

**AFSC
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**SPACE AND MISSILE SYSTEMS
ORGANIZATION:
A CHRONOLOGY,
1954 - 1979**



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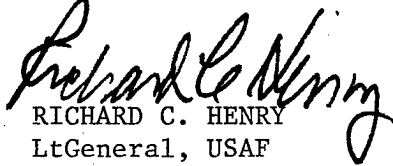
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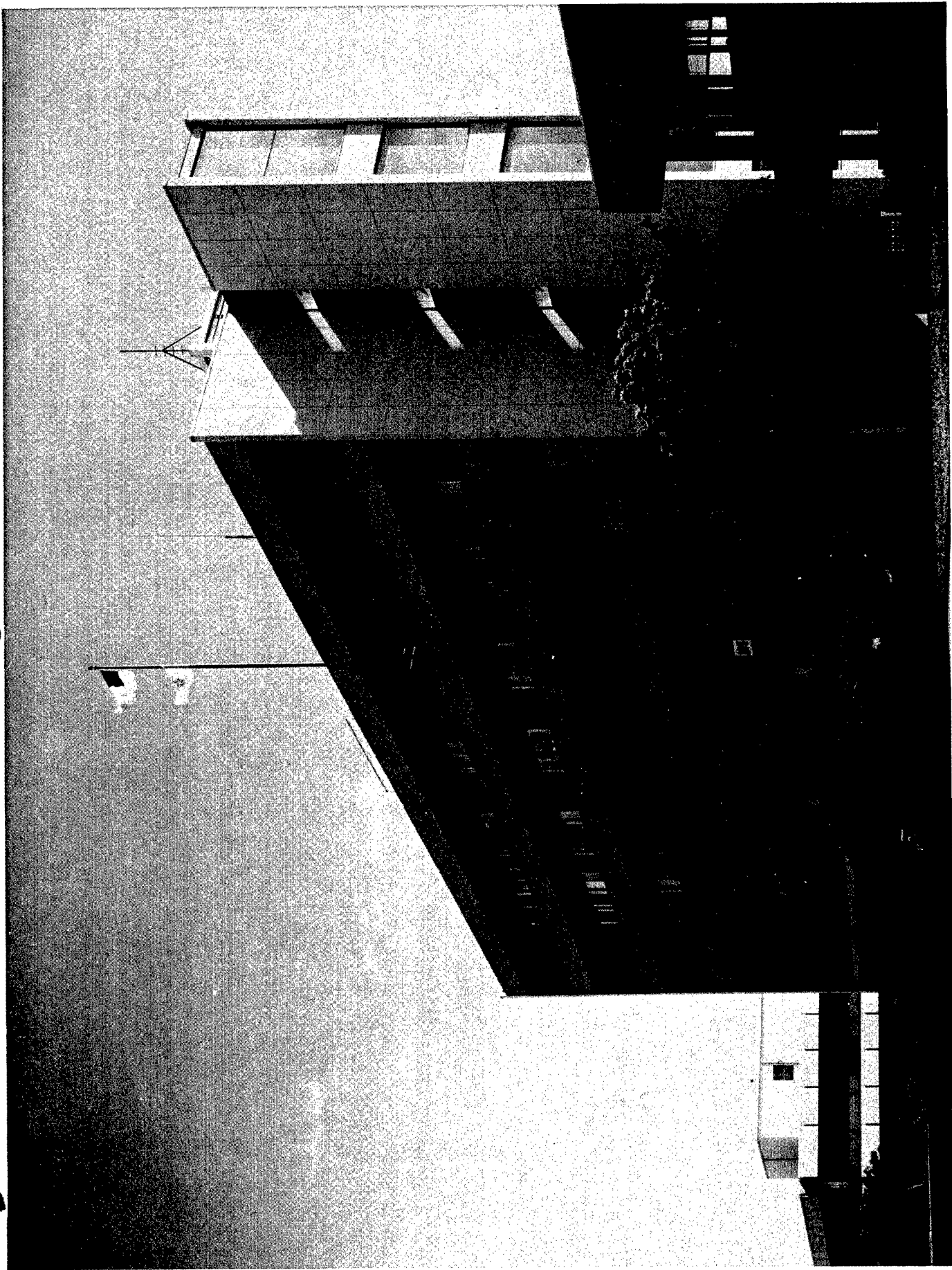
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The Air Force Space and Missile Systems Organization headquarters in Los Angeles, California, is the heart of America's military space activity and deterrent missile force.

FOREWORD

This Chronology deals with the Space and Missile Systems Organization (SAMSO). It begins with 1954, when the first predecessor of SAMSO was established, and ends with 1979, when SAMSO was deactivated and replaced by two new organizations. The chronology is composed of three principal sections: an introductory overview, the chronology itself, and a series of appendices. The overview is a brief narrative summary of the activities of SAMSO and its predecessors. The chronology, as the name indicates, is a detailed chronicle of events and accomplishments. The various appendices are designed to amplify and clarify certain aspects of SAMSO's history. An index has been provided to assist the reader in finding specific information more readily.

The chronology was conceived and initiated by Dr. John T. Greenwood and was completed by other members of the History Office staff. Two editions have been published. The first edition covered the years from 1954 to 1976; the present edition carries the story up through 1979.

The authors hope that this chronology will be a useful volume that will orient newly assigned personnel and serve as a quick reference guide to SAMSO history.

The History Office would appreciate any comments or suggestions for improving future additions.



TIMOTHY C. HANLEY
Chief, Office of History

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SAMSO: AN OVERVIEW

In July 1954, the Air Force established the Western Development Division (WDD) of the Air Research and Development Command (ARDC) in Inglewood, California. The new division was assigned the responsibility for developing the nation's first intercontinental ballistic missile (ICBM), the Atlas.

Few people then could have realized that in the next 25 years the achievements of WDD and its successors would change forever the nature of military technology, national strategy, and international relations while opening the way for the peaceful exploration and routine use of space for civilian and military purposes.

ORIGINS OF THE AIR FORCE BALLISTIC MISSILE PROGRAM

The Air Force ballistic missile development program that began in earnest in 1954 had its origins in U.S. Army Air Corps missile studies and projects initiated immediately after World War II. The prospect of mating two war-developed technologies, the atomic bomb and the German V-2 ballistic guided missile, if realized, could completely revolutionize weaponry and strategic warfare as it then existed.

The prospect, however, remained just that until 1954. Technical problems with both atomic weapons and ballistic missiles made their combination into a single economical and effective weapon system impractical. This lack of feasibility resulted in a lack of funding support for continued ballistic missile research and development (R&D).

By 1953, the situation had changed drastically due to several factors. The "thermonuclear breakthrough" of the early 1950's made lightweight, high-yield nuclear weapons feasible. This advance meant that hitherto restrictive performance criteria for a ballistic missile could be relaxed to a point within the existing state-of-the-art.

These facts, and clear indications of significant Soviet progress in the development of thermonuclear weapons and ICBMs, prompted a reexamination of U.S. strategic missile programs. If the Soviet missile threat were real and the missiles deployed, the USSR could gain a sudden and possibly decisive strategic superiority over the U.S.

In October 1953, the Strategic Missiles Evaluation ("Teapot") Committee, composed of distinguished U.S. scientists, was set up under the chairmanship of Professor John von Neumann to look into the U.S. Air Force's strategic missile programs. In February 1954, the committee submitted its report and recommendations. It stressed the recent technological advances and advocated a reorientation and acceleration of Convair's Project Atlas (MX-1593), the only U.S. intercontinental ballistic missile then under development.

During the following months, these recommendations received the approval and full support of the highest civilian and military leaders of the Air

Force and Defense Department. ARDC was given responsibility for acceleration of the Atlas and was authorized to establish a West Coast field office to manage the new program. On 1 July 1954, that office - the Western Development Division - was activated under the command of Brigadier General Bernard A. Schriever and was charged with reorienting and accelerating Atlas missile development.

THE EARLY YEARS: WDD-AFBMD, 1954-1961

Within a year, WDD not only had the Atlas program well advanced but also had become responsible for the development of an alternative, or backup, ICBM - the Titan. A more advanced, two-stage missile to be built by the Martin Company, the Titan was a hedge against failure or delay in the Atlas program.

By the end of 1955, the Division was given the additional tasks of developing an intermediate range ballistic missile (IRBM), the Thor, and of achieving initial operational capability (IOC) with the missile systems it was building. In barely 18 months, the mission of WDD underwent an enormous expansion.

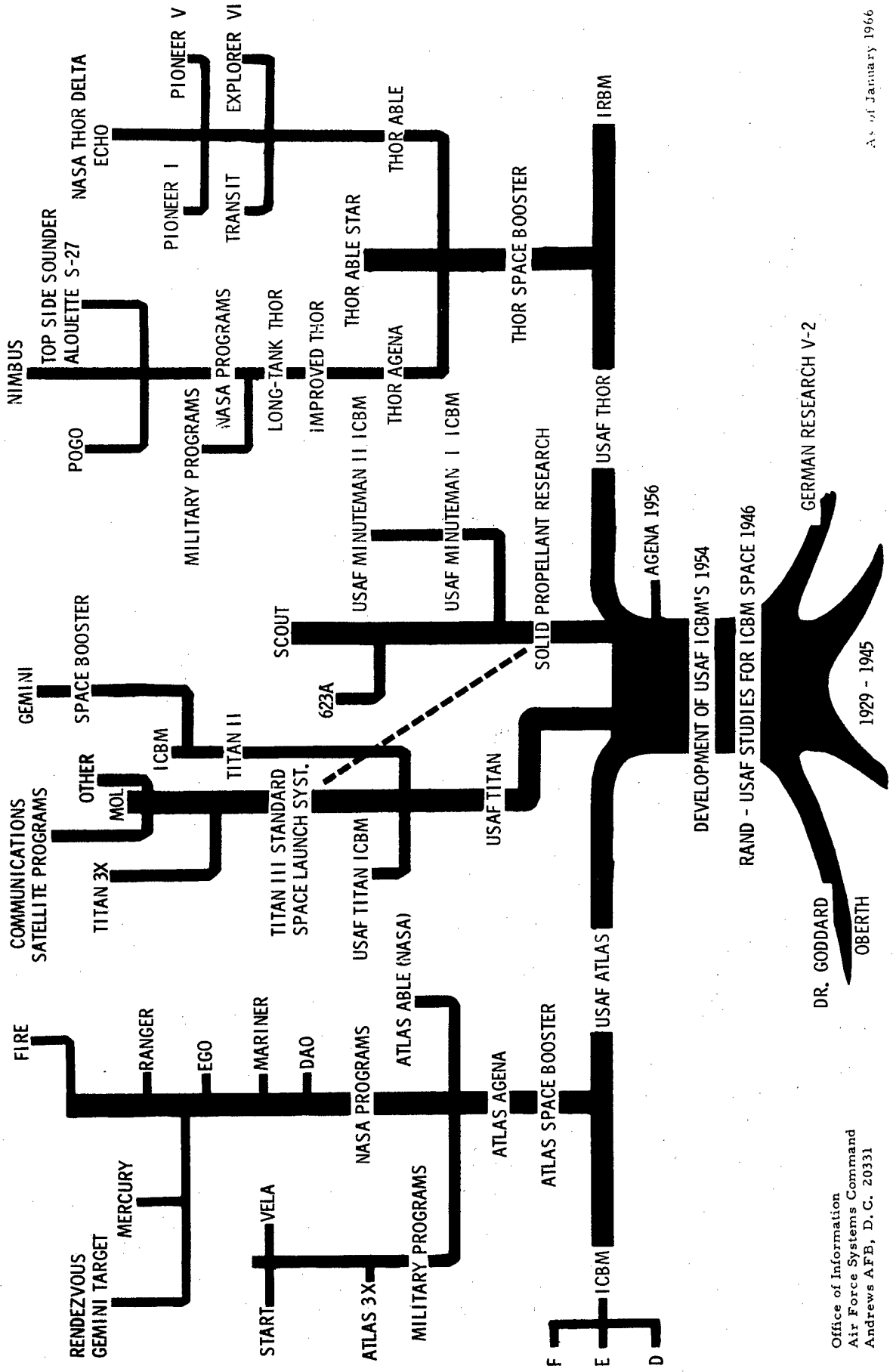
To attain its assigned objective of developing operational missile systems as soon as possible, WDD largely replaced the conventional sequential development pattern with concurrent development. Within the framework of a single overall plan, development, production, testing, and IOC actions were undertaken simultaneously. Although it was not an entirely new concept, WDD applied concurrent development, or "concurrency," on a scale never before used in military development programs.

A pivotal year for the entire Air Force Ballistic missile program was 1957. The urgency once attached to the program waned as the Eisenhower administration made large cuts in defense spending during 1956-1957 in an effort to balance the budget. These actions effectively slowed the drive toward operational ballistic missile systems.

On 1 June 1957, WDD was redesignated the Air Force Ballistic Missile Division (AFBMD), a fitting name in view of its enormous responsibilities. Several months later, on 20 September, the first successful Thor IRBM was launched from Cape Canaveral, Florida. Then, on 17 December, the first successful Atlas launch and short-range flight were made. Although they were the culmination of much effort, the launches were only the first, halting steps toward deployment of operational IRBM and ICBM weapon systems.

But between the first successful Thor and Atlas launches, the Soviet Union used an ICBM to place the first man-made satellite, Sputnik, in earth orbit on 4 October 1957. Sputnik's impact on the Air Force missile program, as well as on its emerging space projects, was immediate and momentous. Both programs were given renewed impetus. Restrictions were quickly lifted, funding was vastly increased, and previous program priorities were reinstated.

EVOLUTION OF MISSILE & SPACE PROGRAMS



After 1957, Air Force missile and space programs progressed rapidly. The first Thor and Atlas missile sites were operational by 1960, the former with the Royal Air Force and the latter with the Strategic Air Command (SAC). The Titan made its flight debut in 1959, but a more advanced version with storable propellants, all inertial guidance, and in-silo launch capability—the Titan II—was already in the process of development.

More importantly, AFBMD had made significant progress in the development of the solid-propellant, three-stage Minuteman ICBM. Begun in 1958, the Minuteman was to be economical, efficient, housed in hardened and dispersed silos, and capable of instantaneous response. The first flight test missile was launched on 1 February 1961, less than three years after program approval was granted.

The ballistic missiles were only part of AFBMD's mission. After 1956, space and military satellite projects came to play an ever more important role in AFBMD's constantly growing efforts. Once proven in their early test flights, Thor and Atlas missiles were pressed into service as booster vehicles for military and civilian space programs. Both the Air Force and the National Aeronautics and Space Administration (NASA), which was created on 1 October 1958, came to rely almost exclusively on Thor and Atlas vehicles for their unmanned and manned space projects. Eventually topped by a wide variety of upper stages (Agena, Delta, Centaur, Burner II) developed by the Air Force and/or NASA, Thor and Atlas launch vehicles have been the backbone of U.S. space programs since 1958.

AFBMD-SSD/BSD-SAMSO: 1961-1967

By 1960, it was increasingly apparent that the ballistic missile and space programs had grown into large and distinct entities that could no longer be effectively managed within the existing framework of AFBMD. Moreover, the ballistic missiles were either already in or fast approaching production and deployment while the space programs were still in their infancy. Therefore, General Schriever, ARDC commander since April 1959, recommended that the research and development complex at Los Angeles be divided. The ballistic missile development team would move to Norton AFB, California, where it could be combined with the Air Materiel Command (AMC) missile site activation offices. The space programs would be retained at the Los Angeles complex.

Subsequently approved, this move was caught up in a much more far-reaching and fundamental alteration in Air Force weapon systems development and acquisition policies that resulted in a major Air Force reorganization. On 1 April 1961, the Air Force Systems Command (AFSC) and Air Force Logistics Command (AFLC) were created from the former ARDC and AMC. As part of this reorganization, the resources of AFBMD and the former AMC Ballistic Missiles Center (BMC) were split between two new commands - Ballistic Systems Division (BSD) and Space Systems Division (SSD). Both new organizations were placed under a Deputy Commander AFSC for Aerospace Systems (DCAS). By July 1962, BSD's move to Norton was almost completed. In October 1962, DCAS was inactivated, and the two Divisions became autonomous, reporting directly to HQ AFSC.

By late 1966, however, it was apparent to AFSC that the continued existence of two separate divisions with compatible missions was an inefficient and uneconomical duplication of effort and personnel. Accordingly, General James Ferguson, Commander, AFSC, ordered that BSD and SSD be reconsolidated at one location by mid-1967. On 1 July 1967, BSD and SSD were inactivated, and the Space and Missile Systems Organization (SAMSO) of AFSC was activated under the command of LtGeneral John W. O'Neill. SAMSO took over the former SSD headquarters at Los Angeles Air Force Station. The Minuteman and Reentry Systems program offices remained at Norton AFB until June 1972 when Reentry Systems was moved to the headquarters complex at Los Angeles.

BALLISTIC MISSILES: 1961-1979

The early 1960's were years of hectic activity for BSD. The division was heavily involved in missile site activation work throughout the United States and in deployment of Atlas, Titan, and Minuteman missiles to SAC. All 132 Atlas and 54 Titan I launchers were operational by the end of 1962 when the first flights of Minuteman I ICBMs were turned over to SAC's 341st Strategic Missile Wing (SMW) at Malmstrom AFB, Montana. In December 1963, the last of 54 Titan II launch complexes was transferred to SAC.

As the Minuteman force grew toward its programmed strength of 1,000 hardened and dispersed missile launchers, the older, less efficient, and less economical Atlas and Titan I missiles were retired from the active inventory during 1964-1965. The Minuteman, together with the Titan II, came to form one part of the TRIAD of strategic deterrent forces that were maintained on day-to-day alert to counter any hostile nuclear attack on the U.S. or its allies.

Even while the initial flights of Minuteman I missiles were being installed in their underground silos, BSD was finishing work on the improved Minuteman II missile that would be emplaced in the sixth, and last, wing at Grand Forks AFB, N.D. To enhance the effectiveness of the Minuteman force further, the Force Modernization Program was initiated in 1964 to replace all Minuteman I missiles with the Minuteman II. In May 1967, the Minuteman force reached its planned strength of 1,000 launchers when BSD turned over the last facilities of Squadron 20 to SAC.

On 16 August 1968, a new chapter in the Minuteman story opened when the first Minuteman III flight test missile was launched from Cape Canaveral and completed its programmed 5,000 mile flight down the Eastern Test Range. Less than two years later, in June 1970, SAMSO's site alteration team turned over the first flight of 10 Minuteman III missiles to SAC's 91st Strategic Missile Wing at Minot AFB, N.D. The deployment of this initial wing was completed on 13 December 1971. The last of another 150 Minuteman IIIs was emplaced at Grand Forks AFB, N.D., early in March 1973, and on 21 January 1975, the last of another 150 Minuteman III missiles was turned over to SAC at Frances E. Warren AFB, Wyoming. The last 50 Minuteman IIIs were turned over at Squadron 20 at Malmstrom AFB, Montana, on 11 July 1975. This ended the nine year Force Modernization program aimed at updating the Minuteman force.

The turnover of the last Squadron 20 site brought the SAC Minuteman force up to a 450 Minuteman II/550 Minuteman III configuration. SAMSO's responsibilities for Minuteman III production and deployment were phased out gradually. Assembly of the last Minuteman III missile was completed on 30 November 1978. Engineering responsibility for maintenance of the Minuteman III system was transferred from Air Force Systems Command to Air Force Logistics Command, with the process being completed on 31 December 1978.

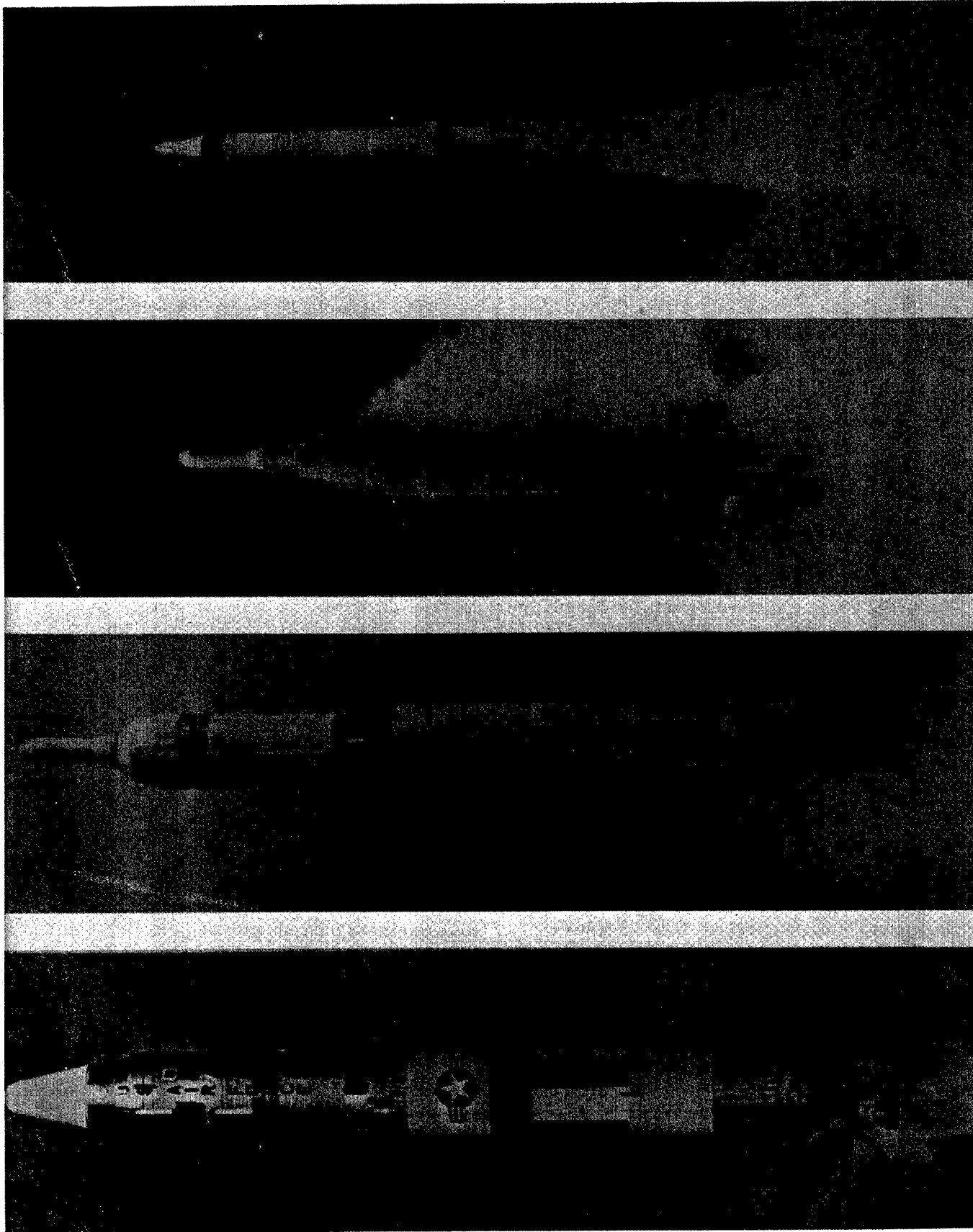
Together with SAC's manned bombers and the Navy's Polaris/Poseidon missile launching submarines, the land-based Minuteman II/III and Titan II missiles form the TRIAD of retaliatory strategic nuclear forces that are on day-to-day alert to deter any hostile nuclear attack on the U.S. or its allies. SAMSO and its predecessors since 1954 played a vital and continuing role in the development and constant improvement of the existing land-based missiles while examining the needs for future missile systems.

Under the terms of the 1972 Strategic Arms Agreement between the United States and the Soviet Union, this country could no longer deploy additional ICBMs and submarine-launched ballistic missiles to maintain a strategic balance with the Soviet Union. It became a question of quality rather than quantity. SAMSO's Deputy for ICBMs began an advanced development program in late 1973 to define technology and design concepts for a large, survivable, highly accurate, MIRVed ICBM designated Missile X. A great amount of effort was devoted to alternate basing options which included air mobile and ground mobile concepts. In June 1979, President Jimmy Carter authorized full-scale engineering development of Missile X and announced a configuration for the missile itself. A decision on the basing mode was deferred until 7 September, when the President announced that the missile would be deployed in a ground mobile mode that would utilize horizontal protective shelters. The various missiles would be moved from shelter to shelter so that they could not be targeted and destroyed in a preemptive first strike.

An integral part of BSD and later SAMSO activity involved the continued development of more advanced reentry vehicles. In July 1963, the new Ballistic Missile Reentry Systems program office was set up at BSD to manage the Defense Department's Advanced Ballistic Reentry Systems (ABRES) program. A joint service effort for reentry vehicle research, development and testing, the ABRES program was intended to investigate reentry phenomena, develop new materials, and test new techniques for penetrating more sophisticated defenses. The program was managed by BSD's Deputy for Ballistic Missile Reentry Systems until 30 June 1967 and by SAMSO's Deputy for Reentry Systems from 1 July 1967 until 5 July 1979. At that time, responsibility for the ABRES program was transferred to SAMSO's Deputy for ICBMs.

SPACE SYSTEMS: 1961-1979

While BSD labored to enhance U.S. deterrent posture, SSD made significant advances in the development of numerous space systems. The division supported NASA programs, such as Mercury and Gemini, by procuring and modifying the Atlas and Titan II boosters and providing launch services at



Shown in scale are the four Air Force intercontinental ballistic missiles developed under SAMSO management. From left to right--Titan II, 103 ft, two stage, liquid propellant; Titan I, 98 ft, two stage, liquid propellant; Atlas, 82 ft, 1½ stages, liquid propellant; and Minuteman I, 54 ft, three stage, solid propellant.

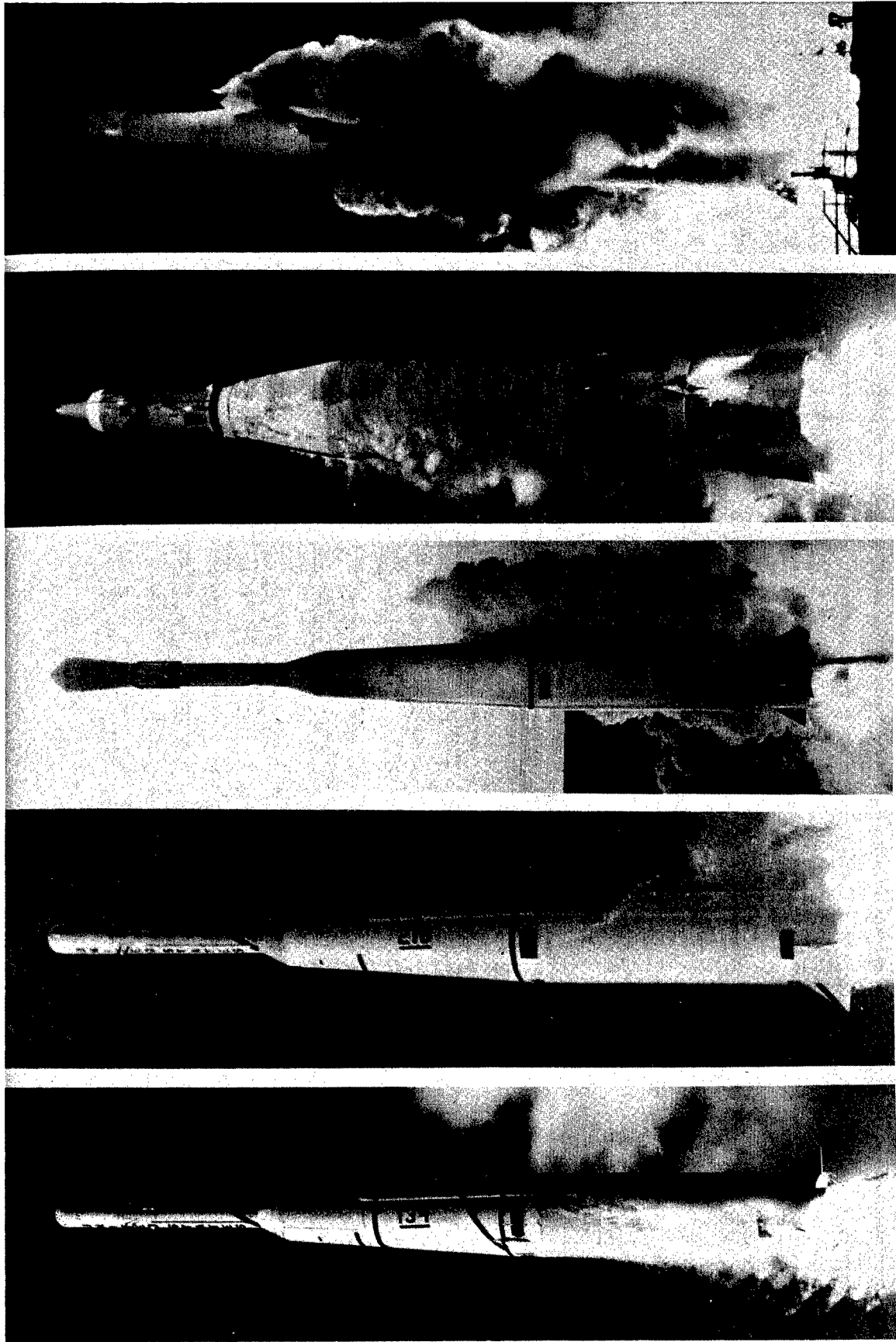
Cape Canaveral. Later, SAMSO worked closely with NASA on the NASA-managed Space Transportation System. NASA was responsible for developing the Space Shuttle--a manned, reusable launch vehicle that would be the key element in the system. SAMSO was responsible for developing the Inertial Upper Stage (IUS) that would be used with the Shuttle to place payloads into high altitude orbits. It was also responsible for activating a launch and landing site for the Shuttle at Vandenberg AFB, California. Full-scale development of the IUS began in April 1978, and ground-breaking at the Vandenberg launch site occurred in January 1979.

Even though SAMSO's support to NASA was glamorous and significant, the development of military space systems and launch vehicles and research on advanced technology and techniques remained the most important functions of SSD and later SAMSO. In addition to this, units attached to the commands conducted ballistic missile and space launches and provided command and control of space vehicles once they achieved orbit.

In late 1961, SSD initiated one of its greatest successes--the Titan III military space launch vehicle. A modified Titan II with two strap-on, 120-inch, solid-propellant booster motors, the Titan III was designed as a heavy duty booster for a wide variety of large payloads. The first R&D vehicle, a Titan IIIA--the basic center core vehicle of the Titan III--was flown on 1 September 1964. The first Titan IIIC (SLV-5C), with its strap-on solid rocket motors generating more than two million pounds of thrust at liftoff, was successfully launched from Cape Canaveral on 18 June 1965. Since that time, the Titan III vehicles have performed exceptionally well in a wide variety of missions and configurations. The family has expanded to include the Titan IIIB/Agenda D, the Titan IIID, and the Titan IIIE/Centaur which made its first flight in February 1974 and was used by NASA for space missions such as the Viking Mars Lander.

The older Thor and Atlas vehicles were improved and standardized to increase their performance and payload capabilities. From these modifications emerged families of standard launch vehicles (SLVs), such as the Thrust Augmented Thor (SLV-2A) and later the Long Tank Thrust Augmented Thor (SLV-2H) (Thorad), that have served the national space program economically and reliably throughout the 1960's and into the 1970's. Similar improvements were made in the Atlas (SLV-3), and a standardized upper stage, the Agenda D, was developed for use with the Thor, Atlas, and Titan III boosters. These improved launch vehicles were essential to the development and deployment of increasingly more sophisticated and heavier satellite systems. The Vela nuclear detection satellite and the Initial Defense Satellite Communication System (IDSCS) programs were among the satellite deployments started by SSD and successfully completed under SAMSO.

The first pair of Vela satellites was placed into orbit by an Atlas/Agenda in October 1963, and a Titan IIIC carried the sixth and last pair into space in April 1970. The Vela satellites were most effective in monitoring the 1963 Nuclear Test Ban Treaty. But they also provided important scientific data on solar flares and on other radiation that could affect man's safety in space.



Air Force-developed ballistic missiles serving as boosters have added many vehicles to the space traffic pattern. (Left to right): NASA's Explorer VI, the "Paddlewheel Satellite;" Pioneer V, the first solar satellite to transmit data from deep space; the Tiros meteorological satellite; Atlas/Agena boosting its versatile payload; and a Thor Able Star boosting a military electronic navigational satellite.

The potential of communications satellites to provide secure, instantaneous worldwide military communications was one of the first areas that AFBMD examined. Indeed, the division's first success in space was Project SCORE, an Atlas booster containing a communications repeater that transmitted President Eisenhower's Christmas message to the world in December 1958.

Following cancellation of the early satellite communications program, Project Advent, in 1962, the Defense Department began work on what later became the Initial Defense Satellite Communication System (IDSCS). The program was designed to develop an interim network of satellites to handle military communications. To simplify the program, small 100-pound satellites would be used. To effect considerable cost savings, it was decided to use the already-paid-for Titan IIIC R&D vehicles to put the satellites into their randomly-spaced synchronous orbits. Integration of payload and launch vehicle was vastly simplified because Space Systems Division managed the spacecraft portion of IDSCS, the Titan IIIC program, and provided launch services at Cape Canaveral.

On June 16, 1966, the first load of seven experimental communications satellites was lifted into orbit by a Titan IIIC. A second load of eight satellites followed on January 18, 1967, joining the first seven satellites to form the basic ring of IDSCS satellites. The last 11 satellites of the 26-satellite system were inserted into orbit on 1 July 1967 and 13 June 1968, completing the IDSCS and providing an experimental but usable worldwide military communications network for the Defense Department.

As the initial system was being deployed, other experimental communications satellites were placed in orbit to test advanced concepts and technology. For example, Lincoln Experimental Satellites 5 and 6 (LES-5 and LES-6), placed in orbit on July 1, 1967 and September 26, 1968 respectively, were all solid-state, ultra-high frequency (UHF) communications satellites. In February 1969, a Titan IIIC boosted the 1,600-pound experimental Tactical Communications Satellite (TACSAT I) into a near-synchronous orbit. TACSAT I relied heavily on technology derived from earlier experimental communications satellites. The primary purpose of TACSAT I was to test the feasibility of communications with small, mobile tactical communications equipment that could be used by ground, naval, and air forces. It also tested satellite communications over long distances. On July 1, 1970, a Tactical Satellite Communications (TACSATCOM) interim operational capability was established using TACSAT I and LES-6.

In March 1969, SAMS0 awarded TRW Systems Group a contract to build an advanced communications system that would incorporate the technology proven on earlier IDSCS, TACSAT I, and Lincoln Experimental Satellites. Once developed, the new Defense Satellite Communications Systems Phase II (DSCS II) would replace the IDSCS. The first pair of 1,200-pound DSCS II satellites was put into synchronous orbit in November 1971. Two launch failures delayed completion of the satellite network, but by January 1979 the full constellation of four satellites was in place and in operation. Planning for DSCS III, a third-generation satellite system, began in 1973. The satellites of this system were to carry multiple beam antennas to provide flexible coverage and resist jamming. A contract for full-scale development of the DSCS III satellites was awarded to General Electric in 1977.

SAMSO also managed the acquisition of the space portion of the Navy's Fleet Satellite Communications (FLTSATCOM) system under the overall program management of the Naval Materiel Command. When completed, the four-satellite FLTSATCOM system would be an operational global satellite communications system that would support the high-priority communications requirements of both the Navy and the Air Force. The satellites were being built by TRW; the first one was launched in February 1978 and the second in May 1979.

In conjunction with FLTSATCOM, SAMSO developed the Air Force Satellite Communications (AFSATCOM) system. Its mission was to allow the Air Force to command and control its strategic forces. The space segment of the system utilized transponders (receiver/transmitters) placed on board FLTSATCOM satellites and other Department of Defense spacecraft. The ground segment consisted of fixed and mobile terminals placed in command posts, strategic bombers, and ICBM launch control centers. The space segment of the system was declared operational in April 1978, and the terminal segment attained its initial operational capability in May 1979.

In addition to the U.S. defense communications satellites, SAMSO has managed development programs that have provided the United Kingdom and the North Atlantic Treaty Organization (NATO) with synchronous communications satellite systems. The British Skynet program began in 1966 as an augmentation of the IDSCS. The first of two satellites, Skynet IA, was placed in orbit on 2 November 1969 and provided the United Kingdom with its first military communications satellite system. The second Skynet satellite was launched from Cape Canaveral in August 1970, but a Delta upper stage malfunction caused permanent loss of contact with the satellite. In 1970, SAMSO and the United Kingdom began development of a more advanced Skynet II satellite system. The first Skynet II satellite was launched in January 1974, but again a Delta upper stage malfunction caused the permanent loss of the satellite. The second Skynet II satellite, launched on 22 November 1974, was a complete success and was turned over to the United Kingdom on 19 January 1975.

Development of the NATO satellites began in April 1968, with NATO IIA placed in orbit on 20 March 1970 and NATO IIB on 2 February 1971. Both the Skynet and NATO satellites were designed to be compatible and usable with each other and with the DSCS system. Work on a more advanced system, NATO III, began in 1973, and three NATO III satellites were successfully launched between 1976 and 1978.

Two of SAMSO's satellite programs addressed the perennial problems of weather and navigation. These were the Defense Meteorological Satellite Program (DMSP) and the Global Positioning System (GPS) Program. The DMSP system provided meteorological data to the entire Department of Defense. The Air Weather Service and SSD began development and deployment of these weather satellites during the 1960's and SAMSO has continued to improve them. Two DMSP satellites are normally in polar orbits about 450 miles above the earth. The DMSP system has allowed much more accurate global weather forecasting and has given up-to-the-minute weather data for operational planning. Data received from the satellites in orbit is now

provided regularly to the National Oceanic and Atmospheric Administration (NOAA). The DMSP satellites have also shown themselves to be an economical and effective means for tropical storm detection and tracking, especially in the Western Pacific.

The mission of the GPS program was to provide navigation and positioning information to users all over the world. As envisioned during this period, the system was to utilize 24 satellites in three subsynchronous orbits of eight satellites each. User equipment would be installed in aircraft, ships, and ground vehicles and in backpacks. This equipment would receive signals from the satellites and process the signals to provide precise, three-dimensional position and velocity information. Four NAVSTAR satellites were launched in 1978, and several types of user equipment were successfully tested with them during 1978 and 1979. Based on the results of the tests, the Secretary of Defense authorized full-scale development of GPS on 24 August 1979.

AIR FORCE SATELLITE CONTROL FACILITY (AFSCF)

After a satellite has been developed, built, and launched, it has to be monitored, tested, and controlled to insure its proper operation and optimum effectiveness. These functions are carried out by the Satellite Test Center at Sunnyvale, California, and by a worldwide network of tracking stations stretching from Greenland to the Seychelles. Both the Test Center and the tracking stations belong to the Air Force Satellite Control Facility (AFSCF), which was established on 1 July 1965. Originally a part of the Space Systems Division, the AFSCF was inherited by SAMSO when the latter organization was established on 1 July 1967.

SPACE AND MISSILE TEST CENTER (SAMTEC)

Along with the AFSCF, SAMSO inherited two other organizations from SSD--the 6595th Aerospace Test Wing (ATW) and the 6555th ATW. The 6595th was responsible for launching ballistic missiles and space boosters from Vandenberg AFB, California, and the 6555th had a similar responsibility at Cape Canaveral, Florida. Both units traced their participation in Air Force missile and space programs back to the 1950's, and the 6555th had the unique distinction of launching all Mercury and Gemini manned orbital missions without a single mishap or accident.

The two Test Wings were complemented by the Air Force Eastern Test Range (AFETR) and the Air Force Western Test Range (AFWTR), which tracked and monitored missiles and space boosters launched out of Cape Canaveral and Vandenberg. The Ranges were originally independent both of SAMSO and of one another, but this situation changed as time went by. On 1 April 1970, AFWTR was inactivated and replaced by the Space and Missile Test Center (SAMTEC), which was assigned to SAMSO. (In a related action, the 6595th ATW was reassigned from SAMSO to SAMTEC, and the 6555th ATW was redesignated an Aerospace Test Group (ATG) and reassigned to the 6595th ATW.) On 1 February 1977, AFETR was inactivated, and its personnel and resources were assigned to SAMTEC as SAMTEC's Detachment 1.

The actions of 1970 and 1977 brought together, in a single organization, functions that had previously been divided among several AFSC units. Responsibility for launching missiles and space boosters on both coasts and responsibility for monitoring and tracking those boosters was now under the overall control of SAMTEC, which in turn reported to SAMSO.

REORGANIZATIONS OF 1 OCTOBER 1979

The alignment described above was revised and made more logical on 1 October 1979. Both SAMTEC and its Detachment 1 were inactivated. An Eastern Space and Missile Center (ESMC) was created to conduct launches from Cape Canaveral and track and monitor the missiles and boosters that were launched. A parallel organization, the Western Space and Missile Center (WSMC), was created to carry out the same function at Vandenberg AFB. A third entity, the Space and Missile Test Organization (SAMTO), was activated at Vandenberg to coordinate the activities of the two Centers.

This reorganization, as important as it was, was overshadowed by an even more basic change that took place on the same date. SAMSO was inactivated, and its personnel and resources were divided between two new organizations--the Space Division (SD), with headquarters at Los Angeles AFS, and the Ballistic Missile Office (BMO), with headquarters at Norton AFB. (SAMTO and the AFSCF were assigned to Space Division.) As a result of this reorganization, space and missile activities, which had been linked together for most of the preceding 25 years, were divorced from one another. One era had ended and another had begun.

CHRONOLOGY

1954

27 January

Mr. Trevor Gardner, Special Assistant to the Secretary of the Air Force for Research and Development, recommended to Air Force Chief of Staff General Nathan Twining, that the Air Force ballistic missile program be substantially reorganized and that the "new" program be provided with centralized management authority. The change was recommended to minimize the existing complexities and to focus attention on the importance of the program.

8 February

A Rand Corporation memorandum by Dr. Bruno W. Augenstein indicated that the Atlas ballistic missile (Project MX-1593), then under development by Consolidated-Vultee Aircraft Corporation (Convair), could be operational by the early 1960s if the existing stringent performance criteria were relaxed while funding and program priority were increased.

10 February

The Strategic Missiles Evaluation ("Teapot") Committee, established in October 1953 and chaired by Professor John von Neumann, submitted its report on intercontinental strategic missiles then under development by the U.S. Air Force. The von Neumann Committee recommended changes similar to those outlined in the Rand study of 8 February. In addition, the report urged the establishment of a development-management group with sufficient authority, funds, and priority to reorient and accelerate the ballistic missile program.

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26 February

Trevor Gardner, Special Assistant to the Secretary of the Air Force for Research and Development, held a meeting in Washington for representatives of the Air Research and Development Command (ARDC), Headquarters USAF, certain former members of the von Neumann Committee, and concerned contractor personnel. Among the problems discussed was the manner of meshing the scientific and technical operations in ballistic missile development with the prime contractor who would actually build the missiles. Finally it was agreed that the scientific-technical group recommended by the Strategic Missiles Evaluation Committee would be placed under an industrial contractor or university and would be balanced by an "Air Force organization set up to supervise the whole show."

26 February

The Air Force issued a contract to North American Aviation for continued development of a liquid-fueled sustainer rocket engine for Convair's Project Atlas.

March

The Rocketdyne Division of North American Aviation began development of the liquid oxygen/hydrocarbon (LOX/RP-1) propulsion system for the Atlas. Previous work undertaken on the booster rocket engine for the Air Force's Navaho cruise guided missile (XSM-64) formed the basis for the Atlas engine development program.

1 March

The United States exploded its first "droppable" hydrogen bomb in the Marshall Islands. A second U.S. thermonuclear device was successfully tested on 20 March. These tests as part of Operation Castle confirmed the feasibility of the development of lightweight, high-yield thermonuclear weapons. This advance allowed the previously

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restrictive performance characteristics of the Atlas to be relaxed to the point where continued development was within the existing "state-of-the-art."

11 March

As a result of the 26 February meeting, Trevor Gardner submitted a plan for accelerating the intercontinental ballistic missile system (IBMS) program to Secretary of the Air Force Harold E. Talbott and Air Force Chief of Staff General Nathan Twining. The plan called for emergency funding and an operational capability as early as 1958-60. Mr. Gardner also recommended that high-ranking military officers be placed in charge of the revised program and specifically named Major General James McCormack, Jr., Vice Commander of ARDC, and Brigadier General Bernard A. Schriever, then Assistant for Development Planning, Deputy Chief of Staff/Development, Headquarters USAF, for the top positions.

16 March

The Air Force Council recommended to the Chief of Staff that the Atlas missile's performance specifications be relaxed so that the program could be accelerated as much as possible. It also recommended the use of Air Force funds to finance the program, a reorientation of the program to achieve the earliest possible operational capability, the assignment of program responsibility to Air Research and Development Command, and the establishment of a special development-management organization to recommend further measures to accelerate the entire Atlas program.

19 March

Air Force Secretary Harold E. Talbott directed General Twining to take all necessary actions to implement the Strategic Missiles Evaluation Committee's recommendations of 10 February and to accelerate the Atlas program.

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- 23 March General Nathan Twining, Chief of Staff of the Air Force, approved the Air Force Council's recommendations of 16 March.
- April Due to the continuing need for the best available scientific advice for the reorientation and acceleration of the Atlas program, Headquarters USAF established the Atlas Scientific Advisory Committee. Subsequently redesignated the ICBM Scientific Advisory Committee, this Committee was essentially a reconstitution of the former von Neumann Committee (Strategic Missiles Evaluation Committee) which had disbanded following the submission of its report on 10 February. The new Committee was also chaired by John von Neumann, but its membership was expanded and slightly different from the old "Teapot" Committee.
- 8 April Headquarters USAF established the new office of Assistant Chief of Staff for Guided Missiles (AFCGM) -- a clear indication of the importance now attached to the missile program by General Nathan Twining and the Air Force.
- 9 April In a memorandum to Secretary of the Air Force Harold E. Talbott, Deputy Secretary of Defense Roger M. Keyes stressed that the plans for the ballistic missile program "be formulated with a thoroughly realistic appraisal of the capabilities of our contractors to meet their commitments." He then emphasized that the program was to move forward "with all practicable speed."
- 14 April Trevor Gardner informed General Twining, Air Force Chief of Staff, that the 19 March memorandum from Secretary of the Air Force Harold E. Talbott and the

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Air Force Council's actions of 16 March were substantially in agreement on the proposed plan to accelerate Atlas. The program was to be reoriented, and its acceleration was to proceed at maximum possible effort with no limitation on funding. The accomplishment of the new program was to be the direct responsibility of a field office under a general officer who would have authority and control over all aspects of the program.

3 May

Headquarters Air Research and Development Command gave the Ramo-Wooldridge Corporation a new contract to continue research and experimental investigations that had been begun in support of the original von Neumann Committee in October 1953. Part of Ramo-Wooldridge's work involved technical evaluations and systems analyses of Project Atlas to be performed over a 12-month period and to be used for the redefinition of the program prior to its acceleration. In addition, conclusions and recommendations resulting from research completed under previous contracts were to be analyzed for possible future applications.

5 May

Brigadier General Bernard A. Schriever was appointed Assistant to the Commander of Air Research and Development Command, effective 1 June 1954.

14 May

General Thomas D. White, Air Force Vice Chief of Staff, informed Headquarters USAF offices and personnel that the Atlas program would be accelerated to the maximum extent that technology would permit. To insure the necessary support, the program was given the highest research and development priority in the Air Force (1-A), while it received a 1-2

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category and precedence rating and a S-1 supply priority. Field responsibility for the Atlas program during development and test would be assigned to Air Research and Development Command which would establish a field office on the west coast commanded by a general officer.

27 May

In addition to his other duties, Brigadier General Bernard A. Schriever was appointed Assistant for Project Atlas to the Director of Research and Development, Deputy Chief of Staff/Development, Headquarters USAF.

28 May

LtGeneral Donald L. Putt, DCS/Development, Headquarters USAF, informed his subordinates that Project Atlas had the highest program priority in the Air Force and that processing any aspect of the program took precedence over any other matters in the Air Force.

21 June

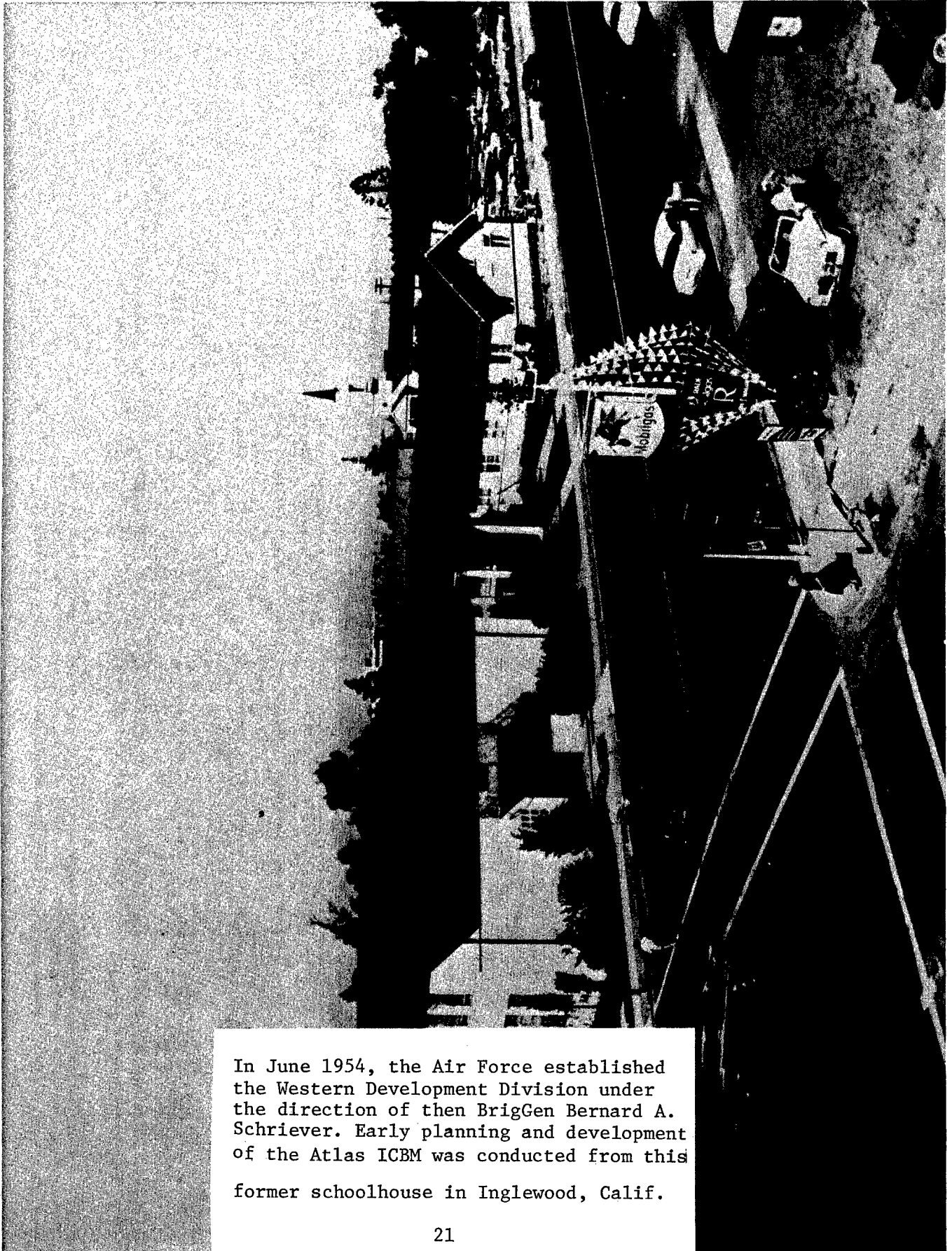
LtGeneral Donald L. Putt officially assigned the responsibility for reorienting and accelerating the Atlas program to Headquarters, Air Research and Development Command, and directed the establishment of an ARDC west coast field office. The general officer appointed to command the office was to be given authority and control over the entire Atlas program which already had been granted the highest priority in the Air Force on 14 May.

1 July

By verbal orders of LtGeneral Thomas S. Power, Commander, ARDC, the Western Development Division (WDD), Headquarters ARDC, was established at 409 East Manchester Boulevard, Inglewood, California, under the command of Brigadier General Bernard A. Schriever.

15 July

Headquarters ARDC General Order Number 42 confirmed LtGeneral Power's verbal orders of 1 July establishing the Western Development Division of Headquarters ARDC.



In June 1954, the Air Force established the Western Development Division under the direction of then BrigGen Bernard A. Schriever. Early planning and development of the Atlas ICBM was conducted from this former schoolhouse in Inglewood, Calif.

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20-21 July

The Air Force Atlas Scientific Advisory Committee--the former von Neumann Committee as reconstituted in April--met at the Western Development Division to discuss the reorientation of the Atlas program. The Committee expressed its dissatisfaction with Convair's lack of progress and noted some serious flaws in the company's technical and managerial approaches. After examining the project management structure proposed by WDD, the Committee unanimously concluded that it was weak and confused and that Convair was not strong enough to be given systems responsibility over the Atlas project. It was recommended that the project management structure, and especially Ramo-Wooldridge Corporation's role therein, be reevaluated and that a new, stronger approach be worked out. In addition, the Committee recommended that a second propulsion system contractor be introduced into the program as a back-up for North American.

29 July

Brigadier General Schriever was assigned full authority, responsibility, and accountability for the Atlas project and given status and prerogatives for a Deputy Commander, Air Research and Development Command, for all matters pertaining to Project Atlas.

2 August

General Schriever personally assumed command of the Western Development Division, Headquarters ARDC.

3 August

The Western Development Division took early action to accelerate the Atlas program when it gave North American Aviation the go-ahead to proceed with their rocket development program, including engine test stand construction and erection of an engine pilot plant.

6 August

Headquarters Air Materiel Command (AMC) announced the establishment of the Special Aircraft Project Office (SAPO)

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under the command of Colonel Harold T. Morris. SAPO was to begin operations in Inglewood, California, on 15 August, and would perform all procurement and contracting functions for the Western Development Division.

