Space Administration.

Chief of the Wing's Titan III Division is Lt Col Marc M. Ducote, Gulfport, Miss.

Test Controller for the launch will be Major Edwin E. Speaker, of Washington, D. C., Chief of the Titan III Division's Operations Branch. Besides controlling launch activities, the Operations Branch controls over-all activation, Aerospace Ground Equipment (AGE) installation and checkout.

Heading Titan's Division Systems Branch is Lt Col Alfred A. Catalano, San Diego, Calif. This branch is responsible for maximum reliability and flight readiness of the vehicle and associated AGE. It reviews and approves all checkout, test and launch procedures, and maintains configuration control.

The Division's Test Support Branch, under Major Ralph S. Davison, Springfield, Ill., is responsible for coordination of mission requirements with the Eastern Test Range.

-more-

A major activity in preparing for the Titan III program at Cape Kennedy has been that of launch site construction and conversion, under the direction of Lt Col Andrew Wright, Rochester, N. Y., Chief of the Wing's System Civil Engineering Office.

These responsibilities include overseeing the "ground-making" and construction of the Integrate-Transfer-Launch facility for Titan III-C.

The Test Wing was awarded the Air Force Outstanding Unit Citation in October, 1962 for its efforts in missile and space booster flights. It is credited with distinguished performance "...through major advancement in research and development testing of the ballistic missile as a weapon system and space booster; thereby improving our national defense...with outstanding savings of the Nation's money and time."

The Wing's outstanding record includes support of both Projects Mercury and Gemini.

AIR FORCE EASTERN TEST RANGE SUPPORT

The Air Force Eastern Test Range will activate its entire 10,000 mile tracking network in support of the second launching of the free world's mightiest rocket. Eleven Test Range sites will be in action to track and receive information and data as the Titan III-C Transtage and payload circles the earth.

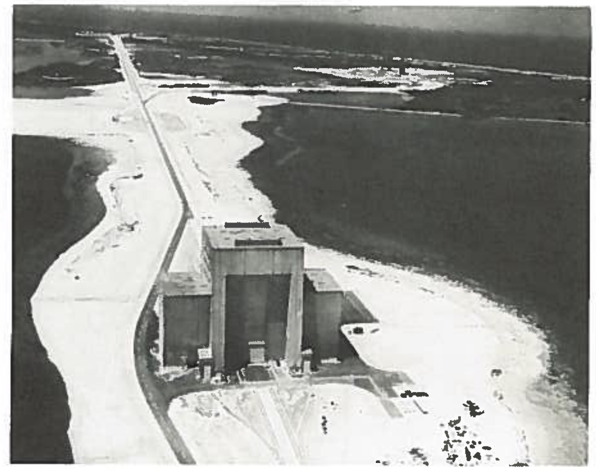
The Director of Operations for this mission will be Col. Charles Carter. It will be his responsibility to provide all the needed support for this mission.

Backing him up will be Lt. Col. Michael M. Kovach as Network Director. The colonel will integrate all the global tracking sites under his command into a single tracking network. He will have the authority to activate any reserve sites so as to satisfy the requirements of the launch agency.

Network Controllers for this mission will be Capt. Paul T. McIntyre and Capt. Neal E. Ausman, Jr. They will be responsible for DoD support during the mission period and insure that all the launch agency requirements are met. Also any changes or additions during the mission will be coordinated through them.

Maj. Robert S. McHargue will be the Chief DoD Network Controller. He will be the official contact point for all support coordination.

Titan III-C Solid motors -- 120 inches in diameter --will be attached to the core vehicle in this Solid Motor Assembly Building (SMAB), part of the Air Force Integrate-Transfer-Launch (ITL) facility at Cape Kennedy. Titan III-A vehicles, which do not use solid boosters, will bypass this building.