11 August

Headquarters USAF issued a "skeleton" general operational requirements, GOR Number 21 (SA-1C), for an intercontinental bombardment weapon system ballistic missile replacing the previous GOR Number 1 of 1 September 1952. The weapon system to satisfy this GOR was expected to emerge from the redefinition and acceleration of the Atlas program.

18 August

After completing an evaluation of possible management approaches, a special WDD study group recommended to General Schriever that the Ramo-Wooldridge Corporation be placed in a line position below the Western Development Division. In this position, the Ramo-Wooldridge Corporation would provide and be responsible for systems engineering and technical direction (SE/TD) for the entire Atlas project and for monitoring hardware development accomplished under Air Force contracts with industry.

23 August

General Schriever forwarded two important recommendations to Headquarters ARDC. First, he recommended that an alternate propulsion system contractor be introduced into the Atlas program as a back-up for North American Aviation. Second, he presented the results of the Atlas management study of 18 August and recommended Ramo-Wooldridge for the SE/TD role in the project.

8 September

Following approval by General Power, ARDC Commander, and General E.W. Rawlings, AMC Commander, Assistant Secretary of the Air Force for Materiel Roger Lewis approved the selection of the Ramo-Wooldridge Corporation to perform systems engineering

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and technical direction functions for Project Atlas under the overall control of the Western Development Division.

25 October

After further study, General Schriever recommended that the Convair program be continued because the company had the experience and could become the nucleus for the Atlas development team. Convair would handle airframe structural and aerodynamic aspects of the program along with the assembly of the vehicle and its components. The Western Development Division and the Ramo-Wooldridge Corporation would provide SE/TD for the Atlas contractor.

25 October

The early results of missile configuration studies conducted by Lockheed, the Glenn L. Martin Company, and the newly formed Guided Missile Research Division (GMRD) of Ramo-Wooldridge, supported by other Air Force studies, indicated the numerous advantages of a two-stage missile. Therefore, General Schriever recommended to LtGeneral Thomas S. Power, Commander, ARDC, that a second, or alternate, configuration and staging approach be introduced into the program to take full advantage of more advanced concepts and to stimulate competition.

28 October

The Western Development Division and the Special Aircraft Projects Office awarded a letter contract to North American Aviation for continued research and development of the liquid oxygen/RP-1 rocket engines for Atlas.

13 December

Air Force Procurement Authorization 54-GM-3 authorized \$3.6 million in P-150 production funding for Atlas. This was the first production funding for Atlas.

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- 4 January The Air Force ICBM Scientific Advisory Committee recommended that an alternate configuration and staging approach to the present Atlas missile be introduced into the ballistic missile program at an early date.
- 6 January A contract was awarded to the Convair Division of the General Dynamics Corporation for the development and fabrication of the Atlas (XSM-65) airframe and control system, the integration and assembly of the various subsystems with the airframe and control system, and for checkout and testing.
- 12 January General Schriever formally proposed to Hq ARDC that an alternate, two-stage configuration intercontinental ballistic missile (ICBM) be developed as a competitor and backup to the Atlas program.
- 14 January The Western Development Division (WDD) and the Special Aircraft Project Office (SAPO) awarded a contract to Aerojet-General Corporation for the development of a liquid oxygen-hydrocarbon propulsion system for possible use in the Atlas operational missile. The contract covered design and fabrication of booster, sustainer, and vernier engines and was intended to provide an alternate propulsion system should the North American Aviation effort encounter delays.
- 24 January WDD and SAPO selected the Lockheed Aircraft Corporation to be awarded a contract to design, construct, and flight test a reentry test vehicle (RTV), the X-17, that could carry suitable nose cone test bodies. As a result of this contract, the three-stage, solid-propellant X-17 was built to test experimental nose cones and to gather data on reentry phenomena. The

1955

RTV was primarily intended to facilitate the investigation of heat transfer at high mach and Reynolds numbers.

29 January

A formal, definitive contract between the Air Force and the Ramo-Wooldridge Corporation fixed the firm's responsibility for systems engineering and technical direction (SE/TD) support for the ICBM program and Project Atlas.

31 January

The Western Development Division and the Special Aircraft Project Office selected the AVCO Manufacturing Corporation to conduct theoretical and experimental investigations to obtain scientific information for the design of nose cone configurations and possible materials that could be used.

14 February

The Air Force awarded the Rocketdyne Division of North American Aviation a contract to fabricate and deliver 12 rocket engine propulsion systems for the Series A Atlas flight test missiles.

16 February

Massachusetts Institute of Technology (MIT) was awarded a contract for the research and development of an all-inertial guidance system, including development of the inertial and electronic components. AC Spark Plug Company was to work with MIT and would fabricate and test the completed guidance system.

24 February

The General Electric Company (GE) was given a contract to design, develop, and fabricate three complete ground-based tracking and command elements of the radio guidance system for Atlas.

1 March

Trevor Gardner, the Special Assistant to the Secretary of the Air Force for Research and Development, became the first Assistant Secretary of the Air Force for Research and Development.

3 March

Hq ARDC recommended to Hq USAF that an alternate configuration ICBM be authorized for development.

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- 12 April The Arma Division of American Bosch Arma Corporation received a contract to design, develop, fabricate, and test a complete airborne all-inertial guidance system for a ballistic missile system as a back-up to the MIT/AC Spark Plug effort.
- 21 April The Western Development Division published the first Development Plan for Atlas (WS107A).
- 28 April Secretary of the Air Force Harold E. Talbott approved development of an alternate ICBM.
- 2 May Hq USAF authorized ARDC to proceed with the selection of an alternate source for the development of the ICBM. The alternate airframe configuration was to be a two-stage missile, subsequently designated XSM-68, Titan (WS 107A-2).
- 25 May The Air Force awarded a contract to General Electric for research, design, and development of a prototype, full-scale nose cone for the Atlas reentry system.
- 25 May Headquarters USAF assigned responsibility for the development of a tactical ballistic missile (TBM) to the Western Development Division.
- 5 July Western Development Division gave the AVCO Manufacturing Corporation a contract to research, design, and develop a second, or back-up, reentry vehicle (nose cone) prototype for Atlas.
- 12 July General Operational Requirement (GOR) Number 104 was issued for a long-range intercontinental ballistic missile.
- 27 July Development Directive 76 was issued for an ICBM weapon system. The directive called for maximum acceleration of the Atlas program and confirmed the assignment of the highest Air Force priority to the project.

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28 July

President Dwight D. Eisenhower and the National Security Council (NSC) were given a complete briefing on the Atlas program by Assistant Secretary of the Air Force Trevor Gardner, Professor John von Neumann, and Brigadier General Bernard A. Schriever, Commander of the Western Development Division.

August

Lockheed's first attempt to launch its X-17 reentry test vehicle (RTV) at Cape Canaveral, Florida, was unsuccessful.

8 September

President Eisenhower and the National Security Council (NSC) declared that the Atlas missile, Weapon System 107A-1, had the highest research and development priority in the nation and that this would be changed only by Presidential action.

13 September

Trevor Gardner, Assistant Secretary of the Air Force for Research and Development, requested that a working group be formed to evaluate the ballistic missile program. Such an evaluation was necessary to assure that the administrative management and control procedures of the program would allow the full project acceleration as directed by President Eisenhower and the National Security Council on 8 September. Accordingly, a committee was established under Hyde Gillette, Deputy for Budget and Program Management, to evaluate these procedures and to recommend means for reducing administrative delays that might impede attainment of the earliest possible operational capability of Atlas.

14 September

After evaluating the Douglas Aircraft Company, Lockheed, and the Glenn L. Martin Aircraft Company proposals for the alternate ICBM, the Air Materiel Command (AMC) declared the Martin Company the winner of the competition to build the two-stage missile.

1955

- October Personnel of the Western Development Division and the Special Aircraft Project Office began moving from the "old schoolhouse" in Inglewood, California, to the Arbor Vitae complex near Los Angeles International Airport where they joined the Guided Missile Research Division (GMRD) of Ramo-Wooldridge Corporation.
- October North American Aviation test fired the first 60,000-pound thrust Atlas sustainer engine.
- 10 October General Thomas S. Power, Commander, ARDC, announced that the management responsibility for the advanced satellite system (WS 117L) would be transferred to the Western Development Division.
- 27 October The Glenn L. Martin Aircraft Company of Baltimore, Maryland, was given a contract authorizing the design, development, and testing of the two-stage Titan ICBM (XSM-68)--Weapon System 107A-2.
- November Ramo-Wooldridge Corporation purchased 41 acres of land at the southeast corner of El Segundo Boulevard and Aviation in El Segundo, California, and announced its plans to begin construction of new research and development facilities on the site by mid-1956.
- 8 November Secretary of Defense Charles E. Wilson approved the report of the Gillette Committee on simplifying administrative procedures for ICBM development programs. In accordance with the Committee's recommendations, Wilson established the Office of the Secretary of Defense Ballistic Missile Committee (OSD/BMC) with exclusive Department of Defense (DoD) authority to review and approve all ballistic missile program requirements. The existing Air Force ICBM Scientific Advisory Committee was also

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to advise the Secretary of Defense on ballistic missile matters. In addition, the Air Force was later authorized to undertake all actions necessary for the construction of ICBM operational bases.

8 November

Secretary of Defense Charles E. Wilson approved a compromise memorandum of the Joint Chiefs of Staff (JCS) recommending the concurrent development of two intermediate range ballistic missiles (IRBMs)--IRBM Number 1 by the Air Force and Number 2 as a joint Army-Navy effort. The former program later became the Thor (XSM-75) program, and the latter became the Jupiter (XSM-78) program.

14 November

In accordance with the Gillette Report and recent OSD decisions, Air Force Secretary Donald Quarles established the Air Force Ballistic Missile Committee (AF/BMC) with exclusive Air Force authority to review and approve all ballistic missile program requirements and plans. The Western Development Division was to submit annual development plans which, when approved, were to become the basis for programming, planning, budgeting, production, testing, and most other aspects of each ballistic missile program.

18 November

Hq USAF assigned Hq ARDC the mission of developing IRBM Number 1 and also that of achieving initial operational capability (IOC) with the new missile weapon systems. Hq ARDC subsequently reassigned these responsibilities to WDD.

December

The Western Development Division's Propulsion Group initiated a research program for a large-size, solid-propellant rocket motor.

December

The Western Development Division notified certain of its subsystem contractors to redirect part of their efforts to the recently authorized IRBM program. North American Aviation was to provide the propulsion system, AC Spark Plug was to

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work on an all-inertial guidance system, and Bell Telephone Laboratories on a radio guidance system and General Electric would handle the nose cone effort.

- December North American Aviation test fired the complete two-engine, 270,000-pound thrust Atlas booster propulsion package for the first time.
- 1 December President Eisenhower officially assigned highest and equal priority to the development of the Atlas and Titan ICBMs and the Thor and Jupiter IRBMs.
- 14 December On the basis of the Hq USAF directive of 18 November, General Thomas S. Power, ARDC Commander, amended the Western Development Division's mission to include responsibility for ICBM initial operation capability (IOC) and for the development of IRBM Number 1 on a priority second only to that of the ICBM program.
- 23 December The WDD-SAPO Source Selection Board chose the Douglas Aircraft Company as the airframe and assembly contractor for Weapon System 315A--the Thor (XSM-75) intermediate range ballistic missile.
- 27 December Following Hq USAF approval of its 23 December selection, the Western Development Division and SAPO awarded a contract to the Douglas Aircraft Company, Incorporated, for the development and fabrication of the airframe for the Thor IRBM (XSM-75) and assembly of the missile.

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- 20 January The Air Force ICBM Scientific Advisory Committee was transferred to the Office of the Secretary of Defense (OSD) to assure common interchange of technical information on all DoD missile programs. The Committee continued to act in an advisory capacity for the Western Development Division and the Air Force ballistic missile program.
- 23 January The Thor IRBM development program was given equal priority with the ICBM program.
- 30 January Headquarters ARDC directed WDD to treat the ICBM and IRBM with equal priority.
- 8 February Trevor Gardner, who was instrumental in the actions leading to the acceleration of the Air Force ballistic missile program two years earlier, resigned as Assistant Secretary of the Air Force for Research and Development to protest the Pentagon's policies concerning missiles and lack of stronger emphasis on the programs.
- 10 February Secretary of the Air Force Donald Quarles approved the Glenn L. Martin Aircraft Company proposal to move its development effort for Titan (XSM-68) from Baltimore, Maryland, to the Denver, Colorado, area.
- 15 February Responsibility for the advanced satellite system (WS 117L) was officially transferred from the Wright Air Development Center (WADC) to the Western Development Division.
- 25 February Major General Bernard A. Schriever, Commander of the Western Development Division, initiated a study of a mobile ICBM.

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- March North American Aviation delivered the first research and development, Series A booster engines to the Convair plant in San Diego, California, where the first Atlas missile was produced during the month.
- 15 March The AMC Special Aircraft Project Office (SAPO) was redesignated the Ballistic Missiles Office (BMO), and Brigadier General Ben I. Funk assumed command.
- 27 March Secretary of Defense Charles E. Wilson created the Office of the Special Assistant for Guided Missiles to establish more centralized control and to assist in coordination of Army, Navy, and Air Force missile programs. Mr. E. V. Murphree was appointed to head the new office.
- 13 April As per authority of the Air Force Ballistic Missile Committee (AF/BMC), Procurement Authorization 56-GM-20 increased the production funding for guided missiles to \$279.05 million.
- 23 April Colonel Osmond J. Ritland became the first Vice Commander of the Western Development Division.
- May The Rand Corporation reported on the feasibility of a lunar instrument carrier using the Atlas as a booster vehicle.
- 28 May Aerojet-General conducted the first test firing of a 150,000-pound thrust engine subassembly of the XLR-87-AJ-1 liquid rocket engine that would be used in the Titan's first stage.
- June The Rocketdyne Division of North American Aviation delivered the first 135,000-pound thrust, MB-1 Thor research and development engine to the Douglas Aircraft Company.

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- 15 June North American Aviation delivered the first production type, Series A XSM-65 Atlas engine to Convair. The early Series A booster engines had a nominal thrust of 270,000-pounds while later versions were increased to 300,000-pounds.
- July The Air Force Ballistic Missile Committee (AF/BMC) transferred the solid-propellant research program from the Western Development Division to the Wright Air Development Center at Wright-Patterson AFB, Ohio.
- July The Rocketdyne Division of North American Aviation completed the first test firing of the 360,000-pound thrust, three-engine propulsion cluster (MA-1) for the Atlas missile.
- 3 July The Air Force Ballistic Missile Committee (AF/BMC) withheld approval of WDD's proposed initial operational capability (IOC) program until a further review was completed as part of the Eisenhower administration's economy drive. Austerity in facilities and reductions in military objectives were recommended. Secretary of the Air Force Donald Quarles and the AF/BMC directed the Western Development Division to adopt a "poor man's approach" when working out the alternate IOC program.
- 9 July The Western Development Division began studying hardened bases for ICBM operational deployment.
- 17 July The first Lockheed X-17 reentry test vehicle (R-2) to complete a successful flight was launched from Cape Canaveral, Florida.
- August The first full-duration, 300-second firing of the North American Aviation 60,000-pound thrust sustainer engine

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for Titan was successfully completed. During the month, Aerojet-General completed maximum duration test firings of the Titan booster engines (XLR-87-AJ-1) for 130 seconds and the sustainer engine (XLR-91-AJ-1) for 155 seconds.

27 August

The first static test firing of a Thor engine was conducted at the rocket engine test facilities at the Air Force Flight Test Center (AFFTC), at Edwards AFB, California.

29 August

Atlas missile 1A was conditionally accepted by the Air Force and delivered to the Convair Sycamore Canyon Test Site for checkout prior to captive testing.

September

The first Thor IRBM flight test missile was assembled in the Douglas plant in Santa Monica, California.

1 September

Secretary of the Air Force Donald Quarles approved the location of ICBM and IRBM operational and training facilities at Camp Cooke, California, contingent upon approval by higher authorities.

27 September

Secretary of the Air Force Donald Quarles rejected WDD's FY 1958 ballistic missile program budget submitted to the Air Force Ballistic Missile Committee by Major General Bernard A. Schriever, Commander of WDD. Secretary Quarles directed a cut from the recommended \$1.672 billion on a maximum of \$1.3 billion and advised a restudy of IOC planning.

28 September

Atlas missile 2A was accepted by the Air Force and delivered to Edwards AFB, Test Stand 1-A, for checkout prior

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to captive test firings scheduled for early 1957.

- October The Western Development Division cancelled the North American Aviation development effort on a back-up sustainer engine for Titan's second stage when tests and technical analyses indicated that Aerojet-General XLR-91-AJ-1 would satisfy the specifications for the required engine.
- October WDD decided to eliminate the inertial platform from the Bell Telephone Laboratories (BTL) radio inertial guidance system for Titan and Thor. This action significantly reduced the cost and complexity of the system.
- 18 October A Tactical Air Command (TAC) C-124 "Cargomaster" delivered the first Thor IRBM flight test missile, Number 101, to the Air Force Missile Test Center (AFMTC) at Patrick AFB, Florida.
- 29 October Lockheed Missile Systems Division was awarded a contract as the prime contractor for the development of the military satellite system (WS 117L) and its associated Hustler (later redesignated Agena) upper stage vehicle.
- 6 November Brigadier General Osmond J. Ritland, WDD Vice Commander, ordered planning to be conducted on how to harden the Titan operational missile sites.
- 10 November The revised WDD ballistic missile development plan was submitted to Secretary of the Air Force Donald Quarles and the Air Force Ballistic Missile Committee. Cuts were made in force structure, and the budget was reduced to \$1.335 billion as already approved by the Air Council. AFBMC also approved the new submission and passed it on to the

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Office of the Secretary of Defense
Ballistic Missile Committee (OSD/
BMC) for consideration.

16 November

Defense Secretary Charles E. Wilson approved transfer of the northern portion of Camp Cooke from the Department of the Army to the Air Force for use as the first operational prototype missile base.

26 November

Secretary of Defense Charles E. Wilson issued a memo to the Armed Forces Policy Council to end the argument between the Air Force and Army on responsibility for missile programs. In an effort to settle the areas of jurisdiction for the services, Secretary Wilson ruled that all long-range missiles, ICBMs as well as IRBMs, with a range of more than 200 miles, would be given to the Air Force.

30 November

Atlas missile 4A, the first flight test vehicle, was delivered to the USAF at Convair's San Diego plant. It was then transported by truck to the Missile Test Center in Florida.

December

Secretary of Defense Charles E. Wilson, Secretary Quarles, and the OSD/BMC approved the \$1.335 billion budget submitted by WDD for FY 1958. Subsequently, however, this approved budget was cut to \$1.135 billion by OSD in an effort to reduce the overall FY 1958 funding requirements of the Air Force.

21 December

Atlas missile 1A made its first captive test firing at Convair's Sycamore Canyon captive test facility.

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- 10 January The Defense Department assigned the highest priority to ICBM/IRBM contracts and purchase orders to expedite the programs.
- 18 January Aerojet-General conducted the first firing of a complete, two-chamber Stage I prototype engine (XLR-87-AJ-1) for the Titan ICBM.
- 22 January A definitive contract was signed with the Glenn L. Martin Company for the continued development and production of Titan missiles.
- 25 January The first attempt to launch a Thor flight test missile from the Air Force Missile Test Center (AFMTC) at Cape Canaveral failed when the vehicle lost thrust immediately after liftoff, dropped back on the pad and exploded. This initial launch attempt came only 13 months after the development contract with Douglas was signed and had been intended to demonstrate the basic missile configuration.
- 5 February The Western Development Division authorized Ramo-Wooldridge's Guided Missile Research Division to initiate studies of second generation ballistic missiles and space vehicles.
- March The first full-duration firing of the prototype XLR-87-AJ-1 Stage I engine for Titan was completed.
- March WDD began feasibility studies on a missile launch detection alarm system (MIDAS) satellite that would provide early warning of hostile missile launches.
- 18 March The first operational elements of the ballistic missile program were established when Headquarters ARDC redesignated Headquarters, 1st Air Division, as Headquarters, 1st Missile

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- Division, at Los Angeles, California. Headquarters, 392d Air Base Squadron, was reconstituted as Headquarters, 392d Air Base Group, at Camp Cooke, California, effective 15 April 1957. Both units were assigned to WDD.
- 1 April Headquarters, Air Research and Development Command assigned responsibility for weapon system planning and management for the solid-propellant missile to the Western Development Division.
- 15 April Headquarters, 1st Missile Division, was established at Los Angeles, California, and Headquarters, 392d ABG was established at Camp Cooke, Lompoc, California. These initial ballistic missile initial operational capability (IOC) and training units were assigned to WDD.
- 19 April The second Thor flight test missile launched on the Atlantic Missile Range (AMR) was successful until the Range Safety Officer (RSO) accidentally destroyed the missile.
- 6 May The Air Force Ballistic Missile Committee approved the use of Francis E. Warren AFB, Wyoming, as the second operational prototype base in the Atlas initial operational capability (IOC) program.
- 1 June The Western Development Division, Headquarters, ARDC, was redesignated the Air Force Ballistic Missile Division (AFBMD), Headquarters, ARDC, without change of station.
- 11 June The first Atlas Series A flight test missile (4A) had to be destroyed shortly after launch from Cape Canaveral due to a booster engine shutdown and loss of thrust. From a technical standpoint, however, this

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first booster-only launch successfully demonstrated the launching mechanism, structural integrity of the airframe, subsystems performance, and operating procedures for launch crew personnel.

1 July

Headquarters, 704th Strategic Missile Wing (SMW), was activated and established at Cooke AFB, California, and assigned to AFBMD.

15 July

Headquarters, 1st Missile Division, was relocated to Cooke AFB, California, from AFBMD headquarters at Los Angeles.

27 July

Colonel Charles H. Terhune, Jr., Deputy Commander for Ballistic Missiles, AFBMD, directed the establishment of a small Solid Weapon System Office to continue development efforts on a solid-propellant ballistic missile system.

29 July

AFBMD presented the Air Force Scientific Advisory Board's Ad Hoc Committee with a summary of follow-on ballistic missile weapon systems and advanced space programs that could be undertaken. Included among the programs was the proposed development of high-thrust space vehicles for orbital and lunar flights.

1 August

The National Security Council approved a Defense Department recommendation to reorient and cut back the ballistic missile programs. Atlas retained its priority, but the Titan program was reduced to second priority. The Thor and Jupiter IRBM programs were to be combined and evaluated by a joint Office of the Secretary of Defense-Air Force-Army Committee that would choose between them for future development.

9 August

In an attempt to reduce program costs, Defense Secretary Charles E. Wilson curtailed the planned production rates for Atlas, Titan, and Thor missiles to four missile each per month for the ICBMs and two per month for Thor through December 1958. He also requested a study of the effects of a monthly production rate of 2-2-2 for the three programs.

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- 16 August Secretary of Defense Charles E. Wilson directed that the ICBM program be limited to a maximum monthly production of four Atlas and two Titan missiles rather than the "4-4" program ordered on 9 August. With other areas also reduced, the Titan program became essentially a research and development effort.
- 30 August The fourth Thor (#104) missile broke up and exploded 96 seconds into its flight.
- 11 September The Air Force Ballistic Missile Committee reviewed the revised AFBMD FY 1958 program that resulted from OSD decisions and directives of August that cut the program from \$1.135 billion to \$944 million. A 4-4-2 monthly production rate was approved for Atlas, Titan, and Thor missiles, and program slippages were accepted in response to Secretary Wilson's guidance of 9 August. The program was later submitted to OSD/BMC and approved on 5 October 1957.
- 20 September After four failures, the fifth Thor flight test missile (#105) successfully demonstrated all on-board systems. The engine operated 137 seconds to automatic shutdown, and missile impacted 1,300 nautical miles down range from Cape Canaveral.
- 25 September The second Atlas flight test missile (6A) was destroyed 32 seconds into the flight because of an engine shutdown.
- October The first production version of the XLR 87-AJ-1 Stage I engine for Titan was delivered by Aerojet-General.
- 4 October The Soviet Union employed an inter-continental ballistic missile to place the first man-made satellite, Sputnik I, into earth orbit.
- 5 October Secretary of Defense Charles E. Wilson approved the revised AFBMD ballistic missile program submitted to the Air Force Ballistic Missile Committee on 12 September. A total of \$991 million was

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approved--\$437 million for Atlas, \$335 million for Titan, and \$148 million for Thor. AFBMD's original FY58 budget submission of October 1956 had requested \$1.672 billion for the ballistic missile programs.

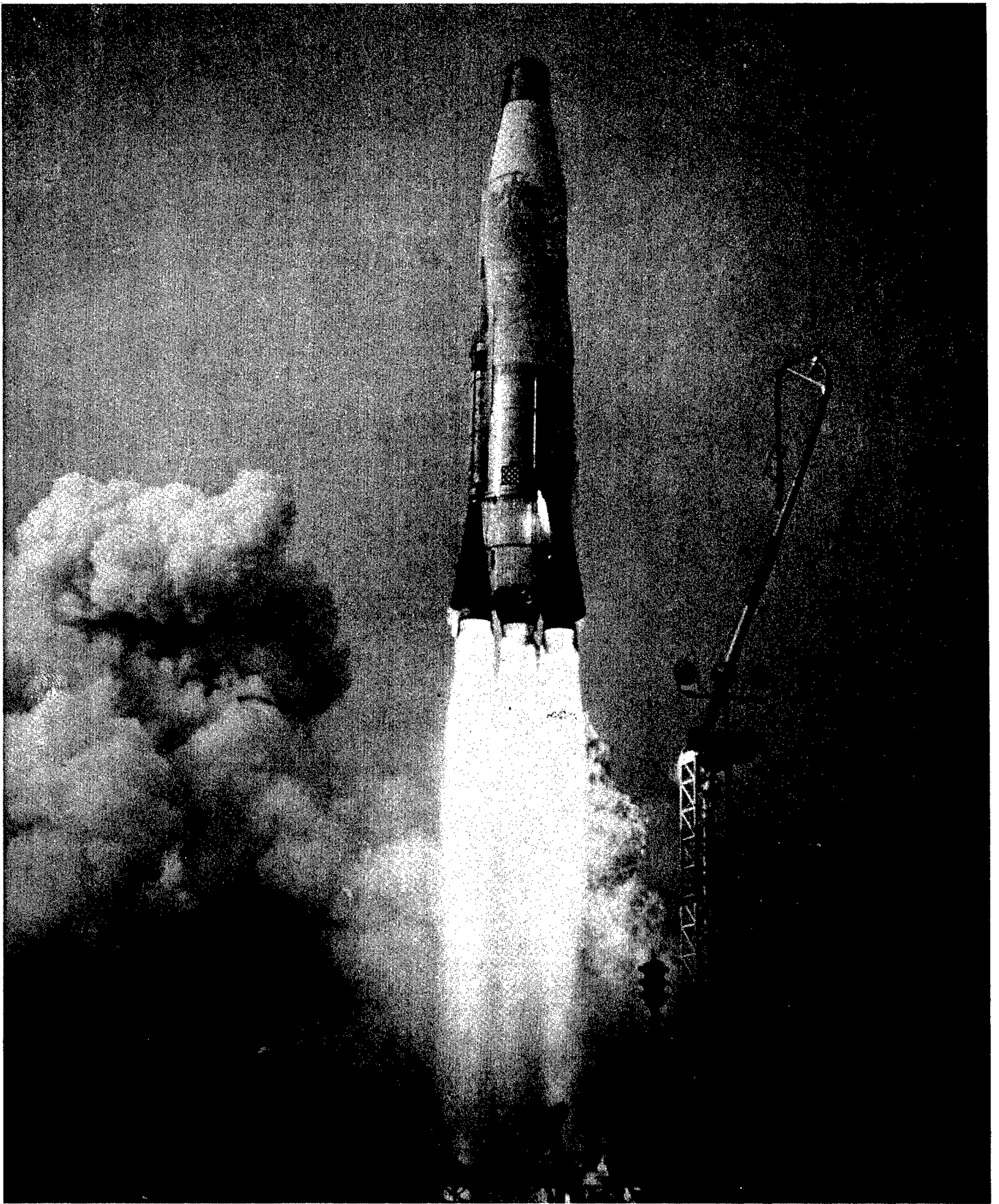
- 5 October In anticipation of directives to revise the objectives of the United States missile programs in light of the Russian success with Sputnik, AFBMD began studies for reprogramming and accelerating its ballistic missile programs.
- 6 October The Defense Department removed the restrictions placed on missile production on 16 August, while the production rates and operational deployment schedules were revised.
- 9 October The Air Force Scientific Advisory Board's Ad Hoc Committee on Advanced Weapons Technology and Environment urged development of second generation ballistic missiles for use as weapon systems and space boosters. After that, priority was recommended for development of military satellite systems for communications, weather prediction, and other purposes. In addition, the Committee recommended that the Air Force Ballistic Missile Division be recognized as a permanent organization for ballistic missile and space satellite projects.
- 11 October The second successful Thor flight test missile was launched from Cape Canaveral, Florida, and attained its design range of 1,500 miles.
- 24 October In its first long-range flight, a Thor missile launched from Cape Canaveral completed a 2,645-mile flight down the Atlantic Missile Range.
- November The Aerojet-General Corporation delivered the first R&D XLR 91-AJ-1 Stage II engine for Titan.
- 4 November The Guided Missile Research Division (GMRD) of the Ramo-Wooldridge Corporation was renamed Space Technology Laboratories (STL).

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- 5 November Colonel Edward N. Hall was relieved of his primary duty as Director, WS 315A (Thor), and assigned primary duty as Director for the Solid Ballistic Weapon System at Air Force Ballistic Missile Division headquarters.
- 12 November Headquarters USAF asked the Defense Department to approve a space program that would provide an early demonstration of space capability and a developmental test vehicle for larger satellite systems. Three Thor IRBMs could be made available for use in such development programs provided they did not interfere with the IRBM program.
- 13 November Major General Bernard A. Schriever, AFBMD Commander, directed preparation of a plan for a program leading to the development of man-carrying vehicle systems for space operation.
- 14 November Headquarters USAF presented its revised and augmented program for ballistic missile development to the Secretary of Defense and the Armed Forces Policy Council. Nine Atlas squadrons were proposed, the first to become operational in June 1959 and the ninth in June 1963 and eight Titan squadrons, the first to be operational in March 1961 and the last in June 1963.
- 15 November Mr. William A. Holaday, Special Assistant for Guided Missiles, OSD, was named Director of Guided Missiles by the newly appointed (9 October) Secretary of Defense, Neil H. McElroy. As Director of Guided Missiles, Mr. Holaday was to direct all Defense Department activities related to guided missile research, development, engineering, production, and procurement.
- 19 November AFBMD was assigned management responsibility for the Ballistic Missile Early Warning System (BMEWS), WS 224A, then being developed to provide warning of any Soviet ICBM attack over the polar regions.

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- 20 November Headquarters USAF instructed the Air Research and Development Command to prepare by 1 December an astronautics program including funding estimates. A complete review of present space programs and projected developments were to be included.
- 21 November The Air Force announced that the first Atlas ICBM operational base and strategic missile squadron would be located at Francis E. Warren AFB, Wyoming.
- 29 November As a result of aroused national interest in the progress of missile development caused by the Soviet Sputniks, General Thomas D. White, Air Force Chief of Staff, announced that ballistic missile operational capability would be accelerated by transferring ballistic missile operational programs as well as IOC facilities and planning from AFBMD to the Strategic Air Command (SAC) as of 1 January 1958. Ballistic Missile logistic support was assigned to the Air Materiel Command's San Bernardino Air Force Depot, Norton AFB, California.
- 29 November President Dwight D. Eisenhower recommended to Congress the formation of an Advanced Research Projects Agency (ARPA) in a Defense Department reorganization proposal. The new agency would provide unified Defense Department direction and management of certain advanced research and development projects.
- 7 December Mr. William M. Holaday, DoD Director of Guided Missiles, directed the Air Force to proceed with the operational deployment of four squadrons each of Thor and Jupiter IRBMs beginning in December 1958.
- 9 December An Avco Manufacturing Corporation proposal for a manned satellite system was forwarded to the Air Force. Avco recommended a Titan booster to be used to place a manned satellite in a 110-nautical mile earth orbit.



An early Air Force Atlas missile thunders off the pad at Cape Canaveral, Florida, leading the way to development of technologies urgently needed for several families of missiles in the 1950s.

1957

- 16-17 December The Air Force Scientific Advisory Committee reviewed Air Force plans for advanced ballistic missile and space programs and recommended that AFBMD manage space technology development.
- 17 December The third flight test missile (12A) became the first successful Atlas Series A missile flight. A short-range, booster-only flight was completed with the booster impacting 575 miles down range from Cape Canaveral. During the flight, all systems performed satisfactorily.
- 19 December The Ballistic Missile Site Selection Panel recommended that the first Titan (SM-68) operational wing be located in the area of Denver, Colorado.
- 19 December The eighth Thor flight test missile, the fourth success, completed the first fully-guided flight using an all-inertial guidance and control system.
- 26 December Headquarters ARDC notified AFBMD that the responsibility for the IOC phase of the ballistic missile program was to be transferred to SAC effective 1 January 1958.
- 31 December SAC and Air Force Ballistic Missile Division signed a memorandum of understanding that provided for the orderly transfer of functions, personnel, units, and bases as part of the transfer of IOC responsibility from ARDC/AFBMD to SAC.

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- 1 January Responsibility for ballistic missile IOC was transferred from ARDC (AFBMD) to SAC. Cooke AFB along with Hq 1st Missile Division, Hq 392d Air Base Group, and Hq 704th Strategic Missile Wing were also transferred to SAC. At Cooke AFB, AFBMD retained responsibility for construction of technical facilities as well as research and development activities. At Los Angeles, the entire staff of AFBMD's Deputy Commander for Plans and Operations, under Colonel William R. Large, Jr., was transferred to man the new Office of the Assistant Commander-in-Chief, SAC (SAC/MIKE), that was established at AFBMD to manage IOC activities.
- 3 January AFBMD recommended to Hq USAF that an early space capability be developed through use of a Thor booster and a modified Vanguard second stage. This combination was to become the Thor/Able booster vehicle.
- 6 January Hq ARDC proposed to Hq USAF the initiation of a program for development of an experimental exploratory space vehicle. This subsequently became the Centaur high-energy upper stage program.
- 6 January Lockheed proposed the acceleration of WS 117L by using Thor boosters and Agena upper stages.
- 22 January LtGeneral Samuel E. Anderson, Commander, ARDC, expanded the AFBMD mission to include improvement of the basic ballistic missile models, future missile systems, and certain space systems.
- 29 January The Defense Department announced plans to establish the Pacific Missile Range (PMR) as part of the Naval Air Missile Test Center at Point Magu, California, and as a national range to be designed for long-range guided missile and ICBM testing.

1958

31 January

The Air Force invited the National Advisory Committee for Aeronautics (NACA) to take part in a program to develop a research vehicle that would explore and solve the problems of manned space flight. The Air Force wanted to achieve the earliest possible manned orbital flight so that the information gained would contribute to subsequent development of scientific and military space systems.

1 February

Secretary of the Air Force James H. Douglas urged Secretary of Defense Neil H. McElroy to approve Air Force use of Thor missiles to boost test satellites into orbit before the end of the year.

3 February

President Eisenhower directed the highest and equal national priority for Atlas, Titan, Thor, Jupiter, the WS 117L advanced military satellite system, and WS 224A Ballistic Missile Early Warning System (BMEWS). This action returned the Titan program to its previous highest national priority status.

7 February

Secretary of Defense Neil H. McElroy activated the Advanced Research Projects Agency (ARPA) and appointed Roy W. Johnson as its first Director. ARPA was placed in charge of all DoD space programs during their research and development phases.

8 February

Colonel Edward N. Hall, Director of the Weapon System "Q" Project Office at AFBMD, recommended an immediate start for a program that would provide a solid-propellant ICBM force by 1965.

10 February

Secretary of the Air Force James H. Douglas, Jr., recommended that the solid-propellant ballistic missile be phased into the Air Force weapons inventory in FY 1963.

10 February

Headquarters ARDC notified AFBMD of the instructions for planning a space

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program. When Defense Department approval was gained, the division was to proceed with development of a ballistic research and test system (WS 609A, Blue Scout) that would satisfy most research flight requirements. Also, the Thor was to be used as a booster for the Able reentry tests, recoverable satellites, and a moon impact mission.

- 15 February AFBMD submitted the first development plan for the solid-propellant Weapon System "Q" to the Air Force Ballistic Missile Committee. Weapon System "Q" was subsequently redesignated Minuteman.
- 27 February Secretary of Defense Neil H. McElroy approved Air Force research and development efforts for the three-stage, solid-propellant Minuteman ICBM.
- 28 February Headquarters USAF authorized AFBMD to proceed with research and development of the Minuteman.
- 4 March Headquarters ARDC assigned Weapon System Number WS 133A to Minuteman and later the new system was given Strategic Missile Number 80 (SM-80).
- 12 March Headquarters USAF limited the WS 133A program to essential research and development, with approval of a full-scale solid-propellant ICBM to await an evaluation of Polaris and WS 133A potentials.
- 15 March American Arma Bosch was awarded a contract to develop and produce an all-inertial guidance system for the Titan ICBM.
- 31 March Major General Bernard A. Schriever, AFBMD Commander, directed the preparation of a development plan for a full-scale manned military space systems program. The ultimate objective of the program was a manned flight to the moon and return to earth.

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- 2 April President Dwight D. Eisenhower proposed to Congress the establishment of a National Aeronautics and Space Agency which would absorb the existing National Advisory Committee on Aeronautics (NACA).
- 2 April Major General B.A. Schriever, Commander, AFBMD, recommended to LtGeneral Samuel E. Anderson, ARDC Commander, that the Air Force Ballistic Missile Committee be advised to seek complete corporate separation of Ramo-Wooldridge Corporation and Space Technology Laboratories (STL).
- 3 April President Eisenhower recommended to Congress the creation of the Office of the Director of Defense Research and Engineering (ODDR&E) that would have more rank and authority than, as well as replace, the present Assistant Secretary of Defense for Research and Engineering (ASD/R&E).
- 9 April The Space Technology Laboratories (STL) was made responsible for SE/TD of the Minuteman program.
- 10 April President Dwight D. Eisenhower reaffirmed the highest and equal national priority for Atlas, Titan, Thor, and Jupiter.
- 23 April The first Thor/Able missile, a special test vehicle designed to examine an improved General Electric lightweight, ablative nose cone at full ICBM ranges, was composed of the basic Thor IRBM as the first stage and a modified Vanguard second stage. The missile had to be destroyed 146 seconds after launch from Cape Canaveral, Florida, due to an engine explosion caused by failure of the first stage turbopump system.

1958

- 25 April AFBMD published the first development plan for an Air Force manned military space system program that would be designed to achieve an early manned lunar landing and safe return to earth.
- May The Air Force accepted the first operational Thor IRBM (SM-75).
- May Headquarters ARDC recommended initiation of a development program for a liquid hydrogen fueled rocket engine (Centaur program) that would be incorporated in the WS 117L advanced satellite system program.
- 2 May AFBMD's second man-in-space development plan concentrated on the first phase of the manned lunar program, designated "Man-In-Space-Soonest."
- 20 May The Air Force and the National Advisory Committee for Aeronautics (NACA) agreed to the development and testing program for the Air Force's hypersonic boost-glide vehicle, Dyna-Soar.
- 21 May Headquarters USAF announced that Lowry Range near Denver, Colorado, would be the first operational site for the Titan missiles (SM-68) that were to be built in Martin's Denver plant.
- 26 May American Bosch Arma Corporation's contract for an all-inertial guidance system was transferred from the Titan (XSM-68) development program to Atlas (XSM-65) that was to become operational sooner. The Bell Telephone Laboratories (BTL) radio-guidance system would be used on all Titan research and development missiles and for the first four Titan operational squadrons.
- 3 June The final Series A Atlas missile (16A) was launched from Cape Canaveral. Of the eight research and development launches, five had been failures, but each had provided vast quantities of important data.

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- 4 June The first Air Force Thor IRBM flight test missile (Number 115) to be fired from a tactical-type launcher was launched at Cape Canaveral. The missile completed a successful flight, impacting 1,170 nautical miles downrange. This was also the first Thor to be launched without a flight readiness firing of its propulsion system.
- 12 June The Air Force recommended to the OSD Ballistic Missile Committee that the last seven Atlas squadrons be in a dispersed 3x3 configuration and that the last five squadrons be hardened to 25 pounds per square inch. The Air Force also recommended that the missiles in the last five squadrons be equipped with an all-inertial guidance system. The Committee approved these recommendations on 19 August.
- 13 June In an agreed draft revision of its "Man-In-Space-Soonest" development plan, AFBMD proposed the use of an Atlas D booster to put the first manned spacecraft into a 115-NM orbit during April 1960 rather than October 1960. If Atlas D performance were not sufficient, an Agena or Vanguard second stage would be added.
- 16 June The Air Force awarded Phase I development contracts for the Dyna-Soar boost-glide orbital spacecraft to the Martin Company and Boeing Airplane Company.
- 16 June The Pacific Missile Range (PMR) was officially established under Navy management at Point Mugu.
- 17 June The Air Force accepted delivery of the first Titan missile (A-1) from the Martin Company's Denver Division.
- 18 June Mr. William M. Holaday, DoD Director of Guided Missiles, approved "Minuteman" as the popular name for WS 133A (SM-80).

1958

- 30 June AFBMD was notified that the Secretary of Defense Neil H. McElroy had given ARPA responsibility for development of the military satellite system (WS 117L).
- 9 July The second Air Force Thor/Able reentry (nose cone) test vehicle, testing a GE ablation-type nose cone, was launched from Cape Canaveral and completed a 6,000-mile flight down the Atlantic Missile Range. While the nose cone was not recovered, this was the first U.S. reentry vehicle to make a full-range ICBM flight and reentry.
- 18 July Headquarters USAF approved the Minuteman source selections of Thiokol Chemical Corporation, Aerojet-General Corporation, and Hercules Powder Company as the propulsion contractors for the solid-fuel motors. Avco Corporation was chosen as the reentry vehicle (nose cone) developer, and Autonetics Division of North American Aviation was selected as inertial guidance and control (G&C) system contractor.
- 19 July The initial Atlas Series B missile flight test vehicle (3B) malfunctioned and broke up 60 seconds after launch from the Air Force Missile Test Center at Cape Canaveral. To the basic Series A airframe, the Series B missiles added the complete North American Aviation MA-1 propulsion cluster of booster and sustainer engines, General Electric's Mod II airborne radio inertial guidance system (open loop), and GE's Mark II nose cone.
- 23 July In its second successful flight test, the Thor/Able (Number 119) advanced reentry test vehicle demonstrated proper

1958

reentry of the advanced General Electric ablative nose cone during a 5,300-mile test flight. Two successful tests established the two-stage Thor/Able as a reliable vehicle for further special test programs. This allowed the Air Force and other government agencies to complete plans for more advanced space programs.

28 July

Deployment of Titan squadrons in a 3x3 hardened and dispersed configuration was approved for the Lowry, Ellsworth, and Mountain Home squadrons.

29 July

President Eisenhower signed House Bill 12575, the National Aeronautics and Space Act of 1958, establishing the new National Aeronautics and Space Administration (NASA). As the civilian agency designated to control peaceful exploitation of space, NASA would assume control of all space programs except those with a specific military requirement.

1 August

Headquarters ARDC organized the 6593d Test Squadron (Special) at Hickam AFB, Hawaii, and attached it to AFBMC for administrative and operational control.

1 August

The Autonetics Division of North American Aviation was awarded a contract to develop the Minuteman inertial guidance and control (G&C) system.

2 August

Flight test missile 4B was the first Atlas Series B missile to be launched successfully and the first ICBM to complete staging. Its 2,500-mile powered flight was the first time that the MA-1 propulsion cluster operated for the planned duration of flight.

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6 August

The last of 18 Thor research and development flight test missiles was launched from Cape Canaveral. Only seven of the 18 launches were categorized as successes while 11 were failures.

6 August

Headquarters USAF issued General Operational Requirement (GOR) 171 that established an Air Force requirement for an economical, quick-reaction, solid-propellant or storable liquids ICBM weapon system. Initial operational capability (IOC) was set as FY1963. The Minuteman (WS 133A) was intended to fulfill this requirement.

17 August

An Air Force Thor/Able II launch vehicle, carrying the first U.S. International Geophysical Year (IGY) lunar payload, exploded 77 seconds after liftoff from Cape Canaveral because of a first-stage engine failure.

22 August

Largely as a result of the successful Thor/Able reentry tests, Brigadier General Osmond J. Ritland, AFBMD Vice Commander, reoriented the Division's reentry vehicle research and development program. Avco was directed to cancel its work on a copper "heat sink" reentry vehicle. General Electric's Mark II copper "heat sink" nose cone would be used on Thor IRBMs and early model Atlas ICBMs. Moreover, GE was assigned to start work on lightweight, second generation nose cones for heavier warheads.

26 August

After examining contractor proposals for a communications satellite relay project since September 1957, Headquarters ARDC presented its original strategic communications satellite development plan to Headquarters USAF and the Advanced Research Projects Agency (ARPA).

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- 26 August LtGeneral Samuel E. Anderson, Commander, ARDC, notified Air Force Vice Chief of Staff, General Curtis E. LeMay, that he had instructed AFBMD to establish and man an organizational element for space systems development because of the increased Air Force concern with military space programs.
- 29 August ARPA issued order Number 19-59 establishing the Centaur program that would provide a high energy, liquid-fuel upper stage for use with either the Atlas or Titan boosters. Pratt and Whitney was to develop the liquid oxygen/liquid hydrogen engines for the upper stage vehicle to be developed by Convair/Astronautics. The development goal was to produce an upper stage vehicle that could place a satellite into a 24-hour, synchronous orbit 23,000 miles above the equator.
- September As the Air Force began studying the feasibility of a mobile ballistic missile system, Major General Bernard A. Schriever directed AFBMD to investigate the possibility of a mobile version of the new solid-propellant Minuteman ICBM.
- September Colonel Otto J. Glasser became Director, WS 133A Project Office, at AFBMD, replacing Colonel Edward N. Hall.
- 4 September The Transit and TIROS satellite programs were initiated with booster responsibilities assigned to AFBMD. Transit was a navigation satellite, while TIROS (Television Infrared Observation Satellite) was to take television pictures of cloud cover and transmit meteorological information for relay to ground stations.
- 12 September In recognition of the increased demands of the new military space programs, AFBMD revised its organizational structure to form four deputy commander

1958

positions--Ballistic Missiles, Installations, Resources, and the new Military Space Systems.

- 12 September As part of an overall Air Materiel Command restructuring, the Ballistic Missiles Office (BMO) was redesignated the Ballistic Missiles Center (BMC).
- 19 September The Minuteman reentry vehicle contract was formally awarded to the Avco Manufacturing Corporation.
- 1 October The National Aeronautics and Space Administration (NASA) was formally organized and began operation as the government agency in charge of the national civilian space program.
- 4 October Cooke AFB, California, was formally redesignated Vandenberg AFB in memory of the late Air Force Chief of Staff, General Hoyt S. Vandenberg (1899-1954).
- 9 October The Boeing Airplane Company was selected as the assembly and test contractor for the Minuteman missile.
- 11 October A Thor/Able launched the NASA Pioneer I, the first successful space probe, to a new altitude record of over 70,000 miles. AFBMD provided the vehicle and launched it under NASA direction.
- 14 October The Boeing Airplane Company was awarded a contract as the missile assembly and test contractor for Minuteman.
- 20 October Titan missile A-2, scheduled for the first flight test, exploded during captive tests at Denver.
- 22 October The Advanced Research Projects Agency informed the Air Force that it planned to develop a satellite communications system. The Army would be responsible for development of the communications payload, while the Air Force was assigned the booster and satellite vehicle.

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- 23 October Titan missile A-3, now scheduled for the first Titan flight test, was delivered to the Air Force by the Martin Company.
- 23 October The first of a series of meetings between AFBMD and NASA's Space Task Group was held to determine support requirements for the new civilian space agency. AFBMD's role in Project Mercury, NASA's manned orbital flight program, required further definition as did matters of booster vehicle procurement, launch services, use of ground facilities, and so on.
- 5 November The initial launch of an operationally configured Thor IRBM (SM-75) was conducted at Cape Canaveral, but the missile had to be destroyed at T+35 seconds after the pitch attitude gyro malfunctioned.
- 5 November The Advanced Research Projects Agency (ARPA) designated the Army Signal Research and Development Laboratory (ASRDL) and the Air Research and Development Command (ARDC) as the military agencies responsible for communications and vehicular aspects of the first U.S. military communications satellite program. Booster and spacecraft development were assigned to AFBMD.
- 8 November ARPA requested a joint Army-Air Force development plan for a 24-hour, synchronous equatorial orbit communications satellite. The Army Signal Corps was to be responsible for the ground and satellite communications while the Air Force (AFBMD) was to handle satellite spacecraft, booster, and launch services.
- 12 November Headquarters ARDC informed AFBMD that it would be responsible for the booster and spacecraft portions of the 24-hour communications satellite program.

1959

to the San Bernardino Air Materiel Area (SBAMA), Norton AFB, California, as of January 1960.

20 February

As requested by the Advanced Research Projects Agency (ARPA), AFBMD forwarded its development plans for the Transit navigation satellite and TIROS weather satellite programs to Headquarters USAF.

25 February

The Air Force Ballistic Missile Committee forwarded to the OSD Ballistic Missile Committee a proposal to accelerate the Minuteman development program.

28 February

In the first use of a Thor as a space booster, the world's first polar orbiting satellite, Discoverer I, was launched by a Thor/Agna (Thor 163) booster combination from Vandenberg AFB. The mission was also the first successful flight test of Lockheed's Agna A upper stage vehicle designed for orbiting U.S. satellite systems.

28 February

The first operational Atlas missile, 6D, was accepted by the Air Force from Convair. Subsequently, 6D was installed in the first Atlas complex, 65-1, at Vandenberg AFB during the first week of March 1959.

March

As a result of numerous refinements evolved during prototype development of the LR87-AJ-1 engine for Titan, an advanced propulsion system--the AJ-3--was authorized for development.

March

Construction began on the Atlas D operational sites assigned to Francis E. Warren AFB, Wyoming, and Offutt AFB, Nebraska.

March

Atlas squadrons five through nine were approved for a 1x9 configuration--each squadron to consist of nine individual launchers.

1959

- 3 March General Thomas S. Power, Commander-in-Chief, Strategic Air Command (CINCSAC), recommended acceleration of the Minuteman program.
- 25 March AFBMD recommended that non-cryogenic propellants be introduced into the Titan program with the seventh squadron.
- April The Television Infrared Observation Satellite (TIROS) meteorological satellite program was transferred from the Defense Department (AFBMD) to NASA for use in the national meteorological satellite program.
- April Construction began on the operational facilities for the first Titan (SM-68) squadron at Lowry AFB, Colorado.
- April AC Spark Plug was selected as the contractor to build the Titan all-inertial guidance system.
- 6 April The first military unit to be charged with conducting military satellite operations, the 6594th Test Wing, was established at Palo Alto, California, and assigned to AFBMD for administrative and operational control.
- 8 April A Thor/Able reentry test vehicle launched from Cape Canaveral, Florida, completed a successful flight down the Atlantic Missile Range. The reentry body of the Thor/Able was recovered at the far end of the range in the South Atlantic. This was the first recovery of an ablative nose cone following an ICBM-range flight.
- 13 April An Air Force Thor/Agena A booster vehicle lifted Discoverer II into orbit from Vandenberg AFB. Discoverer II became the world's first satellite to be stabilized in orbit in all three axes, to be maneuvered on command from earth, to separate a reentry vehicle on command, and to send its reentry

1959

vehicle back to earth. The capsule ejector system malfunctioned, causing the capsule to impact near Spitsbergen on 14 April rather than near Hawaii as planned.

13 April

The Thiokol Chemical Corporation tested a heavyweight Minuteman Stage I engine containing 44,000 pounds of propellant. This was the largest solid-propellant engine yet fired in the world.

14 April

The first Atlas D model flight test missile (3D) had to be destroyed 36 seconds into flight due to a severe engine malfunction and explosions. In addition to other changes, the D series replaced the MA-1 engine package with the Rocketdyne MA-2. The booster engines in the MA-2 produced 309,000 pounds of thrust versus 300,000 pounds for the MA-1. Sustainer engine thrust remained 57,000 pounds. With verniers, total thrust for the MA-2 was 368,000 pounds compared to 357,000 for the MA-1 engine package.

14 April

Aerjet-General Corporation successfully test fired its first Minuteman Stage II engine.

16 April

The first Thor IRBM to be fired by a Royal Air Force (RAF) crew was launched from Vandenberg AFB.

24 April

Thiokol Chemical Corporation fired its first Stage II test engine for Minuteman.

25 April

Major General Bernard A. Schriever became Commander, Air Research and Development Command (ARDC), and was promoted to the rank of Lieutenant General. Brigadier General Osmond J. Ritland, AFBMD Vice Commander, took over command of the Division and was promoted to Major General. Colonel Charles H. Terhune, Jr., replaced

1959

General Ritland as Vice Commander
on 11 May 1959.

28 April

NASA signed a \$24 million contract with Douglas Aircraft Company for development of a three-stage Thor-Vanguard launch vehicle to be called the Thor Delta.

15 May

AFBMD submitted to the Air Force Ballistic Missile Committee a development plan for an operational rail-mobile ICBM system.

20 May

The Office of the Secretary of Defense (OSD) approved the Air Force's proposal for an accelerated Minuteman development program and authorized AFBMD to take all necessary actions to accelerate the program.

22 May

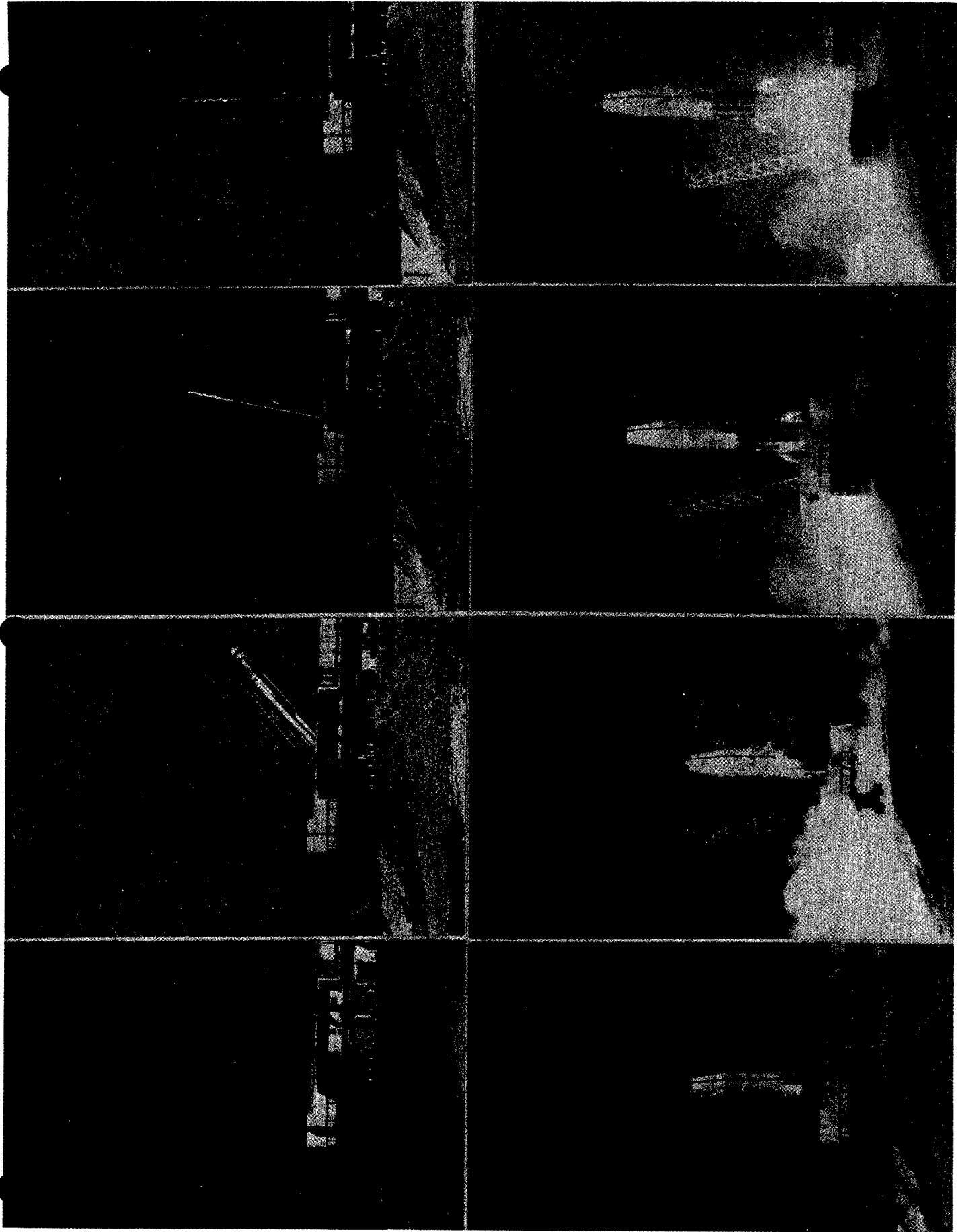
At last realizing the importance of the ground-to-aircraft communications requirements for control of the SAC bomber force, the Advanced Research Projects Agency (ARPA) initiated Project Steer for a six-hour polar communications satellite development program. The defense communication satellite effort now had three distinct elements--Steer; Tackle, for an advanced polar communication satellite; and Decree for a 24-hour synchronous communication satellite to be put in orbit by the as yet undeveloped Atlas-Centaur. Priority was assigned to Project Steer, and project supervision was given to AFBMD. However, ARPA retained control and did not delegate authority and responsibility for systems integration.

June

The first prototype of the XLR87-AJ-3 engine for Titan was completed.

1 June

The 6593d Test Squadron (Special) was assigned to the recently activated 6594th Test Wing located at Palo Alto, California.



An Atlas D ICBM is raised to a vertical position and launched. Atlas D's were stored in unprotected above-ground horizontal launchers. Later models were stored in either semi-hardened, horizontal launchers (Atlas E's) or in hardened vertical silos (Atlas F's).

1959

- 22 June The 77th Strategic Missile Squadron, with fifteen Thor missiles, was transferred to the Royal Air Force at Feltwell, England. This was the first Thor squadron to achieve operational status in Great Britain.
- 30 June The Centaur high-energy upper stage development program was transferred from the Air Force (ARDC) to NASA.
- 30 June Studies of possible non-cryogenic propellants for use on Titan indicated that the most promising combination was a nitrogen tetroxide oxidizer and a fuel blend composed of 50 per cent unsymmetrical dimethylhydrazine (UDMH) and 50 per cent hydrazine, known as Aerozine 50.
- 1 July Headquarters ARDC established the 6596th Instrumentation Squadron (Satellite Control Facility) at Vandenberg AFB, California, and assigned it to the 6594th Test Wing.
- 21 July The first full-scale test of an ablation reentry vehicle (RVX-2) was conducted with the launch and successful flight of Atlas 8C. Following the 4,385 NM flight into the South Atlantic, the reentry vehicle was recovered.
- 28 July After three consecutive failures (3D, 7D, and 5D), Atlas missile 11D became the first Series D flight test missile to complete a successful launch from Cape Canaveral and flight down the Atlantic range to impact in the Ascension Island splash net.
- August Colonel Samuel C. Phillips became Director of the WS 133A (Minuteman) Project Office at AFBMD.
- 14 August Titan missile B-5, scheduled to be the first fully powered-flight test missile, was heavily damaged when a faulty release mechanism allowed an earlier-than-planned liftoff that resulted in engine shutdown and the missile's dropping back on the launch pad.

1959

- 17 August The Department of Defense and the Air Force Ballistic Missile Committee approved an in-silo launch capability for Titan missiles beginning with the seventh squadron (October 1962). As a result of changes initiated during 1959, the Titan missiles from the seventh squadron would have all-inertial guidance systems, storable non-cryogenic propellants, and an in-silo launch capability.
- 24 August The final Atlas Series C missile, 11C, was fired from Cape Canaveral. Three of the six Atlas C research and development test missiles were successful, while the other three were failures.
- 31 August Complex 576A (65-1) at Vandenberg AFB was transferred to SAC and thus became the first fully operational ICBM complex.
- 1 September The Air Force formally declared the Atlas (WS 107A-1) to be operational and transferred the management of the operational Atlas weapon system from AFBMD to SAC with the formal turnover of the first operational Atlas complex (576A) at Vandenberg AFB, California.
- 1 September Thiokol Chemical Corporation fired the first full-scale, flight-weight Minuteman Stage I engine.
- 4 September Headquarters USAF assigned a "DX" priority rating to the Minuteman development program, thus assuring it the highest priority with other ballistic missile programs in procurement actions.
- 9 September A SAC crew conducted the first west coast launch of an Atlas operational configuration missile, 12D, from Vandenberg AFB, to a target near Wake Island. Afterward, General Thomas S. Power, CINCSAC, declared the Atlas

1959

system to be operational. This marked the attainment of operational status for the Atlas one year earlier than the six years that the von Neumann Committee had projected in its February 1954 report.

9 September

The first prototype of the Mercury-Atlas capsule for NASA's Project Mercury was launched atop Atlas 10D from Cape Canaveral.

9 September

Secretary of the Air Force James H. Douglas, Jr., recommended approval of the Titan II (WS 107C) program that would commence with the seventh squadron to be deployed to SAC. The Titan II would be an advanced system, with all-inertial guidance, non-cryogenic propellants, and in-silo launch capability for vastly improved reaction time and reduced vulnerability through hardened and dispersed (H&D) configurations.

15 September

The first silo launch of a tethered, full-scale Minuteman missile was conducted at Edwards AFB, California, using dummy second and third stages. This was the first time in the Air Force ballistic missile program that the initial test of a missile was conducted on schedule.

17 September

A Thor/Able II booster carrying the Navy's Transit IA navigation satellite was launched from Cape Canaveral. A third stage malfunction prevented the satellite from achieving orbit.

18 September

Headquarters USAF notified AFBMD that the Secretary of Defense, Neil H. McElroy, had approved the transfer of MIDAS (Missile Detection Alarm System) and SAMOS (Satellite and Missile Observation System) from the Advanced Research Projects Agency (ARPA) to the Air Force.

1959

21 September

The Office of the Secretary of Defense assigned to the Air Force full responsibility for development and launching of all military space boosters as well as associated systems integration.

21 September

General Curtis E. LeMay, Vice Chief of Staff, USAF, informed Headquarters ARDC that the Secretary of Defense had assigned responsibility to the Air Force for developing and launching all military space boosters except those reserved by the Secretary. The Air Force was also to perform all required systems integration for military space systems. The decision was made for reasons of efficiency and economy.

23 September

Once again, the Defense Department reorganized its space program. Primary responsibility for military space programs was assigned to the Air Force which was given control of all long-range missile and boosters except the Navy's Polaris missiles. ARPA retained responsibility for advanced research on missile defense, solid propellants, and several other projects. Existing projects were reassigned to the military services from ARPA--MIDAS and SAMOS to the Air Force, the Transit navigation satellite to the Navy, and NOTUS to the Army. These reassignments were not immediately effective, but the move toward Air Force development, production, and launching of military space vehicles was quite clear.

1 October

Headquarters ARDC designated and organized the 6594th Instrumentation Squadron at Grenier Field, Manchester, New Hampshire, and assigned it to the 6594th Test Wing.

2 October

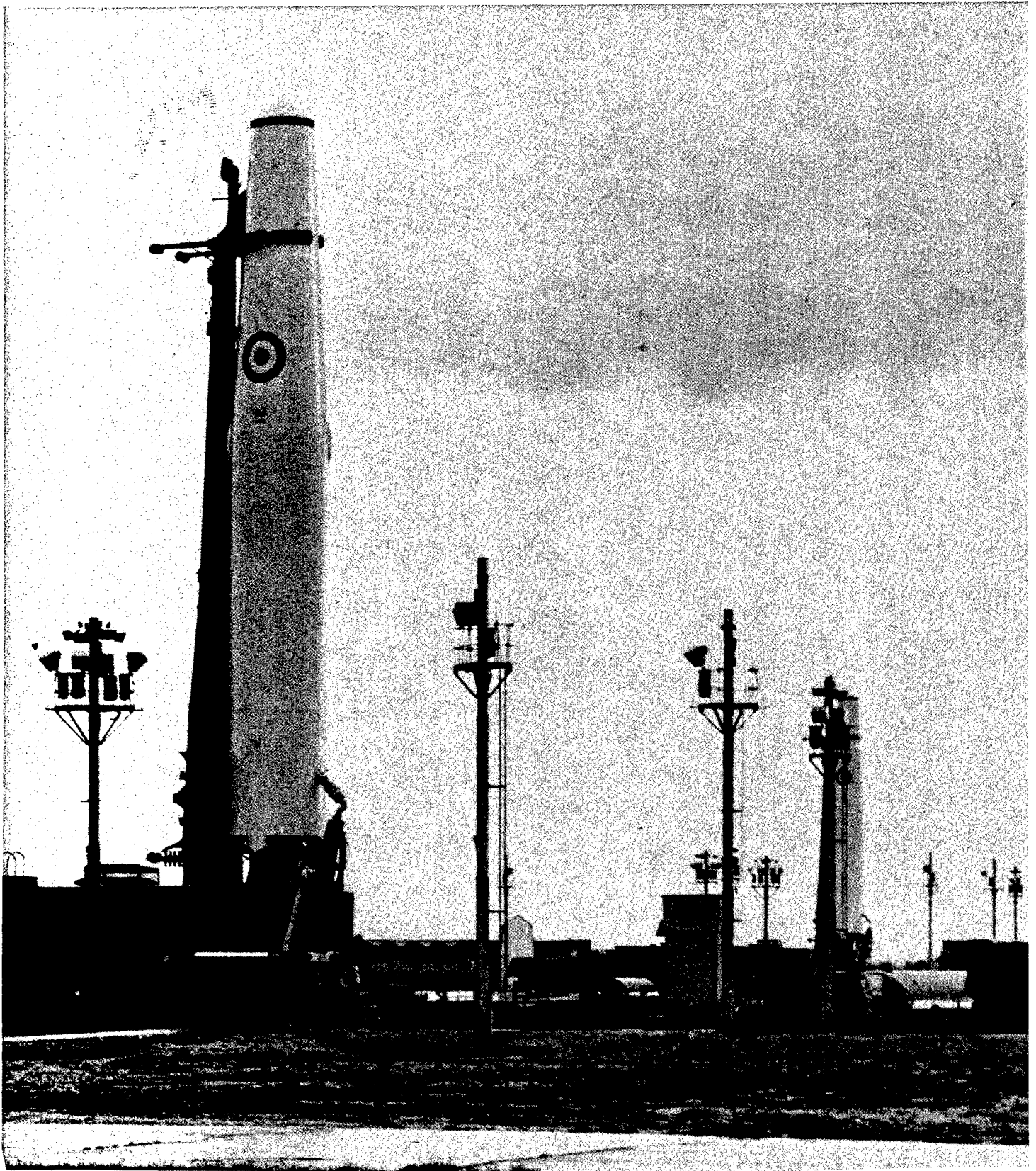
The first Atlas missile was delivered to Francis E. Warren AFB, Wyoming, and was used to check out missile installation and launch facilities.

1959

- 6 October As a result of Advanced Research Projects Agency (ARPA) tasking of 18 September, AFBMD issued an abbreviated Vela Hotel development plan for a system to detect and locate nuclear detonations in space.
- 21 October Secretary of Defense Neil H. McElroy officially approved assignment of the MIDAS and SAMOS programs to the Air Force and ARDC.
- November Aerojet-General delivered the first production XLR87-AJ-3 Stage I and XLR91-AJ-3 Stage II engine for the Titan program.
- 1 November Headquarters ARDC organized and activated the 6594th Recovery Control Group at Hickam AFB, Hawaii, and the 6593rd Instrumentation Squadron at Wheeler AFB, Hawaii. The 6593rd Test Squadron (Special) was reassigned to the 6594th Test Wing.
- 9 November The development contracts for the Dyna-Soar space glider were finally awarded by the Air Force--Boeing was to build the glider stage and Martin would provide the first stage booster.
- 16 November AFBMD was inactivated as Detachment 2, Headquarters ARDC, and Headquarters AFBMD was constituted and activated at Los Angeles with the personnel and equipment formerly assigned to AFBMD, Detachment 2, Headquarters ARDC. This was part of an overall reorganization and decentralization of ARDC that resulted in the establishment of the new Division structure with Wright Air Development Division (WADD) and Air Force Command Control Development Division (AFCCDD) also being set up. As part of this change, a new staff structure was established at AFBMD to bring it into conformity with Headquarters ARDC organization--a Chief of Staff was set up along with a Deputy Chiefs of Staff (DCS) structure. Completing the reorganization, the 6594th Test Wing at Palo Alto, California, was reassigned from ARDC to Headquarters AFBMD.

1959

- 16 November Headquarters ARDC designated and organized Headquarters 6592d Support Group, at Los Angeles and assigned it to Headquarters AFBMD. 6592d USAF Dispensary was assigned to the Support Group.
- 17 November Based on the 23 September decision, all Defense Department satellite and space vehicle programs were to be reassigned to the military services of primary interest. The Discoverer, MIDAS, and SAMOS programs were approved for transfer back to AFBMD from ARPA. All three programs were originally part of the WS 117L program that AFBMD had managed from inception in 1956 until the Advanced Research Projects Agency (ARPA) had assumed responsibility on 30 June 1958.
- 18 November The Air Force Ballistic Missile Committee approved planning for a 14-squadron Titan force and the development of the Titan II weapon system (XSM-68B, WS 107C).
- 27 November Headquarters USAF directed an Atlas program of 13 squadrons.
- December One Atlas D missile at Vandenberg complex 576A was maintained in a state of operational readiness during the month. This marked the introduction of the ICBM into the U.S. strategic offensive alert force.
- December Headquarters USAF approved sites at Ogden and Brigham City, Utah, for Minuteman production facilities.
- 1 December Headquarters USAF authorized the initiation of development for an improved Titan missile, the Titan II.
- 9 December The British Air Ministry announced that the Royal Air Force had attained operational status with the Thor missile.
- 12 December The first flight testing of Titan staging and second stage engine ignition was unsuccessful when Titan C-3 exploded at liftoff due to a faulty relay in the command destruct system.



Thor missiles, in Royal Air Force livery, are shown on station in England after one of the most difficult tasks of its kind ever undertaken. The first Thor wing of 15 missiles was turned over 3½ years after the initial authorization by the U.S. Department of Defense.

1959

17 December

Flight testing of the Thor IRBM was completed with the launch of Thor 217 from Pad 18B at Cape Canaveral, Florida.

21 December

The 6555th Guided Missile Group (Test and Evaluation), located at the Air Force Missile Test Center (AFMTC) at Patrick AFB, Florida, was redesignated the 6555th Test Wing (Development) and assigned to Headquarters AFBMD. Concurrently, AFBMD's Office of the Assistant Commander for Missile Tests at AFMTC was discontinued, and its personnel, equipment, and functions reassigned to the new 6555th Test Wing.

23 December

Aerofjet-General completed the test firing of its first full-scale, flight-weight Minuteman Stage II engine.

1960

- January Production go-ahead for the Minuteman ICBM was accelerated from January 1961 to July 1960.
- January Aerojet-General Corporation completed development of the Ablestar second stage for use with Atlas, Titan, or Thor boosters. Primary improvements over the previous Able vehicles were increased propellant capacity, multiple restart capability, and full-time attitude control.
- January AFBMD awarded contracts for development of first and second stage Titan engines that would use non-cryogenic (storable) propellants. Aerozine 50 (50 per cent UDMH and 50 per cent hydrazine) was the fuel selected to be used with nitrogen tetroxide as the oxidizer.
- 1 January Executive management responsibility for the Thor IRBM (redesignated from WS 315A to WS 115A) was transferred from AFBMD to Air Materiel Command's San Bernardino Air Materiel Area (SBAMA), marking the successful conclusion of the Thor research and development program after only four years.
- 15 January Headquarters ARDC redesignated Headquarters 6594th Test Wing as Headquarters 6594th Test Wing (Satellite), without change of station.
- 19 January Aerojet-General was selected as the production contractor for Minuteman Stage II engines.
- 2 February Titan test missile B7A completed a 2,200-mile flight, achieving successful staging and ignition of the second stage engine at high altitude. The Stage II engine, XLR-91-AJ-1, performed as planned, and the missile impacted almost exactly on target. This was the first successful Titan launch and flight since 4 May 1959.
- 6 February Acting Secretary of Defense James H. Douglas, Jr., transferred program management for various space-oriented Advanced Research Projects Agency (ARPA) projects to the Air Force.

1960

24 February

Titan flight test missile G-4 was launched from Cape Canaveral and completed all test objectives in the first successful long-range flight, with the reentry vehicle impacting 4,335-NM downrange. This flight was the longest to date by a Titan and demonstrated the integrity of all basic design parameters as well as Bell Telephone Laboratories radio-inertial guidance systems.

26 February

The Air Force MIDAS I satellite was launched from Cape Canaveral in the first successful launch of the Atlas D/Agna A booster-upper stage combination. MIDAS I, however, failed to achieve orbit because an accident at the Atlas-Agena staging damaged the Agna. The entire vehicle reentered and burned up about 2,500 miles downrange.

29 February

Advanced Research Projects Agency (ARPA) issued an interim directive cancelling the three-phase development program for a military communication satellite system. Pending a Joint Chiefs of Staff (JCS) and OSD review, Projects Steer, Tackle, and Decree were replaced by a single synchronous communications satellite system subsequently designated Project Advent. AFBMD was directed to conduct a single integrated research and development program for a 24-hour synchronous equatorial global communication satellite system. The Army was to develop the communications equipment while AFBMD handled the booster and spacecraft.

March

Three Atlas missiles were placed in semi-readiness at Vandenberg AFB. Two important decisions were made on the Titan II program during the month. AFBMD received program approval to proceed with the development of the Mark 6 reentry vehicle specifically for use on the Titan II. Configuration for the Titan II operational squadrons was set at nine hardened and dispersed underground silo missile launchers (1x9) in strategic missile wings of two squadrons each (18 missile launchers).

1960

- 7 March The first Atlas missile (42D) equipped with the Arma all-inertial guidance system (open loop) successfully completed its flight test from Cape Canaveral.
- 11 March An Air Force Thor/Able IV booster launched the NASA Pioneer V spacecraft on its journey to Venus. The satellite measured radiation and magnetic fields between Earth and Venus. The last scientific measurements were transmitted back to Earth on 26 June, three and one-half months after launch, from almost 22.5 million miles in space. Pioneer V was by far the most successful space probe yet launched. AFBMD and Space Technology Laboratories managed the Pioneer V satellite, payload, and booster for NASA and provided launch services at Cape Canaveral.
- 23 March Malmstrom AFB, Montana, was selected as the location for the first Minuteman wing (Wing I).
- 25 March The Department of Defense authorized the Air Force to make the necessary production commitments required to achieve a force of 150 Minuteman missiles by mid-1963.
- April Headquarters USAF approved a 1 x 12 configuration for Atlas squadrons 8 through 13--each squadron would have 12 individual launch facilities.
- 1 April A Thor/Able II booster placed NASA's Television and Infrared Observation Satellite (TIROS) weather satellite into the most accurate orbit yet achieved by any U.S. satellite. TIROS I opened a new era in meteorology by transmitting nearly 23,000 pictures of global cloud cover from 450 miles in space and providing the first glimpse of global cloud structure data. TIROS I completed 1,302 orbits before its operational life ceased on 29 June 1960.

1960

- 6 April Atlas E/F silo-lift strategic missile squadrons were enlarged from 9-12 launchers to 10-13 each. In these units, the Atlas missiles would be maintained in hardened underground silos and launched after being lifted to the surface and refueled.
- 7 April Atlas 48D, intended to be the first closed-loop test of the Arma all-inertial guidance system, exploded immediately after launch release as a result of combustion instability in the MA-2 engine cluster.
- 11 April ARPA issued a final, definitive order cancelling Projects Steer, Tackle, and Decree and replacing them with a single synchronous communications satellite system subsequently designated Project Advent.
- 13 April The first Thor/Ablestar launched from Cape Canaveral placed the Navy's Transit IB navigation satellite into orbit. This was the first navigation satellite to be placed in orbit. The Ablestar upper stage demonstrated the first engine restart in space.
- 22 April SAC crews successfully fired the first Atlas missile (25D) to be launched from an operational horizontal "coffin" missile storage/launcher facility at Vandenberg AFB.
- 27 April The last of four 15-missile Thor IRBM squadrons were transferred to the Royal Air Force.
- May The Air Force gave the Martin Company a letter contract for development, captive and flight testing, and production of the Titan II (WS 107C).
- 6 May A tethered Minuteman missile was successfully fired from an underground silo site at Edwards AFB, California.
- 13 May The first three-stage, NASA-developed Thor/Delta space booster was launched from Cape Canaveral, but the Echo passive communications satellite failed to achieve orbit due to a second stage malfunction. This booster was for NASA programs and used the basic Thor first stage with a modified Vanguard second stage as its upper stage configuration.

1960

- 20 May Atlas 56D carried a 3,000-pound payload 7,859 nautical miles (9,040 statute miles) from Cape Canaveral to the target area in the Indian Ocean. This was the longest U.S. missile flight to date.
- 24 May The last Atlas D/Agena A booster to be used by the Air Force placed into orbit the MIDAS II infrared scanning satellite designed to detect and give early warning of missile launchings. Although intended to function for 40 months, the satellite's telemetry system failed on 26 May. MIDAS II was the first early warning satellite system placed in orbit.
- June The Defense Department announced the selection of Little Rock AFB, Arkansas, as the site for the 11th and 12th Titan operational squadrons.
- 6 June The Autonetics Division of North American Aviation was awarded a contract to produce the first increment of Minuteman operational guidance and control (G&C) systems and associated equipment.
- 11 June Atlas flight test missile 54D completed the first successful demonstration of accuracy and reliability of the closed-loop Arma all-inertial guidance system.
- 20 June The Air Force (AFBMD) placed a production contract with the Martin Company for the Titan II (SM-68B) ICBM designed to use storable, non-cryogenic fuels, an all-inertial guidance system, in-silo launch facilities, and to have greater range and payload capabilities than the Titan I (SM-68).
- 22 June A Thor/Ablestar booster placed a U.S. Navy Transit IIA research and development navigation satellite into orbit using the Ablestar second stage with a restart engine. A smaller parasitic radiation-measuring satellite, the Galactic Radiation Experiment Background (GREB), was also placed into orbit. This was the first time two satellites had been carried in "piggyback" alignment on a single booster.
- 25 June The Aerospace Corporation was set up as a not-for-profit corporation to serve Air Force

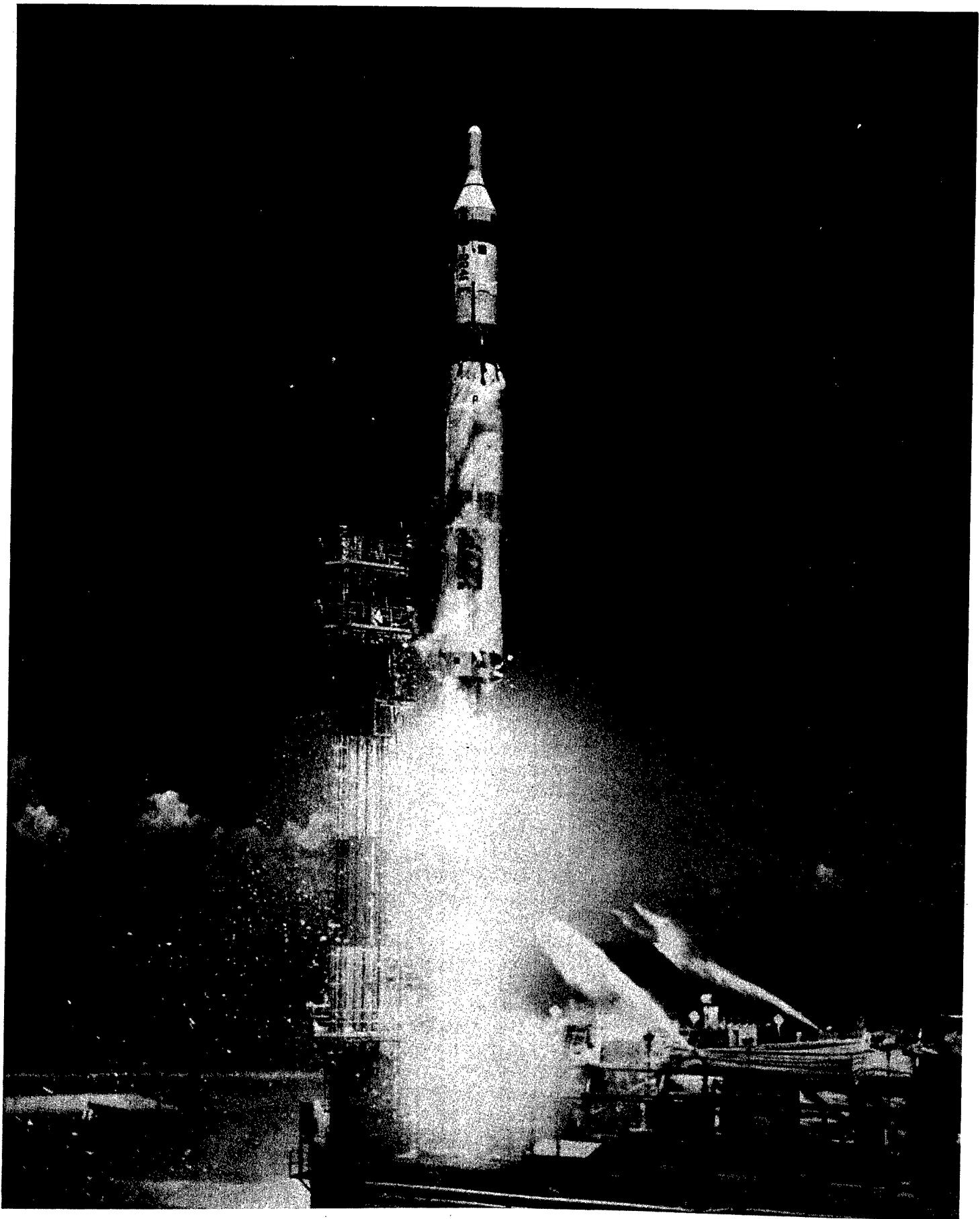
1960

- needs for general systems engineering and technical direction (GSE/TD) of military space systems so that Space Technology Laboratories (STL) of Thompson-Ramo-Wooldridge (TRW) could be freed of its existing functions and be in a position to compete for Air Force space and missile contracts.
- 27 June Headquarters ARDC designated, assigned, and activated the Sunnyvale Satellite Test Center at Sunnyvale, California.
- July The Boeing Airplane Company was selected as integrating contractor for installation and checkout of Minuteman operational facilities.
- 1 July The government-chartered, non-profit Aerospace Corporation began operations, replacing Space Technology Laboratories (STL) in providing technical staff assistance, advanced systems analysis, administrative and technical support services, and general systems engineering and technical direction (GSE/TD) for Air Force space programs. To preserve continuity, and prevent disruption, STL remained the (GSE/TD) contractor for on going ballistic missile development programs.
- 1 July The attempt to launch the first operational configuration Titan I ICBM (J-2) from Cape Canaveral was a failure.
- 7 July The Air Force Ballistic Missile Committee agreed that missile base construction and site activation should be placed under a single field manager controlled by Headquarters Air Materiel Command.
- 11 July Headquarters USAF assigned responsibility for management of all ballistic missile operational site activation work to Air Materiel Command. ARDC retained responsibility for activation of Atlas D squadrons-- the 564th and 565th Strategic Missile Squadrons at F.E. Warren and the 566th at Offutt AFB--and for first-of-a-kind installations at Vandenberg AFB. Under

1960

these arrangements, AMC was to have responsibility for contractor direction and performance while AFBMD retained control of site installation design and some facets of technical engineering and configuration control.

- 11 July Dr. Ivan A. Getting, Raytheon Corporation's Vice President for Research and Engineering, was named the first President of Aerospace Corporation.
- 15 July The 576A Strategic Missile Squadron (Atlas F) was activated at Vandenberg AFB and assigned to SAC's First Missile Division.
- 25 July Atlas D squadron 576B was activated at Vandenberg AFB.
- 26 July General Electric was awarded the contract to develop the Mark 6 reentry vehicle for the Titan II.
- 29 July The first Mercury-Atlas D (MA-1) was successfully launched from Cape Canaveral to test the Mercury capsule and Atlas D booster for future use in NASA's Project Mercury manned orbital flight program.
- 2 August The Air Force Ballistic Missile Committee supported Ballistic Missile Division's recommendation to accept reduced range, reliability, and warhead specifications for the first 150 Minuteman missiles (LGM-30A) and to concentrate on the development of an improved Minuteman with better performance for subsequent deployment (LGM-30B).
- 5 August Complex 564A, designed to house three Atlas D missiles in horizontal "coffin" storage/launcher facilities, was completed at Francis E. Warren AFB, Wyoming, and transferred to SAC.
- 10 August A Thor/Agema A launched from Vandenberg AFB placed Discoverer XIII in orbit. On 11 August, the data capsule was ejected during the 17th pass and recovered in the



The first successful launch and flight of an operational prototype Titan I occurred on 10 August 1960.

1960

- Pacific Ocean near Hawaii by a Navy helicopter that was part of the 6593d Test Squadron's task force. Although the planned mid-air recovery was not made, the return of Discoverer XIII's data capsule marked the first successful recovery of a man-made object ejected from an orbiting satellite.
- 10 August After two previous failures, Titan missile J-7 was the first operational prototype to be launched and complete a successful flight test down the Atlantic Missile Range.
- 12 August A Thor/Delta was launched from Cape Canaveral carrying NASA's Echo I, the first passive communications satellite to be placed into orbit.
- 12 August The Hercules Powder Company was selected to continue research development, and production of the Minuteman Stage III solid-propellant rocket engine.
- 18 August Discoverer XIV was launched from Vandenberg AFB aboard a Thor/Agema A booster.
- 19 August Captain Harold E. Mitchell of the 6593d Test Squadron (Special), flying a C-119J "Flying Boxcar," recovered the descending Discoverer XIV capsule northwest of Hawaii for the first successful aerial recovery of an object returned from orbit.
- 30 August With the transfer of the three-missile Complex 564B, the first operational Atlas D (CGM-16D) squadron at Francis E. Warren AFB, Wyoming, the 564th Strategic Missile Squadron, was turned over to the Strategic Air Command's 706th Strategic Missile Wing.
- September Aerojet-General Corporation completed fabrication of the Titan II (XLGM-25C) prototype booster (XLR 87-AJ-5) and sustainer (XLR 91-AJ-5) engines. Both

1960

- 31 October Headquarters USAF announced the movement of the Ballistic Missile Center (Air Material Command) from the Arbor Vitae Complex in Los Angeles to Norton AFB, California, beginning in November 1960.
- 31 October The Air Force accepted the first operational Titan I missile (HGM-25A) from the Martin Company.
- November Aerojet-General conducted the first successful, full-duration test firing of the XLR91-AJ-5 Stage II engine intended for use in the advanced Titan II ICBM.
- 5 November The initial operational capability (IOC) date for the first Minuteman squadron was advanced by one full year, from July 1963 to July 1962.
- 8 November Thiokol Chemical Corporation delivered the first Minuteman Stage I flight test engine to Cape Canaveral.
- 12 November The second Thor/Agena B to be launched from Vandenberg AFB was the first successful flight of the more advanced Lockheed Agena B upper stage.
- 14 November The Air Force awarded a contract to the Martin Company for development and full-scale flight testing of a lifting reentry body.
- 9 December The Research and Development Center of Space Technology Laboratories (TRW), located at the southeast corner of Aviation and El Segundo Boulevards in El Segundo, California, was purchased by the Air Force for \$23.5 million for use by the recently organized Aerospace Corporation.
- 15 December The Vela Hotel Joint Management Team, with representatives from ARDC, NASA, and the Atomic Energy Commission (AEC), met at AFBMD headquarters to begin planning for a high-altitude satellite system that would be capable

1960

of detecting nuclear explosions on the Earth's surface or in space.

19 December

The Air Force Ballistic Missile and Space Committee directed the selection of Ellsworth AFB, South Dakota, as the support base for the second wing (Wing II) of 150 hardened and dispersed Minuteman missiles.

20 December

A Thor/Agena B vehicle successfully launched Discoverer XIX into a polar orbit from Vandenberg AFB. The spacecraft carried a Project MIDAS test payload.

21 December

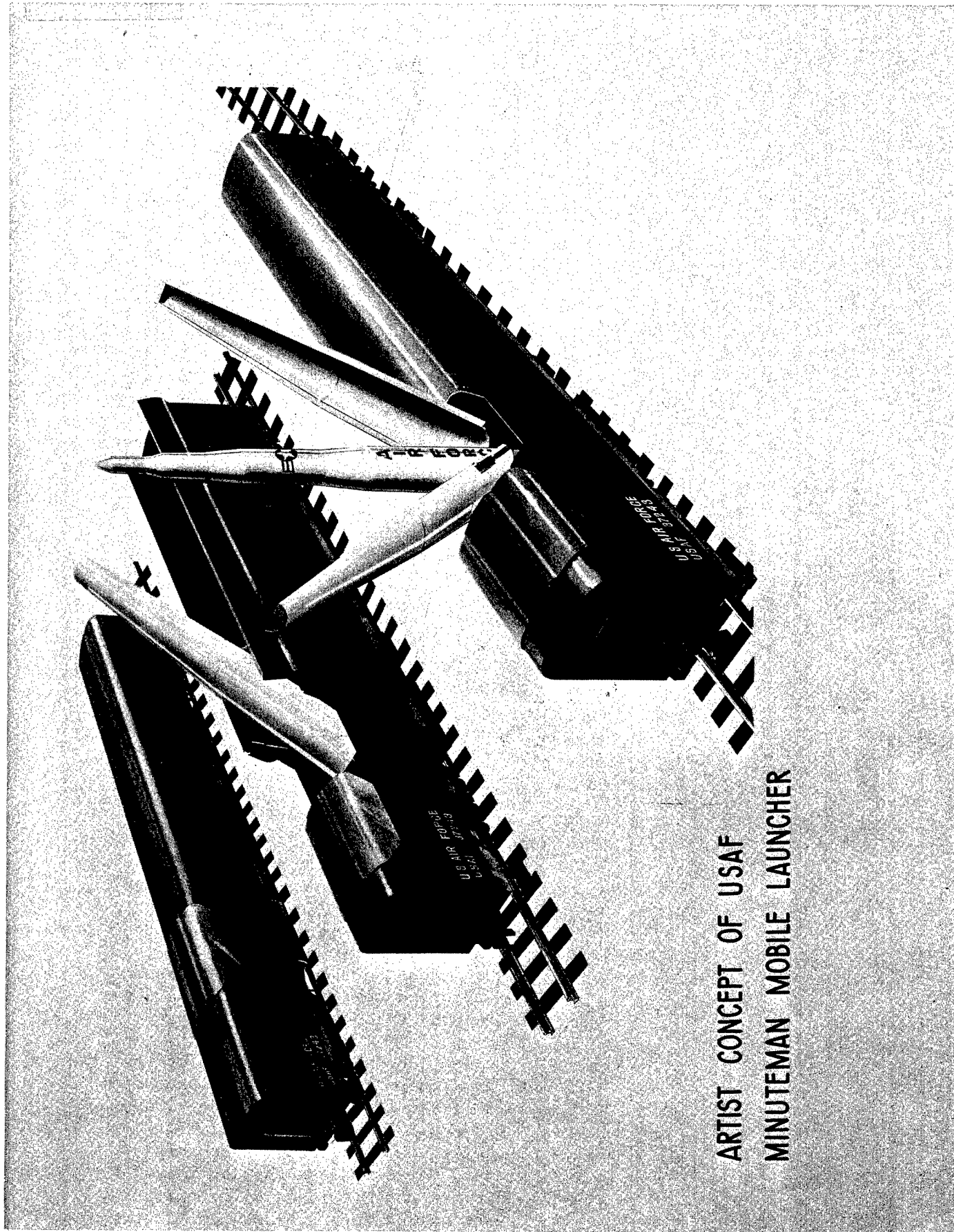
The first ICBM operational reentry vehicle ever recovered was fished out of the Eniwetok Lagoon. It had been launched by an Atlas D from Vandenberg AFB on 16 December.

1961

- January The Avco Manufacturing Company was directed to begin development of the Minuteman Mark 11 reentry vehicle so that it would be available for early introduction of a more advanced warhead.
- January The first production R&D XLR91-AJ-5 Stage II engine for Titan II was delivered by Aerojet-General.
- 9 January Headquarters USAF instructed AFBMD to continue its efforts to define the need for a space launch vehicle with a payload capacity between the Atlas/Centaur (9,000 pounds) and the early Saturn (19,000 pounds).
- 11 January President-elect John F. Kennedy released a special report compiled by a nine-member ad hoc committee headed by Dr. Jerome Wiesner. The committee advised a reorganization of the national space program to increase its effectiveness. Single responsibility within the Defense Department for management of the military space program was strongly urged, as was stronger technical management in NASA. The committee report was especially emphatic in stressing the hazard of failing to complete and deploy ICBMs as part of the nation's deterrent force.
- 20 January Detachment 1, Headquarters AFBMD, was redesignated and organized at Norton AFB, California, in preparation for the planned move of the ballistic missile function and offices from Los Angeles.
- 23 January The flight testing of the Series D Atlas missiles was completed with the successful launch and flight of Atlas 90D from Cape Canaveral. This was the 32d Atlas D to be launched in the research and development series and the 55th Atlas missile to be flown since the first attempted launch on 11 June 1957. During the flight test series to date, 35 missiles were flown successfully and 20 were rated failures.

1961

- 25 January The Titan II was selected as the booster for the Air Force Dyna-Soar I hypersonic boost-glide research vehicle.
- 26 January Aerojet-General Corporation successfully test fired a 20-ton, 65-inch diameter, solid-propellant motor segment that produced 400,000 pounds of thrust for 18 seconds. This firing was part of an Air Force development program for large solid rocket motors.
- 31 January An Air Force Atlas D/Agema A was launched from Vandenberg and successfully placed the SAMOS II satellite into orbit. This was the last Air Force use of an Agema A upper stage vehicle.
- February Letter contracts were issued to Thiokol Chemical Corporation (Stage I), Aerojet-General Corporation (Stage II), and Hercules Powder Company (Stage III) for procurement of the initial Minuteman operational motors.
- 1 February At 1059 EST, the first Minuteman research and development flight test missile (FTM 401) was launched by the 6555th Test Wing from Pad 31 at the Atlantic Missile Range. All the missile stages and subsystems were operational, marking the first time that the first flight test missile was launched with all systems and stages functioning. FTM 401 completed a 4,600-mile flight, and its reentry vehicle impacted in the designated target area. This was the most successful first flight recorded in the history of U.S. missile development.
- 1 February Minot AFB, North Dakota, was selected as the site for Minuteman Wing III, and Whiteman AFB, Missouri, was chosen as Wing IV's location.
- 17 February AFBMD's WS 107A-1 (Atlas) Weapon System Project Office was transferred to Norton AFB, California.



ARTIST CONCEPT OF USAF
MINUTEMAN MOBILE LAUNCHER

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- 24 February Atlas missile 9E made the first successful flight test of the Series E Atlas missile.
- March The first successful, full-duration test of the XLR87-AJ-5 Stage I engine for the Titan II was completed.
- March The construction of Wing I Minuteman operational facilities at Malmstrom AFB, Montana, was begun with the excavation for the Flight A launch control center (LCC) and three silos.
- 4 March The second Atlas D (horizontal storage/launcher) squadron at Francis E. Warren AFB, Wyoming--the 565th Strategic Missile Squadron was transferred to SAC's 706th Strategic Missile Wing (redesignated 389th Strategic Missile Wing on 1 July 1961).
- 6 March Secretary of Defense Robert S. McNamara assigned responsibility for the development of military space systems to the Air Force.
- 7 March The first Titan in-silo captive test firing took place at the Silo Launch Test Facility at Vandenberg AFB, California.
- 18 March Major General Osmond J. Ritland, Commander, AFBMD, and Major General Thomas P. Gerrity, Commander, Ballistic Missile Center (BMC), issued a joint policy letter based on directives from Defense Department as well as USAF, ARDC, and AMC headquarters. Minuteman was accorded the first priority and was to be undertaken as a crash effort.
- 28 March President John F. Kennedy reduced the FY 1962 budget for the Titan force from 14 to 12 squadrons. Accordingly, the Air Force Ballistic Missile Committee cancelled the two Titan II squadrons planned for Griffiss AFB, New York. In addition, the President deferred the current plans for three mobile Minuteman missile squadrons.

1961

30 March

The third and last Series D Atlas complex of nine missiles was turned over to SAC's 549th Strategic Missile Squadron at Offutt AFB, Nebraska.

31 March

The Mobile Minuteman force of three squadrons was officially deferred, and three fixed-base squadrons were added.

1 April

The Air Force reorganized its commands that were responsible for aeronautical ballistic missile and space systems, research and development as well as procurement and production. Three new commands were formed from the former Air Research and Development Command (ARDC) and Air Materiel Command (AMC)-- Air Force Systems Command (AFSC), Air Force Logistics Command (AFLC), and the Office of Aerospace Research (OAR). Out of former ARDC and AMC elements, the new Space Systems Division (SSD) was created with responsibility for military space systems and boosters, and Ballistic Systems Division (BSD) handled ballistic missile development and site activation. Both organizations were placed under the Deputy Commander of AFSC for Aerospace Systems (DCAS), located in Los Angeles. Major General Howell M. Estes, Jr., was appointed as DCAS, Major General O.J. Ritland, former AFBMD Commander, became Commander of SSD, and Major General T.P. Gerrity, former BMC Commander, took over BSD. As part of the reorganization, the 6565th Test Wing at Vandenberg AFB, California, and the 6594th Test Wing (Satellite) at Sunnyvale, California, were assigned to SSD, and the 6555th Test Wing at Patrick went to BSD. The 6592d Support Group was reassigned to DCAS.

1 April

Space Systems Division personnel moved into the R&D Center at El Segundo and Aviation Boulevards in El Segundo, California, while BSD remained at the Arbor Vitae complex until its projected move to Norton AFB in 1962. After BSD had completed its move, SSD would consolidate at the Arbor Vitae complex,

1961

and the recently created Aerospace Corporation would take over the R&D Center formerly occupied by TRW's Space Technology Laboratories.

1 May

Secretary of the Air Force Eugene M. Zuckert approved the move of Ballistic Systems Division to Norton AFB on a phased basis. When completed in 1962, this move would concentrate the ICBM activities at Norton since BSD would join the former BMC site activation and materiel offices that were relocated to Norton in 1960.

3 May

The 6565th Test Wing (Development) successfully conducted the first launch of a Titan (VS-1) from an underground silo at Vandenberg AFB.

5 May

Astronaut Alan B. Shepard, Jr., made the first United States manned space flight in a Mercury spacecraft launched from Cape Canaveral atop the Mercury-Redstone 3 (MR-3) vehicle. "Freedom 7" completed the suborbital, ballistic flight without incident in this historical first mission of NASA's Project Mercury.

13 May

SSD presented a preliminary plan for development of a high-lift booster that would wrap large solid-propellant booster engines around a liquid-rocket second stage center core vehicle.

June

The first production model R&D XLR87-AJ-5 Stage I engine for the Titan II were delivered.

3 June

Aerojet-General test fired a large solid-propellant rocket motor generating 500,000 pounds of thrust at its Sacramento, California, test facility.

5 June

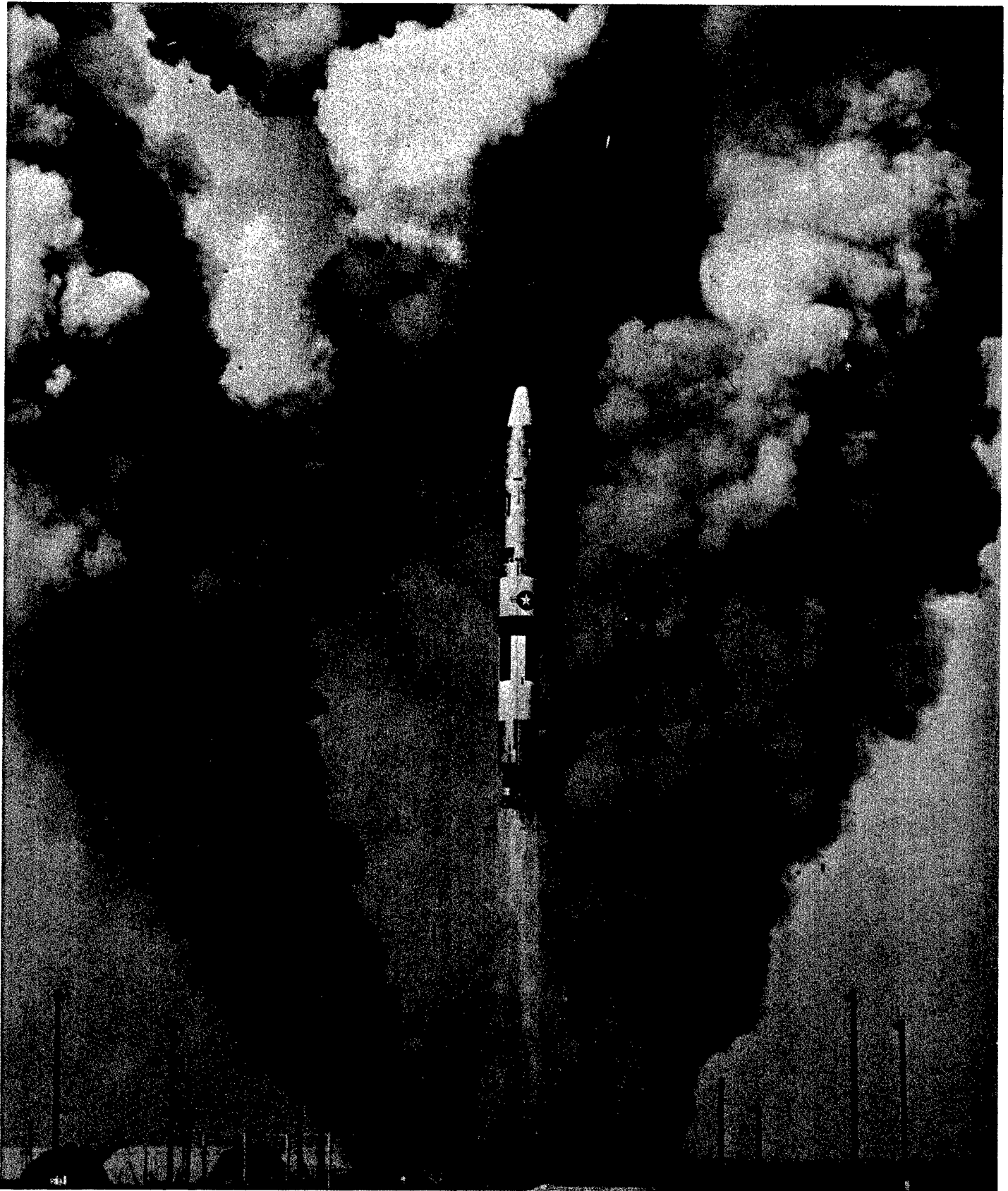
UnderSecretary of the Air Force Joseph V. Charyk instructed Headquarters USAF to prepare a solid booster program that would satisfy the requirements of NASA and the Air Force.

1961

- 7 June Atlas 27E was to be the first Series E operational test launch (OTL) from Vandenberg. However, the missile self-destructed over the launch pad due to a first stage engine failure at T+4 seconds.
- 23 June Titan I (M-1) was the first Series M missile and first inertially-guided Titan missile to be launched from Cape Canaveral. Essentially a Titan I with a Titan II inertial guidance system, M-1 was only a partial success due to a second stage hydraulic failure and loss of control after sustainer engine ignition.
- 30 June Complex 576C (576C Strategic Missile Squadron), the first Atlas E operational complex, was transferred to SAC at Vandenberg AFB. The 576C consisted of one above ground horizontal coffin storage/launcher hardened to withstand 25 pounds per-square inch (psi).
- July Aerojet-General delivered the first production XLR87-AJ-5 Stage I engine for Titan II.
- 6 July Atlas missile 22E completed a flight of 7,863 nautical miles (9,050 statute miles), with the nose cone landing 1,000 miles southeast of Capetown, South Africa. This was the longest U.S. ICBM flight yet recorded.
- 12 July MIDAS III (Missile Defense Alarm System) satellite was launched into polar orbit from Vandenberg AFB by the first Atlas D/Agna B booster (97D/#1201). This vehicle achieved a record 1,850-mile orbit and was the heaviest U.S. satellite put up to date.
- 25 July Titan missile M-2 completed the first full-range (4,342-NM) flight test of a Titan I equipped with an all-inertial guidance system.

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- 25 July The Air Force Ballistic Missile and Space Committee was renamed the Designated Systems Management Group (DSMG).
- August The NASA-DoD Large Launch Vehicle Planning Group met to study policy management and requirements for launch vehicles up to the size of Saturn. Dr. Nicholas E. Golovin, Technical Assistant to the Associate Administrator of NASA, headed the planning group.
- August The first production XLR91-AJ-5 Stage II engine for Titan II was delivered by Aerojet-General.
- 8 August The first Series F Atlas missile (2F) was successfully launched from Complex 13 at Cape Canaveral and completed its test flight.
- 8 August The first Titan II production engine was delivered to the Air Force.
- 22 August The launch of Atlas 101D from Vandenberg AFB completed the initial operational capability (IOC) launch series for the Atlas D ICBM. In 11 launches, only five missiles successfully completed their programmed flights down the Pacific range.
- 25 August Lockheed was awarded an Air Force letter contract to develop and manufacture the first 12 flight models of the standardized configuration Agena D (Standard Stage 01A, SS-01A).
- 30 August The first attempt to launch a Minuteman missile from an underground silo (Silo 32B) at the Atlantic Missile Range was a complete failure when the missile (FTM 404) exploded immediately after first stage ignition.
- September Space Systems Division selected Space Technology Laboratories (STL) as the contractor to build the spacecraft for the Vela nuclear detection satellite program.



Largest ICBM in the inventory, Titan II is shown rising from its underground silo on a test flight. The liquid-fueled missile's propellants are hypergolic and burn on contact with each other.

1961

- 1 September Construction began at the Minuteman Wing II site, Ellsworth AFB, South Dakota.
- 28 September The first Series E Atlas squadron became operational at Fairchild AFB, Washington (567th Strategic Missile Squadron, SAC).
- 3 October Because of delays in the Centaur upper stage development program and increasing management difficulties, Headquarters USAF recommended cancellation of the Advent program and the initiation of a new satellite communications development effort.
- 3 October In a memorandum to Secretary of the Air Force Eugene Zuckert, Secretary of Defense Robert S. McNamara stated an urgent requirement for a highly accurate and reliable mobile mid-range ballistic missile (MMRBM).
- 5 October Space Systems Division provided Headquarters AFSC with a special study of the Titan II with strap-on solid boosters as the concept for a standard military space launch vehicle--named Titan III.
- 10 October The 548th Strategic Missile Squadron, the second Atlas Series E (CGM-16E) missile squadron, became operational at Forbes AFB, Kansas.
- 13 October Dr. Harold Brown, Director of Defense Research and Engineering (DDR&E), authorized the Air Force to begin early program definition actions for the development of the Titan III, a modified Titan II with strap-on solid-propellant booster motors.
- 13 October The 100th successful firing of a Thor placed Discoverer XXXII in orbit.
- 27 October The Air Force accepted the first Titan II (XLGM-25C) missiles.