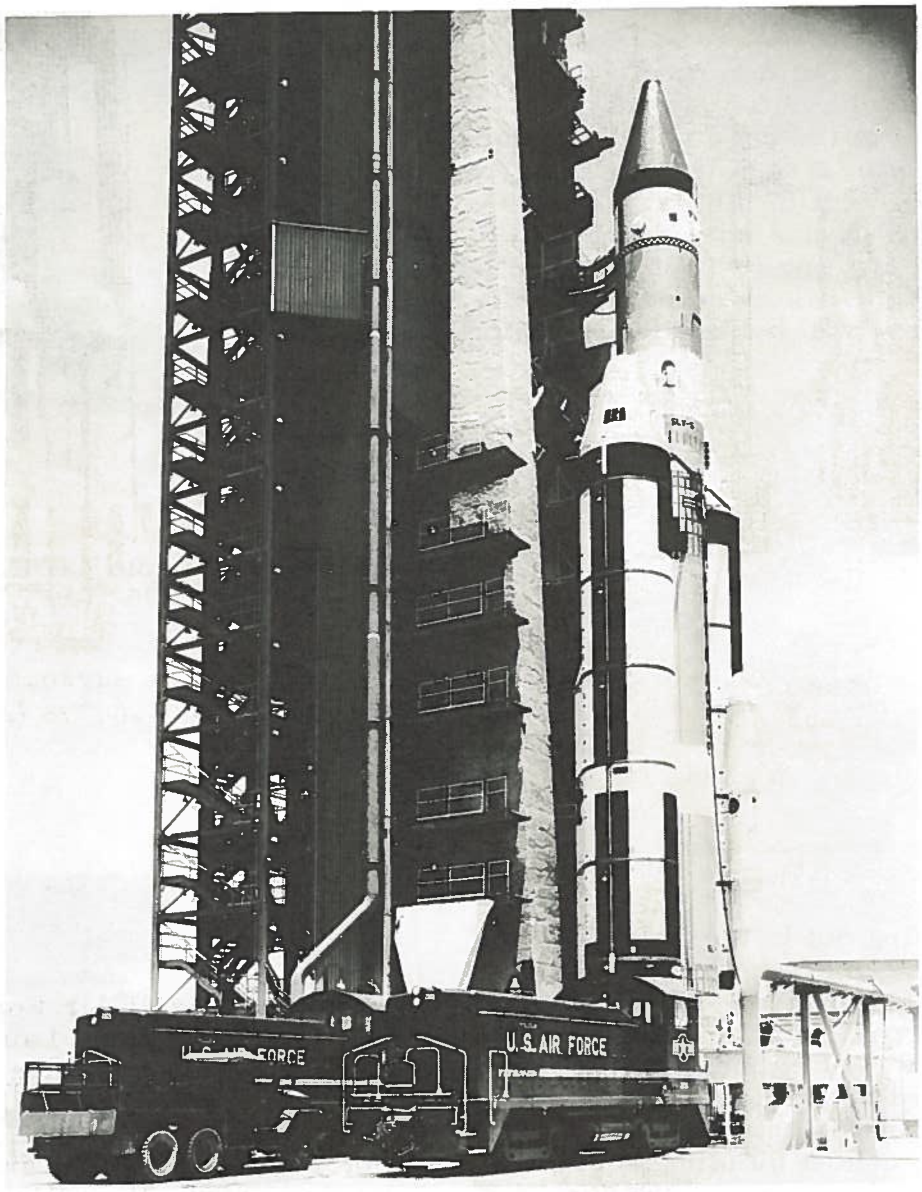


USAF Photo 44203-65(SSD) or
PL65-64752 (AFETR)

Stretching out in the Banana River at Cape Kennedy, the Air Force Integrate-Transfer-Launch (ITL) facility will soon be used for rapid assembly and launch of Titan III Standard Space Launch Vehicles. In foreground is warehouse and control rooms; center building is giant Vertical Integration Building (VIB) where vehicles will be assembled, mated with payloads; in background is Solid Motor Assembly Building (SMAB) where Titan III-C solid motors will be joined to core vehicle. Launch Pads 40 and 41 are beyond.