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- 1 November The 6565th Test Wing was redesignated the 6595th Aerospace Test Wing (ATW), and the 6555th Test Wing was also redesignated an Aerospace Test Wing.
- 17 November Minuteman flight test missile 405 was launched from Silo 32B at the Atlantic Missile Range and completed a flight of 2,993 nautical miles down the range. This was the first successful Minuteman launch from an underground silo.
- 21 November BSD's 6555th ATWg at Cape Canaveral completed the first successful launch of a Titan I (J-22) by an entire Air Force crew.
- 23 November The third and final Series E Atlas missile squadron of nine missiles, the 566th Strategic Missile Squadron of the 706th Strategic Missile Wing at Francis E. Warren AFB, Wyoming, became operational. The wing now had three squadrons--two Atlas D and one Atlas E-- and a total of 24 missile launchers.
- 24 November ARPA selected Space Technology Laboratories to develop the Vela satellite system for detection of nuclear detonations on Earth or in space.
- 27 November Colonel Joseph S. Bleymaier was appointed Director of Titan III Program (Program 624) at Headquarters SSD.
- 29 November Atlas D (53D) was the first missile to be launched by SAC from Vandenberg in the operation test (Category III) launch program.
- 7 December The mobility program for Minuteman weapon systems was cancelled.
- 7 December Robert Gilruth, Director of NASA Manned Spacecraft Center, announced plans to develop a two-man Mercury Mark II capsule that would be boosted into orbit by an Air Force Titan II missile

1961

that was scheduled for first flight in 1962. The major Air Force role in what later became Project Gemini was to be played by Space Systems Division which was to be responsible for the development, procurement, and launching of the Titan II Gemini Launch Vehicles.

- 14 December Deputy Secretary of Defense Roswell L. Gilpatric announced the cancellation of the mobile Minuteman program.
- 15 December SSD established a Deputy for Titan III (Program 624A) program office to develop a space standard launch vehicle (SLV) and system built around a Titan II with two strap-on, 120-inch diameter, solid-propellant motors.
- 18 December United Technology Center (UTC) announced the successful test of a new experimental method to steer large-size solid-propellant rockets. Called liquid thrust vector control (TVC), this technique used a gas or liquid that was sprayed into the exhaust path of rocket engine exhaust, thus deflecting the exhaust and thereby turning the vehicle. The test was conducted on a 450,000-pound thrust solid-fuel engine.
- 21 December SSD awarded a contract to United Technology Center for production of the 120-inch diameter, solid-propellant rocket motor for the Titan III.
- 28 December A Titan II was successfully captive-fired for the first time at Martin's test stand facilities near Denver, Colorado.
- 29 December Deputy Secretary of Defense Roswell L. Gilpatric authorized the Air Force to develop the Mobile Mid-Range Ballistic Missile (MMRBM) for land and surface ship deployment in Western Europe or the Far East.

1962

- 3 January NASA announced that the two-man Mercury Mark II spacecraft would be named "Gemini". Fifty percent larger than the Mercury capsule, the Gemini spacecraft would be used to develop space rendezvous and docking techniques and would be boosted into orbit by modified man-rated Titan II missiles.
- 11 January Headquarters Space Systems Division established the Gemini Launch Vehicle Directorate (SSVL) under Colonel R.C. Dineen as part of the Deputy for Launch Vehicles (SSV).
- 19 January The Martin Marietta Corporation was awarded a letter contract for the development and production of 15 Titan Gemini Launch Vehicles and related aerospace ground equipment (AGE).
- 19 January The Defense Department authorized the Air Force (BSD) to proceed with the development of a mobile mid-range ballistic missile (MMRBM) for eventual deployment in Europe and the Far East.
- 29 January The 47th, and final, Titan I research and development flight test missile (M-7) was successfully fired from Cape Canaveral. Of the launches, 34 were rated successes, nine partials, and only four as failures.
- February Space Systems Division asked the Douglas Aircraft Company to define the performance and design of a Standard Thor (DSV-2C) using three strap-on, solid-propellant motors.
- 13 February Atlas 40E, the 18th and last Atlas E research and development flight test missile to be launched from the Atlantic Missile Range, completed its programmed 7,000-mile flight downrange. Of the 18 missiles launched, nine were successes, seven partials, and two failures.

1962

- 16 February Space Systems Division awarded a contract to the Martin Marietta Corporation to study the design criteria for the Titan III standardized space launch vehicle.
- 20 February The 6555th Aerospace Test Wing launched the Mercury/Atlas D (MA-6), "Friendship 7," that placed the Mercury capsule containing LtColonel John Glenn, USMC, into orbit for the first Project Mercury manned orbital flight. "Friendship 7" completed three orbits before successful reentry and recovery in the Atlantic Ocean.
- March Francis E. Warren AFB, Wyoming, was selected as the site for Minuteman Wing V.
- March Construction work for all six Titan I squadrons was completed.
- 16 March The 6555th Aerospace Test Wing launched the first Titan II (XLGM-25C) research and development flight test missile (N-2) from Cape Canaveral. The Titan II was the most powerful ICBM yet launched by the U.S., its first stage engines generating 430,000 pounds of thrust and the second stage engine 100,000 pounds. The flight of N-2 also marked the first successful test of the AC Spark Plug inertial guidance system.
- 21 March Aerojet-General Corporation was given a letter contract for research, development, and manufacture of 15 sets of Titan Gemini Launch Vehicle propulsion systems and associated aerospace ground equipment (AGE).
- 23 March A new contract with Boeing authorized initial planning and testing for the Wing VI Block Change--the new designation for Improved Minuteman, later to become Minuteman II (LGM-30F).

1962

- 23 March An Air Force crew launched Atlas 134D during the visit of President John F. Kennedy to Cape Canaveral. This was the first time that a President had witnessed a live ICBM launch.
- 4 April Headquarters USAF officially announced that Francis E. Warren AFB, Wyoming, would be the site for the fifth wing of Minuteman ICBMs.
- 7 April A Titan III source selection board recommended United Technology Center as the developer of the solid-propellant booster motors.
- 12 April The Ballistic Systems Division Site Activation Task Force (SATAF) at Lowry AFB, Colorado, turned over Complex A, the first three-missile Titan I (HGM-25A) launch complex, to the 724th Strategic Missile Squadron of SAC's 451st Strategic Missile Wing. These were the first of 54 Titan I launchers programmed for SAC's operational inventory. All Titan I squadrons featured silo-lift facilities, that is, storage in an underground silo and erection to an above ground launch position.
- 14 April Space Systems Division selected the proposal submitted by United Technology Center for the 120-inch diameter, solid-propellant rocket motors for the Titan III and the Space Technology Laboratories-Arma Corporation proposal for the guidance system.
- 19 April The last Titan I (HGM-25A) complex was turned over to the 724th Strategic Missile Squadron of the 451st Strategic Missile Wing (SAC) at Lowry AFB, Colorado. This completed activation and transfer of the first nine-missile Titan I squadron to SAC.
- 23 April The 6555th Aerospace Test Wing launched an Atlas D/Agna B vehicle that carried NASA's Ranger IV to the moon. This was the first U.S. instrument package to impact on the moon.

1962

26 April

The first Scout vehicle (#111) was launched from Vandenberg AFB and carried the Navy's Solar Radiation (SOLRAD 4B) payload. However, a third stage failure resulted in payload impact 225-NM downrange.

1 May

Space Systems Division awarded a letter contract to the Douglas Aircraft Company for the design, development, fabrication, assembly, and pre-flight testing of one Douglas Space Vehicle 2C (DSV-2C) space booster that was originally proposed by the company in June 1961. The DSV-2C, later SLV-2A in Air Force nomenclature, was the Thrust Augmented Thor (TAT) that was the first attempt to combine solid and liquid fuel engines in a single space booster. Intended to fill the gap between the basic Thor booster (LV-2) and the Atlas (SLV-3), the TAT was to use three TX-33-52 solid-propellant Sergeant rocket motors installed around the engine section and attached to the three main thrust beams. Each of the solid-rocket motors would generate 54,500 pounds of thrust for 27 seconds after lift-off. This increased the total thrust of the vehicle to over 330,000 pounds, vastly improving its payload capabilities. The new TAT would have a 50 percent improvement in payload capacity since it could place 1,450 pounds into a 300-NM circular orbit when launched from Cape Canaveral--a 500-pound increase over the present Thor/Agena booster.

2 May

A letter contract was awarded to Atlantic Research Corporation for development and production of 77 Athena missiles for use in Ballistic Systems Division's subscale reentry systems research and development programs.

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- 4 May The second Titan I (HGM-25A) squadron at Lowry AFB, Colorado, the 725th Strategic Missile Squadron of SAC's 451st Strategic Missile Wing, became operational with the turnover of the last of three, three-missile launch complexes. All launch facilities were silo-lift.
- 4 May Titan I flight test missile was the 100th major space and ballistic vehicle to be launched from Vandenberg AFB since 16 December 1958. A total of 21 Thors, 32 Atlases, 5 Titans, and 42 space boosters had been launched from the base.
- 8 May The first attempt to launch an Atlas/Centaur from the Atlantic Missile Range was unsuccessful when the Centaur stage blew up at T+55 seconds due to a second stage structural failure. Despite this failure, the launch marked the first U.S. use of a space vehicle fueled by a liquid hydrogen engine.
- 14 May With Major General O.J. Ritland's transfer to Headquarters AFSC as Deputy to the Commander for Manned Space Flight, Lt General Howell M. Estes, Jr., became Commander of Space Systems Division in addition to remaining as Deputy Commander of AFSC for Aerospace Systems (DCAS).
- 23 May Directives issued by Secretary of Defense Robert S. McNamara effectively cancelled the Advent program and approved development of a new minimum essential satellite communications system for the Defense Department.
- 24 May BSD's 6555th Aerospace Test Wing launched Mercury/Atlas 7 (MA-7), "Aurora 7", into orbit carrying Navy Commander M. Scott Carpenter. This was the second U.S. manned orbital flight mission.

1962

- 29 May The Defense Department and NASA signed a joint agreement that authorized the Defense Department to develop a standardized Agena D upper stage for joint use with Atlas and Thor booster stages. The Agena would use present flight-proven equipment, stress simplification of vehicle design, permit adaptability to advanced components without any basic changes, and permit production at lower costs.
- June The Ballistic Systems Division and Space Systems Division attained complete autonomy with the impending inactivation of Deputy Commander of AFSC for Aerospace Systems (DCAS).
- June The first Minuteman Wing I configuration missile, LGM-30A, was completed at Air Force Plant 77.
- 9 June A Titan I liquid-fueled engine was strapped to the side of a 175-ton solid-propellant rocket motor, and the configuration was test fired by Aerojet-General Corporation to evaluate the compatibility of liquid and solid engines for SSD's Titan III space launch vehicle. The combination generated 700,000 pounds of thrust.
- 11 June The Department of Defense announced the reassignment of responsibility for the Defense Department Communication Satellite program (Advent). The Air Force was now given responsibility for the development, production, and launch of all space devices, in line with the policy on military space systems originally delineated on 6 March 1961. The Army retained responsibility for the ground system. The Defense Communications Agency (DCA) assumed overall responsibility for integration.

1962

- 18 June A Royal Air Force crew launched the 22d and last operational test Thor IRBM (PGM-17A) from Vandenberg AFB.
- 26 June The Dyna-Soar was redesignated the X-20 manned space glider.
- 27 June The first Agena D (#1151) upper stage vehicle was successfully flown on a Thor booster (#340) launched from Vandenberg AFB. The Lockheed Agena D was a redesign of the basic Agena B and was intended to be the standard stage vehicle for most Defense Department and NASA programs. The program was begun in August 1961, revised and accelerated in November, and had its first flight in June 1962.
- 1 July Major General W. Austin Davis assumed command of Ballistic Systems Division from Major General Thomas P. Gerrity who moved to Headquarters USAF as Deputy Chief of Staff for Systems and Logistics (DCS/S & L).
- 5 July Secretary of Defense Robert S. McNamara issued to the Secretaries of the Air Force and Army and to the Director of the Defense Communications Agency (DCA) a memorandum which clearly defined the responsibilities of each organization in their joint task of developing a defense communications satellite system. The Air Force was assigned the development of the space vehicle and satellite communications components and would assume responsibility for operation of the space elements of the system. Space Systems Division was subsequently given these responsibilities for the development of the medium-altitude communications satellite system and point-to-point repeater satellites to be placed in synchronous orbit.
- 10 July A NASA Thor/Delta boosted Telstar, the first commercially developed international communications satellite, into orbit.

1962

- 13 July After two consecutive failures, the first successful launch and flight by an Atlas E (67E) from Vandenberg AFB took place.
- 29 July-30 September Ballistic Systems Division moved from Los Angeles to Norton AFB, San Bernardino, California.
- 1 August The first Atlas F missile (15F) was launched from Vandenberg on an operational test flight.
- 2 August The designated Systems Management Group selected Grand Forks AFB, North Dakota, as the operational location for Minuteman Wing VI, the first Minuteman II (LGM-30F) unit.
- 16 August With the transfer of Complex A, the turnover of the 569th Strategic Missile Squadron to SAC was completed. All nine Titan I missiles were now operational at Mountain Home AFB, Idaho, bringing the total number of launchers transferred to SAC to 27.
- 20 August The Defense Department announced plans to develop the Titan III launch vehicle that was to be operational by 1965. Martin Marietta Corporation would be the systems integration (prime) contractor for the Titan III program that was managed by AFSC's Space Systems Division.
- 26 August An Atlas/Agena B launch vehicle boosted NASA's Mariner II Venus space probe from Cape Canaveral. After a 109-day journey of over 180 million miles, Mariner passed within 21,000 miles of Venus on 14 December.
- 31 August The first Titan II (LGM-25C) operational missile was accepted by the Air Force. This missile was delivered to Davis-Monthan AFB, Arizona, on 11 December 1962.

1962

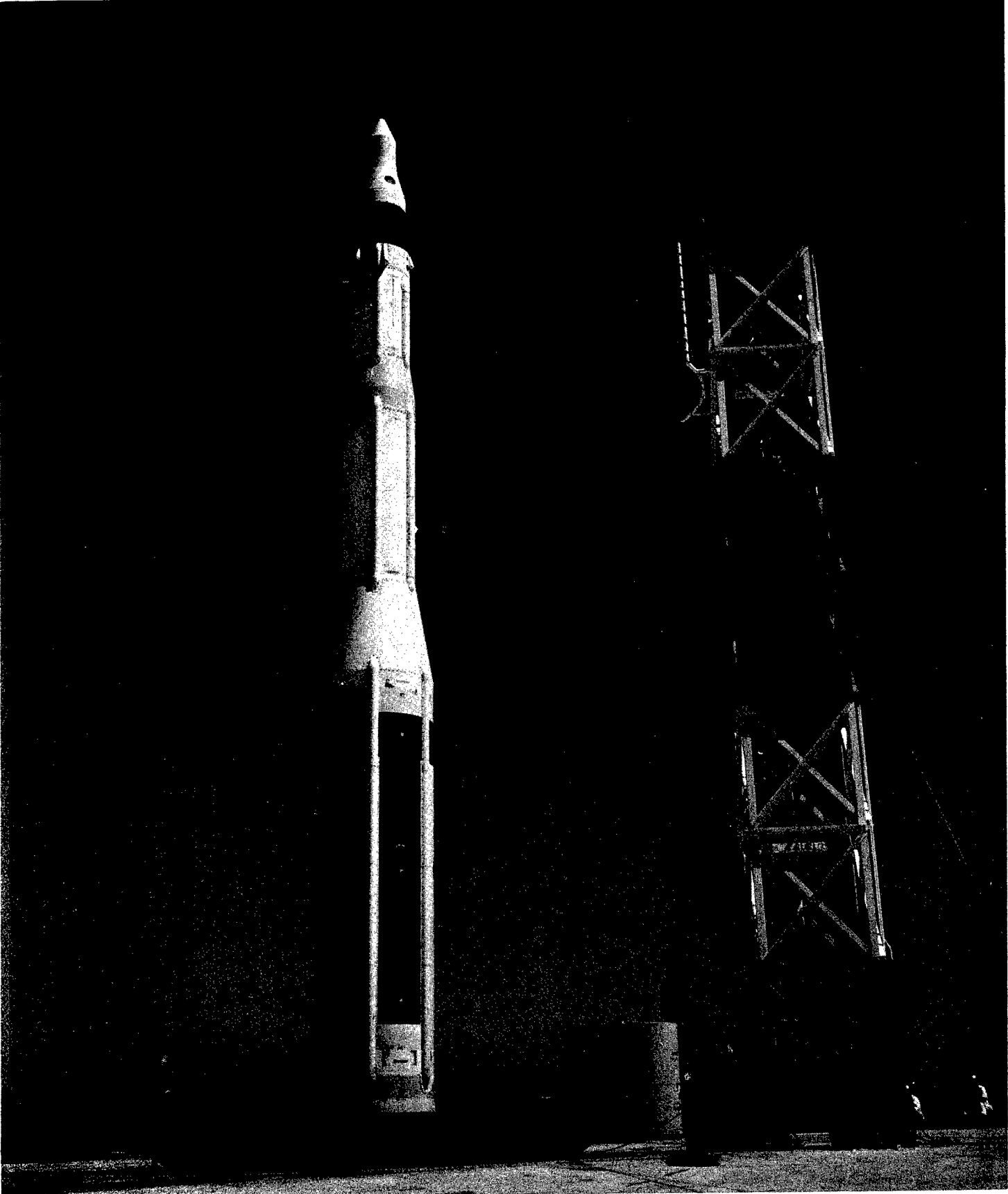
- September The major portion of BSD's move to Norton was completed.
- 7 September The first Atlas F (HGM-16AF) missile squadron, the 550th Strategic Missile Squadron at Schilling AFB, Kansas, was turned over to SAC. This was the first Atlas unit to feature the silo-lift storage/launcher configuration for improved hardness and survivability.
- 8 September The nine Titan I missile launchers at Beale AFB, California, were turned over to SAC's 851st Strategic Missile Squadron.
- 8 September Headquarters USAF announced that the Deputy Chief of Staff for Research and Development (DCS/R&D) would be the focal point for space projects within Headquarters USAF. Lt General James Ferguson, DCS/R&D, would possess Air Force headquarters responsibility for programs such as MIDAS, Titan III, Dyna-Soar, and others.
- 15 September The second silo-lift Atlas F squadron, the 551st Strategic Missile Squadron at Lincoln AFB, Nebraska, was turned over to SAC.
- 17 September The last elements of the Minuteman System Program Office completed their transfer from Los Angeles to Ballistic Systems Division's new headquarters at Norton AFB.
- 19 September Atlas 8F, the seventh Series F R&D missile, was the 100th to be launched from Cape Canaveral since the first abortive launch on 11 June 1957 and the 145th Atlas to be launched from both Cape Canaveral and Vandenberg.
- 26 September The last complex of the 850th Strategic Missile Squadron (Titan I) at Ellsworth AFB, South Dakota, was turned over to SAC.

1962

- 28 September The last of the six operational Titan I squadrons, the 568th Strategic Missile Squadron at Larson AFB, Washington, was transferred to SAC. This brought the Titan I operational force to its programmed strength of six radio-guidance squadrons and 54 silo-lift launchers.
- 28 September The first R&D Category I launch of a Wing I configuration Minuteman missile (LGM-30A), from Vandenberg AFB was completed.
- 3 October An Atlas D booster lifted the Mercury (MA-8), with Walter Schirra aboard, into orbit. Schirra's "Sigma 7" Mercury capsule completed six orbits before reentering and splashing down within five miles of the recovery carrier, the U.S.S. Kearsarge, in the Pacific Ocean.
- 3 October Major General Ben I. Funk assumed command of Space Systems Division from Lt General Howell M. Estes, Jr.
- 9 October The 577th Strategic Missile Squadron at Altus AFB, Oklahoma, was the third Atlas F squadron turned over to SAC by Ballistic Systems Division site activation task forces (SATAFs).
- 10 October Deputy Commander of AFSC for Aerospace Systems (DCAS) was inactivated. Lt General Howell M. Estes, Jr., moved to Headquarters AFSC as Vice Commander, with Major General Ben I. Funk already having assumed command of SSD on 3 October. SSD and BSD were now completely independent divisions and reported directly to AFSC headquarters.
- 24 October Flight A, 10th Strategic Missile Squadron, 341st Strategic Missile Wing at Malmstrom AFB, Montana, was the first flight of Minuteman I (LGM-30A) missile launchers to be delivered to SAC.

1962

- 26 October Atlas 159D was launched from Vandenberg AFB carrying the first payload in the Ballistic Systems Division's Nike Targets program in support of the Army's Nike-X anti-ballistic missile development effort.
- November Secretary of the Air Force Eugene M. Zuckert approved a proposed solution to the facilities problem at Space Systems Division. This included the construction of new Aerospace Corporation buildings on the El Segundo site--at the southwest corner of El Segundo and Aviation Boulevards across from the R&D Center.
- 1 November Ballistic Systems Division's Site Activation Task Forces (SATAFs) for Titan I at Larson, Lowry, and Mountain Home AFBs were discontinued.
- 1 November Space Systems Division awarded a \$173 million contract to United Technology Center for Phase II development of the five-segment, 120-inch diameter, solid-propellant rocket motors for Titan III.
- 4 November The Atlas F missile squadron located at Dyess AFB, Texas--the 578th Strategic Missile Squadron--was turned over to SAC.
- 26 November Space Systems Division published a Proposed System Package Plan for a point-to-point military voice and teletype communications system using stabilized active repeater satellites in synchronous equatorial orbits.
- 29 November Ground was broken at Edwards AFB, California for construction of the largest and most heavily instrumented solid-rocket motor test facility. It was designed to test the five-segment, 120-inch solid-propellant motors for the Titan III program but could handle engines up to and including 156 inches in diameter.
- 30 November The Atlas F silo-lift squadron at Walker AFB, New Mexico, was turned over to SAC (579th SMS) and was declared fully operational 8 December.



This Minuteman I ICBM was the first Minuteman launched in the flight test phase of its development program. The early flight tests occurred from above ground pads. Later missiles in the program were launched directly from their underground silos.

1962

- 1 December Beginning the development phase of the Titan III program, the Martin Marietta Corporation was awarded a contract for Titan III airframe, systems, integration, and testing.
- 3 December The Defense Department announced cancellation of plans for the immediate development of a detector-interceptor satellite (Project Saint). SSD held program management responsibility for Saint development.
- 5 December The final Atlas F research and development flight test missile (21F) was launched down the Atlantic Missile Range. Ten missiles were launched in this series--seven were successes and three failures. The launch of Atlas 21F brought flight testing of Atlas operational missiles from Cape Canaveral to an end after almost five and one-half years. Since the first R&D Atlas was launched on 11 June 1957, 83 Atlas Series A through F missiles had been fired from the Cape--52 of them successes or partials and 31 failures.
- 7 December The first Minuteman I (LGM-30B) flight test missile (FTM 424) was launched from Cape Canaveral.
- 7 December With the transfer of the 556th Strategic Missile Squadron at Plattsburgh AFB, New York, to SAC, the activation of the Atlas ICBM force was completed. The 556th was declared fully operational on 20 December. Between 7 September and 7 December 1962, Ballistic Systems Division had turned over 72 Atlas F missile launchers to SAC. Since August 1959, a total of 132 Atlas D, E, and F missile sites had been turned over to SAC.
- 11 December Minuteman weapon system (WS 133A) became operational with the turnover of the first two flights of 10 missiles each to SAC's 341st Strategic Missile Wing at Malmstrom AFB, Montana.

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21 December

Headquarters Space Systems Division awarded a \$30 million contract to United Technology Center (UTC) for the design, development, delivery, and flight testing of large, segmented, solid-propellant rocket motors.

27 December

The first operational Titan II (LGM-25C) missile was installed in the lead complex of the 570th Strategic Missile Squadron at Davis-Monthan AFB, Arizona. This was a major milestone in the transition of the Titan II from research and development to fully operational status with the Strategic Air Command.

1963

- 9 January The Defense Department announced its approval of the conversion of the Thor IRBM to a space booster.
- 22 January NASA Administrator James E. Webb and Secretary of Defense Robert S. McNamara announced the NASA-DoD agreement setting up the Gemini Program Planning Board to delineate NASA and DoD requirements and to monitor the Gemini program. The provisions for the Gemini program previously agreed upon were reaffirmed.
- 31 January Headquarters Space Systems Division solicited requests for proposals (RFPs) for the development of a medium-altitude military communications satellite system that would be developed in place of the former Project Advent.
- February Construction of the Aerospace Corporation's new buildings began.
- 6 February A Titan II (N-16) completed a 6,500-mile flight down the Atlantic Missile Range carrying the heaviest payload ever to travel that far on a U.S. missile. This was also the first Titan II (XLGM-25C) launched by an entire Air Force crew.
- 8 February The Air Force officially announced the selection of Grand Forks AFB, North Dakota, as the site for the sixth and final Minuteman operational wing (Wing VI).
- 14 February NASA's Syncom I (Synchronous Communications) satellite was placed in orbit by a Thor/Delta launch vehicle. During firing of the apogee kick motor, contact was lost with the satellite. Syncom was a NASA project supported by DoD ground stations and communications experiments.
- 16 February The 6595th Aerospace Test Wing at Vandenberg AFB conducted the first west coast launch of a Titan II research

1963

and development test missile (N-7) from an underground silo. In this first silo launch of a Titan II, the missile destroyed itself at 56 seconds into powered flight.

20 February

Minuteman FTM 421B was successfully launched from the Eastern Test Range by an all-Air Force crew, thus completing the Atlantic range test program for the Wing I configuration Minuteman missile (LGM-30A).

23 February

United Technology Center (UTC), the contractor for the Titan III solid-rocket motors, successfully conducted the first static firing of one segment of the large-size, 120-inch diameter solid-propellant rocket motor that would be used as the first stage (Stage 0) booster. UTC was developing a single engine of five segments as the basic booster.

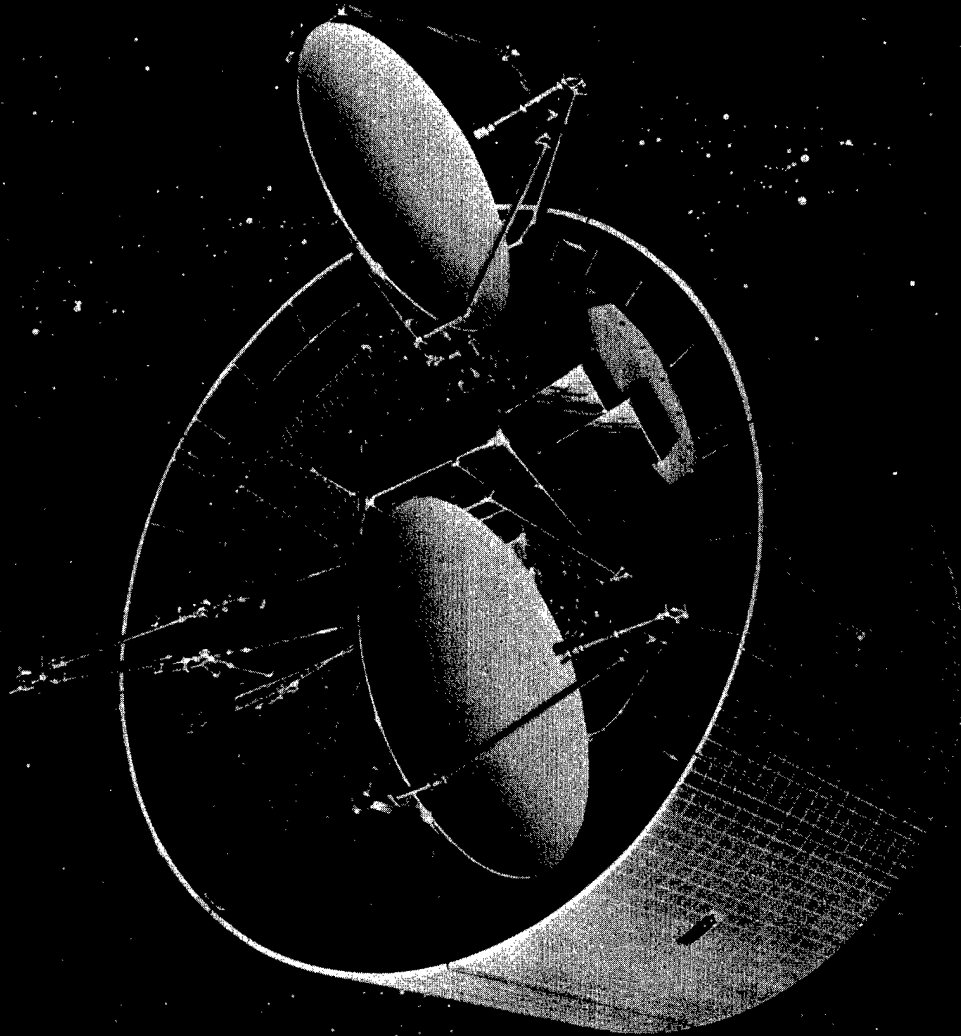
25 February

The Air Force announced the formal contract award to Martin Marietta Corporation for the design, development, fabrication, and delivery of Titan III standard launch vehicles for space missions. Martin Marietta would act as the systems integration contractor, while Aerojet-General would produce the liquid-fuel propulsions systems for the Titan core section and United Technology Center (UTC) would provide the solid-rocket motors (SRMs) for the booster.

28 February

Five years after development was approved, the first fully operational Minuteman squadron, the 10th Strategic Missile Squadron of the 341st Strategic Missile Wing at Malmstrom AFB, Montana, was turned over to SAC when the transfer of Flight E was completed.

UNCLASSIFIED



Artist's rendering of the DSCS II satellite.

UNCLASSIFIED

1963

- 3 April All major site construction on the Titan II force was completed at Davis-Monthan AFB, Arizona; Little Rock AFB, Arkansas; and McConnell AFB, Kansas.
- 11 April The first successful launch of a fully operational Minuteman missile from Vandenberg by an Air Force crew was completed under simulated operational conditions.
- 17 April The Defense Department announced the selection of Thiokol Chemical Corporation, Aerojet-General Corporation, and Lockheed Propulsion Company to conduct work on the development of large solid-propellant motors as part of the Space Systems Division's Large Solid Rocket Motor Program (Program 623A). Development work was divided into four tasks: (1) Thiokol and Aerojet-General were to develop 260-inch diameter, solid rocket motors of 3 million pounds of thrust for demonstration static firings; (2) Thiokol was to work on a 156-inch, 3 million-pound thrust, two-segment solid rocket motor; (3) Thiokol was to develop and static fire a 156-inch, one-segment solid rocket motor of one million pounds thrust demonstrating thrust vector control (TVC) through movable nozzles; and (4) Lockheed was to static fire a 156-inch, single segment solid rocket motor of one million pounds thrust that demonstrated TVC through jet tabs.
- 27 April Titan II (N-8) was the second research and development missile and the first successful flight test vehicle to be launched from a silo at Vandenberg AFB. This was the first successful Titan II launch and flight after three consecutive failures, one (N-7) at Vandenberg and two (N-18 and N-21) at the Atlantic range.
- 1 May The Titan I research and development flight test program ended with the launch of missile V-4 from Vandenberg. V-4 self-destructed over the launch pad, recording one of the seven failures in the Titan I flight test program that began in

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February 1959. Since then, a total of 57 Titan I R&D missiles had been fired-- 47 from the Atlantic range and 10 from Vandenberg. Of these, 36 were complete successes, 14 were partially successful, and seven were registered as failures.

14 May

The Advanced Ballistic Reentry System (ABRES) program, Program 627A, was established as a Defense Department joint-service program for reentry vehicle research, development, and testing. The Deputy for Ballistic Missile Reentry Systems (D/BMRS) office, established at Headquarters Ballistic Systems Division at Norton AFB in February 1963 would manage the program. The program director for ABRES would be Colonel Darwin C. Middlekauff, BSD's Deputy for Ballistic Missile Reentry Systems.

15 May

Mercury/Atlas 9 (MA-9) carried Major R. Gordon Cooper, Jr., USAF, into space for 22 trips around the Earth in the fourth, and final, Project Mercury manned orbital flight.

24 May

Headquarters USAF recommended that Atlas D,E, and Titan I missiles be phased out of SAC's active operational inventory between 1965 and 1968. The older liquid-fueled ICBMs were expensive to operate, required a large manpower commitment, were slow-reacting and thus vulnerable when compared to the more advanced Minuteman and Titan II missile that were being deployed.

24 May

The 6595th Aerospace Test Wing launched flight test missile 458, the first Minuteman I (LGM-30B) missile to be launched from Vandenberg.

June

The final Minuteman I (LGM-30A) missile was completed at Air Force Plant 77.

1 June

Philco/Space Technology Laboratories and General Electric/Motorola initiated Phase IB, Program Definition, on the defense communications satellite program managed by Space Systems Division.

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- 8 June The first Titan II operational squadron, the 570th Strategic Missile Squadron, was activated at Davis-Monthan AFB, Arizona, and assigned to SAC's 390th Strategic Missile Wing.
- 29 June An Air Force Thor/Agena B launched from Vandenberg established a number of distinctive records. It was the 200th Thor to be launched since Number 101 was launched at Cape Canaveral on 25 January 1957. It was the first, last and only Thrust Augmented Thor/Agena B to be used by the Air Force. It was the final Agena B (#2314) to be employed with a Thor booster.
- 30 June Responsibility for the Atlas E weapon system was transferred from BSD (AFSC) to the Air Force Logistics Command (AFLC).
- 30 June The first Titan II flight at Davis-Monthan AFB was turned over to SAC's 570th Strategic Missile Squadron.
- 1 July The 6555th Aerospace Test Wing at Patrick AFB, Florida, was transferred from BSD to SSD. This brought all Air Force missile test and space launching responsibilities under Space Systems Division which already had the 6595th ATW at Vandenberg AFB.
- 1 July The first Minuteman I (LGM-30B) Wing II configuration flight test missile to be launched from Cape Canaveral was launched from Silo 32B.
- 3 July The first three-squadron, 150-missile Minuteman wing, the 341st Strategic Missile Wing at Malmstrom AFB, Montana, was completed and turned over to SAC.
- 3 July Atlas 69E successfully led off the seven-missile Atlas E operational program launch series from Vandenberg.

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- 5 July Flight test missile 518 was launched from Vandenberg AFB. This was the last of 31 Minuteman I (LGM-30A) research and development missiles to be launched--23 from Cape Canaveral and eight from Vandenberg.
- 12 July The Air Force launched its first Atlas D/Agna D from Vandenberg. This was the 100th Agna (Number 4702) space vehicle used since 28 February 1959.
- 15 July After a detailed, six-month review of the Titan III program, Secretary of Defense Robert S. McNamara approved the continued development of the Titan III in accordance with existing Space Systems Division plans.
- 18 July The final Air Force Atlas D/Agna B (75D/1207) was launched from Vandenberg AFB.
- 20 July The first full-scale, five-segment solid-propellant booster motor for the Titan III, the world's largest solid-rocket motor (SRM), was test fired at the United Technology Center's test facility at Sunnyvale, California. The motor produced over 1,000,000 pounds of thrust during its 110-second firing.
- 23 July At its Sacramento test facility, the Aerojet-General Corporation conducted the first test firing of the twin-engine propulsion system that would power the Titan III upper stage. The engines, producing 16,000 pounds of thrust, fired for 284 seconds.
- 26 July NASA's Syncom II synchronous communications satellite was placed in orbit by a Thor/Delta launched from Cape Canaveral.
- 31 July The Titan I weapon system acquisition phase was completed and engineering responsibility for the Titan I (WS 107B) was transferred from Ballistic Systems Division (AFSC) to AFLC.

1963

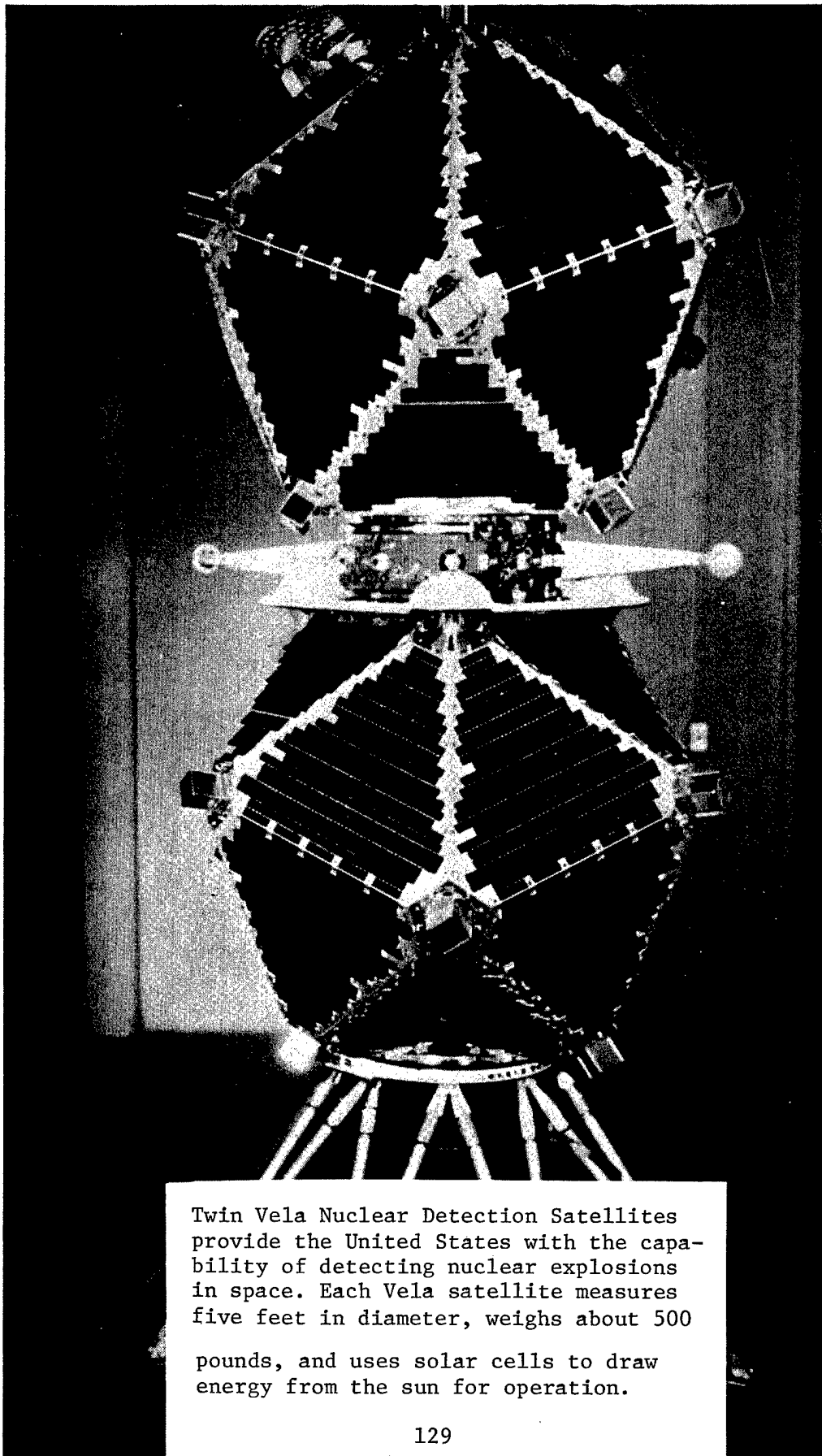
- 1 August Executive management responsibility for the Titan I weapon system (WS 107A-2) was transferred from BSD (AFSC) to San Bernardino Air Materiel Area (AFLC), Norton AFB, California.
- 5 August Brigadier General Samuel C. Phillips became BSD's Vice Commander, and Brigadier General John L. McCoy took over General Phillips' job as Deputy Commander for Minuteman.
- 8 August Official turnover ceremonies for Minuteman Wing I took place at Malmstrom AFB, Montana.
- 9 August The Defense Department informed Congress that the Mobile Mid-Range Ballistic Missile (MMRBM) was cancelled. Phase I work would continue but under separate contracts.
- 17 August General Dynamics' Convair/Astronautics fired the Centaur liquid hydrogen/liquid oxygen upper stage for the first time using both RL-10 engines.
- 19 August Work on the first squadron of Minuteman Wing II, the 66th Strategic Missile Squadron of the 44th Strategic Missile Wing at Ellsworth AFB, South Dakota, was completed and the squadron turned over to SAC.
- 23 August Headquarters Space Systems Division awarded two contracts in its program to develop the technology for large-solid-propellant motors (Program 623A). Thiokol Chemical Corporation and Aerojet-General Corporation received contracts for demonstration static firings of 260-inch diameter, solid-propellant rocket motors of approximately 3 million, pounds thrust. Following the test firings, one of the contractors would be selected to continue development of the 260-inch motor.

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- 29 August The 67th Strategic Missile Squadron of the 44th Strategic Missile Wing at Ellsworth AFB was completed and turned over to SAC by Ballistic Systems Division's Site Activation Task Force (SATAF).
- 29 August The first Thor standard launch vehicle, SLV-2, with an Agena D upper stage vehicle, was launched from Vandenberg AFB.
- 6 September Headquarters USAF approved General Electric as the contractor for the Mark 12 reentry vehicle system for the Minuteman ICBM.
- 6 September NASA and DoD announced a new agreement for NASA's use of Air Force-developed Agena vehicles. Space Systems Division was to be responsible for design, engineering, and acceptance testing of basic Atlas and Thor vehicles and the Agena D upper stages. NASA would buy these from the Air Force, modify them as needed, and launch the Atlas/Agenas from the Atlantic Missile Range while the Air Force conducted all Atlas/Agena and Thor/Agena launches from Vandenberg.
- 18 September A Thor (SLV-2) booster lifted the first Aerothermodynamic/Elastic Structural Systems Environmental Tests (ASSET) program vehicle (ASV-1) on a successful suborbital flight from Cape Canaveral. The ASSET program was designed to test materials and study flight characteristics of glide reentry vehicles. SSD provided the boosters and launch services for the program, while Flight Dynamics Laboratory was responsible for overall program management.
- 23 September The MMRBM program plan was reoriented, with the "go-ahead" development decision date set for 31 July 1964.

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- 23 September Titan II (N-23) became the first Category II research and development missile to be launched successfully from Vandenberg AFB by the 6595th Aerospace Test Wing.
- 28 September Trevor Gardner, in many ways the driving force behind the acceleration of the Air Force ballistic missile program from 1953 through 1956, died in his Washington home.
- 28 September The first Thor/Ablestar launch from Vandenberg carried a Navy payload that became the first satellite to be operated completely with nuclear power. A SNAP-9A satellite nuclear power supply, built by the Martin Company and the Atomic Energy Commission, was used to power the satellite.
- 9 October General Electric began development of the Mark 12 reentry vehicle for use with both the Minuteman and Polaris/Poseidon weapon systems.
- 16 October Space Systems Division, acting as program manager for the Defense Department, launched two Vela nuclear radiation detection satellites from Cape Canaveral aboard the first Atlas D/Agna D (SLV-3/SS-01A) launch vehicle (197D). The Vela satellites were developed and produced by the TRW Systems and were the first pair in a series of satellites designed to provide information on nuclear detonations in the atmosphere or in outer space to a distance of 100 million miles. The 297-pound satellites were placed in near-circular orbits approximately 70,000 miles above the Earth's surface.
- 17 October SAC launched the first Minuteman I (LGM-30A) missile (FTM 672) from Vandenberg in its operational testing program.



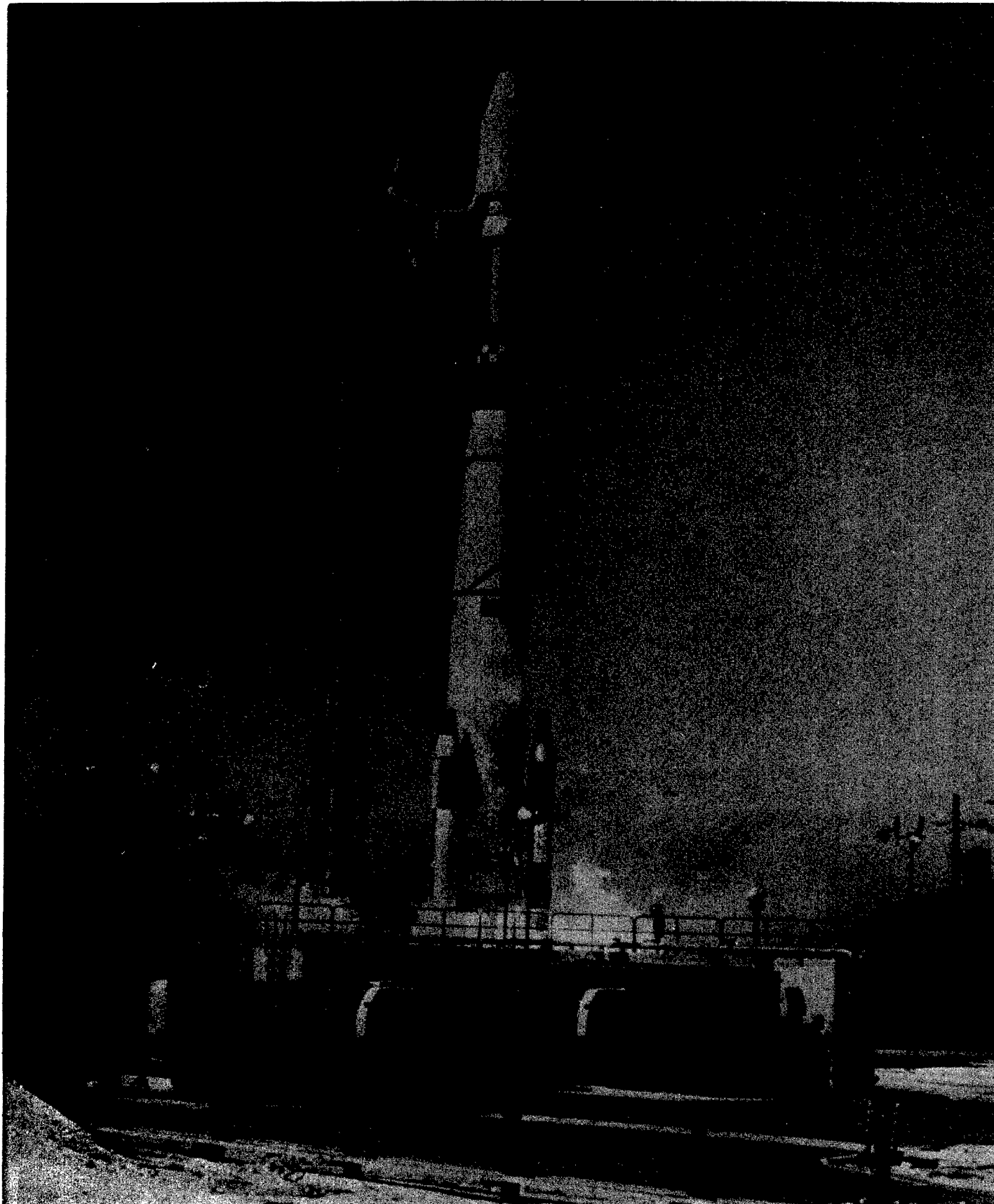
Twin Vela Nuclear Detection Satellites provide the United States with the capability of detecting nuclear explosions in space. Each Vela satellite measures five feet in diameter, weighs about 500 pounds, and uses solar cells to draw energy from the sun for operation.

1963

- 23 October With the turnover of the 68th Strategic Missile Squadron, the second Minuteman wing, the 44th Strategic Missile Wing at Ellsworth AFB, was completed and transferred entirely to SAC.
- 24 October As a result of Congressional compromise on the requested budget of \$73.1 million for FY 1964, Headquarters USAF was able to announce that Mobile Mid-Range Ballistic Missile (MMRBM) contracts with Hughes, Thiokol, Goodyear, and Aeronutronics would be reinstated.
- 25 October From the Martin Marietta Corporation, the Space Systems Division accepted the first Titan II Gemini Launch Vehicle intended for use as the booster in NASA's two-man Gemini manned flight program to begin in 1965.
- 30 October The Defense Department and NASA announced that the Thrust Augmented Thor (TAT) space booster developed by the Air Force would be added to the national launch vehicles program as a booster for Agena and Delta upper stages. The TAT increased total thrust to over 330,000 pounds and would improve the Delta's payload into earth orbit from 800 to 1,000 pounds.
- 4 November The first Advanced Ballistic Reentry System (ABRES) program launch from Vandenberg was successfully completed when SAC's Atlas D booster (232D) carried the Chrysler-built REX-3 reentry vehicle down the Pacific Missile Range.
- 13 November SAC launched Atlas D (158) in the final Atlas D operational program launch from Vandenberg. The missile was a failure, making the final tally for the 26 launches nine failures and 17 successes.

1963

- 13 November A Minuteman flight test missile with a first stage cylindrical skirt and a gas injection steering system was successfully flight tested. These were Wing VI technical innovations that would be introduced with the Minuteman II (LGM-30F) missile.
- 20 November The Defense Department announced that the Naval Missile Facility at Point Arguello, California, and the Navy tracking stations in the Pacific would be transferred to the Air Force which would become the single manager for ICBM and space tracking activities. This would include control of the Atlantic Missile Range, the Pacific Missile Range, and the satellite control facilities at Sunnyvale, California, and combine them under a single component of the Air Force.
- 25 November The 570th Strategic Missile Squadron became fully operational and was turned over to SAC. This was the first Titan II (LGM-25C) squadron to reach fully operational status.
- 27 November Launched from Cape Canaveral, Atlas/Centaur (AC-2) was the first successful use of the high-energy liquid hydrogen/liquid oxygen Centaur upper stage vehicle developed for NASA by General Dynamics. The spent Centaur stage entered orbit.
- 27 November The 533d Strategic Missile Squadron, the first Titan II squadron at McConnell AFB, Kansas, was turned over to SAC.
- 27 November Space Systems Division accepted the first Titan III engine from Aerojet-General at its Sacramento facilities. The first and second stage liquid engines, 430,000 and 100,000 pounds of thrust respectively, were for the Titan IIIA vehicle that would test the basic center core configuration



With all motors firing, this Thrust-Augmented Thor Standard Launch Vehicle (SLV-2A) lifts off its launch pad at Vandenberg AFB, California. Thrust of the original Thor was almost doubled by addition of three solid propellant engines mounted on the airframe.

1963

(Stages 1 and 2) of the eventual Titan IIIC vehicle.

29 November

All 18 Titan II launchers at Davis-Monthan AFB were operational with the turnover of the second squadron, the 571st Strategic Missile Squadron, to SAC's 390th Strategic Missile Wing.

4 December

The second McConnell Titan II squadron of LGM-25C missiles, the 532d Strategic Missile Squadron, was turned over to SAC.

8 December

The first operational Titan II squadron at Little Rock AFB, the 373d Strategic Missile Squadron, was transferred to SAC.

10 December

The Department of Defense announced cancellation of the Dyna-Soar (X-20) program.

10 December

Secretary of Defense Robert S. McNamara assigned responsibility for the development of a near-earth Manned Orbiting Laboratory (MOL) to the Air Force. First manned flight was tentatively planned for late 1967 or early 1968. A modified Titan III, the Titan IIIM, would be used to place the laboratories in orbit from Vandenberg.

16 December

General Bernard A. Schriever, AFSC Commander, assigned Space Systems Division the responsibility for managing the entire military manned space effort, including the Manned Orbiting Laboratory (MOL) and the unmanned glider flight test (ASSET) program.

18 December

Atlas 109F was the final Atlas research and development flight test missile to be launched. Since the first attempted launch of a Series A Atlas on 11 June 1957, 95 Atlas missiles had been used in the R&D program--eight As, nine Bs, six Cs, 32 Ds, 24 Es, and 16 Fs. All but 12 of these were launched from Cape Canaveral. Of the 95 launches, 57 were considered successful while 38 were failures.

1963

- 19 December In its first NASA use from Vandenberg AFB a Scout rocket (#122) was successfully launched. The 18-pound Explorer 19 atmosphere density satellite was successfully injected into orbit.
- 20 December The last Royal Air Force Thor IRBM squadron was inactivated and the missiles retired from the Royal Air Force inventory.
- 28 December Headquarters USAF effectively cancelled BSD's Advanced ICBM program when it directed all studies to be separate line items in exploratory and advanced development areas.
- 28 December The sixth and final operational Titan II squadron, the 374th Strategic Missile Squadron, was transferred to SAC at Little Rock AFB, Arkansas. This action completed the programmed activation of the force of 54 Titan II (LGM-25C) missile launchers.
- 31 December Brigadier General Samuel C. Phillips, Vice Commander, Ballistic Systems Division, and former Minuteman program director, was appointed Deputy Director of the Apollo Manned Lunar Landing Program (NASA) effective 15 January 1964.

1964

- January In accordance with the Headquarters AFSC directive of 16 December 1963, Space Systems Division planned to expand the ASSET program and to establish a new program--Spacecraft Technology and Advanced Reentry Tests (START).
- 2 January Headquarters AFSC established Headquarters National Range Division (Provisional) at Patrick AFB, Florida, under Major General Leighton I. Davis, former Air Force Missile Test Center (AFMTC) commander. Brigadier General Harry J. Sands, Jr., Vice Commander of AFMTC, became its new commander. The Air Force Space Test Center (Provisional) was established at Vandenberg AFB, California, with Brigadier General Jewell C. Maxwell, former Commander, 6595th Aerospace Test Wing, as its commander. Headquarters NRD was to coordinate launch and range activities at the Atlantic Missile Range, AFMTC, and at the Pacific Missile Range, AFSTC.
- 6 January The update program for the Atlas F missile sites began on schedule.
- 15 January Engineering responsibility for Wing I Minuteman missiles (LGM-30A) was transferred from Ballistic Systems Division (AFSC) to Ogden Air Materiel Area (AFLC), Hill AFB, Utah.
- 24 January The 740th Strategic Missile Squadron of the 455th Strategic Missile Wing (Wing III) at Minot AFB, North Dakota, was turned over to SAC.
- 27 January During the Defense Department budget hearings before the House Armed Services Committee, Secretary of Defense Robert S. McNamara announced that a Minuteman Force Modernization Program would be established to replace the earlier model Minuteman I (LGM-30A and LGM-30B) missiles with the more advanced Wing VI configuration, Minuteman II (LGM-30F) missile, in Wings I - V. In his FY 1965 budget request, Secretary McNamara also included

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\$110 million for continued development of the Mobile Mid-Range Ballistic Missile (MMRBM) weapon system.

- 1 February Space Systems Division was named the Air Force executive agent for the Manned Orbiting Laboratory (MOL) spacecraft.
- 1 February Ballistic Systems Division transferred system and engineering responsibility for the Atlas F missile to AFLC's San Bernardino Air Materiel Area (SBAMA), Norton AFB, California.
- 5 February Dr. Harold Brown, Director of Defense Research and Engineering (DDR&E), directed the Air Force to make a feasibility study of a Transportable Mid-Range Ballistic Missile (TMRBM) using the second and third stages of the Minuteman ICBM.
- 10 February The first Athena test missile was launched from Green River, Utah, toward the White Sands Missile Range (WSMR) in New Mexico. The Athena research rocket was designed for the support of the Advanced Ballistic Reentry Systems (ABRES) program. Subscale models of ballistic reentry vehicles would be flown on the Athenas to test reentry vehicle concepts and phenomena. This first missile only had two operational stages, and several system failures resulted in the premature impact of the missile some 11 miles from Durango, Colorado.
- 24 February The first successful multiple Minuteman ICBM launch was executed at the Pacific Missile Range when two Wing II Minuteman I (LGM-30B) missiles (FTM 813 and 688) were launched by SAC's First Strategic Aerospace Division (1STRAD). Both missiles were launched separately in the salvo mode; the ripple mode was not used for these launches. These were also the initial two Minuteman IB operational test launches.

1964

- 25 February The first and only Atlas E (5E) ABRES vehicle to be launched from Cape Canaveral completed a successful flight down the Atlantic Missile Range.
- 27 February The 455th Strategic Missile Wing's second Minuteman I (LGM-30B) squadron, the 741st Strategic Missile Squadron, was turned over to SAC at Minot AFB, North Dakota.
- 29 February The second multiple launch of two SAC Minuteman I missiles was conducted at Vandenberg AFB. Minuteman I (LGM-30A) missiles (FTM 581 and 636) were successfully launched from Vandenberg 20 minutes apart in the first ripple mode launch ever conducted. In this mode, a single launch crew gave both commands to launch.
- 12 March The 500th operational Minuteman missile, a Wing IV configuration (LGM-30B), was shipped from Air Force Plant 77 at Ogden Air Materiel Area (OOAMA), Utah, to Whiteman AFB, Missouri.
- 13 March The 10th, and last, Titan II (XLGM-25C) research and development flight test missile (N-30) to be launched from Vandenberg completed a successful flight.
- 19 March The third wing of Minuteman ICBMs was completed when the 742d Strategic Missile Squadron was turned over to SAC at Minot AFB. The Minuteman force then totaled 450 missiles, Wing I of 150 LGM-30As and Wing II and III each of 150 LGM-30B missiles.
- 24 March The second flight test of the ASSET reentry vehicle from Cape Canaveral failed when the second stage of the Thor/Delta failed to ignite. The test objectives were not met.

1964

- April The former R&D Center was redesignated Los Angeles Air Force Station and became the home of Space Systems Division. The R&D Center and the former Navy Douglas facilities at the northwest corner of El Segundo and Aviation Boulevards in El Segundo, California, were transferred from industrial to command facilities.
- 1 April The last of four Atlas F (137F) ABRES test missiles was flown down the Atlantic Missile Range from Cape Canaveral.
- 8 April An Air Force Titan II Gemini Launch Vehicle (GLV-1), carrying an unmanned version of the Gemini spacecraft, was successfully flight tested from Cape Canaveral. This was the first of two tests preceding the initial manned Gemini mission. Space Systems Division was responsible for the Titan II booster that would place the Gemini astronauts in orbit and for the launch services at the Cape.
- 9 April The 23d, and last, Titan II research and development missile (N-3A) to be launched down the Atlantic range completed a successful flight. With the 10 test flights from Vandenberg, a total of 33 Titan II (XLGM-25C) R&D flights had been completed since 16 March 1962--27 successes and only six failures.
- 20 April The first squadron of Minuteman Wing IV, the 508th Strategic Missile Squadron of the 351st Strategic Missile Wing at Whiteman AFB, Missouri, was turned over to SAC.
- May A study group headed by Colonel B.W. Hunsaker of Headquarters AFSC recommended the reconsolidation of Space Systems Division and Ballistic Systems Division at Los Angeles Air Force Station, with a Deputy Commander for Ballistic Missiles to be located at Norton AFB, California.
- 15 May Headquarters National Range Division (NRD) was organized at Headquarters AFSC under Major General Leighton I. Davis.

1964

Headquarters Air Force Space Test Center (Provisional) at Vandenberg AFB was inactivated, and Headquarters Air Force Western Test Range (AFWTR) was activated in its place. Headquarters Air Force Missile Test Center (AFMTC) at Patrick AFB, Florida, was redesignated Headquarters Air Force Eastern Test Range (AFETR). Both ranges were assigned to Headquarters NRD, as was the Satellite Control Facility (SCF) at Sunnyvale, California.

16 May

The Defense Department tentatively established phase out of the Atlas E and Titan I missiles during the third and fourth quarters of FY1965 (January-June 1965) and that of the Atlas F in FY1968.

25 May

Wing IV's second Minuteman squadron, the 509th Strategic Missile Squadron, was turned over to SAC's 351st Strategic Missile Wing at Whiteman AFB, Missouri.

28 May

The Atlas E update program was completed nearly two months ahead of schedule.

28 May

Lockheed Propulsion Company test fired a 156-inch diameter, solid-propellant rocket motor for the first time. The one-segment test motor (156-3-L), with tab jet thrust vector control, produced more than 900,000 pounds of thrust during its 110-second firing. The test was conducted as part of the Space Systems Division's Large Solid Rocket Motor research and development program (Program 623A).

26 June

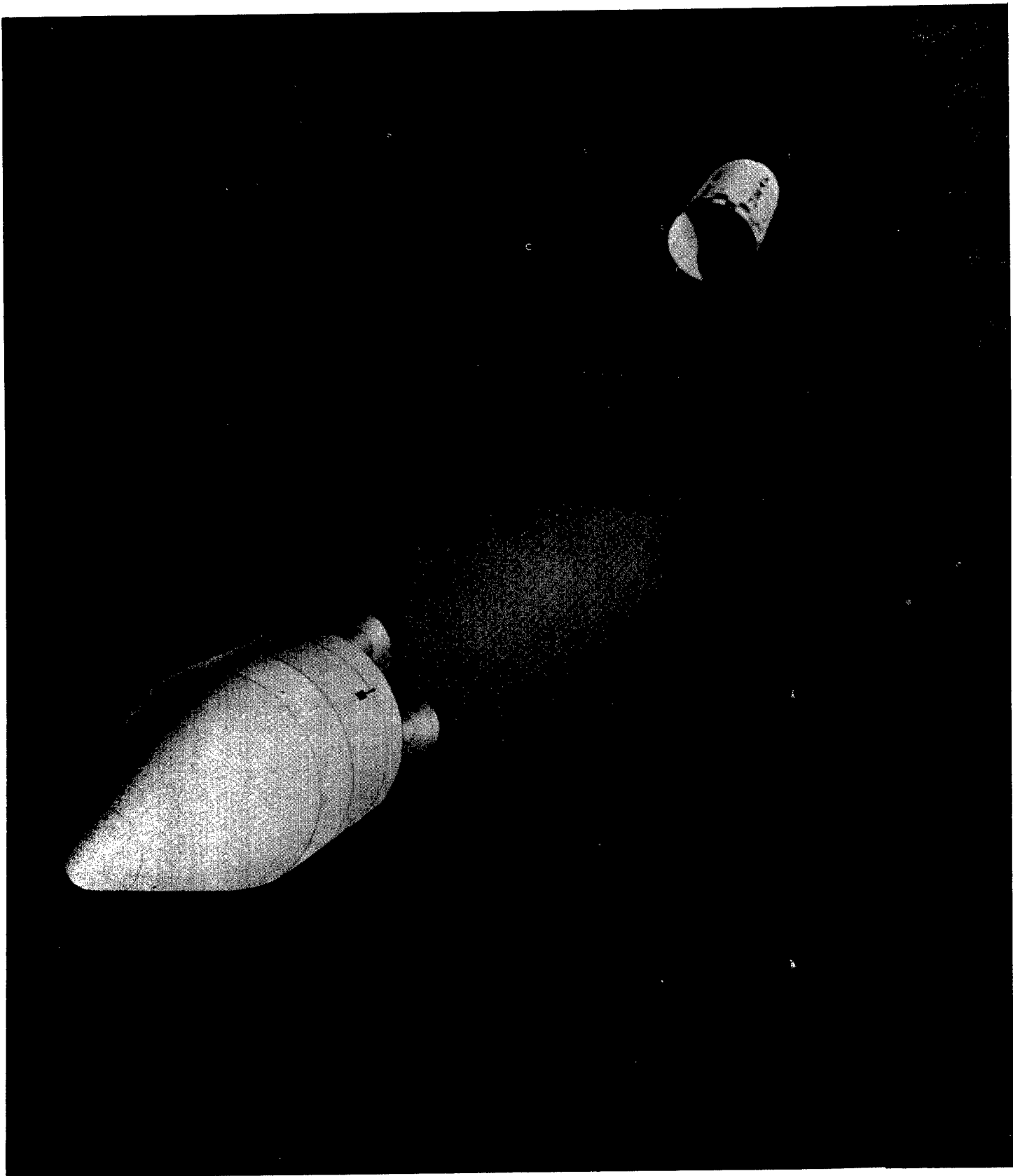
Space Systems Division accepted the first of the programmed 17 flight test versions of the Air Force Titan III standard space launch vehicles from the Martin Marietta Corporation. This vehicle was the first of five Titan IIIA (SLV-5A) missiles that would test the center core section before the two strap-on solid-rocket motors were added to form the first Titan IIIC booster vehicle.

1964

- 30 June Flight N, the final 10 Minuteman missiles of the 510th Strategic Missile Squadron, was turned over to the 351st Strategic Missile Wing at Whiteman AFB, Missouri. This completed Wing VI and brought the total number of Minuteman missiles turned over to SAC to 600.
- July Space Systems Division began definition phase efforts for a new member of the Titan III family--the Titan IIIIX space booster. The new vehicle would be two stages, Stage I with the man-rated components of the Titan Gemini Launch Vehicle and Stage II similar to that being used on the Titan III. The Titan IIIIX would use radio rather than inertial guidance.
- July Discussions between the Titan III System Program Office (SPO) and the Initial Defense Communications Satellite Program (IDCSP) SPO were initiated to investigate the possibility of using IDCSP satellites as secondary payloads on Titan IIIIC research and development launches.
- 5 July The Air Force Western Test Range (AFWTR) facilities at Point Arguello became part of Vandenberg AFB.
- 7 July Secretary of Defense Robert S. McNamara reported to President Lyndon B. Johnson that Space Systems Division's Titan III contract with Martin Marietta was one of the best managed contracts in the Defense Department due to the incentives applied to the program. At present, McNamara reported that the Titan III program was one percent below cost estimates and savings were being accomplished without harm to defense posture.
- 8 July The first successful launch of an Athena test missile took place at Green River, Utah. The missile impacted on the White Sands Missile Range in New Mexico.

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- 10 July In ceremonies commemorating the 10th Anniversary of the Air Force Ballistic missile program and activation of the former Western Development Division (WDD), General Bernard A. Schriever, Commander, AFSC, dedicated the new Space Systems Division headquarters and facilities at Los Angeles Air Force Station, California.
- 11 July The Titan III Transtage engine was successfully static fired for over six minutes. This test firing verified its various subsystems.
- 15 July Defense Secretary Robert S. McNamara announced that negotiations with the Communications Satellite Corporation for a defense communications network were terminated, and he directed the Defense Department to proceed with the full development of a military satellite communications system to be built by Philco-Ford. This was the Initial Defense Communications Satellite Program (IDCSP).
- 17 July An Atlas D/Agena D launch vehicle (Atlas 216D), carrying the second set of Vela Nuclear Detection Satellites, was launched from Cape Canaveral and placed the satellites in their prescribed orbits.
- 19 July Brigadier General Harry J. Sands, Commander, Air Force Eastern Test Range, assumed command of Ballistic Systems Division replacing Major General W. Austin Davis, who was promoted to Lt General and made Vice Commander, AFSC.
- 22 July The third Air Force delta-winged Aerothermodynamic/elastic Structural Systems Evaluation Test (ASSET) vehicle (ASV-3) was launched down the Eastern Test Range by a Thor booster. The ASV-3 was a boost-glide reentry vehicle that was designed to obtain temperature and pressure distribution data and to



As the third stage of the Titan IIIC, the Transtage provided the final thrust and pitch adjustments for direct injection of the payload into position.

1964

test materials and structural concepts during reentry. The vehicle was recovered 1,650 miles southeast of Cape Canaveral after reentering the atmosphere at 13,000 miles per hour and reaching reentry temperatures of 4,000° F. A part of the Spacecraft Technology and Advanced Reentry Tests (START) program managed by Space Systems Division, ASSET provided valuable data on the conditions encountered by a spacecraft during reentry.

30 July

A SAC crew launched the first Titan II (LGM-25C) on a successful Demonstration and Shakedown Operation (DASO) test flight from Vandenberg AFB. DASO missions were intended to test launch techniques.

30 July

Headquarters USAF announced that one additional squadron of 50 Minuteman II (LGM-30F) missiles would be collocated with the existing three Minuteman I (LGM-30A) squadrons of the 341st Strategic Missile Wing at Malmstrom AFB, Montana.

August

The six Titan I (HGM-25A) squadrons completed the operational updating program.

August

Martin Marietta Corporation of Denver, Colorado, initiated a study of the Titan IIIIX/Agena system.

12 August

Dr. Harold Brown, Director of Defense Research and Engineering (DDR&E), decided to cancel the Mobile Mid-Range Ballistic Missile (MMRBM) program.

14 August

The first Atlas/Agena D standard launch vehicle (SLV-3, 7100 Series) was successfully launched from Vandenberg AFB. This vehicle, Number 7101, was the first Atlas booster to be designed and produced to fully standardized specifications.

19 August

NASA's Syncom III synchronous communications satellite was launched into orbit by a Thrust Augmented Thor/Delta (TAD) launch vehicle in its first use as a space booster. By the end of August,

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Syncom III was maneuvered into a synchronous position over the Pacific Ocean where it would handle communications between Clark Air Force Base in the Philippines and Camp Roberts, California.

21 August

Colonel Edmund F. O'Connor, the System Program Director for the Mobile Mid-Range Ballistic Missile (MMRBM), notified all contractors that the MMRBM program was cancelled as of 31 August due to the lack of funding support.

28 August

An Air Force Thor/Agena B was launched from Vandenberg and placed NASA's first Nimbus meteorological satellite into orbit.

29 August

The first successful ballistic flight test of a cesium ion contact engine was conducted on a Scout booster launched from Vandenberg. Built by Electro-Optical Systems Corporation under an Air Force contract, the engine was the first of its kind to operate in space.

31 August

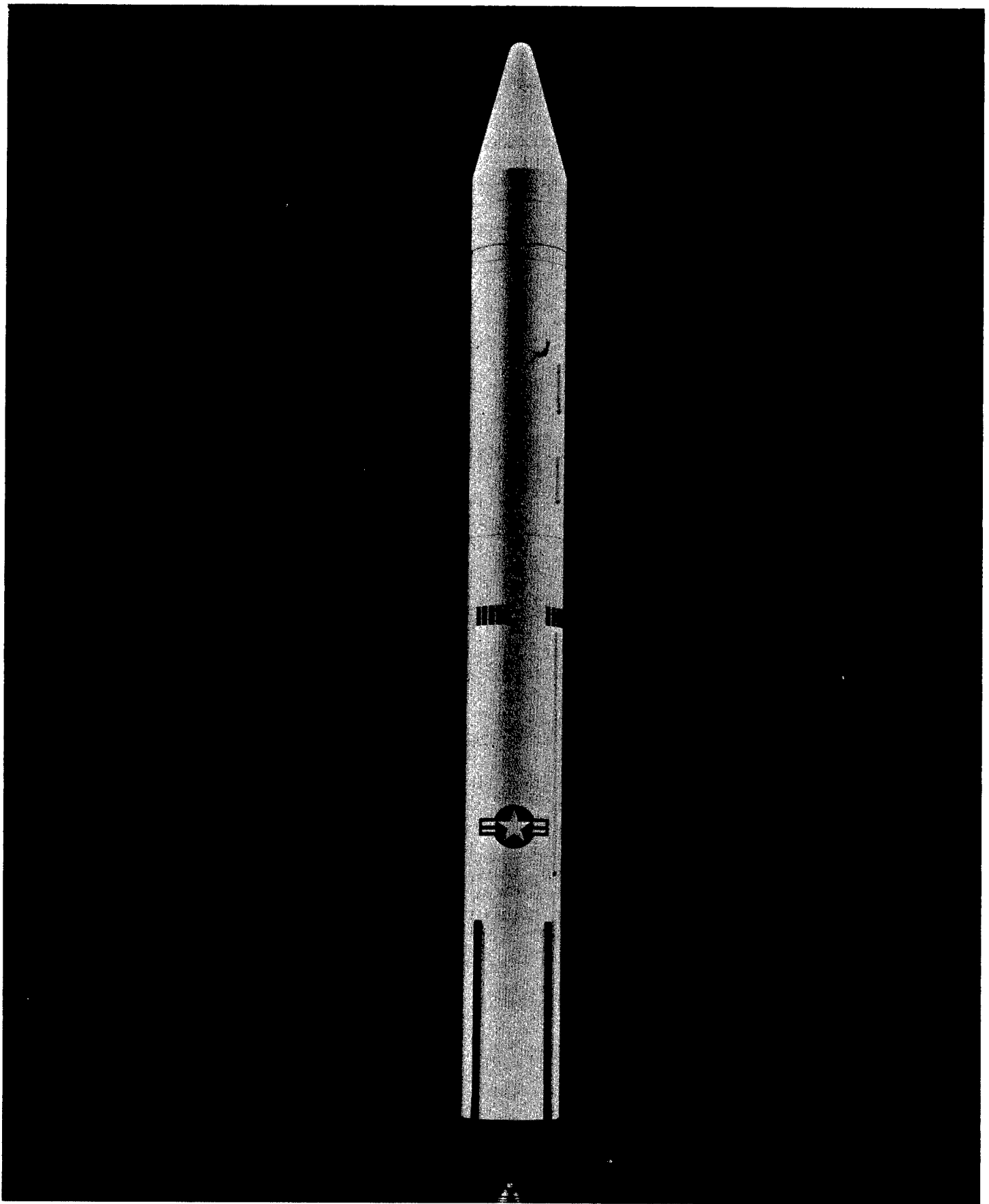
The Mobile Mid-Range Ballistic Missile (MMRBM) was finally cancelled because of the lack of funds.

September

The Defense Department began military communications experiments between Saigon, Republic of South Vietnam, and Hawaii using the Syncom II synchronous communications satellite. These Saigon-Hawaii experiments further extended the Defense Department's usage of Syncom II that had begun several months earlier.

1 September

The 6555th Aerospace Test Wing launched the first Titan IIIA space booster (Vehicle #2) from the Eastern Test Range. Essentially the liquid-propellant core section of the Titan IIIC, the Titan IIIA performed satisfactorily except for a transtage (Stage 3) malfunction. After the first two stages had performed flawlessly, a premature shutdown of the transtage engine resulted from the failure



The Titan IIIA was the first configuration of the versatile Titan III Space Launch Vehicle series. The system was developed to support the National Launch Vehicle Program.

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of an onboard helium pressure valve and prevented the 3,750-pound dummy test payload from being injected into orbit.

- 1 September The first Atlas D squadron, the 564th Strategic Missile Squadron at Francis E. Warren AFB, Wyoming, was inactivated.
- 10 September NASA announced that its Lewis Research Center (LeRC) would assumed management responsibility for the large solid-rocket motor development program. NASA would take over the 260-inch diameter solid-motor development program from Space Systems Division, and the Aerojet-General and Thiokol developed contracts initiated by SSD in June 1963 were to be transferred to NASA. The 156-inch diameter solid-motor program would remain under SSD control.
- 18 September The initial Minuteman squadron of Wing V, the 319th Strategic Missile Squadron of the 90th Strategic Missile Wing at Francis E. Warren AFB, Wyoming, was completed and turned over to SAC.
- 24 September The first Minuteman II (LGM-30F) test missile (FTM 449) was successfully launched down the Eastern Test Range from Silo 32B.
- 29 September The final Minuteman I (LGM-30B) R&D flight test missile (FTM 445) was launched from Cape Canaveral. This brought the total number of Minuteman IB launches to 36--31 from the Eastern Test Range and five from Vandenberg. A total of 67 Minuteman I (LGM-30A and LGM-30B) flight test missiles had been launched since FTM 101 on 1 February 1961, 54 from the Cape and 13 from Vandenberg.
- 30 September In a second test firing, Lockheed Propulsion Company fired a 156-inch diameter, solid-propellant motor (156-4-L) for 140 seconds, and it produced over one million pounds of thrust. Space Systems Division rated the firing as a complete success.

1964

- 30 September Engineering responsibility for the Titan II weapon system (WS 107C) program was transferred from Ballistic Systems Division to AFLC's San Bernardino Air Materiel Area (SBAMA) at Norton AFB, California.
- 5 October The 100th Thor/Agena, a Thrust Augmented Thor/Agena D (421/1170) was launched from Vandenberg AFB by the 6595th ATWg.
- 20-21 October Headquarters USAF and AFSC directed the go-ahead for Phase II of the Initial Defense Communications Satellite Program (IDCSP) with a funding ceiling of \$30 million after 14 September 1964. This action approved the launch of three IDCSP payloads on Titan IIIC research and development vehicles that were to be launched in the first half of 1966.
- 22 October The last Atlas D missile of the 549th Strategic Missile Squadron at Offutt AFB, Nebraska, was dispatched from the base in preparation for final inactivation of the unit in December.
- 27 October A single-stage Thor SLV-2, topped by the AEV-1 test vehicle, was successfully launched from Pad 17B at Cape Canaveral on a ballistic trajectory down the Eastern Test Range. AEV-1, part of Space Systems Division's Aerothermodynamic/elastic Structural Systems Evaluation Test (ASSET) program, was the first of two tests to obtain data on structural behavior during reentry, with emphasis on thermoelastic effects. The AEV-1 was not recovered.
- 28 October The Titan II Gemini Launch Vehicle (GLV-3) for the first manned Gemini spaceflight mission (GT-3) was turned over to the Air Force at Martin Marietta's Baltimore, Maryland, plant.
- 28 October Based on Headquarters USAF and AFSC approval of 20 and 21 October, Space Systems Division issued a letter contract

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to Philco-Ford Corporation for the initiation of Phase II work on the IDCSP.

- 4 November The fifth, and final, Titan II demonstration and shakedown operation (DASO) launch was conducted by the SAC crew from Vandenberg.
- 6 November The first successful launch of a fully instrumented, four-stage Athena missile was made at Green River, Utah. The missile, designed to test reentry vehicles, impacted on the White Sands Missile Range in New Mexico.
- 9 November SAC's Minuteman IA operational test program concluded after 24 launches with the launch of FTM 661 from Vandenberg.
- 13 November A 250-ton, 120-inch diameter, solid-propellant rocket motor was static test fired for 110 seconds as part of the Air Force's Titan III standard launch vehicle research and development program. Two of the 120-inch motors were to be attached to a Titan II liquid-propellant core vehicle to form the Titan IIIC space booster (SLV-5C). This test firing was important because it was the first test of the booster's flight instrumentation and the newly designed ablative nozzle-throat that replaced the former carbon throat.
- 19 November Secretary of Defense Robert S. McNamara officially announced his decision to retire Atlas E,F, and Titan I ICBM weapon systems from the active operational inventory because they were no longer supportable from requirements, cost, or manpower use standpoints. Moreover, the relative slow-reacting, liquid-fueled Atlas and Titan I missiles had provided the initial deterrent that was necessary and would now be replaced by the less vulnerable, more easily maintained Minuteman and Titan II ICBMs.

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- 20 November The Department of Defense directed a build-up of the Minuteman force to 20 squadrons (1,000 missile launchers) by the end of FY1967.
- 21 November Headquarters USAF issued Atlas System Program Directive 107A-65-1 announcing the scheduled phase out of the Atlas F from the operational force by the end of FY1965 (30 June 1965).
- 1 December The 565th Strategic Missile Squadron (Atlas D) of SAC's 389th Strategic Missile Wing at Francis E. Warren AFB, Wyoming, was inactivated.
- 7 December To gain a significant budget reduction, NASA cancelled its plans for Gemini 13, 14, and 15, and directed the termination of the acquisition of Gemini Launch Vehicles 13, 14, and 15.
- 8 December The 6555th Aerospace Test Wing successfully launched the fifth ASSET reentry test vehicle from Cape Canaveral.
- 10 December The second Titan IIIA (Vehicle #1) military space booster was launched from Cape Canaveral and achieved a completely successful test flight.
- 10 December Headquarters USAF issued a System Program Directive making revisions in the Minuteman program. The operational Minuteman force would number 1,000 missiles in six operational wings with a total of 20 squadrons by the end of FY1967 rather than the previously planned 1,200 missiles. The Office of the Secretary of Defense directed a Force Modernization program that would provide the Minuteman I wings with capabilities equivalent to those of the Minuteman II (LGM-30F). Force Modernization was to begin in July 1966, with retrofit to proceed on a squadron-by-squadron basis (later changed to wing-by-wing). Other improvements in the Minuteman systems were directed.

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- 12 December Thiokol Chemical Corporation's Wasatch Division fired its first 156-inch, one-segment, solid rocket motor (156-1-T) with gimballed nozzle thrust vector control. The motor produced approximately 1.3 million pounds of thrust for two minutes. This was the third test firing of a 156-inch solid rocket motor in Space Systems Division's Large Solid Rocket Motor Program (Program 623A).
- 15 December The last of the three SAC Atlas D squadrons, the 549th Strategic Missile Squadron at Offutt AFB, Nebraska, was inactivated.
- 18 December The second of Francis E. Warren's four Minuteman squadrons, the 320th Strategic Missile Squadron, was completed and turned over to SAC's 90th Strategic Missile Wing.
- 22 December Headquarters USAF directed that the Titan I ICBMs be retired from the operational inventory by 30 June 1965. There were then six Titan I Strategic Missile Squadrons of nine missile launchers each (54 missile launchers) assigned to SAC.
- 22 December United Technology Center (UTC) successfully fired its 120-inch diameter, one million-pound thrust, solid-propellant rocket motor at Edwards AFB. This was the fourth static test firing of the motor within two months, and it completed the development phase of the Titan III solid-rocket motor (SRM) program.
- 28 December A memo from the Office of the Secretary of Defense to the Secretary of the Air Force, Eugene M. Zuckert, approved the Titan III program and requisite lengthening of Titan III research and development that was necessary for the new program. The Titan III was essentially the Titan IIIA's first and second stages plus an adapter section that would allow the vehicle to be used with the Agena D

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upper stage.

29 December

A Headquarters USAF directive for Minuteman approved the development of the Mark 12 multiple independently targetable reentry vehicle (MIRV) system.

1965

- January Space Systems Division initiated Phase I studies with Martin Marietta Corporation, Thiokol, and United Technology Center (UTC) to determine what performance increment could be gained by strapping existing solid rocket motor segments to the Titan III core vehicle. Minuteman first stages were to be considered along with two and three segments of the 120-inch diameter United Technology Center motors. The Titan III/Strap-on configuration definition and acquisition phases were to be greatly compressed, with first launches from Vandenberg AFB expected in 1967. The Titan III/Strap-on was subsequently designated Titan IIID.
- 1 January The acquisition phase of the Titan II program was completed, and the Ballistic Systems Division Titan System Program Office was discontinued as of 31 December 1964. Support for Titan II weapon system (WS 107C) was transferred to AFLC.
- 1 January NASA transferred the operation of Syncom II and Syncom III synchronous communications satellites to the Defense Department which had provided the communications ground stations for the program.
- 8 January Atlas 106F concluded SAC's Atlas F operational test launch program from Vandenberg AFB that had begun on 9 September 1959. During the series, 51 Atlas missiles were launched by SAC crews to verify the operational missiles, with 30 of them ruled successes.
- 8 January A Headquarters USAF program management directive (PMD) approved the acquisition program for the Titan III/Agena D (Program 624B), subsequently redesignated Titan IIIB/Agena D. This newest addition to the Titan III series of boosters would consist of the Titan IIIA first and second stages, an adapter section, and an Agena D third stage--everything up to the Agena

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interface being the Titan IIIIX launch vehicle. Contracts were later awarded for 24 Titan IIIIX vehicles, with first launch planned for the summer of 1966.

12 January

A \$9.5 million contract was awarded to Peter Kiewit Sons Company for Project Yard Fence, Titan II Facilities Update. The project was to utilize improved technology of minimize maintenance activities and to improve Titan II support equipment of the squadrons at Davis-Monthan, Little Rock, McConnell, and Vandenberg.

13 January

The Defense Department announced that by the end of FY1965 (June 1965), 150 more ICBM sites would be inactivated and the Atlas E, F, and Titan I missiles removed and placed in storage at San Bernardino Air Materiel Area (SBAMA) facilities at Norton AFB, California. The retired missiles would be replaced by more advanced Minuteman missiles whose annual combat-ready costs were \$100,000 per missile compared to nearly \$1.0 million for each of the older, more complicated liquid-fueled ICBMs. In addition, manpower savings would be substantial since only 12 men were required for support of each Minuteman versus approximately 80 for each Atlas or Titan.

18 January

The first Air Force Thor/Altair (Burner I) space booster was launched from Vandenberg AFB. The Altair upper stage was the fourth stage of the Scout rocket.

19 January

The second Titan II Gemini Launch Vehicle (GLV-2) carried the unmanned, instrumented Gemini spacecraft (GT-2) for a suborbital shot preliminary to the first U.S. two-man Gemini mission.

February

The Martin Marietta Corporation was selected to design and build the SV-5P manned low-speed maneuverable lifting body vehicle for the PILOT low-speed reentry vehicle program.

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- 1 February Space Systems Division received contract go-ahead for the Titan IIIIX/Agema program.
- 1 February The Air Force Western Test Range at Vandenberg AFB assumed ICBM and space vehicle support functions and control of instrumentation on the Pacific Missile Range from the U.S. Navy, five months ahead of schedule.
- 11 February Titan IIIA, Vehicle #3, was launched from Cape Canaveral. In a maneuverability test involving three separate orbits, the Transtage and two satellites were successfully placed into their programmed orbits. The primary objective of the mission was the triple ignition of the Transtage engine that was required for the three separate orbits. When it placed the Lincoln Experimental Satellite (LES-1) into orbit, the vehicle became the first Titan III to inject an operational payload into orbit.
- 23 February The Aerothermodynamic/elastic Structural Systems Environmental Test (ASSET) program concluded when a Thor booster launched the last of the experimental vehicles from the Eastern Test Range. The payload reentered down range but was not recovered.
- 27 February The Thiokol Chemical Corporation (Brunswick Division) static-fired a two-segment, 156-inch diameter, 100-foot long solid-propellant rocket motor (156-2-T). This 900,000-pound motor, the largest solid-propellant motor yet fired, generated over three million pounds of thrust for one minute, more than twice as much as any previous motor. This test firing was intended to validate design criteria for the 260-inch motor program that was officially transferred from Space Systems Division management to that of NASA's Lewis Research Center (LeRC) on 1 March.
- 1 March Operation Long Life, the first test launch of a specially designed Minuteman test missile from an operational launch facility, was successfully concluded at Wing II, Ellsworth AFB, South Dakota. With a first stage engine designed to burn only a short

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time, the Long Life missile carried dummy second and third stages that were up to full operational weight. The missile landed about a mile from the silo after a first stage burn of seven seconds.

3 March

General Bernard A. Schriever, Commander, AFSC, announced plans to develop a wingless, maneuverable reentry vehicle (SV-5) as a follow-on to the Aerothermodynamic/elastic Structural Systems Environmental Test (ASSET) program. The new vehicle was under Space Systems Division management and was part of the new Precision Recovery Including Maneuvering Reentry (PRIME) program. Both PRIME and the ASSET programs were part of the larger Spacecraft Technology and Advanced Reentry Test (START) program.

5 March

SAC launched the 20th, and the last, Titan I (HGM-25A) ICBM from Vandenberg as Nike target missile in support of Army requirements.

9 March

A Thor/Agena D booster was employed to launch eight military satellites into orbit from Vandenberg AFB. This was the largest number of individual payloads yet orbited by the United States with one launch vehicle.

12 March

The Minuteman Retrofit Program was changed from a squadron to a wing conversion basis.

22 March

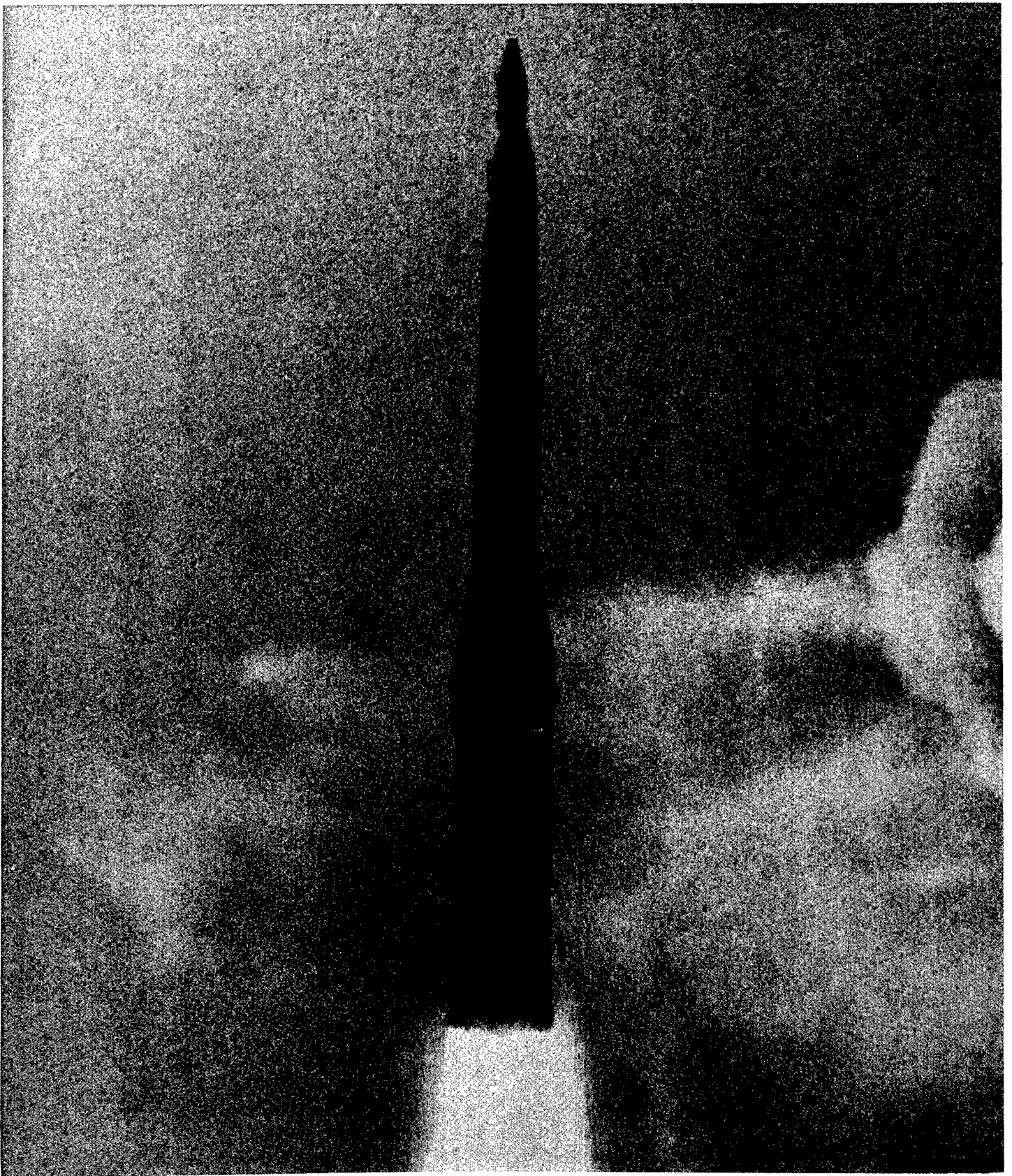
The third Wing V Minuteman squadron, the 321st Strategic Missile Squadron, was turned over to SAC at Francis E. Warren AFB, Wyoming.

23 March

An Air Force Titan Gemini Launch Vehicle (GT-3) lifted Astronauts Virgil Grissom and John Young from Cape Kennedy. The three-orbit Gemini 3 mission was the first manned Gemini flight. During this mission, a manned spacecraft was maneuvered in orbit, changing its orbital path, for the first-known time.

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- 24 March The first Titan II operational test (OT) missile was launched from Vandenberg.
- 25 March Eight Atlas and Titan I missile squadrons were inactivated--two Atlas E units, the 566th Strategic Missile Squadron (SMS) at Warren and the 548th SMS at Forbes AFB, Kansas; three Atlas F squadrons, the 577th SMS at Altus, the 578th SMS at Dyess, and the 579th SMS at Walker; and three Titan I squadrons, the 851st SMS at Beale, the 850th SMS at Ellsworth, and the 568th SMS at Larson AFB, Washington.
- 3 April The 6595th Aerospace Test Wing launched an Atlas/Agena which boosted the Atomic Energy Commission (AEC) Snapshot spacecraft into orbit carrying the SNAP-10A satellite nuclear power supply experiment. The onboard nuclear reactor was used to provide electric power for an ion engine, marking the first attempt to test a reactor-ion system in orbit.
- 5 April The final Atlas E missile was removed from its launcher/storage site at Fairchild AFB, Washington, and was retired from the operational inventory.
- 9 April Space Systems Division and NASA signed an agreement for the Gemini/Atlas/Agena Target Vehicle (GAATV) program. NASA had overall management responsibility for the program while SSD was responsible for acquiring and launching the Atlas/Agena vehicles.
- 13 April Headquarters USAF issued a Minuteman system program directive (SPD) that established an operational force of 1,000 missiles by the end of FY1967 and directed implementation of the Force Modernization Program to configure the entire force with Minuteman II (LGM-30F) missiles by FY 1972.



The Minuteman II missile, shown here during a launch, was an improved version of the Minuteman I. It had a larger second stage motor, improved guidance, greater range and payload capabilities, more flexible targeting, and a greater ability to survive an attack.

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- 15 April The last Titan I (HGM-25A) was removed from its silo at Lowry AFB, Colorado, in preparation for the 724th Strategic Missile Squadron's inactivation on 25 June.
- 20 April The final Atlas F missile departed Lincoln AFB, Nebraska (551st Strategic Missile Squadron), for retirement and storage.
- 6 May The fourth Titan IIIA flight test missile (Vehicle #6) was launched from Complex 20 at Cape Canaveral in a maneuverability test for the Transtage. The primary aim was for the Transtage engine to accomplish four separate ignitions, something never before attempted. In the process of successfully completing its four programmed ignitions and burns, the Transtage placed two satellites into orbit--a Lincoln Experimental Satellite (LES-2) and a hollow aluminum radar calibration sphere (LCS-1). By completing its assigned tasks, the Transtage extended the capabilities of the Titan IIIA beyond its specific requirements. Because of this highly productive mission, the planned fifth Titan IIIA (Vehicle #4) launch was cancelled and the booster was converted to a Titan IIIC configuration.
- 3-7 June The second Gemini manned flight, Gemini 4 (GT-4), was successfully launched from the Eastern Test Range by a manrated Titan II. Astronauts James McDivitt and Edward White completed four days and 62 orbits (97.9 hours). On the third orbit, Astronaut White made a 22-minute spacewalk, the first ever by an American astronaut. Gemini 4 reentered on 7 June and was recovered 450 miles east of Cape Canaveral.
- 15 June The fourth and final Wing V Minuteman squadron, the 400th Strategic Missile Squadron, was turned over to SAC's 90th Strategic Missile Wing at Francis E. Warren AFB, Wyoming, and subsequently declared operational on 30 June. This

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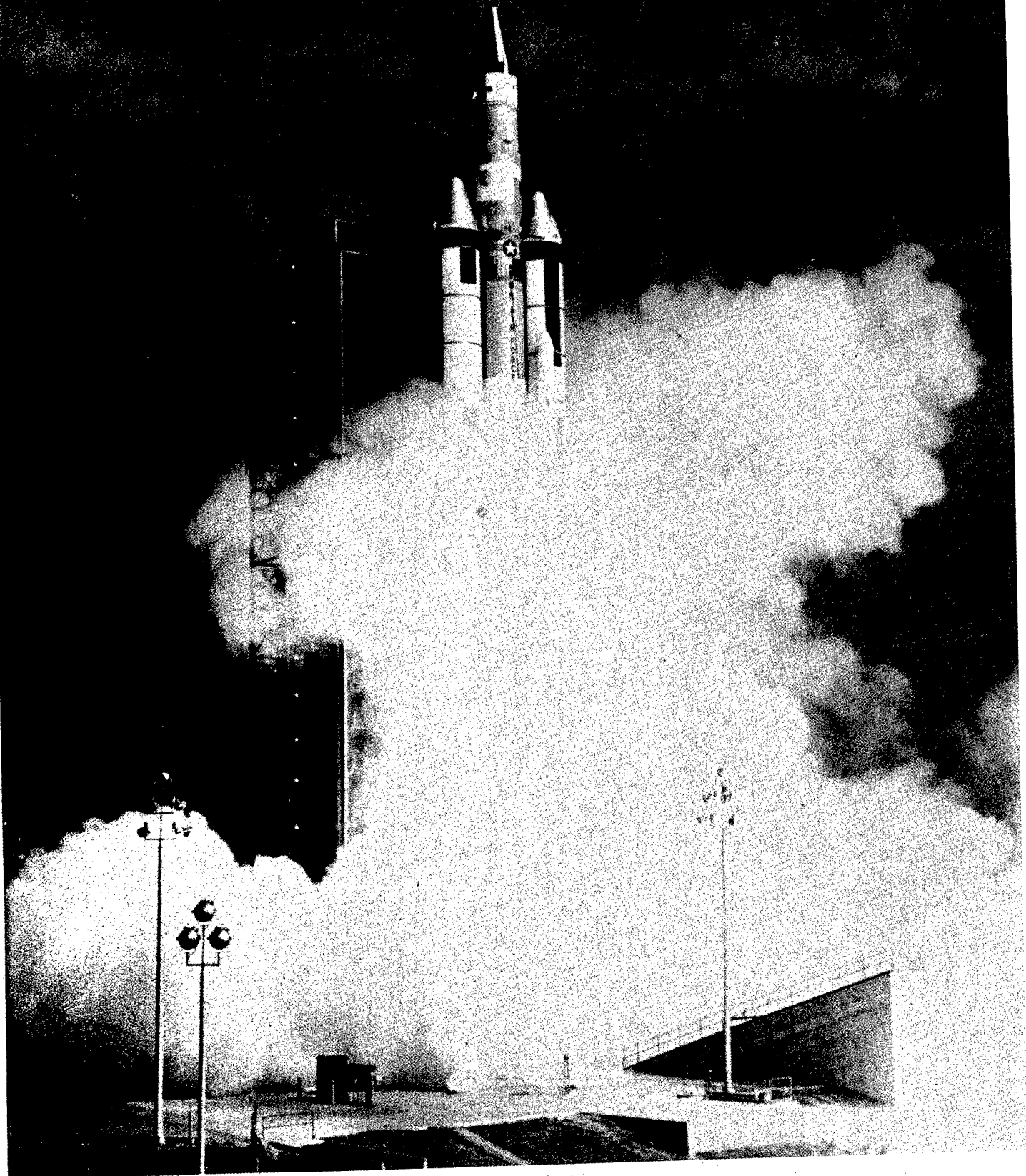
action completed the only four-squadron wing of Minuteman missiles yet deployed. The 90th SMW's 200 missiles brought to 800 the total number of Minuteman missiles turned over to SAC.

18 June

The first Titan IIIC (SLV-5C) research and development vehicle (Vehicle #7) was successfully launched from Cape Canaveral. The Titan IIIC, the first Air Force vehicle specifically designed and developed as a military space booster under Space Systems Division management, was the first heavy-duty booster to combine the thrust of large-size, strap-on solid rocket motors with a three-stage, liquid-powered rocket. The Titan IIIC weighed more than 1.4 million pounds fully fueled but without its payload. At takeoff, the two United Technology Center solid rocket motors (SRMs) generated a peak thrust of 2,647,000 pounds--making the Titan IIIC the most powerful rocket yet launched. When the two solid motors were jettisoned two minutes after lift-off, the liquid-fueled center core section took over-- Stage 1 engines producing 520,000 pounds of thrust, then Stage 2 with 100,000 pounds, and finally Stage 3 (Transtage) with its 16,000-pound thrust engines and carrying the payload. This first Titan IIIC placed a 21,000-pound test payload into a 100-NM (low earth) circular orbit-- the heaviest payload yet orbited by the U.S. The Titan IIIC was capable of placing a 3,200-pound payload into a 22,000-mile, synchronous equatorial orbit. When fully operational, the new booster would provide a vast increase in the size and range of satellites that could be placed in orbit. This capability would eliminate one of the primary limitations on a number of satellite programs--the limited payload capability of the present Thor and Atlas space booster families.

18 June

Headquarters AFSC approved the name Satellite Control Facility (SCF) for the new organization to be created



Two and a half million pounds of thrust from segmented solid propellant rocket motors boost a Titan III C standard launch vehicle into orbit. America's versatile military space booster will continue to launch large payloads until the advent of the reusable space shuttle in the 1980s.

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from the merger of Space Systems Division's Deputy for Space Test Operations and 6594th Aerospace Test Wing at Sunnyvale, California.

- 25 June The remaining seven Atlas and Titan I squadrons assigned to SAC were inactivated--the last Atlas E squadron, the 567th Strategic Missile Squadron (SMS) at Fairchild; three Atlas F units at Schilling (550th SMS), Lincoln (551st SMS), and Plattsburgh (556th SMS); and three Titan I squadrons, and the 569th SMS at Mountain Home along with the two units at Lowry, the 724th and 725th SMSs. These actions concluded the phase out of all Atlas and Titan I ICBMs in the SAC operational inventory.
- 30 June The first operational Minuteman II (LGM-30F) missile was delivered to Wing VI, Grand Forks AFB, North Dakota.
- 1 July The Air Force Satellite Control Facility (AFSCF) was organized at Space Systems Division headquarters under the command of Colonel W.H. Hedrick, Jr. This realignment created an efficient, flexible organization capable of performing all satellite control functions.
- 1 July TRW Space Technology Laboratories (TRW/STL) was renamed TRW Systems Group. The new organization continued to provide systems engineering and technical direction (SE/TD) functions for the Ballistic Systems Division's missile program.
- 6 July The last of 50 Minuteman I (LGM-30B) operational test launches was conducted by SAC's First Strategic Aerospace Division (1STRAD).
- 8 July The transfer of Syncom II and III from NASA to the Defense Department was completed. The Defense Communications Agency (DCA) directed their use, but the Air Force Satellite Control (AFSCF) and its operating locations in the

1965

Pacific and Indian Oceans maintained precise control and positioning of the two synchronous communications satellites. The Army and Navy were responsible for the ground communications facilities that were used with the Syncom satellites.

20 July

An Air Force Atlas/Agena D lifted the third pair of Vela nuclear detection satellites into their 70,000-mile, nearly circular orbits.

5 August

The first Atlas F (147F) Advanced Ballistic Reentry Systems (ABRES) program launch was conducted at Vandenberg. The four previous Atlas F/ABRES launches were from Cape Canaveral, and the rest would be conducted on the Western Test Range.

5 August

Ballistic Systems Division directed Autonetics Division of North American Aviation to proceed with the development of a Post Boost Control System for Minuteman that would incorporate guidance, propulsion, and directional control of a reentry vehicle after it separated from the third-stage motor.

18 August

The 500th major launch from Vandenberg AFB since 16 December 1958 was also the first Minuteman II (LGM-30F) research and development missile to be launched down the Western Test Range by the 6595th Aerospace Test Wing as well as the 250th launch from Vandenberg by Air Force Systems Command and its predecessor, Air Research and Development Command.

20-29 August

The Gemini 5 spacecraft carrying Astronauts L. Gordon Cooper and Charles Conrad, Jr., was lifted from Cape Canaveral by an Air Force Titan II Gemini Launch Vehicle. The Gemini 5 (GT-5) mission lasted eight days in orbit and completed a record-setting

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120 revolutions before reentering and splashing down some 600 miles east of Jacksonville, Florida. Among the eight world's records set on the Gemini 5 mission were the longest manned space flight (190 hours, 55 minutes) and the most revolutions for a manned space flight (120).

24 August

A SAC crew at Vandenberg launched the 100th Minuteman missile to be fired from Cape Canaveral and Vandenberg. Flight test missile 677 was the first Minuteman I (LGM-30A) follow-on operational test (FOT) launch and the 38th Minuteman I missile to be launched from Vandenberg.

25 August

President Lyndon B. Johnson announced that he had approved the Defense Department plans for the development of a Manned Orbiting Laboratory (MOL) that would cost \$1.5 billion. The Air Force was to continue its management of the MOL program. Douglas Aircraft Company was to design and build the spacecraft that would be boosted into orbit by the Titan IIIM version of the Titan IIIC space launch vehicle.

31 August

Secretary of the Air Force Eugene M. Zuckert named General Bernard A. Schriever as Director of the Manned Orbiting Laboratory (MOL) Program in addition to his duties as Commander, AFSC. Brigadier General Harry L. Evans was named Vice Director of the MOL Program.

31 August

General Bernard A. Schriever, Commander, AFSC, named Brigadier General Joseph S. Bleymaier as Commander, Air Force Western Test Range (AFWTR), with headquarters at Vandenberg AFB. General Bleymaier, former Titan III (Program 624A and 624B) program director and Deputy for Manned Systems

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at Headquarters Space Systems Division, replaced Brigadier General Jewell C. Maxwell.

1 September

The Titan II operational test launch program began and was scheduled to use 25 Titan missiles through August 1966.

15 September

Major General Ben I. Funk, Space Systems Division commander, announced the development of a new, low-cost space upper stage called Burner II. Adaptable for use with almost all Air Force standard launch vehicles, the Burner II would be to orbit small and medium-sized payloads. When completed, the Burner II would be the smallest maneuverable upper stage in the Air Force space vehicle inventory.

15 October

The second Titan IIIC (Vehicle #4) was successfully launched from Cape Canaveral. This was the first Titan IIIC to carry an operational payload. Three satellites were placed in orbit--an LCS-2 radar calibration sphere, an OV 2-1 radiation sensor, and a metal-ballasted dummy payload. All systems performed well until the second planned burn of the Transtage engines just prior to the injection of the multiple payload into orbit. At this point in the mission, the Transtage exploded due to a malfunction, abruptly terminating the mission.

15 October

Brigadier General John L. McCoy, Ballistic Systems Division's Vice Commander, became Acting Commander in place of Major General Harry Sands who was assigned to temporary duty as Senior Member of the United Nations Truce Supervisory Commission until 14 May 1966.

25 October

Gemini 6, scheduled for launch from the Eastern Test Range with Astronauts Walter Schirra and Thomas Stafford as the crew, was cancelled when the Gemini Agena Target Vehicle (GATV) for this mission failed to achieve orbital insertion after a nominal separation from its Atlas booster.

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26 October

Headquarters USAF issued a System Management Directive to add an Airborne Launch Control System (ALCS) for Minuteman I and II systems so that SAC would be able to use its EC-135 airborne command post aircraft to launch Minuteman missiles that were isolated from ground control.

1 December

The High Explosive Simulation Technique (HEST) Test began at a Minuteman I, Wing V, launch facility at Francis E. Warren AFB, Wyoming. Developed by the Air Force Weapons Laboratory, the HEST Test was intended to use high explosives to simulate ground motions associated with, and induced by, a nuclear airblast and thus validate hardness assessment of ground facilities and the degree of structural survivability.

2 December

NASA approved the development of new standard launch vehicles, the Atlas/Agena (SLV-3A) and the Atlas/Centaur (SLV-3C). Both Atlas boosters were to be of improved design to provide higher performance and reliability.

4-18 December

An Air Force Titan II Gemini Launch Vehicle lifted Gemini 7 (GT-7) into orbit from Cape Canaveral. Astronauts Frank Borman and James Lovell completed the 14-day mission, the longest U.S. space flight to date (330 hours, 35 minutes) and 206 revolutions, and were recovered on 18 December, 700 miles southwest of Bermuda. During their record flight, Borman and Lovell piloted GT-7 as the target vehicle for the first space rendezvous between manned spacecraft. Astronauts Walter Schirra and Thomas Stafford aboard Gemini 6 were launched on 15 December and completed the first space rendezvous with Gemini 7 the same day.

6 December

The first operationally configured Minuteman II (LGM-30F) was fired from an underground silo and completed a flawless flight downrange from Vandenberg AFB. All research and development goals were attained.