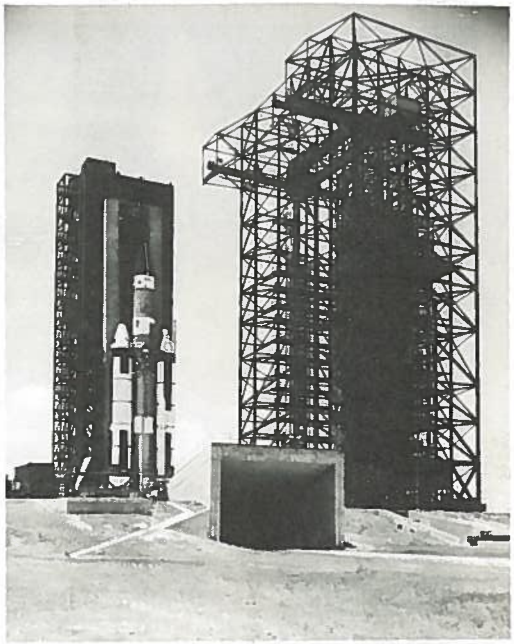
USAF Photo 44184-65(SSD) or
PL65-64733 (AFETR)

(GLOSSY PRINTS AVAILABLE BY NUMBER)

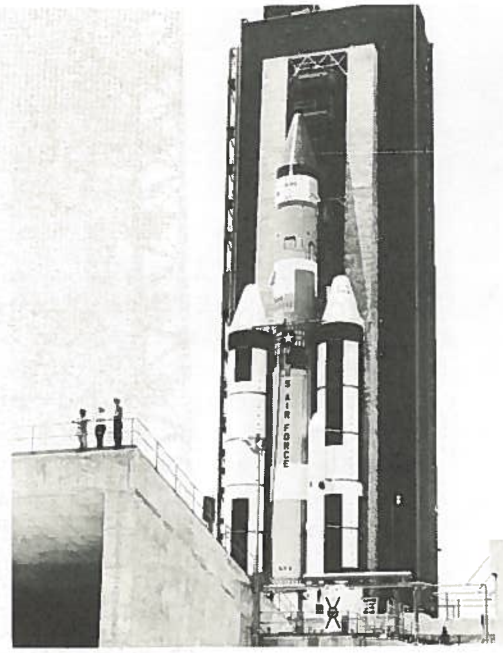


The Air Force Titan III-C Standard Space Launch Vehicle awaits launch from Cape Kennedy, Fla. Poised on Pad 40 at the Air Force's new Integrate-Transfer-Launch Facility (ITL), the big booster can develop nearly $2\frac{1}{2}$ million pounds of thrust at lift-off -- which makes it the most powerful rocket launched anywhere to date. Diesel-electric locomotives in the foreground are part of the ITL's rail system which makes possible rapid transport of rockets and components from assembly buildings to one of two launch pads.

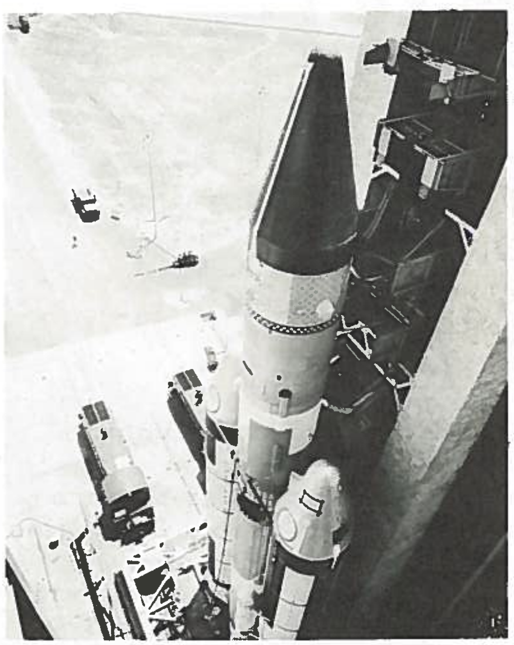
USAF Photo 44238-65 (SSD) or PL65-64773 (AFETR)
(GLOSSY PRINTS AVAILABLE BY NUMBER)



USAF Photo 44145-65 (SSD) or
PL65-64689 (AFETR)



USAF Photo 44240-65 (SSD) or
PL65-64775 (AFETR)