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- 8 December Secretary of Defense Robert S. McNamara approved development of the Minuteman III (LGM-30G) to increase the future capability of the weapon system. The Minuteman III was to be based on the Minuteman II (LGM-30F) and grew out of the requirement to improve the LGM-30F third stage motor and to add the Mark 12 multiple independently targetable reentry vehicle (MIRV) reentry system. The Minuteman III would have an improved Third Stage, improved propulsion system, enlarged post boost control system, increased hardness throughout the missile, and a new, resized reentry system to provide greater target flexibility with the Mark 12 MIRV reentry system.
- 14 December Lockheed Propulsion Company test fired the first flight-weight, 156-inch diameter, solid-propellant rocket motor (156-5-L) of three million pounds of thrust as part of Space Systems Division's Large Solid Rocket Motor Program (Program 623A). This was the fifth 156-inch motor test fired in the program, and the third Lockheed motor.
- 15-16 December Gemini 6 (GT-6), with Astronauts Walter Schirra and Thomas Stafford onboard, was lifted into orbit from the Eastern Test Range by its Titan II booster. This was the fifth manned space flight in the Gemini series and the first rendezvous mission. Gemini 6 completed the rendezvous with Gemini 7 on 15 December. On the 16th, Astronauts Schirra and Stafford made the first controlled reentry to a predetermined landing point in the U.S. manned spacecraft program.
- 21 December For the first time, Launch Complex 41, at the just completed Integrate-Launch-Transfer (ITL) complex at Cape Canaveral was used to launch the third Titan IIIC research and development space booster (Vehicle #8). As with the second vehicle, this Titan IIIC performed flawlessly throughout the liftoff and boost segments of the flight plan. However, severe difficulties were encountered when the Transtage engines malfunctioned and

1965

did not restart for the programmed third burn. Thus, the vehicle failed to reach near-synchronous equatorial orbit with its four-satellite payload. Lincoln Experimental Satellites LES-3 and LES-4 were released as was Oscar IV, but the OV2-3 payload remained attached to the Transtage.

23 December

A new Minuteman Systems Management Directive was issued covering approved actions to implement the changes in the Minuteman program resulting from Secretary of Defense Robert S. McNamara's decision in approved Format B of 8 December. This SMD approved a Minuteman force of 1,000 missiles deployed in six wings with 20 squadrons by the close of FY1972. Production of the Mark 12 and Mark 17 reentry systems was approved along with other improvements in the Minuteman system.

1966

January

Space Systems Division announced the purchase of newly designed Long Tank Thor (SLV-2G) space boosters to replace the Thrust Augmented Thor (SLV-2A). The Long Tank Thrust Augmented Thor (LTTAT) would be 14 feet longer than the older SLV-2A and would have a 40 percent increase in the volume of the liquid propellant fuel tanks. The additional fuel would give the Long Tank Thor a longer burn time than the Thrust Augmented Thor, 216 seconds versus 146 seconds. As a result of this improvement and the replacement of the Castor I (TX-33-52) solid-rocket booster motors with Thiokol's Castor II (TX-354-5) motors of 70,540 pounds of thrust, the new SLV-2G, dubbed the Thorad, would provide a 20 percent increase in payload capacity over the SLV-2A.

15 January

Lockheed Propulsion Company fired its fourth 156-inch diameter, solid-propellant rocket motor. Motor 156-6-L was a monolithic motor with a high burn rate propellant and submerged nozzle. During its one minute test firing, the motor generated over three million pounds of thrust. This was the sixth test firing in Space Systems Division's Large Solid Rocket Motor Program (Program 623A).

19 January

The first Titan IIIB configuration vehicle was completed by the Denver Division of the Martin Marietta Corporation.

22 January

The first Force Modernization Minuteman II research and development missile (FTM 2022) was launched from a modernized Minuteman I silo at Vandenberg AFB. Performance through first and second stage ignition was satisfactory, but malfunctions forced the missile to be dumped 150 miles down range. The Force Modernization launch program concluded on 11 May 1967 after nine launches.

1966

- 27 January The first SAC Minuteman I (LGM-30B) Follow-On Operational Test (FOT) was conducted from Vandenberg.
- 1 February Ballistic Systems Division's Deputy for Ballistic Missile Reentry Systems (D/BMRS) awarded letter contracts to the Avco Corporation for the Reentry Vehicle Technology and Observables Phase 1A program (RVTO 1A) and to General Electric for the Phase 1B (RVTO 1B) flight test program.
- 2 February Headquarters USAF established a schedule for preparation of documentation and submission of a Preliminary Technical Development Plan for an Advanced ICBM program which was subsequently designated Weapon System 120A.
- 11 February Headquarters USAF informed AFSC that both the Precision Recovery Including Maneuvering Reentry (PRIME) and PILOT low-speed reentry vehicle program development plans had been approved and that PRIME, PILOT, the Aerothermodynamic/Elastic Structural Systems Environmental Tests (ASSET) program, and Advanced Maneuvering Entry were all new projects within the Spacecraft Technology and Advanced Reentry Tests (START) program managed by Space Systems Division.
- 16 February The last Minuteman II (LGM-30F) research and development flight test missile (FTM 2033) was launched from Vandenberg AFB as part of the continuing Minuteman II R&D launch program.
- 19 February Headquarters USAF announced the beginning of Force Modernization at Wing IV, Whiteman AFB, Missouri.
- 24 February The Air Force Western Test Range (AFWTR) supported the first simultaneous ("salvo") launch of two SAC Minuteman I missiles--Flight Test Missiles 529 and 629. The launches were intended to evaluate multiple-firing techniques to be used in operational conditions.

1966

16 March

The world's first space docking mission was flown by Astronauts Neil A. Armstrong and David R. Scott in Gemini 8. An Atlas booster lifted the Gemini Agena Target Vehicle (GATV) into orbit from Cape Canaveral, and it was followed 100 minutes later by the Titan Gemini Launch Vehicle topped by Gemini 8 (GT-8). Rendezvous and docking were successfully accomplished, but shortly thereafter, the Gemini 8-GATV 8 combination began to yaw and roll violently. This led to undocking, an ensuing struggle to stabilize the spacecraft, and an early emergency reentry and recovery 500 miles west of Okinawa. The Number 8 thruster of the Orbital Attitude and Maneuver System (OAMS) on the Gemini 8 spacecraft was found to have frozen in the open position, resulting in the shutdown of the entire OAMS package.

17 March

The first flight test of the General Electric Mark 12 reentry vehicle was made aboard a Minuteman II (LGM-30F) booster fired from Vandenberg.

25 March

Headquarters AFSC authorized the formation of an Advanced ICBM (WS 120A) task group at Headquarters Ballistic Systems Division.

25 March

The Air Force Western Test Range (AFWTR) established a new record by supporting four missile launches from Vandenberg in one day.

28 March

Headquarters USAF gave Ballistic Systems Division the approval necessary to proceed with the development of the Mark 17 reentry vehicle, the Improved Third Stage (ITS), and a reoriented Post Boost Control System (PBCS-2) for the Minuteman ICBM.

30 March

The last Thor/Altair (Burner I) was launched from Vandenberg AFB. The improved Burner II would replace the Altair upper stage.

1966

- 6 April Ballistic Systems Division used a contract change notice in the Boeing contract to incorporate the Minuteman III development into the Minuteman program.
- 11 April A Headquarters USAF Systems Management Directive (SMD) for Minuteman I and II directed that an Improved Third Stage (ITS) propulsion system be used with the Mark 12 and Mark 17 reentry vehicles and a Post Boost Control System (PBCS) and that initial operational capability (IOC) be achieved in July 1969. The Minuteman with the new third stage was designated the Minuteman III (LGM-30G) weapon system and was to be compatible with either the WS 133B or WS 133A/M ground systems.
- 14 April An AFSC directive authorized establishment of a cadre system program office (SPO) for WS 120A at Ballistic Systems Division headquarters.
- 15 April The Thiokol Chemical Corporation successfully test fired the Burner II solid rocket motor.
- 18 April The Boeing Company shipped the first Burner II flight vehicle to Vandenberg AFB.
- 20 April A SAC crew launched the 19th, and final, Titan II Operational Test (OT) missile (#62-12298) from Vandenberg.
- 25 April The first complete Minuteman II (LGM-30F) squadron, the 447th Strategic Missile Squadron of the 321st Strategic Missile Wing (SAC), entered operational service with the transfer of the last 10-missile flight. The squadron was declared fully operational on 3 May.
- 26 April Space Systems Division selected Martin Marietta Corporation to develop the SV-5P manned lifting-body vehicle that would be used to investigate flight characteristics and atmospheric

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maneuverability of wingless lifting bodies. The SV-5P was to be developed as the Piloted Low-Speed Test (PILOT) portion of the Spacecraft Technology and Advanced Reentry Test (START) program managed by SSD.

- 7 May Force Modernization conversion from Minuteman I (LGM-30B) to Minuteman II (LGM-30F) began at Wing IV, Whiteman AFB, Missouri.
- 15 May The last Thrust Augmented Thor/Agna B was used to place NASA's NIMBUS II meteorological satellite into orbit.
- 17 May The Gemini 9 mission was scrubbed when the Atlas booster launched from Cape Canaveral failed to place the Gemini Agna Target Vehicle (GATV) in its planned circular orbit. A malfunction of the number 2 booster engine of the Atlas caused both the Atlas and Agna to fall into the ocean. The Gemini 9-Atlas/Agna mission was later rescheduled to 1 June using the Augmented Target Docking Adapter (ATDA).
- 25 May The first Titan II Follow-On Operational Test (FOT) missile to be launched from Vandenberg was a failure.
- 30 May The Douglas Aircraft Company shipped the first Long Tank Thor (SLV-2G) to Vandenberg AFB. This was also the first vehicle to be sent directly from the factory to the launch pad without a checkout at the contractor's facility.
- 30 May-2 June The first operational Atlas/Centaur (AC-10) carried the NASA Surveyor I spacecraft to the moon in a direct ascent lunar transfer trajectory. This was the first in a series of seven Surveyors designed to develop soft-landing technology and to provide basic scientific and engineering data in support of Project Apollo. On 2 June, Surveyor I became the first U.S. spacecraft to soft-land on the moon and transmit television pictures

1966

back to the Jet Propulsion Laboratory (JPL) in Pasadena, California.

1 June

The first and only Atlas/Augmented Target Docking Adapter (ATDA) Gemini Agena (#5304) was launched from the Eastern Test Range as part of the Gemini 9 mission. The ATDA was a back-up for the Gemini Agena Target Vehicle (GATV) and similar to it except that it lacked the capability to maneuver in space.

3-6 June

Astronauts Thomas P. Stafford and Eugene A. Cernan manned the Gemini 9 (GT-9A) spacecraft that was successfully launched from the Eastern Test Range atop an Air Force Titan Gemini Launch Vehicle. Astronaut Cernan was scheduled to evaluate extravehicular life-support and maneuvering equipment and procedures using the Astronaut Maneuvering Unit (AMU) developed by Space Systems Division. When Cernan's faceplate visor began to fog up and his communications became garbled, Stafford recalled him to the Gemini spacecraft. Docking with the Augmented Target Docking Adapter (ATDA) launched on 1 June proved to be impossible because the shroud had not jettisoned, leaving the ATDA looking "like an angry alligator," according to Stafford. Gemini 9 reentered on 6 June and was recovered 345 miles east of Cape Canaveral.

9 June

The first Atlas SLV-3/Agena D (7200 Series, Vehicle #7201) standard booster was successfully launched from Vandenberg.

16 June

A Titan IIIC (Vehicle #11) successfully supported a record-setting mission by placing eight satellites into near-synchronous orbits 18,200 miles above the equator. Seven communication satellites and one gravity gradient experimental satellite were included in this first launch in a series designed to establish a ring of experimental communications satellites dispersed around the equator. When completed, this

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satellite system would provide the Defense Department with a global military communication system designated the Initial Defense Satellite Communication System (IDSCS). Each of the seven satellites could relay 600 voice or 6,000 teletype channels. Space Systems Division was responsible for the development and launch of the spaceborne elements of the IDSCS as well as the Titan IIIC booster and launch services.

July

Ballistic Systems Division completed the Preliminary Technical Development Plan for the Advanced ICBM (WS 120A).

18-21 July

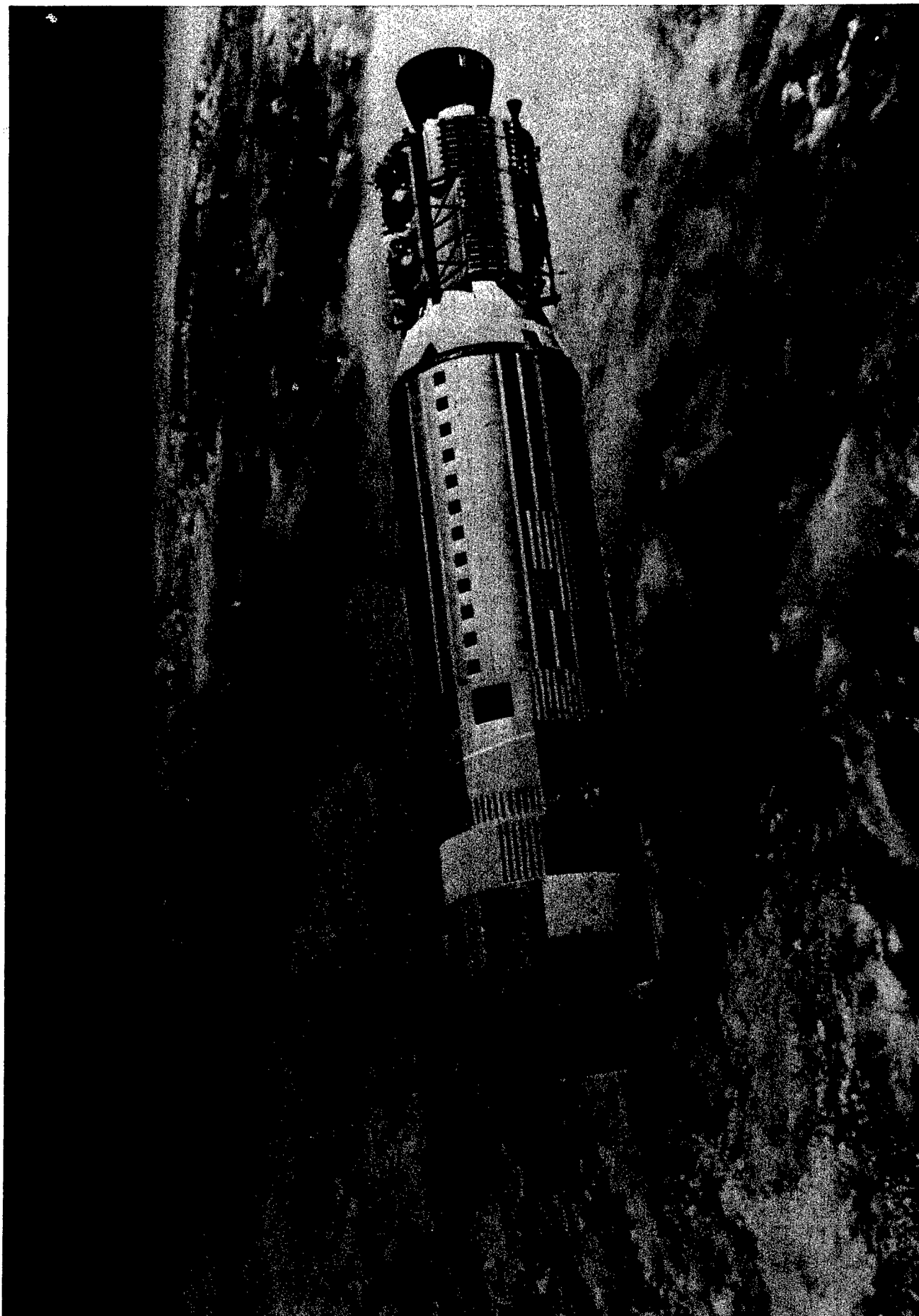
An Air Force Titan Gemini Launch Vehicle placed the Gemini 10 (GT-10) spacecraft into orbit for the three-day mission of Astronauts John Young and Michael Collins. Rendezvous and docking were accomplished with the Gemini Agena Target Vehicle (GATV) that had been launched from Cape Kennedy aboard an Atlas Booster just ahead of GT-10. Using the GATV-10 Primary Propulsion System (PPS), the docked vehicles achieved a manned-flight altitude record of 476 miles. Reentry was accomplished on 21 July and recovery was made 544 miles east of Cape Canaveral.

20 July

Major General John L. McCoy became Commander of Ballistic Systems Division replacing Major General Harry J. Sands, Jr., who was reassigned as Commandant, Air Command and Staff College, Maxwell AFB, Alabama. Brigadier General Arthur W. Cruikshank replaced General McCoy as Deputy for Minuteman.

29 July

After the initial launch attempt on the 28th was held at T minus 12 seconds, the first Titan IIIB/Agena D was successfully launched from Vandenberg AFB. All primary and secondary test objectives were met during the launch and flight which completed the research and development program for the Titan IIIB. This newest member of the Titan III (SLV-5)



The Agena Target Vehicle (as it was seen in space by the Gemini astronauts) is an adapted version of the basic Air Force satellite which can be precisely controlled in orbit. It was used to perfect manned space flight techniques of rendezvous and docking during the Gemini program.

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diameter motor case was ejected from a Minuteman silo with the first stage motor using inhibited propellant grain for the low pressure gas needed for ejection energy. Lockheed Propulsion Company conducted the test.

3 November

A Titan IIIC (Vehicle #9), the ninth research and development Titan III and sixth Titan IIIC to be launched from Cape Canaveral, completed the most difficult flight plan and most successful mission to date. The primary objective of injecting a modified Gemini spacecraft into a suborbital trajectory to test the reentry heat shield for the Manned Orbiting Laboratory (MOL) program was accomplished. After dipping down to 80 nautical miles to eject the MOL load, the Transtage pitched up and placed a canister containing 11 experiments into a 160-nautical mile circular orbit.

10 November

For the first time, three Athena reentry test vehicles were launched from the Utah Launch Complex at Green River to the White Sands Missile Range in a single day.

11-15 November

A Titan Gemini Launch Vehicle successfully completed the Gemini series of space missions by lifting Gemini 12 into orbit from Cape Canaveral. Manned by Astronauts James Lovell and Edwin Aldrin, Gemini 12 (GT-12) rendezvoused and docked with its Agena Target Vehicle. Astronaut Aldrin set a world record for extravehicular activity (EVA) by remaining outside the spacecraft for a total of 5 hours and 28 minutes.

19 November

The first two Minuteman flights to complete Force Modernization at Wing IV, Whiteman AFB, Missouri, were turned over to the 509th Strategic Missile Squadron of the 351st Strategic Missile Wing.

22 November

The final Minuteman II (LGM-30F) squadron of Wing VI, the 448th Strategic Missile Squadron, was turned over to

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SAC's 321st Strategic Missile Wing at Grand Forks AFB, North Dakota. This brought Minuteman ICBM strength to 950 missile launchers--Wings I-V with 800 Minuteman I (LGM-30A/B) and Wing VI with 150 Minuteman II (LGM-30F) missiles. Boeing checkout and formal turnover to SAC were completed on 7 December.

23 November

At NASA's Manned Spacecraft Center in Houston, Texas, Space Systems Division personnel were honored for their support of the Gemini program.

2 December

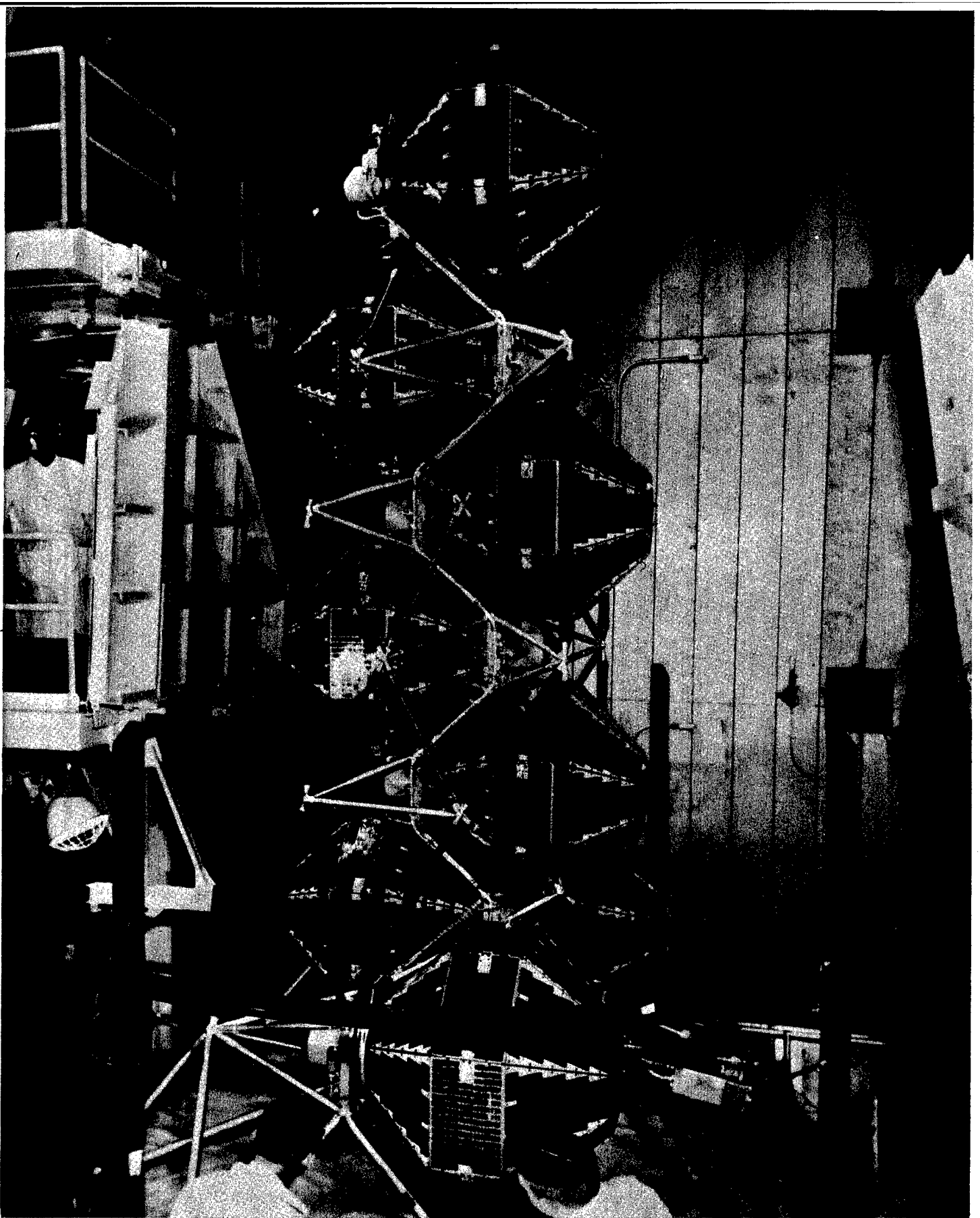
General James Ferguson, Commander, AFSC, directed that Ballistic Systems Division and Space Systems Division be consolidated at one location by 1 July 1967.

21 December

The first SV-5D Precision Recovery Including Maneuvering Entry (PRIME) maneuverable reentry vehicle was launched from Vandenberg by the first Series 7000 Atlas standard launch vehicle (SLV-3, Vehicle #7001). Managed by Space Systems Division, PRIME was designed to explore and advance the development of possible future manned and unmanned lifting body vehicles that would have the capability of operating like a spacecraft in orbit and of flying and maneuvering like an aircraft in the sensible atmosphere. Research was to be applicable to later Space Transportation System (STS) technology.

1967

- January The completed Advanced ICBM (WS 120A) Alternate Basing Study was submitted to AFSC, Headquarters USAF, and Secretary of the Air Force Dr. Harold Brown.
- 11 January The third and final Minuteman II flight test missile with a Mark 12 reentry vehicle was launched from Vandenberg AFB.
- 11 January Space Systems Division selected the Hughes Aircraft Company as the contractor to proceed with research and development of the experimental communications satellite for the U.S. military services. With a target price of \$23.5 million, the contract called for design, engineering, assembly, and testing of what became the Tactical Communication Satellite (TACSAT I).
- 12 January The first Minuteman III third stage development motor (TFW-3) was successfully static test fired by Thiokol.
- 15 January Project Yard Fence, the updating of Titan II sites, was completed at Little Rock AFB, Arkansas.
- 18 January Launched from Cape Canaveral, a Titan IIIC (Vehicle #13) space booster lifted eight 100-pound military communications satellites into synchronous orbits 21,000 miles above the equator. The satellites, together with the seven placed in orbit on 16 June 1966, formed the Initial Defense Satellite Communication System (IDSCS).
- 7 February The final flight of the first Force Modernized Minuteman squadron at Whiteman AFB, Missouri, was turned back to SAC's 351st Strategic Missile Wing.
- 5 March The second SV-5D Precision Recovery Including Maneuvering Reentry (PRIME) lifting body was successfully launched from Vandenberg by an Atlas booster. Although the SV-5D was not recovered, its on-board sensors provided excellent



Model of the eight communication satellites placed into orbit by a Titan IIIIC on 18 January 1967. The satellites formed part of the Initial Defense Satellite Communications System (IDSCS).

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data on the effects of reentry. This was also the first spacecraft to perform cross-range maneuvers during reentry.

8 March

Space Systems Division awarded the Space and Reentry Systems Division of Philco-Ford Corporation a contract for the development and production of the spacecraft for the United Kingdom's Skynet defense communication satellite system. Two spin-stabilized, synchronous, station-keeping satellites were to be produced. Thrust Augmented Thor/Delta boosters and launch services would be procured from NASA by Space Systems Division to place the satellite into orbit. When operational, both Skynet satellites would form part of the larger United States Initial Defense Satellite Communication System Program (IDSCS).

16 March

The second Maneuvering Ballistic Reentry Vehicle (MBRV-2) was launched down the Western Test Range by Atlas 151F. Performance of the launch vehicle was satisfactory, but the MBRV failed to accomplish its planned reentry.

17 March

The 1,000th Minuteman missile, an LGM-30F, was shipped to Squadron 20 at Malmstrom AFB and emplaced on 23 March.

17 March

Space Systems Division's 6555th Aerospace Test Wing at Cape Canaveral was awarded the Air Force Association's Theodore von Karman trophy for "its spectacular stride in advancing the nation's exploration of space and improving the national defense posture throughout 1966." The 6555th ATW had safely launched 10 Gemini missions carrying 20 astronauts and was responsible for all Air Force space booster and ballistic missile launches from Cape Canaveral.

17 April

The first flight test of the Airborne Launch Control System (ALCS) was successfully conducted.

1967

- 19 April The third and last SV-5D Precision Recovery Including Maneuvering Entry (PRIME) flight vehicle, essentially a small maneuverable reentry spacecraft, successfully performed cross-range maneuvers after being launched from Vandenberg on an Atlas booster. The series of three flights was so successful in demonstrating that a maneuverable spacecraft could survive reentry that the planned fourth flight test was cancelled.
- 21 April The final flight of Squadron 20 Minuteman II missiles was turned over to SAC. This brought the strength of the 341st Strategic Missile Wing at Malmstrom AFB to 200 Minuteman missiles--50 Minuteman IIs collocated with 150 Minuteman I missiles. The formal turnover on 3 May completed the deployment of the programmed 1,000 Minuteman missile launchers.
- 21 April The 100th Minuteman IB (LGM-30B) missile (#65-101) was launched from Vandenberg AFB, California.
- 22 April Secretary of the Air Force Dr. Harold Brown and Air Force Chief of Staff General John McConnell approved the proposed combination of Ballistic Systems Division and Space Systems Division into a single organization that would have its headquarters in Los Angeles.
- 28 April Two new and heavier Vela Nuclear Detection Satellites and three scientific satellites were placed in orbit by a Titan IIIC (Vehicle #10) launched from Cape Canaveral. The two Vela satellites joined six other Vela spacecraft already on sentry duty 69,000 miles above the earth.
- 3 May Ballistic Systems Division announced that the 20th Minuteman ICBM squadron, Squadron 20 (the 564th Strategic Missile Squadron) at Malmstrom AFB, Montana, was now operational and that the total deployment of 1,000 missiles was completed.

1967

- 11 May The ninth, and last, Force Modernization Minuteman II (LGM-30F) research and development flight test missile, FTM 2095, was launched from Vandenberg AFB. This missile also carried the fourth Mark 12 reentry vehicle to be test flown on a Minuteman missile launched from Vandenberg AFB.
- 12 May Headquarters USAF instructed Headquarters AFSC to cancel the fourth planned Precision Recovery Including Maneuvering Entry (PRIME) flight and to apply the resulting savings to the Spacecraft Technology and Advanced Reentry Tests (START) program.
- 26 May Headquarters AFSC issued Special Order G-85 discontinuing Ballistic Systems Division and Space Systems Division headquarters effective 1 July. In their place, Headquarters Space and Missile Systems Organization (SAMSO) was constituted and activated effective 1 July. SAMSO would assume the personnel and functions assigned to the former divisions.
- 26 May Thiokol Chemical Corporation's Wasatch Division test fired the ninth 156-inch diameter, solid-propellant motor in Space Systems Division's Large Solid Rocket Motor Program (Program 623A). Motor 156-9-T demonstrated a flexible seal thrust vector control system while generating more than one million pounds of thrust for one minute.
- 31 May The last Air Force Thor/Agena D, SLV-2 #443 and SS-01B #2704, was launched from Vandenberg.
- 4 June The final Air Force Atlas/Agena D (SLV-3 #7128/SS-01B #4837) was successfully launched from Vandenberg AFB.
- 28 June Two scientific satellites, an Army Sequential Collation of Range (SECOR) and a Navy Aurora I, were launched from Vandenberg aboard a Thor/Burner II. This was the first flight in the Department of

1967

Defense's Space Experiments Support Program (SESP), a tri-service program that allowed qualified government-sponsored space experimenters to fly payloads on Air Force boosters. Space Systems Division managed the program and provided boosters, payload integration, and launch services.

1 July

The functions and personnel of Space Systems Division and Ballistic Systems Division were combined to form the new Space and Missile Systems Organization (SAMSO) under the command of Lt General John W. O'Neil, formerly, Commander, Electronic Systems Division (ESD). SSD and BSD were inactivated, with Major General Paul T. Cooper, former SSD commander, becoming Deputy Commander for Space, and Major General John L. McCoy, the last BSD commander, becoming Deputy Commander for Missiles. Headquarters SAMSO took over SSD headquarters while General McCoy remained at Norton AFB with the Minuteman and Advanced Ballistic Reentry Systems (ABRES) program offices.

1 July

A Titan IIIC booster (Vehicle #14) launched from Cape Canaveral placed a multiple payload of six satellites into orbit. Three of the satellites completed the Pacific link of the Initial Defense Satellite Communication System (IDSCS) program between Washington D.C., and South Vietnam. A fourth was a special communications satellite, the Despun Antenna Test Satellite (DATS), designed to test a despun antenna system for possible use on future communications satellites. DATS was designed to transmit 75 percent of radio signal strength to earth stations compared to the 15 percent for previous systems. Also included in the payload were a Defense Department Gravity Gradient Experiment (DODGE) satellite and a Lincoln Experimental Satellite, LES-5, the first all solid-state Ultra-high Frequency (UHF) band communication satellite intended to test communications with frontline troops.

1967

The first tactical communications by satellite between the Air Force, Army, and Navy was accomplished via LES-5 on 3 and 4 July.

14 July

The final squadron of Wing IV at Whiteman AFB was received from SAC's 351st Strategic Missile Wing for Force Modernization.

29 July

Launched from Vandenberg AFB atop Atlas booster 150F, the third Maneuvering Ballistic Reentry Vehicle (MBRV-3) achieved the first successful flight and reentry of a maneuvering ballistic reentry vehicle in the Advanced Ballistic Reentry Systems (ABRES) program. MBRV-3 successfully accomplished its planned terminal maneuver during reentry, and all objectives were achieved.

October

Headquarters USAF planners began to move away from the concept of the WS 120A Advanced ICBM missile system and toward the concept of a dual-capable silo for the Minuteman III weapon system. Using the basing concept devised for WS 120A, the new approach was to concentrate on the development of a silo that could hold the Minuteman III when it became operational and could later accommodate an advanced ICBM.

3 October

The final flight of Force Modernization Minuteman II missiles was turned over to SAC at Whiteman AFB. Wing IV was completed on schedule and turned back to SAC's 351st Strategic Missile Wing three days later.

19 October

The first phase of the Minuteman ICBM Force Modernization (WS 133A-Modernized or WS 133A-M) program was officially completed with the formal turnover of 150 Minuteman II (LGM-30F) missile launchers to SAC's 351st Strategic Missile Wing at Whiteman AFB, Missouri. The completion of the first Force Modernization wing gave the Strategic Air Command 350 of the advanced Minuteman II missiles out of the total force of 1,000 Minuteman ICBMs.

1967

- 30 October The last of 18 updated Titan II ICBM sites was returned to the 390th Strategic Missile Wing at Davis-Monthan AFB, Arizona. The work was completed as part of the Project Yard Fence update program begun in 1965.
- November The Department of Defense directed SAMSO to procure a communications satellite system for the North Atlantic Treaty Organization (NATO). Essentially, the NATO system was a duplication of the British Skynet communications satellite system developed and built by Philco-Ford.
- 1 November As a result of a Minuteman Task Force Study, Headquarters SAMSO reorganized and strengthened the Minuteman System Program Office (SPO) at Norton AFB. This action finally ended the management system that had been functioning since Ballistic Systems Division completed its move to Norton in August 1962. In addition, the systems engineering and technical direction (SE/TD) function for Minuteman, previously divided between TRW Systems Group and Aerospace Corporation, was given completely to TRW with Aerospace to be phased out of the Minuteman program.
- 7 November Atlas 94D was the 91st, and last, D series missile to be launched from Vandenberg AFB since 12D was launched on 9 September 1959.
- 15 November The Titan III System Program Office (SMVT) of SAMSO's Deputy for Launch Vehicles initiated work on the design, development, and production of the Titan IIID launch vehicle system. Major reprogramming was required for the new Titan IIID program.
- 12 December The first flight of the first Wing I squadron to complete Force Modernization to the LGM-30F, the 12th Strategic Missile Squadron, was returned to SAC's 341st Strategic Missile Wing at Malmstrom AFB, Montana.

1967

21 December

An Air Force System Management Directive (SMD) confirmed cancellation of the advanced Mark 17 reentry vehicle development, revised the operational deployment schedule for Minuteman III (LGM-30G), and slipped Force Modernization of the Minuteman wings by an additional six months.

21 December

The 125th Minuteman I (LGM-30B) missile was launched from Vandenberg AFB and was the 200th Minuteman ICBM to be launched down the Western Test Range since September 1962.

1968

- 12 January The Defense Department officially announced cancellation of the Mark 17 reentry vehicle program after expenditure of \$45 million. Funds originally earmarked for Mark 17 development were now redirected to Mark 11 reentry vehicle work.
- 17 January The last scheduled Air Force Thrust Augmented Thor/Agena (SLV-2A #498/SS-01B #2733) to be launched from Vandenberg AFB was the 150th Thor/Agena vehicle fired from there since Discoverer I was launched on 28 February 1959. From now on, the Air Force would use the more advanced Long Tank Thrust Augmented Thor (SLV-2G)--Thorad--and the newer SLV-2H.
- 6 February Minuteman II (LGM-30F), FTM 468, carrying a research and development Mark 12 reentry vehicle, was launched from Silo 32 at Cape Canaveral. This was the 26th Minuteman II R&D launch--20 from the Eastern Test Range and six from Vandenberg.
- 10 February The final Mark 12 reentry vehicle test launch was conducted from Vandenberg AFB.
- 21 February SAMSO's Deputy of Reentry Systems and Deputy for Launch Vehicles signed a Memorandum of Agreement that established the working relationship for the conduct of full-scale flight test programs assigned to Reentry Systems.
- March A SAMSO Source Selection Board selected Hughes Aircraft Company and TRW Systems Group to perform preliminary concept formulation and system design studies for System 621B, a satellite system for precise navigation.
- March The 100th Athena missile was launched from the Green River launch complex in Utah to White Sands Missile Range, New Mexico.
- March The Advanced ICBM (WS 120A) Provisional System Program Office (SPO) at Norton was dissolved, and most of its personnel

1968

were transferred to the Minuteman SPO as the core cadre for the Hard Rock Silo (HRS) development program.

6 March

The Air Force Western Test Range supported the initial west coast use of an Atlas E (74E) as a booster in an Advanced Ballistic Reentry Systems (ABRES) reentry vehicle development program.

12 March

Headquarters USAF announced that SAMSO would provide flight support for all Defense Department and government agency research and technology space experiments in its Space Experiment Support Program (SESP).

26 March

The Joint Pacific Area Scheduling Office (JPASO) was established at Vandenberg AFB to centralize coordination and scheduling for all Department of Defense offensive/defensive ballistic missile test operations in the Pacific area, without regard to point of origin. Representatives from the Air Force Western Test Range, the Army's Kwajalein Missile Range (KMR), and the Navy's Pacific Missile Range (PMR) were the primary participants in the scheduling meetings.

April

After completion of an agreement between the Defense Department and the North Atlantic Treaty Organization (NATO), SAMSO initiated procurement of a two-satellite communications system for NATO. Philco-Ford Corporation was selected to build the two satellites that would be nearly identical to those produced for the United Kingdom's Skynet program.

13 April

A NASA Thorad/Agema was launched from Vandenberg AFB and successfully boosted a Nimbus B2 meteorological satellite and an Army-sponsored Sequential Collocation of Range (SECOR) satellite into orbit.

1968

- 16 April Atlas 68E, the 16th and last E model to be launched from Vandenberg AFB, completed its mission to Kwajalein as part of the SAMSO-Army Reentry Measurements Program Phase B (RMP-B).
- 1 May Headquarters USAF issued a System Management Directive (SMD) to initiate the Hard Rock Silo (HRS) Development Program for Minuteman III. The aim of the program was to develop and test a new, very hard basing system that would be compatible with an Advanced ICBM but initially used for Minuteman III. This SMD was the culmination of previous studies undertaken by the Defense Department and the Air Force on advanced ICBM systems.
- 1 May SAMSO awarded Hughes Aircraft and TRW Systems Group contracts to prepare preliminary designs for a navigation satellite system that would provide for precision navigation by high-speed aircraft.
- 27 May The final flight of the first Force Modernization squadron at Wing I, the 12th Strategic Missile Squadron, was completed and returned to SAC.
- 13 June An Air Force Titan IIIC, Vehicle #16, was launched from Cape Canaveral and successfully inserted eight 100-pound communications satellites into near-synchronous orbits. These satellites augmented and completed the deployment of the Initial Defense Satellite Communications System (IDSCS) which now consisted of 26 operational satellites.
- 20 June Force Modernization work was officially completed on the first squadron (12th Strategic Missile Squadron) of Minuteman II missiles at Malmstrom AFB, Montana. The work included renovation of the underground launch facilities (LFs) so that they would accommodate the Minuteman II missile.

1968

25 June

Thiokol-Wasatch Division test fired the 10th, and final, 156-inch diameter, solid-propellant rocket motor (156-8-T). The motor developed one million pounds of thrust during its 118-second firing, which tested a segmented fiberglass case and non-hydroclaved nozzle provided by the Air Force Materials Laboratory (AFML). This test firing completed the Large Solid Rocket Motor Program (Program 623A) begun under Space Systems Division management in 1963.

6 August

The first "stretched" Atlas SLV-3A/ Agena D was launched from the Eastern Test Range. The "stretched" Atlas had an additional 117-inch tank section to provide more fuel, a longer burn time, and increased payload capability.

16 August

The first 76,000-pound Minuteman III (LGM-30G) flight test missile (FTM 201) was launched from Silo 32 at Cape Canaveral and completed a successful flight 5,000 miles downrange.

16 August

An Atlas/Burner II (SLV-3, #7004), the first Atlas to be launched with a Burner II upper stage, was launched from Space Launch Complex 3 East (SLC-3E) at Vandenberg but failed to place its payload in orbit due to a malfunction of the nose-fairing heat shield separation system.

5 September

A High Explosive Simulation Test (HEST-V) was completed at Grand Forks AFB, North Dakota, to evaluate the effects of surface overpressure on a Minuteman launch facility and its equipment.

26 September

A Titan IIIC space booster (Vehicle #5) was launched from Complex 41 at the Eastern Test Range and inserted four satellites into separate earth orbits. The primary payload was the Lincoln Experimental Satellite (LES-6) which was the second all-solid-state ultra-high frequency (UHF) band communication satellite to be placed into a synchronous

1968

orbit. It was designed to test communications with aircraft, ships, and ground forces. The other three satellites were Office of Aerospace Research (OAR) payloads--two Experimental Research Satellites (ERS-21 and ERS-28) and an Orbiting Vehicle (OV 2-5) research satellite.

8 October

SAMSO asked qualified contractors to submit proposals for the development of an advanced satellite communications system, the Defense Satellite Communication System Phase II (DSCS II) (Program 777).

18 December

NASA conducted its first successful Long Tank Thrust Augmented Thor/Delta (Thorad/Delta) launch from Cape Canaveral. The Intelsat IIIB satellite was placed in a synchronous earth orbit.

1969

29 January

The Air Force Western Test Range supported four missile launches from Vandenberg, equalling the single-day record first set on 25 March 1966.

February

The Minuteman II Retrofit program began.

1 February

SAMSO awarded the Boeing Airplane Company an integration, instrumentation, and launch service contract for the launching of nine obsolescent Minuteman I missiles as target vehicles in the Safeguard System Test Targets Program (SSTTP) in support of the Army anti-ballistic missile (ABM) missile system development program.

9 February

Air Force Titan IIIC, Vehicle #17, was launched from Cape Canaveral and placed the 1,600-pound experimental Tactical Communications Satellite, TACSAT I, into a near-synchronous orbit at an altitude of 19,300 nautical miles above the equator. TACSAT I, built by Hughes Aircraft Company under SAMSO management, was the largest communications satellite yet launched and placed in orbit by the United States. It was to determine the feasibility of using satellite communications repeaters with small mobile ground tactical communications equipment. In addition, using the technology already developed with earlier Despun Antenna Test System (DATS) and Lincoln Experimental Satellites (LES) test spacecraft, TACSAT I would test the feasibility of satellite communications over great distances while also testing the new gyrostat stabilization system. The satellite could handle transmission of television or multiple telephone/teletype communications channels.

12 February

The final Minuteman I (LGM-30A) missile was taken out of its silo at Malmstrom AFB, Montana, marking the end of the operational deployment of the original model Minuteman ICBM missile. This removal was part of the continuing Force Modernization program at Malmstrom.

1969

- 3 March SAMS0 awarded a \$74 million contract to TRW Systems Group to develop and produce six flight models of an advanced communication satellite for the Defense Satellite Communications System Phase II (DSCS II) (Program 777). Designed to use steerable, narrow-beam antennas to increase performance, the new satellites were intended for use with small surface terminals.
- 17 March Atlas 104F was launched from Vandenberg AFB and placed 41 scientific experiments into orbit as part of SAMS0's Space Experiments Support Program (SESP).
- 11 April Minuteman III (LGM-30G) flight test missile (FTM) 301, the first test missile launched from Vandenberg but the fourth R&D missile to be fired, completed a 5,000-mile flight and impacted near the Marshall Islands.
- May SAMS0 selected General Dynamics/Convair, Lockheed Missiles and Space Company, North American Rockwell, and McDonnell Douglas to prepare design concepts for a reusable space vehicle for the Space Transportation System (STS).
- May SAMS0 initiated development of the universal boattail Thor (SLV-2K) space booster for NASA. The new booster would provide a Thor with the capability to use three, six, or nine strap-on Thiokol solid rocket motors.
- 20 May SAC's launch of Titan II (#63-07738) completed its Follow-on Operational Test (FOT) program launches of the Titan II (LGM-25C).
- 20 May A SAC crew launched the 50th Minuteman II missile (#64-15525) from Vandenberg AFB.
- 23 May The 13th, and final, Titan IIIC research and development booster (Vehicle #15) lifted two Vela satellites, the fifth pair of such nuclear detection spacecraft, and three experimental satellites into

1969

- orbit from Cape Canaveral. This launch concluded the highly successful Titan III research and development program initiated in 1962. Out of 13 Titan IIIC and four Titan IIIA vehicles launched, 10 Titan IIICs were complete successes, two were partial successes, and only one was a failure, while three of the four Titan IIIA launches were rated successful.
- 27 May The last flight of Force Modernization Minuteman II missiles was turned over to SAC's 341st Strategic Missile Wing at Malmstrom AFB, Montana. Wing I Force Modernization turnover was officially completed on 13 June 1969.
- June SAMSO began development of the Burner IIA solid-propellant second-stage vehicle that would provide a tandem motor injection stage and on-orbit capability nearly twice that of the existing Burner II.
- 10 June Deputy Secretary of Defense David Packard announced the cancellation of the Air Force's Manned Orbiting Laboratory (MOL) program because of the continuing need to reduce Federal defense spending and the advances made in automated techniques for unmanned satellite systems.
- 16 June SAMSO awarded contracts to North American Rockwell, McDonnell Douglas, General Dynamics/Convair, and Lockheed Missiles and Space Company to study Space Transportation System (STS) design concepts and technical objectives.
- July SAMSO awarded a contract to the Honeywell Aerospace Division, for the first time establishing a second source supplier for the Minuteman III missile guidance and control system.
- 8 July The 250th Minuteman missile to be launched from Vandenberg AFB was a SAC Operational Test flight missile.
- 30 July SAC's First Strategic Aerospace Division (1STRAD) turned over to SAMSO a Minuteman

1969

launch facility at Vandenberg for use in support of the Army's Safeguard System Test Targets Program (SSTTP) that was to evaluate the Army anti-ballistic missile (ABM) missile systems then under development.

- 1 September Lieutenant General Samuel C. Phillips, former director of NASA's Apollo program, became Commander of SAMSO, replacing Lieutenant General John W. O'Neill who moved up to become Vice Commander, AFSC.
- 6 September An Air Force System Management Directive (SMD) confirmed a Minuteman force of 1,000 missile launchers and the introduction of the Minuteman III (LGM-30G) into the operational inventory by 30 June 1970.
- 31 September The Minuteman II Retrofit program began at Wing I, Malmstrom AFB, Montana.
- October NASA and the Air Force agreed on the development of a reusable space vehicle that would meet both civilian and military space requirements. NASA proposed a two-stage shuttle with a cargo area 60 feet long and 15 feet in diameter.
- 2 October SAC's 1st Strategic Aerospace Division launched the 150th Minuteman IB, LGM-30B #64-424, to be launched from Vandenberg.
- November As directed by SAMSO, the Aerospace Corporation began an in-depth study of a coordinated Minuteman/Safeguard system.
- 21 November Skynet IA, the first of two Skynet military communications satellite built for the United Kingdom by the Philco-Ford Corporation, was launched from Cape Canaveral aboard a NASA Long Tank Thrust Augmented Thor/Delta (DSV-3L). The satellite was turned over to the United Kingdom on 30 January 1970, providing the United Kingdom with its first operational military communications satellite system. The Skynet satellites were designed to be usable with the Initial Defense Satellite Communication

1969

System (IDSCS) satellites of the United States.

28 November

In response to Headquarters USAF Development Directive 235-2 of 30 June 1969, Headquarters AFSC submitted SAMSO's development plan for System 621B, the Satellite System for Precise Navigation. This later became the Defense Navigation Satellite System, Program 621B.

5 December

A SAC Minuteman I missile was the 500th major missile and space launch from Vandenberg since 1958 that was supported by the Air Force Western Test Range.

1970

- 10 January A NASA/Defense Department agreement provided that NASA would contract for the services of a Scout (SLV-1) launch team beginning on 1 July 1970. Under Air Force supervision, the team would launch Scout vehicles from Vandenberg AFB for both NASA and the Defense Department.
- 12 January Force Modernization to the Minuteman III (LGM-30G) began at Wing III, the 91st Strategic Missile Wing, at Minot AFB, North Dakota.
- 14 January The 25th Air Force Titan IIIB/Agena D space booster was launched from Vandenberg AFB.
- 23 January NASA successfully launched the Improved Tiros Operational Satellite (ITOS I) (TIROS-M) from Vandenberg AFB aboard a two-stage, Long Tank Thrust Augmented Thor/Delta (SLV-2K), Thorad/Delta, using six solid-propellant, strap-on Thiokol TX 354-5 Castor II motors. This was the first use of the "Super Six" Thor/Delta (DSV-3N-6) booster vehicle that employed the six Castor II motors, three of which ignited 30 seconds after lift-off. Generating nearly 600,000 pounds of thrust, the new launch vehicle could orbit a spacecraft weighing more than twice as much as the previous Tiros Operational Satellites.
- 13 February Work was completed on the new, highly sophisticated spacecraft Environment Enclosure for the Titan IIIC facilities at Launch Complex 40 at Cape Canaveral. The \$1.6 million enclosure on the Mobile Service Tower (MST) would provide a temperature and humidity controlled environment for a variety of spacecraft to be orbited by the Titan IIIC. This would allow crews to adjust or repair spacecraft without removing them from the MST. Official Air Force acceptance was announced on 12 March 1970.

1970

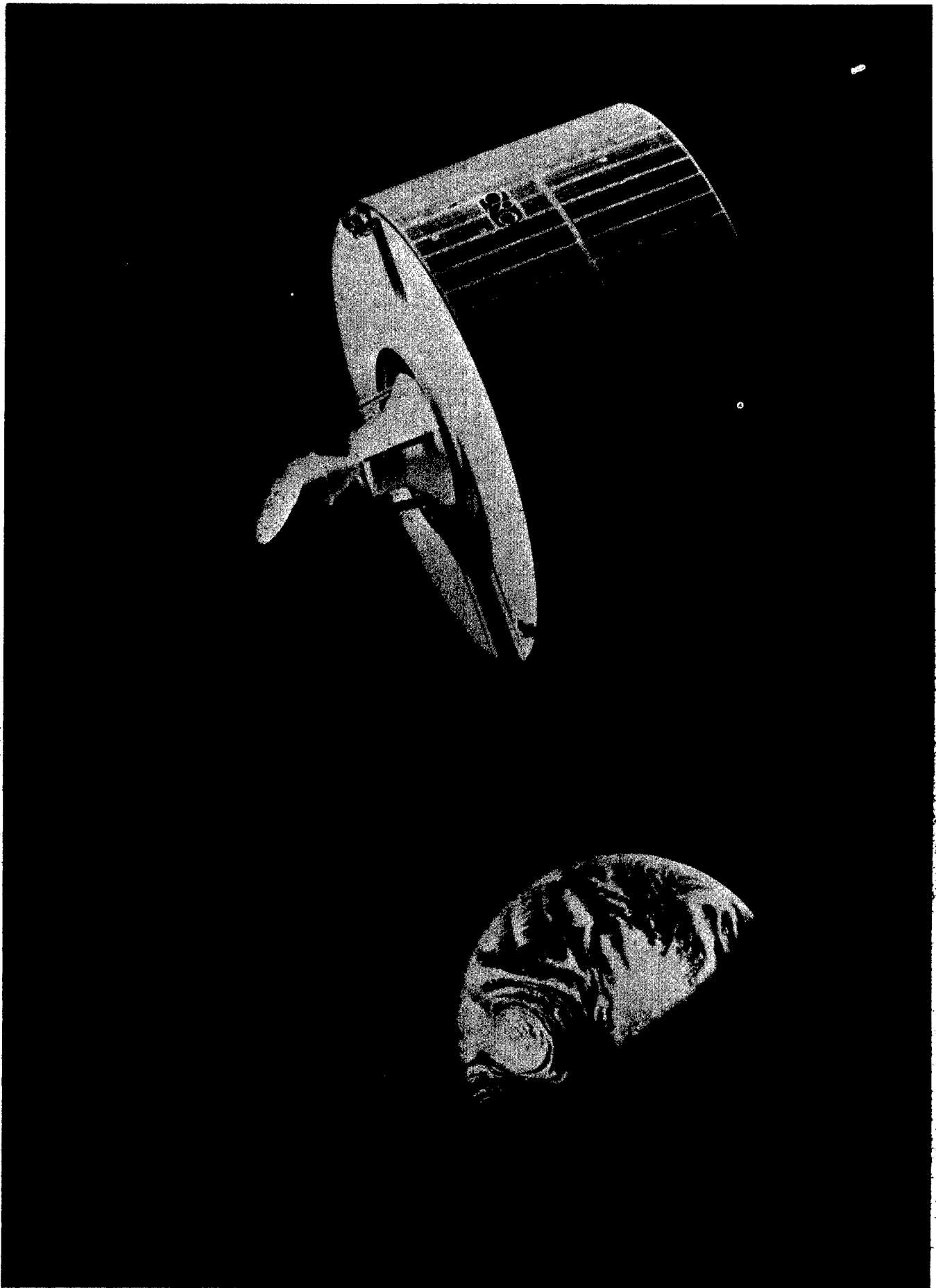
- 17 February NASA and the Air Force signed an agreement to insure that the Space Transportation System (STS) would provide maximum utility to both military and civilian users at lower operating and maintenance costs than present space launch systems. NASA would manage STS development, and a NASA-USAF Committee would review the program to guarantee that it met Defense Department and NASA requirements.
- 25 February A Wing II configuration LGM-30B Minuteman I became the 275th Minuteman missile to be launched from Vandenberg AFB since September 1962.
- 3 March The first operational Minuteman III (LGM-30G) was completed at Air Force Plant 77.
- 20 March The first of two communications satellites built for the North Atlantic Treaty Organization (NATO) by the Philco-Ford Corporation under a SAMSO contract was launched from Cape Canaveral aboard a NASA Long Tank Thrust Augmented Thor/Delta booster. Inserted into synchronous orbit on 23 March, the satellite was turned over to the Supreme Headquarters Allied Forces Europe (SHAPE) on 19 May.
- 25 March SAMSO and NASA signed a Memorandum of Understanding that defined the roles and responsibilities of each organization for a Titan III/Centaur coordinating group which would acquire Titan III launch vehicles for NASA's Viking Mars Lander and other future space programs.
- 30 March SAMSO published the Minuteman Rebasing Task Force Report that offered an analysis and cost projections of several optional solutions to the problem of maximizing Minuteman system survivability.
- 31 March Minuteman II Retrofit at Wing I, Malmstrom AFB, Montana, was completed.

1970

- 1 April Headquarters Air Force Western Test Range (AFWTR) was inactivated and Headquarters Space and Missile Test Center (SAMTEC) was activated at Vandenberg AFB and assigned to the Space and Missile Systems Organization. The 6595th Aerospace Test Wing at Vandenberg was reassigned from SAMSO to SAMTEC. The 6555th Aerospace Test Wing at Patrick AFB, Florida, was redesignated the 6555th Aerospace Test Group and assigned to the 6595th Aerospace Test Wing as part of the reorganization that brought AFSC range and launch operations at Vandenberg under a single command for the first time.
- 1 April SAMSO's Minuteman Booster Program Office was integrated into the Ballistic Missile Defense Targets Division of the Deputy for Reentry Systems. The merger combined all SAMSO activities supporting the Army's Safeguard Systems Test Targets Program (SSTTP) under the Deputy for Reentry Systems.
- 8 April A Long Tank Thrust Augmented Thor/Agena D space booster lifted NASA's Nimbus 4 meteorological satellite into orbit from Vandenberg. This was the 400th launch of the Thor booster that was originally developed by the Air Force as an intermediate range ballistic missile (IRBM) in the 1950s.
- 23 April SAMSO resumed Athena test launches from the Utah Launch Complex at Green River, Utah, after a seven-month pause for remodeling the facilities so that the longer, heavier, improved Athena H test missile could be launched from them.
- 1 May The 6595th Space Test Group and 6595th Missile Test Group were organized and assigned to the 6595th Aerospace Test Wing at Vandenberg AFB. This completed the reorganization of SAMSO missile and space launch units that had begun with the establishment of the Space and Missile Test Center (SAMTEC) on 1 April.

1970

- 15 May Facility construction was completed at the Titan III launch pad, Space Launch Complex 4 East (SLC-4E) at Vandenberg. The new facilities provided a temperature and humidity controlled environment for payloads that were to be flown aboard the Titan III launch vehicles.
- 1 June The British government, assisted by Air Force Systems Command's Space and Missile Systems Organization (SAMSO), began development of Skynet II, an advanced satellite communications system.
- 19 June The first flight of Minuteman III (LGM-30G) missiles was turned over to the 741st Strategic Missile Squadron of SAC's 91st Strategic Missile Wing at Minot AFB, North Dakota. Force Modernization involved refurbishment of Minuteman facilities to accommodate the Minuteman III configuration missile. Air Force Logistics Command (AFLC) also had its depot facilities ready to repair Minuteman III systems as of 19 June-- this was the first time in the history of U.S. missile systems that initial operational capability (IOC) of a major new weapon system and depot repair capability were achieved simultaneously.
- July Thiokol Chemical Corporation was selected as a second source contractor for the Minuteman III third stage propulsion system. The other manufacturer of the motors was the Aerojet General Solid Rocket Company. Thiokol already produced the first-stage solid-propellant motors for Minuteman III, and Aerojet built Stage II motors.
- 1 July The Tactical Satellite Communication (TACSATCOM) interim operational capability, consisting of the Tactical Communications Satellite (TACSAT I) and the Lincoln Experimental Satellite LES-6, was established. TACSAT I was initially designed to demonstrate the feasibility of handling tactical



Typical international satellites managed by SAMSO for NATO and United Kingdom users are NATO II and Skynet I and Skynet II represented by the artist's conception here.

1970

communications by satellite. The tests had been so successful with both satellites that tri-service traffic was added for relay through the system.

11 July

An Athena test missile launched from Green River, Utah, toward the White Sands Missile Range veered off course and landed some 200 miles inside Mexico. This led to a halt in Athena launches from Green River until the cause of the malfunction could be determined.

23 July

Flight Test Missile 970, a Minuteman I (LGM-30B), was the 300th Minuteman missile launched from Vandenberg AFB and the first missile launched in support of the Army's Safeguard System Test Targets Program (SSTTP). Since the first Minuteman missile was fired on 28 September 1962, 165 LGM-30Bs, 50 LGM-30As, 75 Minuteman IIs and 10 Minuteman IIIs had been launched from Vandenberg.

28 July

The final flight test missile in the basic Minuteman III research and development program was launched from Vandenberg AFB. Twenty-five missiles had been launched in the program--eleven from Vandenberg and fourteen from Cape Canaveral.

19 August

The second of two British Skynet I communication satellites (Skynet B) was launched from Cape Canaveral for U.S. Air Force and United Kingdom aboard a NASA Long Tank Thrust Augmented Thor/Delta (DSV-3M) space booster. The spacecraft was placed in a transfer orbit prior to firing of the apogee kick motor that was to put it into a synchronous orbit over Kenya. Contact with Skynet B was lost during the firing of the apogee kick motor on 22 August

1970

and was not regained. The Skynet I satellites were part of the Initial Defense Satellite Communication System (IDSCS) program which was managed for the United Kingdom by SAMSO, with NASA providing launch vehicles and services.

21 August

Headquarters USAF announced the termination of the Hard Rock Silo program for Minuteman.

27 August

The last Scout booster to be launched by an all-military crew was fired from Vandenberg AFB. Future Scout operations would be conducted by contractor launch teams under Air Force technical management.

14 September

The 81st Minuteman II (LGM-30F) missile to be fired from Vandenberg AFB became the 1,000th missile to be launched from the base since December 1958.

16 September

The first Minuteman III flight test missile was launched from the Eastern Test Range in the follow-on test program.

1 October

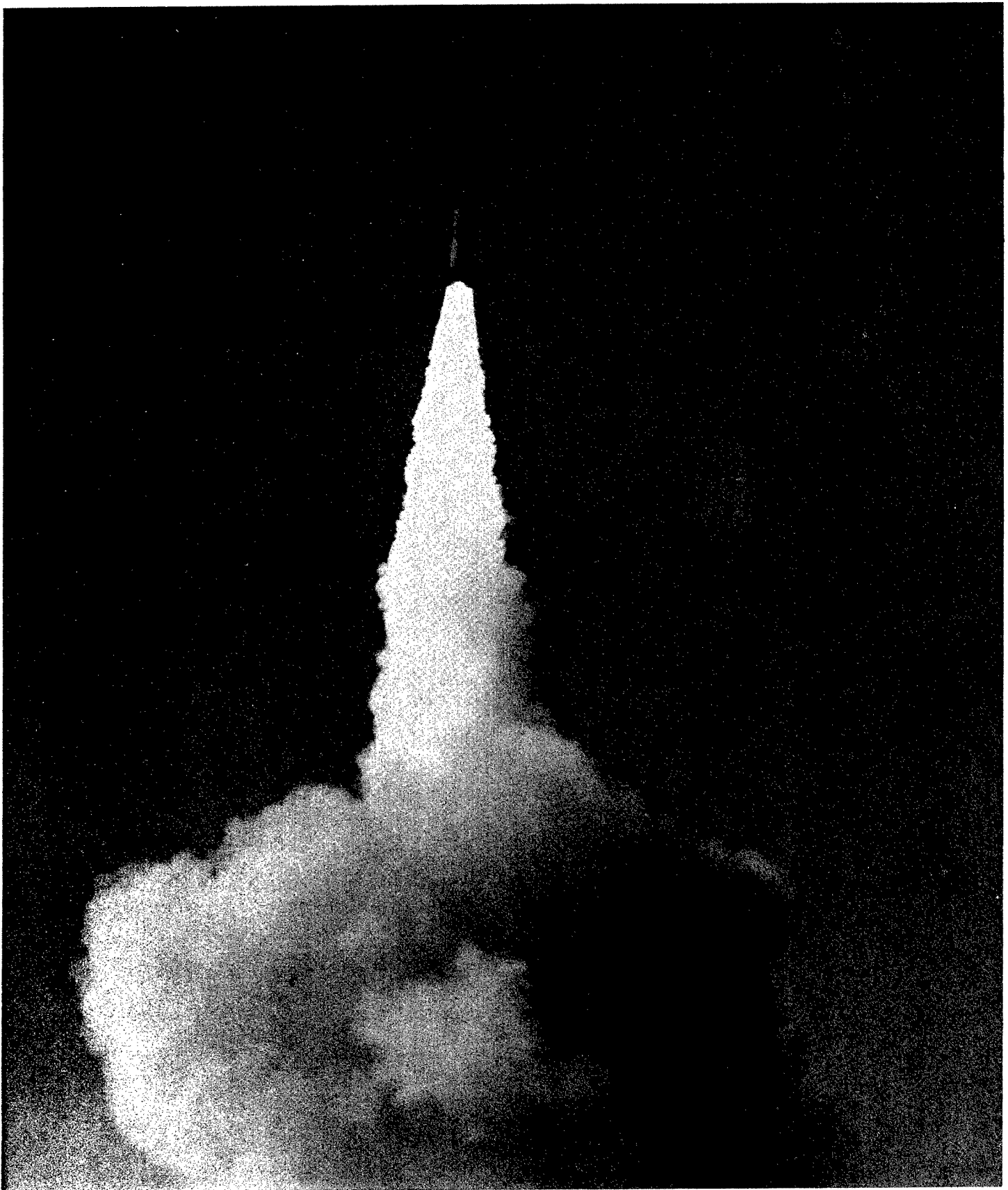
The British government announced the contractual awards for acquisition of Skynet II, a more advanced satellite communications system. As with Skynet I, SAMSO participated actively in the development and acquisition of the system.

22 October

Space and Missile Test Center (SAMTEC) supported the first salvo launch of two Minuteman II missiles from Vandenberg AFB. This was the third simultaneous launch of Minuteman missiles from Vandenberg.

28 October

Headquarters USAF issued a Requirements Action Directive (RAD) that assigned AFSC, in effect SAMSO's Deputy for Space Communication Systems, the task of preparing a development concept paper (DCP) for an advanced satellite



The Minuteman III, shown here during a launch, was an improved version of the Minuteman II. It featured an improved third stage motor and a new re-entry system with greater accuracy and an increased payload.

1970

communication system designed primarily for mobile terminals.

4 November

The first Minuteman III follow-on R&D flight test missile was launched from Vandenberg AFB.

6 November

An Air Force Titan IIIC launched the 500th satellite to be placed in orbit successfully by a vehicle launched from Cape Canaveral.

24 November

The Wing VI Minuteman II Retrofit program was completed at Grand Forks AFB, North Dakota.

24 November

Headquarters AFSC announced that SAMSO had proposed the development of a navigation system employing several clusters of satellites and ground stations (Program 621B). When developed, the system would provide three-dimensional position and velocity information for users.

14 December

The launch of the 91st Minuteman missile, a Minuteman III, from the Eastern Test Range marked the completion of Minuteman R&D testing at the range after almost 10 years of operations.

23 December

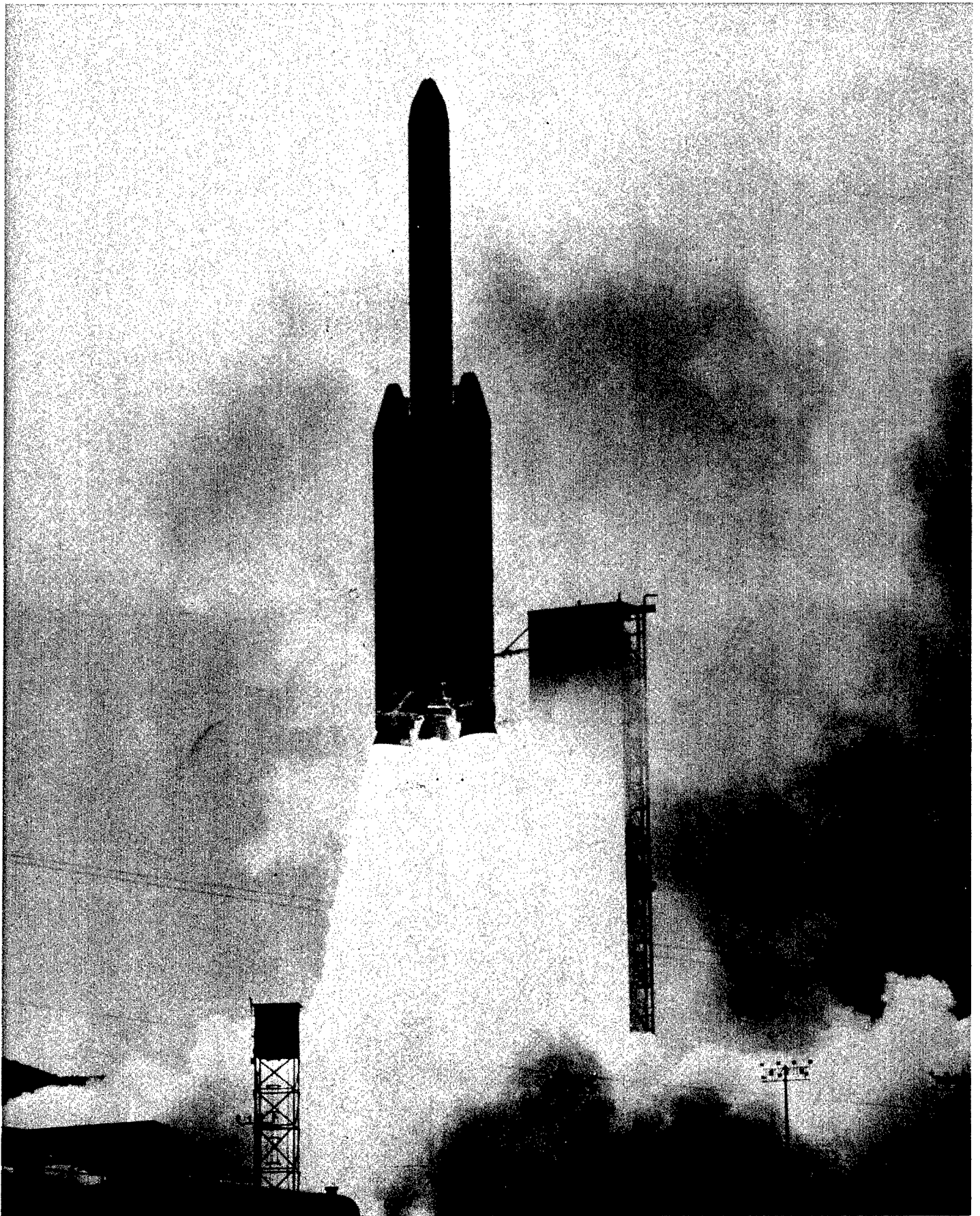
A Minuteman I flight test missile was fired down the Western Test Range from Vandenberg AFB as part of the Safeguard System Test Targets Program (SSTTP) managed by SAMSO's Deputy for Reentry Systems. An Army Sprint missile intercepted the nose cone, recording its first test intercept.

31 December

Force Modernization and emplacement of Minuteman III missiles were completed on the last flight of 741st Strategic Missile Squadron of SAC's 91st Strategic Missile Wing at Minot AFB, North Dakota. This marked the turnover of the first complete Minuteman III squadron to SAC. Formal turnover took place on 8 January 1971.

1971

- 8 January The first squadron of Minuteman III (LGM-30G) ICBMs was officially turned over to SAC's 91st Strategic Missile Wing at Minot AFB, North Dakota.
- 9 January After a six-month halt due to the 11 July 1970 malfunction, Athena testing was resumed from the Green River, Utah, complex.
- 2 February The second NATO military communications satellite (NATO IIB) was launched by NASA aboard a Thrust Augmented Thor/Delta booster. Developed for NATO under SAMSO program management, the spacecraft was first placed in a transfer orbit and then moved into an acceptable synchronous orbit on 4 February. Although numerous difficulties were experienced prior to launch, the satellite achieved its stationary orbit and has performed successfully since then.
- 16 February A Thor/Burner II launch vehicle successfully carried out a Space Experiments Support Program (SESP) orbital flight for the Naval Research Laboratory.
- 13 March In its first use at Cape Canaveral, a NASA Long Tank Thrust Augmented Thor/Delta boosted Explorer 43 into orbit. This was the first "Super Six" configuration Thor/Delta, with strap-on solid-rocket boosters motors, to be launched from the Eastern Test Range.
- 23 March SAC launched the first Minuteman III Operational Test (Phase I) missile from Vandenberg AFB.
- 3 April The first Athena H flight test missile was launched from Green River, Utah, to the White Sands Missile Range. Although the upper stages were inert, over 90 percent of the planned flight test objectives were achieved.
- 15 May The submission of a development concept paper (DCP) for a Military Satellite Communications (MILSATCOM) system to be developed by SAMSO was halted at



This Titan IIID was the fourth configuration of the versatile Titan III Space Launch Vehicle series.

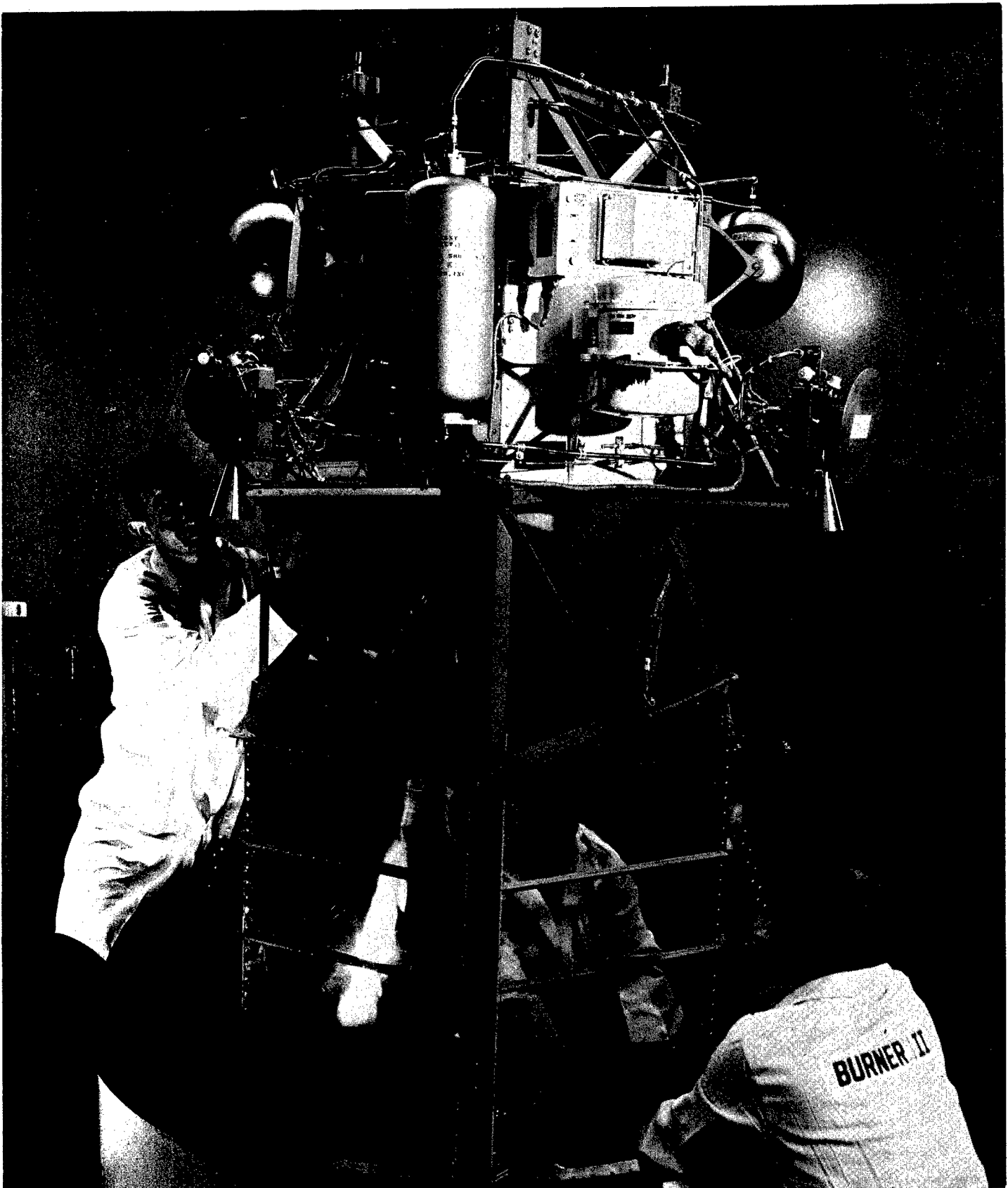
1971

- Headquarters USAF after an agreement between Secretary of the Air Force Robert C. Seamans, Under Secretary John L. McLucas, and Deputy Secretary of Defense David Packard. It was agreed that the Navy's proposed tactical satellite communications system, the Fleet Satellite Communications Satellite (FLTSATCOM), would be developed with some channels set aside for Air Force use.
- 20 May Headquarters AFSC instructed SAMSO to cancel all efforts on the development of the Military Satellite Communications (MILSATCOM) system.
- 26 May A Minuteman III fired for a SAC Phase I Operational Test was the 350th Minuteman missile launched from Vandenberg AFB since September 1962.
- 26 May The final flight of the 740th Strategic Missile Squadron, the second Force Modernization squadron of Minuteman III missiles to be completed at Wing III, was turned over to the 91st Strategic Missile Wing (Minot AFB, North Dakota).
- 1 June The Martin Marietta Corporation was given the go ahead to build two Titan III/Centaur launch vehicles and to design, build, and install required aerospace ground equipment (AGE) to activate Eastern Test Range Launch Complex 41 in support of NASA Titan III/Centaur missions.
- 15 June The 6595th Space Test Group at Vandenberg AFB launched the first Titan IIID space booster (Vehicle D-1).
- 29 June The Space and Missile Test Center (SAMTEC) equalled its previous record by supporting four missile launches from Vandenberg in a single day.
- July SAMSO's Space Experiments Support Program (SESP), with total responsibility for providing spacecraft support to all Defense Department

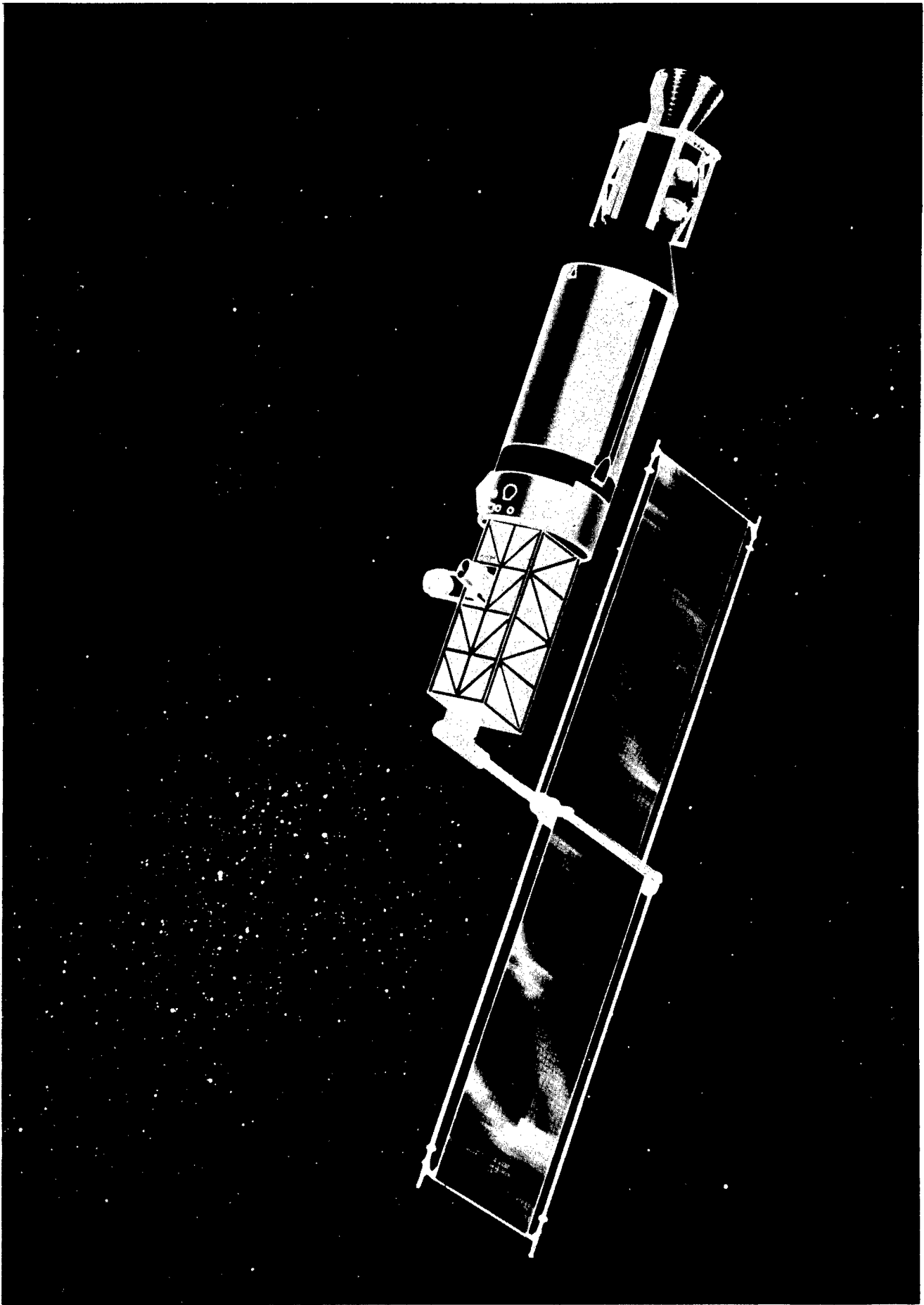
1971

research and development as well as certain operational payloads, was redesignated the Space Test Program (STP).

- 6 August Atlas 76F, with two upper stage Orbital Vehicle propulsion modules, OVI-20 and OVI-21, was launched from Vandenberg as part of SAMSO's Space Test Program (STP). This mission, STP 70-2, successfully placed six spacecraft with nine separate payloads into polar orbits.
- 13 August An Athena H rocket test vehicle, the second launched and the first with all three stages operating, successfully completed a flight over the Inland Range from Green River, Utah, to the White Sands Missile Range in New Mexico.
- 16 September The final Standard Athena rocket was launched from Green River, Utah.
- 27 September Deputy Defense Secretary David Packard approved the development concept paper (DCP) for the acquisition of the Navy's proposed Fleet Satellite Communications (FLTSATCOM) system. The spaceborne segment of this global (less polar) ultra-high frequency (UHF) communications system would be developed for the Navy by SAMSO's Deputy for Space Communications Systems. In addition, the DCP approved the acquisition of UHF airborne and ground terminals for Air Force use with the FLTSATCOM and other selected satellite systems. Upon completion, this program, the Air Force Satellite Communications System (AFSATCOM), would provide the Air Force with a communications system for high priority Air Force requirements.
- 17 October Space Test Program Flight 71-2 (STP 71-2), a Thorad/Agena launch vehicle, inserted four payloads into orbit from Vandenberg.
- 2 November A Titan IIIC, launched from Cape Canaveral, placed into synchronous orbits the first pair of 1,200-pound advanced communications satellites of the Defense Satellite Communication System Phase II (DSCS II).



The Burner IIA upper stage, first used on 14 October 1971, was an evolutionary successor to the Air Force's highly successful Burner kick-stage. The workhorse rocket was used with virtually the entire family of Air Force boosters to accurately position payloads in earth orbit.



Artist's view of a typical experiment for the Department of Defense Space Test Program is of the Flexible Rolled-Up Solar Array, launched 17 October 1971. The panels, containing more than 34,000 solar cells to convert sun's energy into 1,500 watts of power, were unfurled in space after launch into a 400-mile orbit.

1971

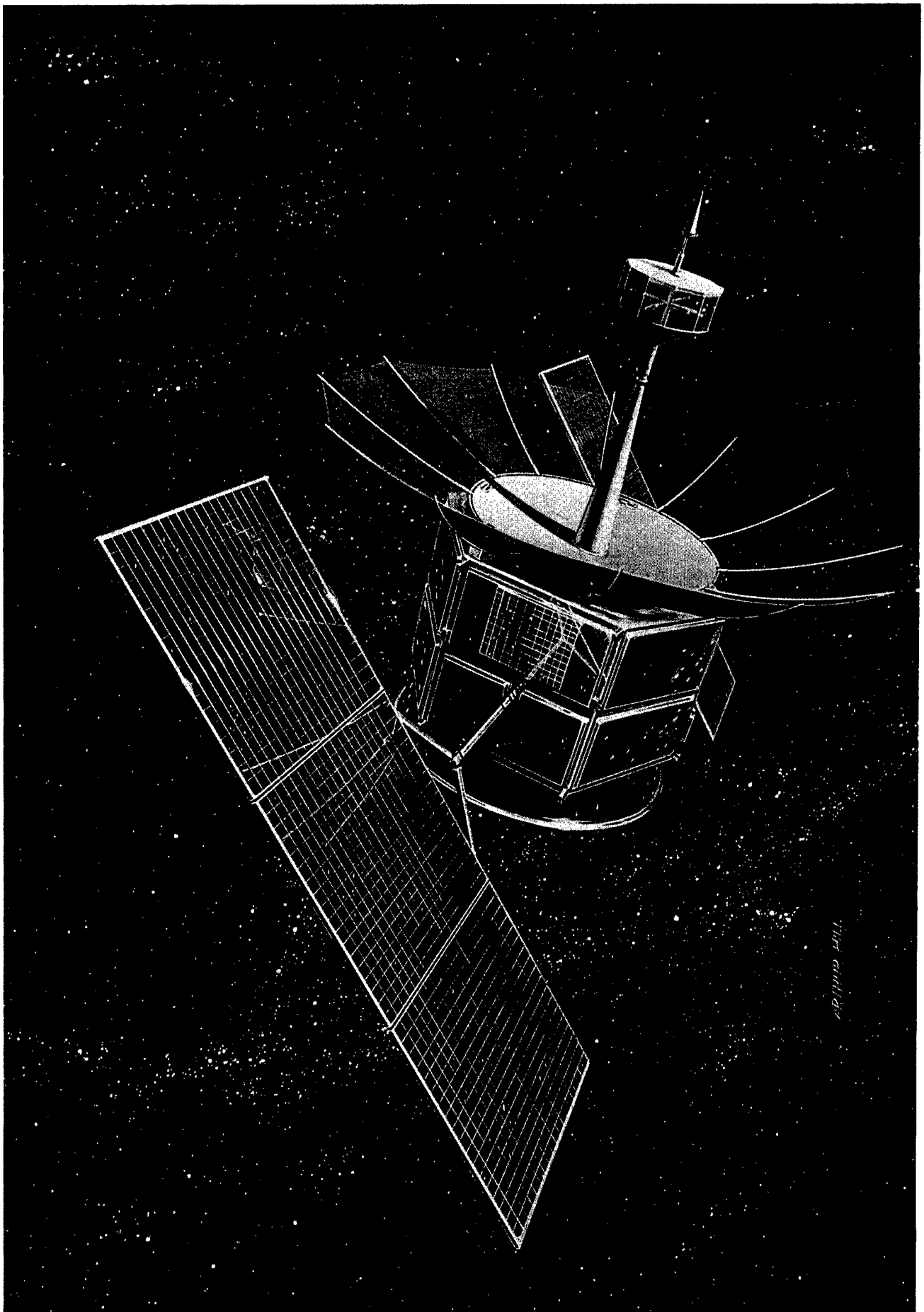
After some initial difficulties with the satellites, telemetry and command links were established with both satellites by 5 November. Under SAMSO program management, TRW Systems Group manufactured these second generation communications satellites that were intended as replacements for the 26-satellite Initial Defense Satellite Communication Systems (IDSCS). Each of the DSCS II (Program 777) satellites would be able to handle voice, teletype, computerized digital data, and video transmissions.

3 November

The Airborne Minuteman concept--Minuteman missiles carried by a 747-type wide-bodied jumbo jet--was presented as a possible alternative to the Navy's Undersea Long-Range Missile Systems (ULMS), the Trident.

13 December

The last flight of 10 Minuteman III missiles was turned over to the 742d Strategic Missile Squadron of SAC's 91st Strategic Missile Wing at Minot AFB, North Dakota. This completed Force Modernization at Minot and deployment of the first 150-missile Minuteman III (LGM-30G) strategic missile wing to SAC.



High priority communications requirements of both the U.S. Navy and Air Force will be met by the Fleet Satellite Communications system.

1972

- 5 January President Richard M. Nixon announced that NASA would manage a \$5.5 billion program to develop a space shuttle to be the work-horse of future U.S. space efforts and to replace all present launch vehicles except the smallest and largest.
- 17 March The third Athena H rocket was launched from the Green River, Utah, launch complex. The flight test completed qualification of the vehicle for operational use in the Advanced Ballistic Reentry Vehicle (ABRES) program managed by SAMSO's Deputy for Reentry Systems (RS).
- 6 April Headquarters USAF released the year's third Minuteman Program Management Directive (PMD) that authorized further actions in the continuing Upgrade Silo program.
- 14 April NASA announced that the Kennedy Space Center in Florida and Vandenberg AFB in California would be the operational bases for the future Space Transportation System (STS). The research and development launches of the Space Shuttle would be made from Cape Canaveral, as would the civilian space launches, while the military Space Shuttle launches would be from Vandenberg AFB. SAMSO was the responsible Defense Department agency for defining the military applications and requirements for the Space Shuttle and for cooperating with NASA in the development of the STS.
- 2 May NASA asked the aerospace industry to submit proposals for the development of the Space Shuttle.
- 31 May The 6595th Missile Test Group launched the first Minuteman III Production Verification Missile (PVM) from Vandenberg.
- 7 June The 200th Minuteman I (LGM-30B) was launched from Vandenberg in the Safeguard System Test Targets Program (SSTTP) and completed a successful flight down the Western Test Range to Kwajalein where it was intercepted by an Army Sprint missile.

1972

- 13 June SAMSO launched the first Minuteman II missile from Vandenberg to test an improved command destruct system for use in SAC's Operational Base Launch (OBL) program, Giant Patriot.
- 30 June SAMSO's Deputy for Reentry Systems (RS), the Advanced Ballistic Reentry Systems (ABRES) program office, completed its move from Norton AFB to Los Angeles Air Force Station. This left only the Deputy for Minuteman at Norton.
- 18 July The Improved Digital Computer Unit (IDCU) for Minuteman was deleted from the approved program at Wing V, Francis E. Warren AFB, Wyoming.
- 23 July The first Long Tank Thrust Augmented Thor/Delta to be launched from Vandenberg AFB using nine solid rocket motors successfully placed the Environmental Resources Technology Satellite (ERTS-A) in orbit.
- 25 July The second Giant Patriot test missile was launched from Vandenberg to evaluate the Operational Base Launch Safety System (OBLSS) in anticipation of implementation of SAC's OBL program, Giant Patriot, in 1974.
- 26 July NASA awarded a \$2.6 billion contract to North American Rockwell (now Rockwell International) for the development of the national Space Transportation System (STS) and the Space Shuttle through first flight in 1976 and first orbital mission in 1979.
- 12 August The first operational flight of an Athena H configuration booster was made from Green River, Utah, to the White Sands Missile Range carrying an Advanced Ballistic Reentry Systems (ABRES) payload.
- 25 August LtGeneral Kenneth W. Schultz assumed command of SAMSO from LtGeneral Samuel C. Phillips who was reassigned to head the National Security Agency (NSA) at Fort George Meade, Maryland. General

1972

- Schultz had been Deputy Chief of Staff/ Systems at Headquarters AFSC since August 1971 and previous to that had served as SAMSO's Deputy for Minuteman from June 1967 through August 1971 and as Deputy for Ballistic Missile Reentry Systems (D/BMRS) at Ballistic Systems Division from July 1965 to June 1967.
- 1 September SAMSO's Deputy for Minuteman transferred responsibility for the Minuteman II Operational Targeting Program (MOTP) to Ogden Air Materiel Area (OOAMA) in Utah.
- 2 September A Scout rocket launched from Vandenberg boosted an improved Navy navigation satellite (TRIAD OI-IX) into orbit.
- 2 October An Atlas F/Burner IIA launch vehicle, carrying SAMSO's Space Test Program Flight 72-1, was launched from Vandenberg. This was the first use of this booster/upper stage combination.
- 16 October The 42d Minuteman III (LGM-30G) missile fired was the 400th Minuteman missile to be launched from Vandenberg AFB. By type, the total included 20 Minuteman IA, 193 LGM-30B, 115 Minuteman II, and 42 Minuteman III missiles.
- 26 October The fifth Athena H vehicle was flown from the Green River, Utah, Launch Facility with an Advanced Ballistic Concepts (ABC)-2 payload. This mission was the first to employ the UNIVAC 1108 Real Time Computer System.
- 9 November A Thor/Delta booster launched from Cape Canaveral successfully placed a Canadian communications satellite, ANIK I, into orbit. This was the 75th Thor/Delta to be launched from the Cape and the first Long Tank Thrust Augmented Thor/Delta to be launched from the Cape with nine strap-on solid rocket motors.

1972

It placed the Telestar-A (ANIK) communications satellite in orbit for Canada.

- 15 November The USAF Clinic Los Angeles was relieved from assignment to the 6592d ABG and assigned to HQ SAMSO.
- 20 November The first Minuteman III Modified Operational Missile (MOM) test was conducted at Vandenberg AFB.
- 24 November Headquarters USAF ordered the Improved Digital Computer Unit (IDCU) program experiment to be ended in December at Wing III, Minot AFB, North Dakota.
- December LtGeneral Kenneth W. Schultz, SAMSO Commander, transferred responsibility for the Advanced Missile (M-X) from the Deputy for Development Plans (XR) to the Deputy for Minuteman (MN).
- 12 December General Schultz established the SAMSO Commander's NCO/Airman Advisory Council.
- 14 December The Operations and Maintenance functions of the 6592d ABG were transferred to Edwards AFB, California.
- 22 December Celesco Industries was issued a letter contract to activate an Athena launch complex on Wake Island and to launch 11 Athena H missiles in support of the HAVE MILL program. This program was managed by SAMSO's Deputy for Reentry Systems (RS) for the Army's Safeguard Systems Command (SAFSCOM).

1973

- 1 January In line with the decision to transfer all AFSC Communications-Electronics (C-E) functions to the Air Force Communications Service (AFCS), a Communications-Electronics Support Office (CESO) was established at SAMSO.
- 10 January RCA and Collins Radio were awarded dual development contracts for the Air Force Satellite Communications (AFSATCOM) system.
- 10 January The SAMSO Deputy for Attack Assessment (AA), organized and established on 1 July 1972, was discontinued. It was placed as a Directorate within the Deputy for Development Plans (XRA).
- February NASA cancelled Air Force procurement of a Titan IIIC launch vehicle for the planned 1975 launch of its High Energy Astronomy Observatory (HEAO) satellite which was cancelled in favor of smaller satellites and more economical boosters.
- 26 February The Deputy for Minuteman completed the program plan for the Advanced Missile (M-X).
- March A SAMSO-Navy Strategic System Program Office Memorandum of Agreement was amended to provide Minuteman I boosters in addition to the Atlas vehicles already scheduled for HAVE FLY, the Trident Supplemental Flight Test (SFT) program managed by the Deputy for Reentry Systems.
- 3 March The 150th Minuteman III (LGM-30G) missile was emplaced in its silo at Grand Forks AFB, North Dakota. This completed the Wing VI F/G Changeout program that replaced the 321st Strategic Missile Wing's Minuteman II (LGM-30F) missiles with Minuteman IIIs.
- 5 March The Air Force announced that a \$27.6 million contract had been awarded to Philco-Ford Corporation for development of the NATO III satellite communications system. SAMSO provided the program management for the Defense Department.

1973

- 13 March The 68th Strategic Missile Squadron, the third and final squadron of the 44th Strategic Missile Wing (Wing II) at Ellsworth AFB, South Dakota, was returned to SAC control after completion of Force Modernization, Upgrade Silo, and other miscellaneous force improvements. Turnover was completed 30 days ahead of schedule.
- 26 March A Program Management Directive (PMD) was issued for the development of a Satellite System for Precise Navigation that was to be developed in the Defense Navigation Satellite Development Program (DNSDP) managed for the Defense Department by SAMSO.
- 3 April SAMSO presented the Advanced Missile (M-X) briefing to Headquarters AFSC.
- 5 April NASA's Atlas/Centaur was launched from Cape Canaveral carrying Pioneer 11 (Jupiter-Saturn). This was the first SLV-3D Atlas booster (vehicle 5011D), and the first SLV-3 to use the new 370,000-pound thrust MA-5 booster package for improved payload performance.
- 7 April The Wing V Operational Snow Test was successfully completed at Francis E. Warren AFB with the firing of the Minuteman launcher closure door carrying a full-criteria load of snow and ice. This test verified the performance of the Upgrade Silo Program Launcher Closure System.
- 17 April Deputy Secretary of Defense William P. Clements designated the Air Force as the Executive service for the Defense Navigation Satellite Development Program (DNSDP). In turn, the Air Force was authorized to establish a program manager and a joint Army, Navy, Air Force program office to prepare detailed plans for the Defense Navigation Satellite System and to manage the program if approved.
- 24 April The Boeing Company was awarded a contract to continue launch services and integration support for the Army's Safeguard System Test Targets Program (SSTTP).

1973

- 14 May An Air Force Program Memorandum on DOD Space Shuttle Utilization was completed that assumed the DOD would develop the shuttle's Interim Upper Stage (IUS) needed for high energy missions until NASA introduced the Space Tug at a later date.
- 16 May The 40th Titan IIIB/Agena D was launched from Vandenberg AFB by the Space and Missile Test Center's 6595th Space Test Group.
- 17 May The last Minuteman III Modified Operational Missile (MOM) test was completed at Wing III, Minot AFB, North Dakota.
- 24 May Two SAMSO offices were elevated to deputy level effective 1 July--the Directorate for Defense Navigation Satellite System (XRN) of the Deputy for Development Plans became the Deputy for Defense Navigation Satellite System (YE) and the Defense System Applications System Program Office (SZH) became the Deputy for Defense System Applications (YD), later to be redesignated Deputy for Defense Meteorological Satellite Systems in January 1974.
- 31 May The 50th Minuteman III (LGM-30G) missile to be launched from Vandenberg was the third Production Verification Missile (PVM) fired by the Space and Missile Test Center (SAMTEC) in support of the Deputy for Minuteman (MN) PVM program.
- June The last kit for the Minuteman II Balance of Force Retrofit program was delivered to Ogden Air Materiel Area (OOAMA). This program was designed to increase Minuteman II survivability.
- 4 June The Boeing Company was awarded a \$50.4 million contract for the Missile Suspension Systems (MSS) for Wings III, VI, and Squadron 20, and the Launch Equipment Room floors for all of Wing III, and the Launch Equipment Room floor springs for all of Wing VI and Squadron 20.

1973

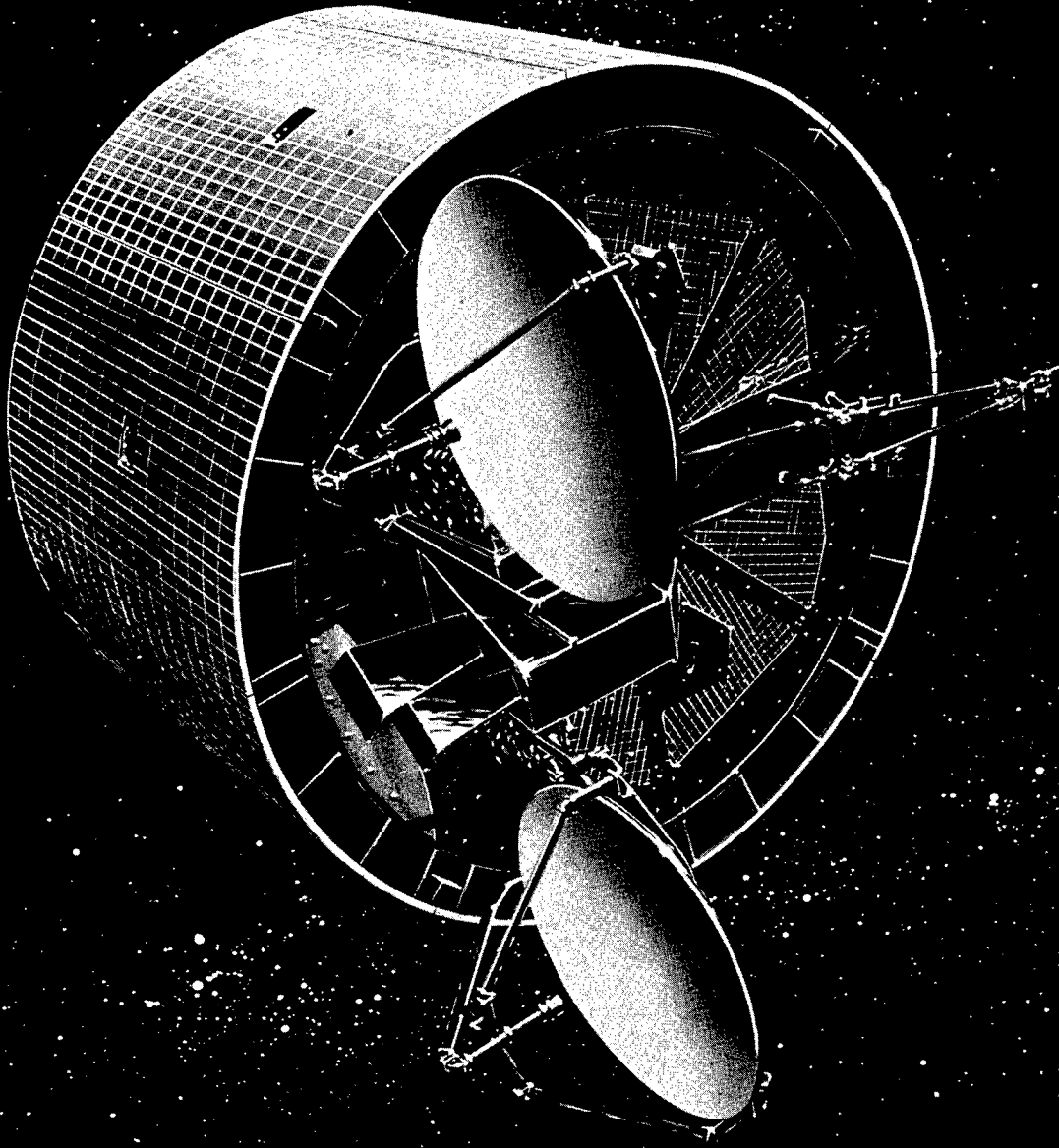
- 20 June The first flight of the 400th Strategic Missile Squadron of the 90th Strategic Missile Wing at Francis E. Warren AFB, Wyoming, was returned to SAC. The Wing V Integrated Program at Warren included Force Modernization, replacement of LGM-30Bs with Minuteman III missiles, installation of Command Data Buffer (CDB), Extended Survivability, and Upgrade Silo program modifications.
- 22 June The Air Force accepted the first Titan IIIIE (E-1) from the Martin Marietta Corporation. The vehicle was then shipped to the Eastern Test Range for final assembly, checkout, and mating with Centaur upper stage prior to the planned proof launch in January 1974. SAMSO procured the Titan IIIIE, a Titan IIID modified to accept a Centaur upper stage, for NASA's use in its Viking Mars Lander program and other future projects.
- 26 June Use of Minuteman I missiles in a launch program to support the Navy's Trident Supplemental Flight Test (SFT) program was authorized.
- 29 June Air Force Logistics Command (AFLC) completed the Minuteman II Balance of Force Retrofit program at Wing I, Malmstrom AFB, Montana.
- July The first SLV-3A standard Atlas booster (Vehicle 5506A) with the 370,000-pound thrust MA-5 propulsion system was delivered to the Air Force by Convair/Astronautics.
- 1 July Engineering responsibility for Stages I, II, and the Propulsion System Rocket Engine (PSRE) of the Minuteman III was transferred from SAMSO's Deputy for Minuteman to AFLC's Ogden Air Materiel Area (OOAMA) at Hill AFB, Utah. SAMSO temporarily retained responsibility for Stage III.
- 1 July SAMSO Detachment 31, the Site Alteration Task Force (SATAF) at Whiteman AFB, Missouri, was inactivated.
- 1 August Operating Location-Comptroller, 6592 Air Base Group inactivated at Norton Air Force Base, California.

1973

- 15 August The Talos-Terrier-Recruit (TATER) launch vehicle was successfully test launched at the Tonopah Test Range.
- 17 August Defense Meteorological Satellite Program satellite F-29 was successfully launched.
- 24 August An Athena H missile was fired from the launch complex at Green River, Utah, carrying an Advanced Ballistic Reentry System (ABRES) payload. This was the 11th Athena H to be fired from Green River in support of the ABRES program and the 141st Athena to be launched from Green River since the beginning of the program in February 1964. Following this launch, the Green River complex was closed and Athena launch operations were transferred to Wake Island.
- 28 August After completing Critical Design Reviews (CDRs) for Collins Radio and RCA, SAMSO's Deputy for Space Communications Systems (SK) terminated the RCA development contract for the AFSATCOM program.
- September The Advanced Noretip Test (A.N.T.) program began to develop a system of multiple small reentry vehicles to be simultaneously flight tested on Minuteman I boosters to obtain reentry shape changed and recession performance data on advanced noretip materials and designs.
- 30 September Atlas 108F, carrying the Advanced Control Experiment 1 (ACE 1) vehicle, was launched from Vandenberg AFB and impacted in the Kwajalein area. The ACE 1 vehicle was to test the development of a preprototype of maneuvering reentry vehicle (MaRV) as part of the Advanced Ballistic Reentry Systems (ABRES) program.
- 15 October NASA decided to procure three additional Titan IIIIE (Titan/Centaur) launch vehicles for future space missions and directed SAMSO's Deputy for Launch Vehicles (SAMSO/LV) to make the necessary procurement arrangements with Martin Marietta Corporation.

1973

- 17 October A memorandum of agreement was signed by HQ SAMSO and TRW putting a ceiling of \$54.2 million on the government's financial obligation under the Fleet Satellite Communications (FLTSATCOM) development contract.
- 29 October SAMSO launched a Transit navigation satellite into orbit from Vandenberg Air Force Base. It replaced a polar orbiting spacecraft which had ceased to operate.
- 1 November SAMSO was relieved of jurisdiction, accountability and control of real property and improvements thereon of Air Force Plant 57. Plant was transferred to National Aeronautics and Space Administration (NASA).
- 2 November The first Talos-Terrier-Recruit (TATER) clear air launch occurred at Wallops Island, Virginia. The purpose of the flight was to evaluate carbon-phenolic nosetips and heatshields.
- 3 November An Atlas/Agena D launched Mariner 10 (Mariner Venus-Mercury) from the Eastern Test Range. The spacecraft was scheduled for Venus flyby in February 1974 and Mercury in March 1974--it would be the first space probe ever to approach Mercury.
- 16 November The 400th Strategic Missile Squadron of the 90th Strategic Missile Wing was the first squadron to complete the Wing V Integrated Program, including Force Modernization to Minuteman IIIs, Command Data Buffer (CDB), and Upgrade Silo program modifications.
- December A new inertial guidance system, manufactured by Delco Electronics for the Titan IIIC made its first flight. The new system consisted of an inertial measurement unit and a missile guidance computer.
- 13 December An Air Force Titan IIIC, launched by the 6555th Aerospace Test Group from the Eastern Test Range, boosted two Program 777



The Defense Satellite Communications System, Phase II (DSCS II) replaced the Initial Defense Satellite Communications System.

1973

communications satellites into synchronous equatorial orbits. These Defense Satellite Communication System Phase II (DSCS II) satellites were placed in orbit using the first vehicle with a 3,200-pound orbit all-up payload capacity, an increase of 850 pounds for synchronous orbits. The increase resulted from the initial use of the lightweight Carousel V Inertial Guidance System (IGS) plus other weight saving changes.

15 December

The Wake Island Athena launch complex was activated for the HAVE MILL program.

22 December

Deputy Secretary of Defense, William P. Clements, Jr., authorized initiation of Phase I of the Global Positioning System development program.

23 December

MARK12A Validation Phase Study directed by Program Management Directive R-P2134(2), dated 11 May 1973, was completed.

28 December

The Defense Department publicly announced its intention to conduct an eight-missile Operational Base Launch (OBL) program, Giant Patriot. Subject to Congressional approval.

1974

- 18 January The first of two British satellites-Skynet IIA-was launched from the Eastern Test Range. The payload was lost due to a malfunction of the Thor Delta launch vehicle.
- February The Missile X Program Office was established in SAMSO's Deputy for Minuteman located at Norton AFB, California.
- 11 February The newest addition to the Titan III series, the Titan IIIE/Centaur--a meld of Air Force and NASA technology, suffered a partial failure in its first flight test from Cape Canaveral when the Centaur engine malfunctioned after Titan staging. The Titan/Centaur vehicle will be used as the launch vehicles for NASA's Viking Mars Lander in 1975 and for the United States-German Helios program.
- 13 February The first launch in the HAVE MILL program occurred; the launch vehicle was an Athena H, and the launch site was the Wake Island Launch Complex.
- 1 March Hardness Surveillance Definition Program was implemented. The purpose of this program was to identify tests and inspections on hardware that would give SAC and AFLC timely logistics capability to detect hardness degradation in operational Minuteman force.
- 1 March An impact and capability study for MARK12A was submitted to HQ USAF by the Atomic Energy Commission Laboratories.
- 8 March The Air Force completed a revised Program Memorandum on DoD Space Shuttle Utilization that was to become the basis for Air Force planning for the Space Transportation System.
- 16 March Defense Meteorological Satellite Program (DMSP) satellite F-31 was successfully launched.



A Defense Meteorological Satellite program photo, taken from about 400 miles altitude, captures the developing squall line which preceded a devastating tornado in the midwest in April 1974.