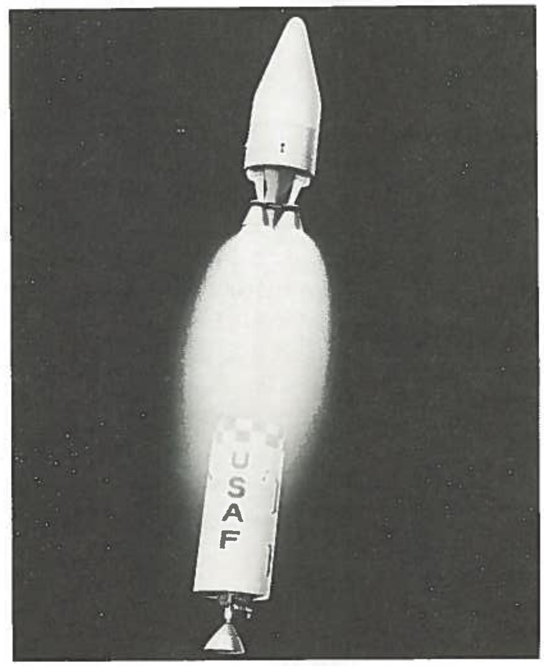


USAF Photo 44150-65 (SSD) or
PL65-64694 (AFETR)

The 12-story tall Air Force Titan III-C Standard Space Launch Vehicle, awaits launch from Cape Kennedy, Fla. The new booster, 127 feet tall with 86-foot tall solid propellant motors attached to its sides, can develop nearly 2½ million pounds of thrust at lift-off -- which makes it the most powerful rocket launched by the United States to date.

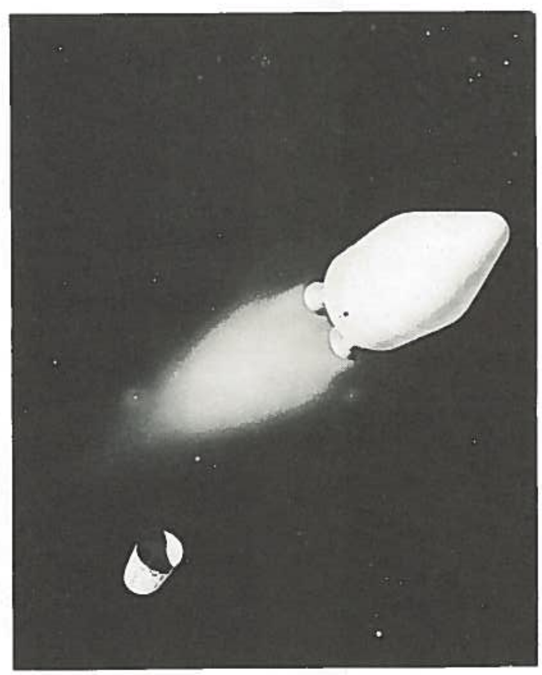
(GLOSSY PRINTS AVAILABLE BY NUMBER)

The Air Force Titan III-C's sophisticated Transtage (for "transfer stage") will separate from Stage Two as in this artist's concept and continue its programmed flight plan. The versatile Transtage can -- and has -- switched into four separate orbits aboard a Titan III-A.



USAF Photo 35433-63(SSD)

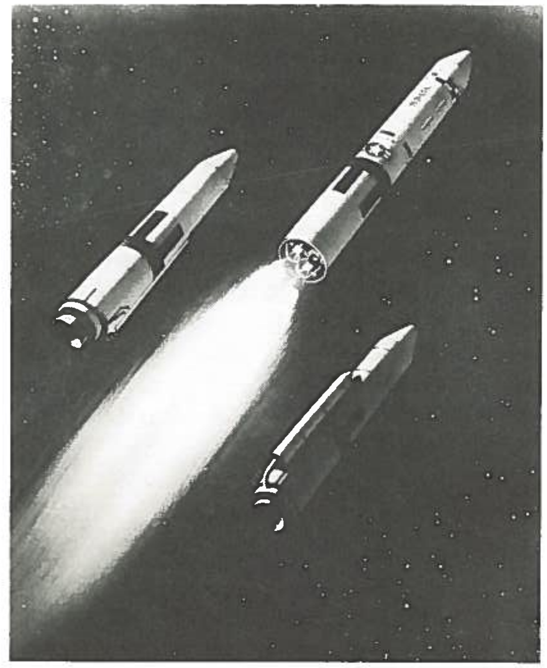
This Artist's view shows the Air Force's Titan III-C Transtage streaking into orbit after leaving the vehicle's spent second stage behind. The Transtage (for "transfer stage") can -- and has -- switched into four orbits in a single mission aboard a Titan III-A.



USAF Photo 35434-63 (SSD)

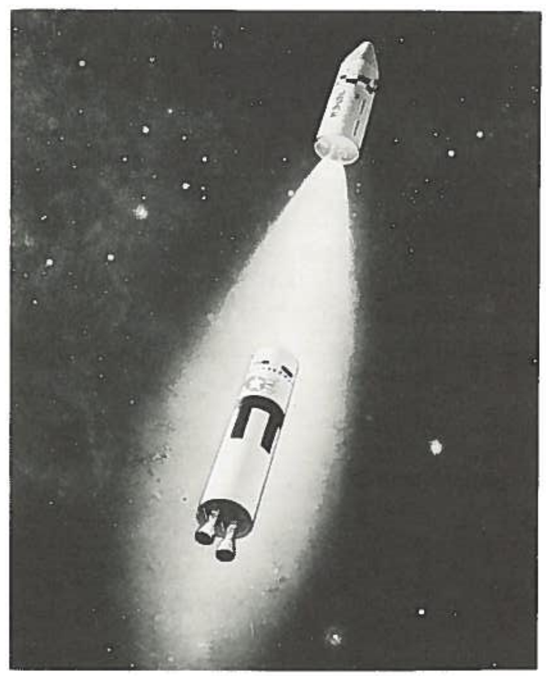
(GLOSSY PRINTS AVAILABLE BY NUMBER)

Jettisonning of the solid boosters, pictured here in an artist's concept, will occur approximately two minutes after lift-off of the Air Force Titan III-C --most powerful rocket launched by the United States to date. The spent boosters fall into the sea far down the Air Force Eastern Test Range, while the rest of the space launch vehicle combination continues the mission.



USAF Photo 35429-63(SSD)

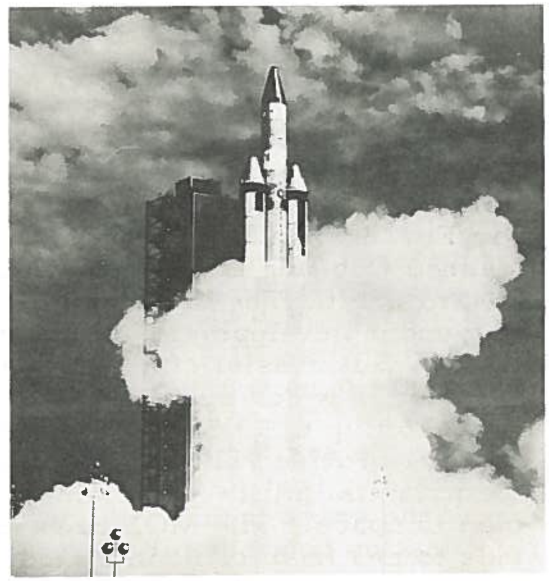
After Stage One has consumed its liquid fuel, Stage Two ignites, separates from Stage One, and moves further into space. The Titan III generates roughly 470,000 pounds of thrust in the first stage, and 100,000 pounds in the second. When the second stage has used its fuel, the Transtage (for transfer stage) with 16,000 pounds of thrust, ignites to put itself and its payload into orbit. The Transtage, with its restart capability, has already demonstrated its ability to transfer into four separate orbits.



USAF Photo 35430-63 (SSD)

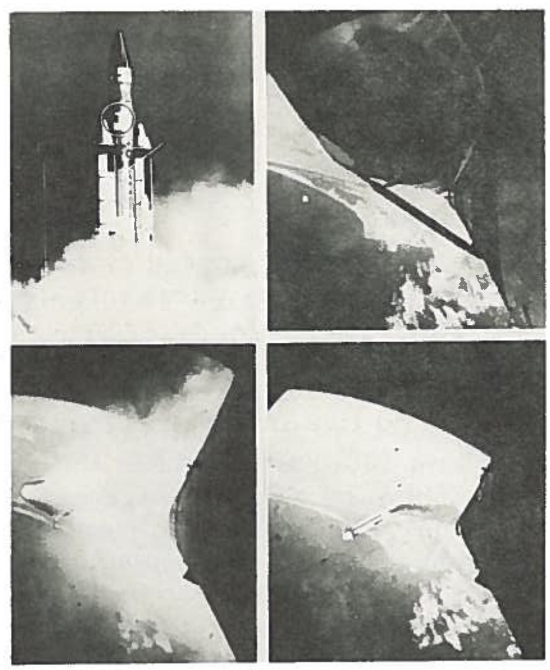
(GLOSSY PRINTS AVAILABLE BY NUMBER)

The U. S. Air Force's first Titan III-C Standard Space Launch Vehicle lifts from its pad in a maiden voyage acclaimed "an unqualified success." The launch took place on June 18, 1965, at Cape Kennedy, Fla. (See First Launch Report, at the beginning of this book, for more details).



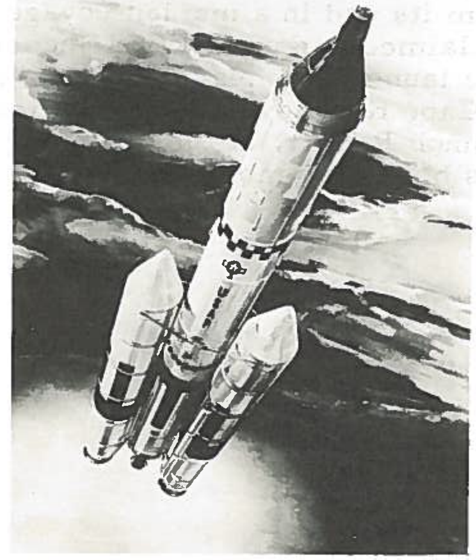
USAF Photo 44462-65 (SSD)

A camera mounted on the first Titan III-C's liquid core (upper left photo) recorded these striking photographs of the big rocket's solid fuel motors being jettisoned following booster stage burn-out. The spent boosters fell into the Atlantic about 135 miles downrange from Cape Kennedy, Fla.



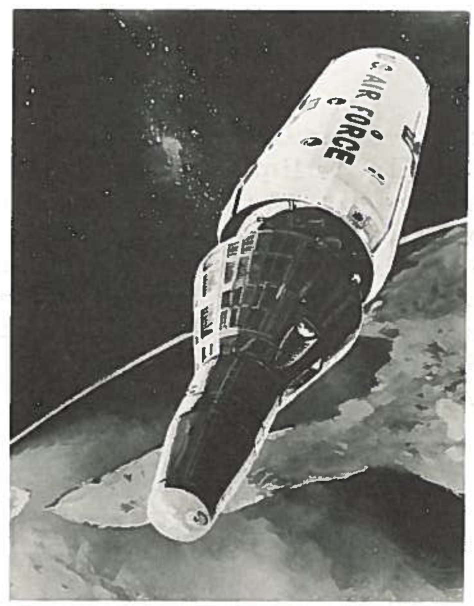
Martin Co. Photo P379
USAF Photo 45412-65 (SSD)

This artist's concept depicts the Air Force Titan III boosting the Manned Orbiting Laboratory (MOL) toward orbit. The MOL, which is now under development by the Air Force, will consist of a pressurized cylinder in which space pilots may stay aloft up to 30 days. The space lab will provide valuable data about the potential military usefulness of men in space. The MOL crew will ride to and from orbit in a modified Gemini spacecraft.



USAF Photo 37822-64 (SSD)

This artist's concept shows the modified Gemini spacecraft separating from the MOL for the crew's return trip to earth. The crew will ride both ways in the Gemini capsule, but will work and live in the pressurized MOL.



USAF Photo 38294-64 (SSD)