1974

- 23 March The second Advanced Control Experiment (ACE) vehicle was flight tested and all objectives were met.
- 27 March The First Strategic Aerospace Division (1STRAD) launched the 125th Minuteman II (LGM-30F) to be fired from Vandenberg AFB.
- April Space Test Program flight S73-7 was launched. The launch was successful but the mission failed when the payload -an infrared calibration balloon - failed to deploy.
- April The Wing I Force Modernization Program at Malmstrom Air Force Base, Wyoming, was initiated.
- 1 April Det 2, HQ SAMSO, inactivated at Woomera, Australia.
- 6 April Atlas 73F was launched from Vandenberg and was the first mission in the Trident Supplemental Flight Test program (SFT-1), designated HAVE FLY. Managed by SAMSO's Deputy for Reentry Systems (RS), this reentry vehicle research and development program was conducted for the Navy's Strategic System Program Office (SSPO). The SFT missions were for the Trident missile system and were part of the joint-service Advanced Ballistic Reentry System (ABRES) program.
- 30 April The Missile X Upper Stage motor development program contractor selections were made. Contract FO4701-73-C-0423 went to the Aerojet Solid Propulsion Company, Sacramento, California.
- 30 April The Minuteman System Program Office awarded the Missile X Lower Stage Nozzle Development Program contract FO4701-74-C-0215 to United Technology Center, Sunnyvale, California.
- 30 May An Air Force Titan IIIC boosted NASA's Applications Technology Satellite (ATS-F) into orbit from Cape Canaveral. Built by

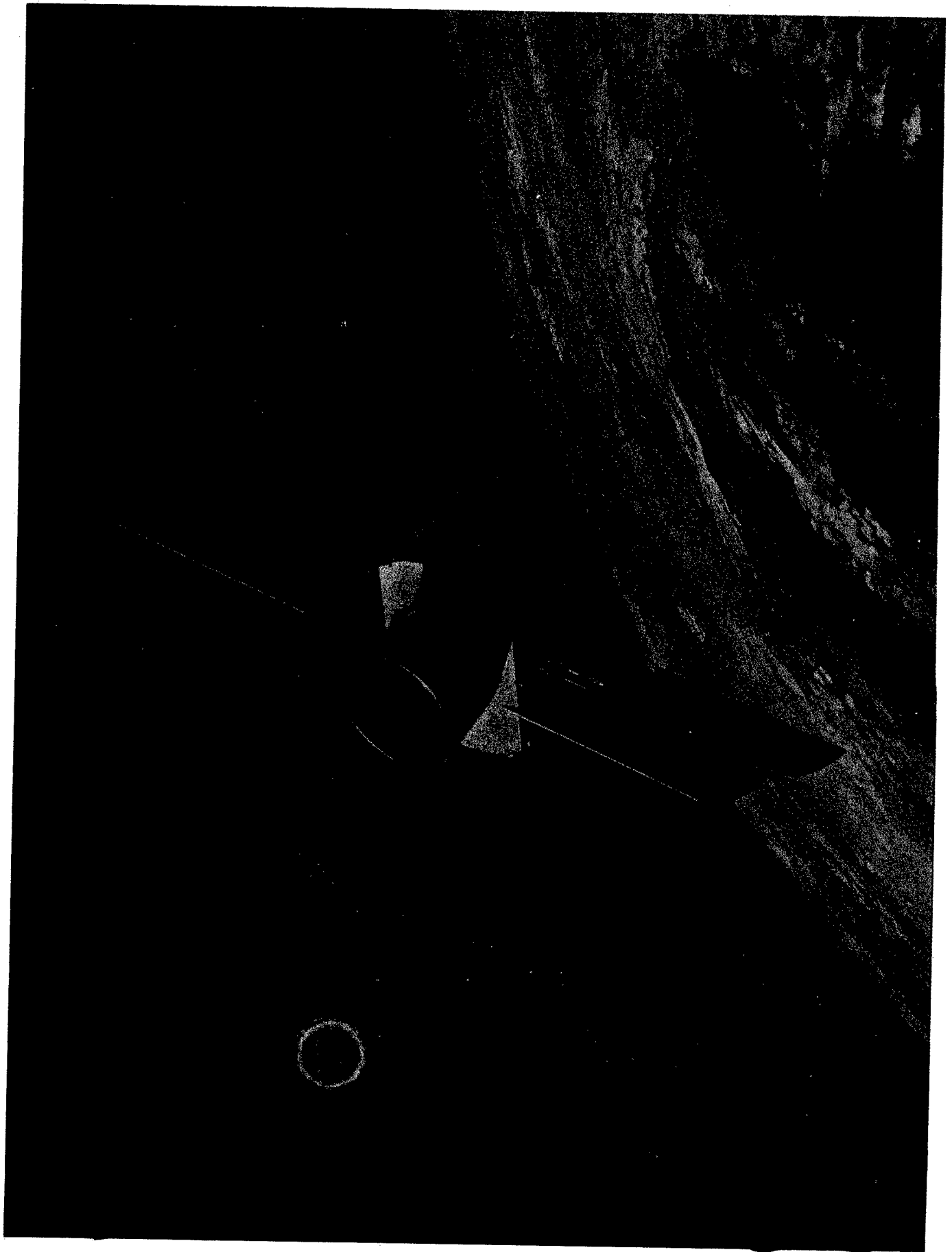
1974

Fairchild Industries, the \$180 million satellite was used for one year by the Indian government to beam educational television programs to its people in a concerted effort to reduce illiteracy among the population. ATS-6 was the first satellite ever built to beam signals directly to individual television sets.

- June Air mobile concepts for Missile X were reduced to three aircraft types- modified wide-bodied types, new endurance types and a new high acceleration aircraft- and three operating modes-continuous air alert, dash-on warning strip alert and combination of previous two.
- June Delivery of Minuteman III Stage III motors produced under Fiscal Year 1973 contract FO4701-70-C-0182, Option B, was completed.
- 1 June HQ SAMSO formally transferred management responsibility for Standard Launch Vehicle-3 (SLV-3) vehicle to National Aeronautics and Space Administration (NASA).
- 6 June The U.S. Senate voted to prohibit the Air Force from conducting its planned eight-missile Operational Base Launch (OBL) program, Giant Patriot, scheduled for the winters of 1974-1975 and 1975-1976. The \$26 million request for the test launches was deleted from the military procurement bill by the Senate vote, and the Senate restricted Minuteman operational test launches to Vandenberg AFB.
- 20 June A contract for the fabrication of three Navigation Development Satellites for the Global Positioning System Program was awarded to Rockwell International. The value of the contract was \$42,847,777.
- 22 June An Athena H was launched from Wake Island in the HAVE MILL program, the Army Special Targets Program. This was the seventh Athena H launched in support of Army requirements and the final programmed use of the Athena H test missile by SAMSO's Deputy for Reentry Systems.

1974

- 30 June OL-AF, SAMSO, inactivated at Green River, Utah.
- 30 June OL-AA, SAMSO, inactivated at Wake Island.
- 11 July The Sandia ABRES Materials and Systems Test 02/Miniature Instrumented Nosedip Test (SAMAST 02/MINT) reentry vehicles were successfully launched on a Minuteman I booster out of Vandenberg Air Force Base, California.
- 13 July Space Test Program flight P73-3 was launched from the Western Test Range, and the payload - Navy Navigation Technology Satellite #1 (NTS-1) - was successfully placed into orbit.
- 19 July The first known aerial recovery of a payload launched by a sounding rocket was completed at White Sands Missile Range. The rocket was a Nike-Hydac and the payload was a Low Light Level Television package.
- August The Wake Island Launch Complex was closed down following the completion of the HAVE MILL program.
- 1 August The last flight in the Safeguard System Test Target Program (SSTTP) occurred. This program provided targets that allowed functions and system checkout of the Safeguard radars and interceptors for the Army's Safeguard Antiballistic Missile System. Since 23 June 1970, there had been 27 Minuteman I and 7 Titan II flights.
- 9 August Defense Meteorological Satellite Program (DMSP) satellite F-32 was successfully launched.
- 15 August The Minuteman operational targeting program, Minuteman Operational Executive Program 3102.02 (MOTP 3102.02) was delivered to SAC as part of the command data buffer software program.



Twenty-four satellites, similar to this one, will make up the NAVSTAR Global Positioning System.

1974

17 August

The first SAC Targeting Support Software 0400 (STSS 0400) was delivered to SAC and integrated testing was performed at SAC using Minuteman Operational Executive Program 3102.02 (MOTP 3102.02), SAC Targeting Support Software 0400 (STSS 0400) and SAC Target Constant Reformating Verification 100 (STRIVE 100). The purpose was to demonstrate capability to generate non-command data buffer magnetic target tape equivalent utilizing this software.

September

A tri-agency agreement on the convergence of military and civilian meteorological satellite systems was signed by the Under Secretary of the Air Force and the Administrators of the National Aeronautics and Space Administration and the National Oceanic and Atmospheric Administration.

8 September

The third Advanced Control Experiment (ACE) reentry vehicle was launched but malfunctioned and the mission objectives were not met.

13 September

Wing III silo upgrade program began at Minot AFB, North Dakota.

1 October

The Air Force awarded firm-fixed-price (FFP) level of effort contracts of about \$635,000 to \$640,000 each to Martin Marietta Corporation, Lockheed Missiles and Space Company, General Dynamics Convair Division, The Boeing Company, and McDonnell Douglas Astronautics Company for nine-month IUS System Study efforts. These companies had in-production, existing operational upper stages and the studies would provide baseline data for future acquisition efforts.

14 October

Surplus Atlas 31F was launched from Vandenberg AFB carrying a Reentry Vehicles Technology and Observables (RVTO-3A-1) payload. This successful launch and flight marked the apparent end of the use of Atlas D, E, and F ICBMs in support of various Advanced Ballistic Reentry Systems (ABRES) and other governmental agency programs.

1974

Since Atlas 159D was launched from Vandenberg AFB on 26 October 1962 in support of the Nike Targets Program, a total of 113 Atlas missiles--54Ds, 4Es, and 55Fs--have been launched with only 11 failures.

23 October

A contract for the development of ground stations and user equipment for the Global Positioning System was awarded to General Dynamics. The value of the contract was \$29,509,671.

24 October

As an early air mobile flight demonstration of the feasibility of launching a ballistic missile from a wide-bodied aircraft, a Minuteman I missile was dropped from an Air Force C-5A over water at the Western Test Range. Ignited at 8,000 feet, the Minuteman rose to 20,000 feet before expending its propellant and falling into the ocean 20 miles from Vandenberg AFB. SAMSO's Deputy for Minuteman at Norton AFB, California, completed the necessary work for the air mobile demonstration in just over two months. The data gathered from this first live demonstration of the air mobile concept will be used in SAMSO's Advanced ICBM Technology (M-X) program that will determine technology and basing concept for the next generation of U.S. land-based strategic missiles.

29 October

Space Test Program flight S73-5 was successfully launched. This was the first of three launches to be made under the Small Secondary Satellite (S3) project.

30 October

HQ USAF ordered the termination of the Earth Limb Measurement Satellites (ELMS) Program.

22 November

A Thor-Delta launched from the Eastern Test Range lifted the second of two Skynet II (Skynet IIB) defense communications satellite for the United Kingdom into an elliptical transfer orbit. Two days later, a firing of the satellite's apogee boost

1974

motor placed the satellite in a near circular orbit prior to final positioning in a synchronous orbit over the Indian Ocean. The first Skynet II satellite, Skynet IIA, was lost in January 1974 due to a booster failure after launch from Cape Canaveral.

- 7 December The first aerial recovery of a sounding rocket payload over the broad ocean area was accomplished. The rocket was an Honest John-Nike-Hydac and the payload was provided by the HAVE JEEP II program.
- 10 December A Titan IIIE/Centaur launched from Cape Canaveral boosted the United States-West German HELIOS spacecraft into heliocentric orbit as a solar probe to investigate the properties and processes of solar/terrestrial relationships. This was the first completely successful flight of the Titan IIIE/Centaur booster combination.
- 20 December IBM was awarded a contract to develop a Simplified Processing Station for the Defense Support Program. Target price of the contract was \$23.3 million.
- 31 December OL-AH, SAMSO, designated, and activated at Huntsville, Alabama.
- 31 December OL-AI, SAMSO, designated and activated at Sunnyvale Air Force Station, California.

AIR MOBILE FEASIBILITY DEMONSTRATION

VANDENBERG AFB CALIFORNIA 24 OCTOBER 1974



The sequence of photos above shows the air-mobile feasibility demonstration that took place at Vandenberg AFB on 24 October 1974. A Minuteman I missile was dropped from a C-5A aircraft, was ignited at 8,000 feet, and rose to an altitude of 20,000 feet before using up its propellant and falling into the ocean.

1975

- January Replacement of Minuteman II missiles with Minuteman III missiles began at Wing I, Malmstrom Air Force Base, Montana.
- 15 January The office controlling Purchase Requests (PR) and Military Interdepartmental Purchase Requests (MIPR) was transferred from the SAMS0 Directorate of Procurement to the SAMS0 Comptroller Office.
- 17 January All Production/Manufacturing Operations functional responsibilities were reassigned to the Directorate of Acquisition Support (DR) from the Directorate of Procurement and Production (PP).
- 19 January The first Minuteman launch in the HAVE FLY Program occurred. This was part of the Navy's Trident Supplemental Flight Test program.
- 21 January The last Wing V squadron was turned over to the Strategic Air Command to complete the Wing V integrated program at Francis E. Warren AFB, Wyoming, 20 days ahead of schedule. This program, the greatest single effort in the Minuteman program since the early days when the Minuteman I was placed in operation, included the swap-out of Minuteman I missiles for Minuteman IIIs.
- 23 January HQ USAF issued a Program Management Directive specifying that initial DOD space shuttle mission operations would be planned and controlled by a predominantly NASA team rather than by a DOD team and that NASA facilities would be used for the purpose. The Program Management Directive also directed that action be taken to minimize the impact of DOD communications security requirements on shuttle operations.
- 31 January Message traffic was sent from an airborne Air Force Satellite Communications terminal at Wright-Patterson Air Force Base, Ohio, to a ground Air Force

1975

Satellite Communications terminal at Verona, New York. This marked the beginning of combined Development, Test and Evaluation/Initial Operational Test and Evaluation (DT&E/IOT&E) for the Air Force Satellite Communications program.

31 January

SAMSO awarded a \$4,499,465 contract to Fairchild Space and Electronics Company for the development of the upper stage for the Global Positioning System.

4 February

The first live demonstration flight of a Pedro Recruit sounding rocket occurred at Wallops Island, Virginia. It was a clear air launch of a carbon-phenolic nosetip from an F-4 aircraft. The launch, part of the Fighter Launched Advanced Materials Experiment (FLAME), was successful, but the payload was not recovered. Attempts on 20 September and 9 October to drop an inert Pedro Recruit rocket from an F-4 aircraft had failed. This was a DNA-sponsored experiment.

12 April

Space Test Program flight P72-2 was launched; it carried two infrared radiometers and three other payloads. The launch failed when the Atlas F launch vehicle malfunctioned.

6 May

Minuteman III Production Verification Missile 10 was successfully launched. This was the first Minuteman to be launched with the new Wing VI command data buffer hybrid explicit software.

15 May

A two million dollar contract was issued to the Raytheon Company for the fabrication, demonstration, and test of a brassboard version of a fault-tolerant spaceborne computer.

16 May

Special Test Missile-9W (STM-9W) was the first Pave Pepper flight test. It was successful. The program was designed to evaluate the use of increased numbers of reentry vehicles on the Minuteman III missile.

1975

- 20 May The third pair of Defense Satellite Communications System II satellites was launched; the launch failed due to a malfunction in the Transtage of the Titan IIIC launch vehicle.
- 23 May Nosetip Technology Vehicle-03 was successfully launched from Vandenberg Air Force Base, California.
- 24 May Defense Meteorological Satellite Program (DMSP) satellite F-33 was successfully launched.
- 4 June The sixth and last flight of the Pedro Recruit sounding rockets for the FLAME program occurred at Wallops Island, Virginia.
- 1 July SAMSO's responsibility for the Vela Program came to an end.
- 1 July OL-AH, HQ SAMSO, inactivated at Huntsville, Alabama.
- 1 July Program 405B, Laser Communications, moved from the Air Force Avionics Laboratory to SAMSO's Deputy for Technology.
- 2 July Production verification missile (PVM)-11 was successfully launched from Vandenberg AFB to evaluate Stage III thrust termination capability of the hybrid explicit flight program.
- 11 July With the completion of the Force Modernization Program at Squadron 20, Malmstrom AFB, Montana, there were 450 Minuteman II and 550 Minuteman III missiles under the operational control of the Strategic Air Command. The Force Modernization Program had lasted nine years.
- 22 July Aeronutronic Ford Corporation was awarded a \$7.25 million contract to modify the satellite tracking sets at the DSP ground stations so that they would be compatible with the Performance Improvement Modification (PIM) satellites.

1975

- 26 July Special Test Missile (STM)-10W was successfully launched from Vandenberg AFB.
- August The final test of the Launch Equipment Room Full-Up Floor Test Program was completed at Vandenberg AFB. This test program began in January 1973 with tests of the complete Wing V upgraded floor shock isolation system with mass-simulated electronics (Block I) and continued with tests of the Wing V upgraded floor with operating electronics (Block II), tests of single isolators (Block III), and tests of a Wing VI upgraded floor with mass-simulated electronics (Block IV). The highly successful program not only qualified the upgraded floor to design criteria, but also demonstrated that the subsystem had inherently harder shock capability than was required.
- 20 August A Titan IIIIE carrying a Viking payload was successfully launched from LC-41, Eastern Test Range. This was the first flight of a new oxydizer accumulator developed for the IIIIE.
- 29 August LtGeneral Thomas W. Morgan replaced retiring LtGeneral Kenneth W. Schultz as Commander of SAMSO. General Morgan had been Commander of the Air Force Special Weapons Center since November 1972. He had served as SAMSO's Vice Commander from August 1971 to November 1972. He was assigned to the Space Systems Division from 1963 to 1967.
- 3 September A Management Review Team reported that development of the Simplified Processing Station (SPS) would slip by six to eight months.
- 4 September Dr. Walter LaBerge, Assistance Secretary of the Air Force for Research and Development, announced that the Interim Upper Stage, to be developed for use with the Space Transportation System, would be an expendable vehicle with a solid propulsion system.
- 9 September A Titan IIIIE carrying a Viking payload was successfully launched from LC-41, Eastern Test Range. This was the first flight of a new Command Receiver Set. A fire occurred at the launch site following launch and caused \$2 million damage to the Aerospace Ground Equipment building.

1975

- 18 September A memorandum of agreement became effective between SAMSO and the Electronic Systems Division under which SAMSO was given the lead division responsibilities for AFSATCOM I/II/III.
- 18 September A nosetip recovery vehicle was successfully launched from Wallops Island, Virginia, on a STRYPI VII booster and was recovered by the Coast Guard. This was the first time that a high-performance reentry vehicle had been "soft-landed"(in water) and recovered.
- October Colonel B.W. Parkinson, Director of the Global Positioning System program, presented a paper on his program to the Guidance and Control Panel of NATO's Advisory Group for Aerospace Research and Development at the Hague in the Netherlands. The Global Positioning System was planned as a highly accurate positioning system. When the system was fully operational with its 24 satellites, it would be able to determine a 3-dimensional position within 33 feet, velocity within one-tenth of a mile per hour, and time within a millionth of a second anywhere on earth.
- 1 October The integrated program began at Wing VI, Grand Forks AFB, ND with the 447th SMS. The program included silo upgrade, electromagnetic pulse protection, command data buffer, and emplacement of the last 35 missiles to be dust hardened.
- 11 October A Scout vehicle carrying a Transit Improvement Program payload was launched from SLC-5, Western Test Range. Launch was successful, but the solar panels of the satellite failed to deploy after the satellite had reached orbit.
- November SAMSO/YE briefed Canadian military research and development personnel on the Global Positioning System.
- November The development program for a large, advanced ballistic reentry vehicle was cancelled.

1975

- 15 November The Development Test and Evaluation/Initial Operational Test and Evaluation program for the AFSATCOM system was successfully completed. It involved both terminals and space segments.
- 17 November SATAF Detachment 31, located at Wing IV, Whiteman AFB, Missouri, was reactivated by Boeing AFPRO personnel.
- 28 November Transfer of the basic Minuteman III missile series to AFLC was completed.
- December HQ USAF decided that the DOD would not acquire its own mission operations system for the space shuttle but would use NASA's system instead.
- 15 December The Critical Design Review for the Global Positioning System Stage Vehicle was held.
- 18 December Congress approved funding for the activation of SLC-3E, Vandenberg AFB, and its conversion to an Atlas F configuration.
- 31 December The transfer of engineering responsibility to AFLC for Minuteman II, which had started in January 1968, was completed.

1976

- January SAMSO/YE briefed the Royal Institute of Navigation in London on the Global Positioning System.
- January Program 405B, Laser Communications, transferred from the Deputy for Technology to the newly formed Directorate of Advanced Space Communications Capabilities.
- 9 January The first flight test of the operational hybrid explicit flight program was conducted successfully from Vandenberg AFB aboard PVM-12.
- 15 January A Titan IIIIE carrying a West German Helios payload was successfully launched from LC-41, Eastern Test Range.
- 27 January Special Test Missile (STM)-13 was successfully launched from Vandenberg AFB.
- 30 January Effective on this date, Ball Brothers Research Corporation was awarded a \$10.3 million contract to develop a space vehicle system for Space Test Program Flight P78-1.
- 2 February A \$6.88 million contract for the development of an operational Satellite Attack Warning System was awarded to Grumman Aerospace Corporation.
- 2 February SAMSO awarded R&D contracts to General Electric Company, Space Division (FO4701-76-C-0092) and to Hughes Aircraft Company (FO4701-76-C-0093) for DSCS III.
- 18 February A Thor/Burner IIA was launched from SLC-10, Western Test Range, carrying a DMSP Block 5C satellite as its payload. The launch failed when the booster's engine shut down prematurely.

1976

23-26 February

A joint DOD/NASA study was carried out on the consolidation of expendable launch vehicles during transition to the space shuttle. The study recommended that the Interim Upper Stage, being developed for the space shuttle, be used with the Titan III during the transition period.

27 February

The advanced nosetip test vehicle (A.N.T.)-1 was successfully launched from Vandenberg AFB. The purpose of the flight was to test the performance of four nosetips of various materials and shapes with fine-weave carbon-carbon nosetips in high stagnation pressure and clean air.

27 February

The last SAMSO program at Wing V, the retrofit of microfarad capacitors, was completed.

27 February

The integrated program at Wing III, Minot Air Force Base, North Dakota, was turned over to SAC. This program had included silo upgrade modifications, electromagnetic pulse protection, dust hardening, and conversion to the command data buffer system.

March

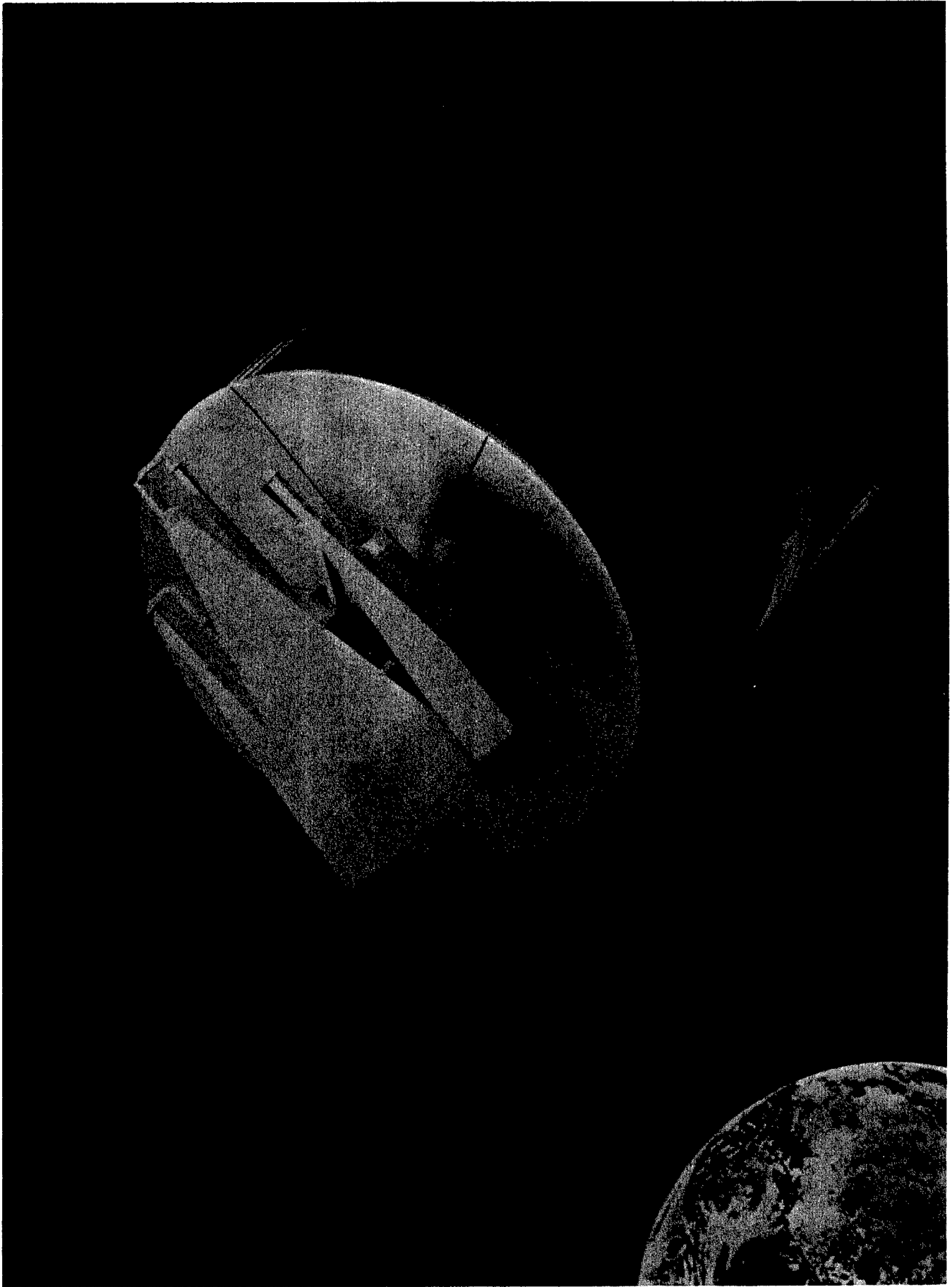
Global Positioning System system testing began at Yuma Proving Grounds, Arizona with Mini-Test III.

March

The Air Force decided to procure a 38-foot antenna for the Simplified Processing Station in place of the 15.5-foot antenna planned on previously.

1976

- March Construction began on the activation of SLC-3E, Vandenberg AFB, and its conversion to an Atlas F configuration.
- 1 March Approval was given for the production of the second FLTSATCOM flight model F-2.
- 1 March Effective on this date, Martin Marietta Corporation was awarded a \$12.36 million contract to develop a spacecraft for Space Test Program Flight P78-2.
- 8 March Contracts for Phase I of the Mosaic Sensor Development Program were awarded to Aerojet ElectroSystems Company and Grumman Aerospace Corporation effective on this date.
- 9 March The 37th launch of the Sandia ABRES Materials Study (SAMS) program occurred from Wallops Flight Center, Virginia, into inclement weather. It tested the Aerojet platelet tip transpiration-cooled nosetip concept.
- 9 March The Missile X program was reviewed by the Defense Systems Acquisition Review Council (DSARC)-I. This review approved the conceptual work that had been initiated in 1973 as well as plans for the validation phase.
- 14 March A Titan IIIC carrying a Space Test Program payload, Flight P74-1, was successfully launched from LC-40, Eastern Test Range. Flight P74-1 was made up of Lincoln Experimental Satellite 8 and 9 (LES 8/9) and Solar Radiation satellites 11A and B (SOLRAD 11A/B).
- 15 March Production Verification Missile (PVM)-13 was successfully launched from Vandenberg AFB. It was the last flight of the Wing VI hybrid explicit program prior to it becoming operational. It also served as a development test and evaluation/initial operational test and evaluation flight for the upgrade Wing VI configuration.
- 18 March The Wing II waterstop modification project, aimed at preventing water seepage into the rattlespace area of the launch facility, was completed. This was SAMSO's final effort at Wing II.



The NATO III communications satellite system, consisting of three satellites, will provide rapid and secure communications among NATO member nations.

1976

- 27 March The 38th launch of the Sandia ABRES Materials Study (SAMS) program occurred from Wallops Flight Center, Virginia, into inclement weather. It tested the General Electric fine-weave carbon-carbon nosetip.
- 29 March A contract for the Satellite Infrared Experiment (SIRE) was distributed to the Hughes Aircraft Company.
- 29 March Deputy for Minuteman was renamed Deputy for Intercontinental Ballistic Missiles because of the growth of the Missile X program.
- April The critical design review for the Mark 12A reentry vehicle was held.
- April to October A joint USAF/NASA study concluded that it would cost \$125 million to modify NASA's space shuttle mission control center so that it could be used by the DOD.
- 1 April SAMSO's Deputy for Technology was renamed the Deputy for Advanced Space Programs and was combined with the Deputy for Development Plans.
- 2 April The first Materials Screening Vehicle (MSV) launch occurred from Wallops Island, Virginia, into clear weather. The purpose of the flight was to obtain recession and erosion flight data on nosetip and heatshield materials and designs.
- 22 April A Thor/Delta carrying the NATO IIIA satellite was successfully launched from LC-17B, Eastern Test Range.
- 25 April The 39th and last launch of the Sandia ABRES Materials Study (SAMS) program occurred from Wallops Flight Center, Virginia into inclement weather. It tested the Aeronutronics scan tip transpiration - cooled nosetip concept.
- 29 April The first meeting of SAMSO's Technology Advisory Council was held.
- 30 April SAMSO Operating Location - AK, the Deputy for ICBMs, was inactivated at Norton AFB, California and on the following day, 1 May 1976, was supplanted by SAMSO Detachment 1, Deputy for ICBMs. This was done to give the Detachment commander command authority over his personnel.

1976

- 1 May The Directorate of Procurement was replaced by the Deputy for Procurement and Manufacturing which consolidated most of SAMSO's procurement offices into a centralized office.
- 22 May DMSP 5C satellite F-31 was declared non-operational.
- 22 May A Scout vehicle carrying a Space Test Program spacecraft was successfully launched from SLC-5 at the Western Test Range. The spacecraft, Flight P76-5, carried a wideband signals experiment sponsored by the Defense Nuclear Agency.
- 30 June A contract for the development of an improved injector for the Titan IIIC Transtage was distributed to the Aerojet Liquid Rocket Company; it carried a target price of \$4.82 million.
- 30 June SATAF Detachment 32, Wing III, Minot AFB, ND, and SATAF Detachment 33, Wing II, Ellsworth AFB, SD, were deactivated.
- July to November Tests were conducted at NASA's Marshall Space Flight Center to determine the optimum configuration for the space shuttle launch pad to be built at Vandenberg AFB.
- July A supplemental agreement to contract F04701-74-C-0527 directed the procurement of two additional Navigation Development Satellites for the Global Positioning System. They would be delivered in April and May 1978.
- 1 July A \$12.81 million contract for HALO Focal Plane Array Technology was awarded to Rockwell International, effective on this date.
- 1 July The fabrication phase of the pulse doppler map matching (PDMM) program began.
- 1 July SAMSO began a new reservist program which utilized research and development reserve officers in the SPOs. It promised to be very successful.
- 2 July A contract was distributed to Martin Marietta for Titan III launch services from July 1976 to September 1978; the value of the contract was \$80.47 million.

1976

- 14 July A \$13.4 million contract for HALO Focal Plane Array Technology was awarded to Hughes Aircraft Company, effective on this date.
- 15 July The first flight of the Advanced Inertial Reference Sphere (AIRS) occurred on STM-11W from Vandenberg AFB. The purpose of the AIRS flight test was to demonstrate the technical feasibility of the floating ball reference sphere. The flight was successful. It was also the first flight of the missile performance measurement system.
- 22 July Contract FO4701-76-C-0081 was distributed to Martin Marietta for the preparation of design criteria for space shuttle facilities at Vandenberg AFB. The target price of the contract was \$28 million.
- 23 July A contract was distributed to Chemical Systems Division of United Technologies Corporation for five sets of Titan III solid rocket motors to be delivered at a price of \$50.31 million.
- 26 July The NATO IIIA satellite became fully operational.
- 30 July Colonel Joseph L. Pospisil replaced Colonel Judson A. Herriott as Commander of the Air Base Group.
- August Vandenberg AFB, California, was chosen as the site for testing of the Simplified Processing Station.
- August Colonel B.W. Parkinson, Director of the Global Positioning System Program, presented briefings on the Global Positioning System in France, Norway, the Netherlands, and Great Britain.
- 4-5 August A preliminary design review of McDonnell Douglas' efforts on a satellite transmitter for Program 405B, Laser Communications, was successfully held.
- 19 August All user access on NATO satellite IIB was terminated because of the failure of the last traveling wavetube amplifier. The satellite was moved to 107 degrees West longitude on 31 October 1976 and was used for on-orbit life tests.

1976

- 19 August The SAMAST 3/MINT 2 flight test, designed to develop and test reentry vehicle materials, systems, and testbeds, was launched successfully from Vandenberg AFB's Western Test Range. This was the first ICBM flight test of the pyrotechnic metal oxide generator (PMOG) wake quenching device.
- September A contract was awarded to Avco Corporation to develop an operational prototype carbon-carbon nosetip for the Mark 12A reentry vehicle.
- September The first flight model of the Global Positioning System Stage Vehicle was delivered.
- 1 September A Scout vehicle carrying a Transit Improvement Program payload was launched from SLC-5, Western Test Range. Launch was successful, but the solar panels of the satellite failed to deploy after the satellite had reached orbit.
- 1 September Major General Howard E. McCormick became the SAMSO Vice Commander replacing Major General Richard C. Henry, who was reassigned to the Pentagon.
- 3 September A contract was distributed to the Boeing Aerospace Company for the validation phase of the Interim Upper Stage development program. The contract, F04701-76-C-0234, carried a target price of \$20,816,300.
- 3 September McDonnell Douglas Astronautics Company was awarded a \$52.1 million contract for the development and flight test of two advanced maneuvering reentry vehicles (AMaRV).
- 9 September DSCS satellite 9433 failed after 33 months in operation.
- 9 September The advanced maneuvering reentry vehicle (AMaRV) development program began.
- 11 September A Thor booster carrying the first DMSP Block 5D satellite was launched from SLC-10, Western Test Range. The launch was successful but the satellite lost stability and began to tumble after attaining orbit.



The Block 5D Integrated Spacecraft System (ISS) was part of the Defense Meteorological Satelllite Program (DMSP). Weather data from DMSP satellites was made available to the civilian community through the U.S. Commerce Department's National Oceanic and Atmospheric Administration.

1976

- 17 September A U.S./NATO memorandum of agreement was signed which allowed the Defense Communications Agency the use of the NATO III B spacecraft until December 1977 for the Eastern Pacific Communications Requirement. This would supplement the DSCS II satellite coverage.
- 17 September The roll-out of the first space shuttle vehicle took place.
- 30 September TRW was awarded a contract, effective on this date, to continue development of the Warning Information Correlation System.
- October DSCS III subsystem and system preliminary designs reviews were held throughout the month.
- October Work on the Passive Communication Satellite project was suspended due to a shortage of funds.
- 6 October A contract was distributed to Aerojet Liquid Rocket Company for three Transtage engines and ten sets of Titan III Stage I and Stage II engines, to be delivered at a price of \$36.57 million.
- November System 6.1 software for the Defense Support Program (DSP) Ground Data System was turned over to the Aerospace Defense Command.
- November The Structure-Media Interaction program, a 3-year project to establish prediction techniques for Minuteman launch facility response to nuclear blast and shock, was successfully completed.
- November Major General H.E. McCormick established a Resources Utilization Review committee to investigate the utilization and needs of manpower resources within local SAMSOC offices.
- 1-13 November A site survey was made in the north central part of the United States to evaluate possible locations for the master control station for the Global Positioning System.
- 3 November The integrated program at Squadron 20, Malmstrom AFB, Montana, began. It included silo upgrade, the addition of command data buffer, electromagnetic pulse protection, and dust hardening.
- 10 November The DSP Ground Communications Network was subjected to stress testing.

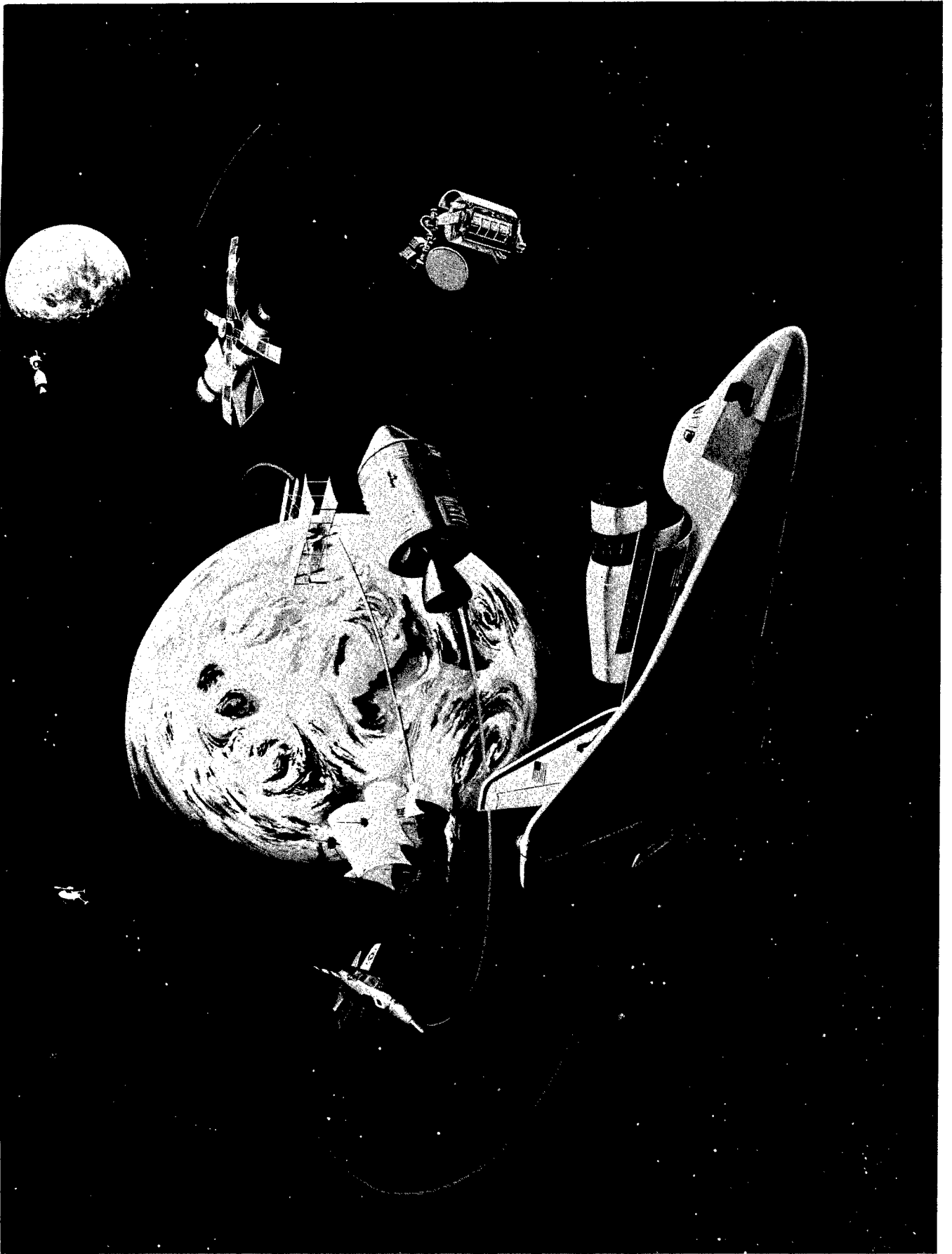
1976

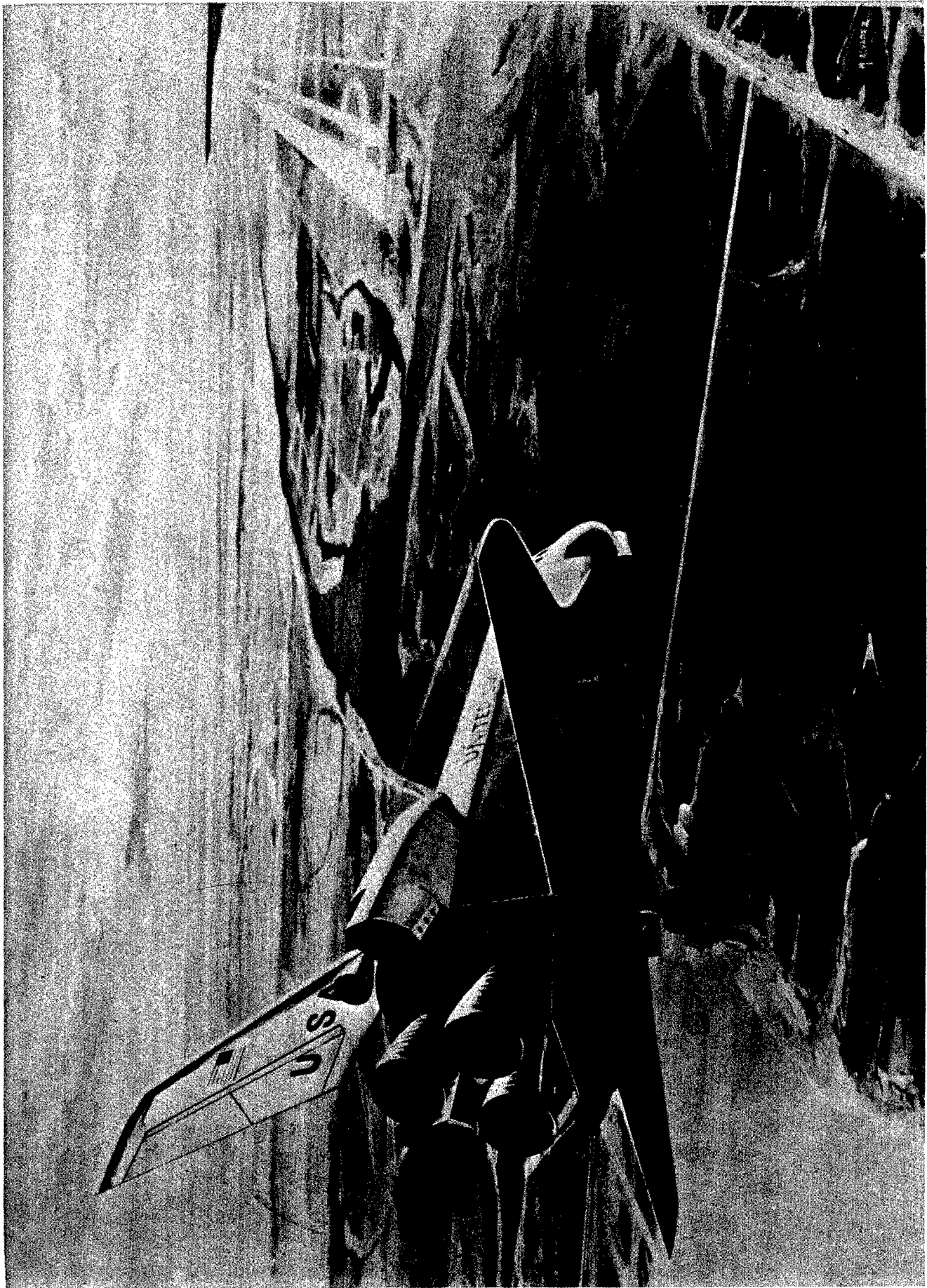
- 12 November Special Minuteman test flight STM-12W was launched from Vandenberg AFB. Among the tests included was an evaluation of various polyacrylonitrile (PAN) fibers. It was the first Fly-2 flight test (dual NS20 IMU).
- 16 November The DSARC III review was held for the FLTSATCOM program. It approved procurement of a third spacecraft in FY 1977.
- December IBM estimated that the SPS development program would slip by eight and one-half months. This was the second schedule slip incurred by the program during this period.
- December The Preliminary Design Review for the DSP Sensor Evolutionary Development (SED) Program was held.
- December SAMSO selected the Sisler process as the best of three competing methods for manufacturing hydrazine fuels for the Titan III and the space shuttle.
- 3 December Negotiations were completed between SAMSO and Martin Marietta regarding the procurement of eight new Titan III launch vehicles, to be delivered by 30 September 1980 at a price of \$79.35 million.
- 6 December SAMSO completed negotiations with McDonnell Douglas for the procurement of three Titan IIIIC payload fairings at a price of \$3.25 million.
- 6 December A contract was awarded to Collins Radio Group for the initial production buy for AFSATCOM terminals. The contract was worth \$74.155 million.
- 7-9 December Briefings were presented to HQ AFSC, HQ USAF, and SAF/SS outlining three alternative methods of providing the DOD with a mission operations system for the space shuttle: modification of NASA facilities at the Johnson Space Center, expansion of the Air Force Satellite Control Facility, and construction of an all-new DOD facility to be called the STS Operations and Planning Center.



Departing on a mission in the 1980s, the space shuttle will be launched much like a missile. It will consist of the payload-carrying shuttle spacecraft, two solid propellant rocket boosters and a large fuel tank.

In orbit, the space shuttle places a satellite in space. On its way into space, the shuttle dropped the two rocket boosters and the fuel tank. The boosters are returned to earth for reuse while the tank burns up on return into the atmosphere. Shuttle will also have the capability of returning payloads to earth or repairing them in space





Its mission completed, the space shuttle returns to earth, landing on a runway much like an airliner. Within a short time, the shuttle will be ready for another space trip.

1976

- 8 December SAMSO awarded Avco Corporation a 34-month, \$26.7 million contract to design, build, and flight test an advanced ballistic reentry vehicle (ABRV).
- 9 December DMSP 5C satellite F-29 was declared non-operational.
- 10-15 December TRW Systems Group, contractor for the FLTSATCOM satellites, conducted an AFSATCOM terminal/FLTSATCOM satellite compatibility test. All test objectives were met and compatibility was verified in all modes.
- 14 December The system design review of the advanced maneuvering reentry vehicle (AMaRV) was held successfully.
- 15 December The second Materials Screening Vehicle (MSV) launch occurred from Wallops Island, Virginia, into inclement weather. The purpose of the flight was to obtain recession and erosion flight data on nosetip and heatshield materials and designs.
- 16 December SAMSO held the critical design review for the thrust replica decoy flight test vehicles.
- 31 December The responsibility for Minuteman ground test missiles was transferred to AFLC.

1977

- January Avco Corporation began work on a system design for an Advanced Ballistic Reentry Vehicle.
- January The Deputy for ICBMs authorized development of a baseline carbon-carbon nosetip for the Mark 12A reentry vehicle.
- January The U.S. Army Corps of Engineers began designing the mate/demate facility, the airfield, and the tow route to be used by the space shuttle at Vandenberg AFB, California.
- January The McDonnell Douglas Astronautics Company went on contract to provide three payload fairings for the Titan IIIC.
- January The Navy began an audit of the financial management of the FLTSATCOM space segment. The audit was completed in March.
- 17 January The Deputy Secretary of Defense approved initiation of the General Purpose Satellite Communications System Program and the Strategic Satellite System Program.
- 26 January A Missile X upper stage motor developed by Aerojet Solid Propulsion Company was successfully test-fired at the AFRPL.
- 27 January A Delta booster launched the NATO III-B communications satellite into orbit from Cape Canaveral, Florida.
- 30 January Special Test Missile 13W, a Minuteman III, was launched from Vandenberg AFB down the Western Test Range. It deployed two Mark 12A Mod I reentry vehicles. All elements of the system performed satisfactorily.
- February A tracking system was installed at Hickam AFB, Hawaii, that allowed Hickam to track DMSP satellites and receive data directly from them. The system was declared operational in June, and Hickam began functioning as a weather readout station in the DMSP system.

1977

February HQ USAF approved full-scale development of a single channel transponder for the AFSATCOM program, to be deployed on DSCS III satellites. A contract for the development of the transponder was awarded to General Electric in March.

February A partial stop-work order was issued to General Dynamics, the contractor for the Global Positioning System's control segment and user equipment segment. The stop-work order was a response to a cost overrun of almost \$30 million in the General Dynamics contract.

2 February SAMSO awarded a contract for Phase II of the DSCS III program to the General Electric Company. GE was to build and test one qualification model satellite and two flight model satellites.

2 February HQ AFSC directed SAMSO to terminate the laser communications program in FY 1978. This action was taken after the DOD removed \$14 million from the program's FY 1978 budget.

13 February Fugro International Corporation completed a coarse screening investigation of potential sites for deployment of Missile X.

17 February The upload station for the Global Positioning System was delivered to Vandenberg AFB, California.

22-24 February A NATO committee met in Brussels to discuss NATO participation in the Global Positioning System program. The committee met a second time on 16-18 May.

28 February SAMSO ordered a third FLTSATCOM satellite from TRW Systems Group. The satellite was ordered through a supplemental agreement attached to the original FLTSATCOM production contract.

March System integration testing for the WS 133B Minuteman III guidance improvement program began at the Sylvania Integration Test Center in Needham, Massachusetts.

1977

March Report of the Resource Utilization Review Committee, established by Major General H.E. McCormick to investigate the utilization needs of manpower resources within SAMSO, was submitted.

March The task of activating Space Launch Complex 3 East, Vandenberg AFB, and converting it to an Atlas F configuration was completed.

March Martin Marietta was awarded a contract to build a space sextant for flight-testing aboard a satellite.

March Raytheon Corporation delivered a laboratory model of a fault-tolerant computer. Prior to the delivery, the computer had been tested, and the feasibility of the fault-tolerant concept had been demonstrated.

March The preliminary design review of the MHAT (mechanical high altitude timer) was completed by the Reentry Systems program office.

1 March Upgrading of Wing VI was approved by SAMSO and Ogden ALC by Amendment 5 to the Minuteman III Engineering Transfer Package.

9 March SAMSO awarded the Ralph M. Parsons Company a contract for the Missile X Buried Trench Construction and Test Project.

15 March Testing of GPS user equipment began at the U.S. Army Proving Ground at Yuma, Arizona. The first tests were accomplished by installing user sets in aircraft and flying them over GPS transmitters deployed on the ground.

20 March The third and final flight of the MSV (materials screening vehicle) program was successfully launched on an Athena D booster from Wallops Flight Center, Virginia, through adverse weather. Three small reentry vehicles gathered data on nosetip materials and designs.

23 March The integrated program of modifications to the Minuteman system was completed at Wing VI, Grand Forks AFB, North Dakota. The program was completed, and the last flight returned to SAC, 10 days earlier than scheduled.

1977

- 24 March The first DMSP Block 5D satellite, which had gone into a spin following its launch in September 1976, was successfully de-spun. This action climaxed a three phase recovery effort which had lasted five months.
- 28 March A software patch was uploaded into the computer of the first DMSP Block 5D satellite. The patch allowed the satellite to function without the services of its roll gyro, which was about to go bad.
- 29 March The Critical Design Review was held for the Global Positioning System manpack being developed by Texas Instruments.
- 30 March Program Management Directive 9 postponed full scale development of the Missile X system to FY 1979 following President Carter's proposed funding reduction of \$160 million for the program's FY 1978 budget.
- 31 March TRW Systems Group finished integrating the first flight model of the FLTSATCOM satellite. The satellite went through acceptance testing from April to November.
- April Aerojet ElectroSystems Company was awarded a contract to complete the design of an improved sensor for the Defense Support Program satellites. The sensor would be incorporated into satellite 14 and retrofitted into satellites 5 and 6.
- April The Navy completed installation of a DMSP production model shipboard terminal aboard the USS Kitty Hawk. This was the second production model DMSP terminal to be installed aboard an aircraft carrier.
- April Texas Instruments delivered a laboratory model of a low density solid state mass memory, also known as a magnetic bubble memory. SAMSO and NASA agreed to continue the solid state mass memory program on a joint basis.
- 14 April Work began on the integrated program of improvements to the Minuteman System at Wing I, Malmstrom AFB, Montana.

1977

- 15 April SAMSO ordered four more DSCS II satellites from TRW Systems Group. The satellites were ordered through a supplemental agreement attached to the original DSCS II replenishment contract.
- 15 April The Global Positioning System monitoring station at Vandenberg AFB, California, was checked out and ready for operation by this date.
- 19 April Responsibility for directing Scout launches at Vandenberg AFB was transferred from the Air Force to NASA.
- 28 April First of the HAVE HOST tests at Luke AFB, involving survivability testing of Missile X shelter and trench designs with detonation of conventional high explosives in wind tunnel facilities. Five such tests were conducted during CY 1977.
- 30 April The master control station for the Global Positioning System was delivered to Vandenberg AFB, California.
- May NATO personnel visited the U.S. to gather data relating to a NATO IV satellite communications system. In September, a NATO study team started to formulate options for the system.
- 2 May SAMSO awarded a FY 1977 contract to Aerojet Solid Propulsion Company for Production of Minuteman III Stage II motors. Production was limited to an initial increment of ten motors.
- 4 May SAMSO released the FY 1977 production contract negotiated with Thiokol Chemical Corporation for Stage I and Stage II motors of Minuteman III. A limit of Government Obligation clause restricted production to components for ten operational missiles.
- 5 May Special Test Missile 14W, a Minuteman III booster, was to be launched from Vandenberg AFB down the Western Test Range. The launch was aborted because of a malfunction in the Stage I safe and arm device.

1977

- 12 May A Titan IIIC launched a pair of DSCS II satellites into orbit from Cape Canaveral, Florida.
- 17-21 May Software modifications were installed in the computer of the first DMSP Block 5D satellite, allowing its attitude control system to function without the pitch and yaw gyros. Coupled with an earlier modification which had allowed the satellite to function without the roll gyro, this action prevented the spacecraft from being lost due to deterioration of its gyros.
- 18 May TDV-1, the first of three technology development vehicle flights in CY 1977, was successfully launched from Vandenberg AFB to the Kwajalein missile range on a Minuteman I booster. It successfully conducted complex experiments dealing with nosetip materials, aerodynamics, and electronics.
- 18 May A sub-scale model of an extendible nozzle exit cone (ENEC), developed by Hercules Incorporated for Missile X second and third stages, was successfully tested at the AFRPL. This was the first successful deployment of an ENEC over a rocket motor plume which did not result in structural damage to the nozzle.
- 18 May TRW Systems Group finished testing the qualification model of the FLTSATCOM satellite. This brought the development phase of the FLTSATCOM program to an end.
- 23 May A successful test was conducted of the payload recovery techniques to be used in the Balloon Altitude Mosaic Measurements Program.
- 25 May SAMSO issued a request for proposal to General Electric Company for initial procurement of the Mark 12A reentry system. The RFP was later revised to accommodate design changes.
- June Chemical Systems Division of United Technologies Corporation went on contract to provide five sets of solid rocket motors for the Titan III.

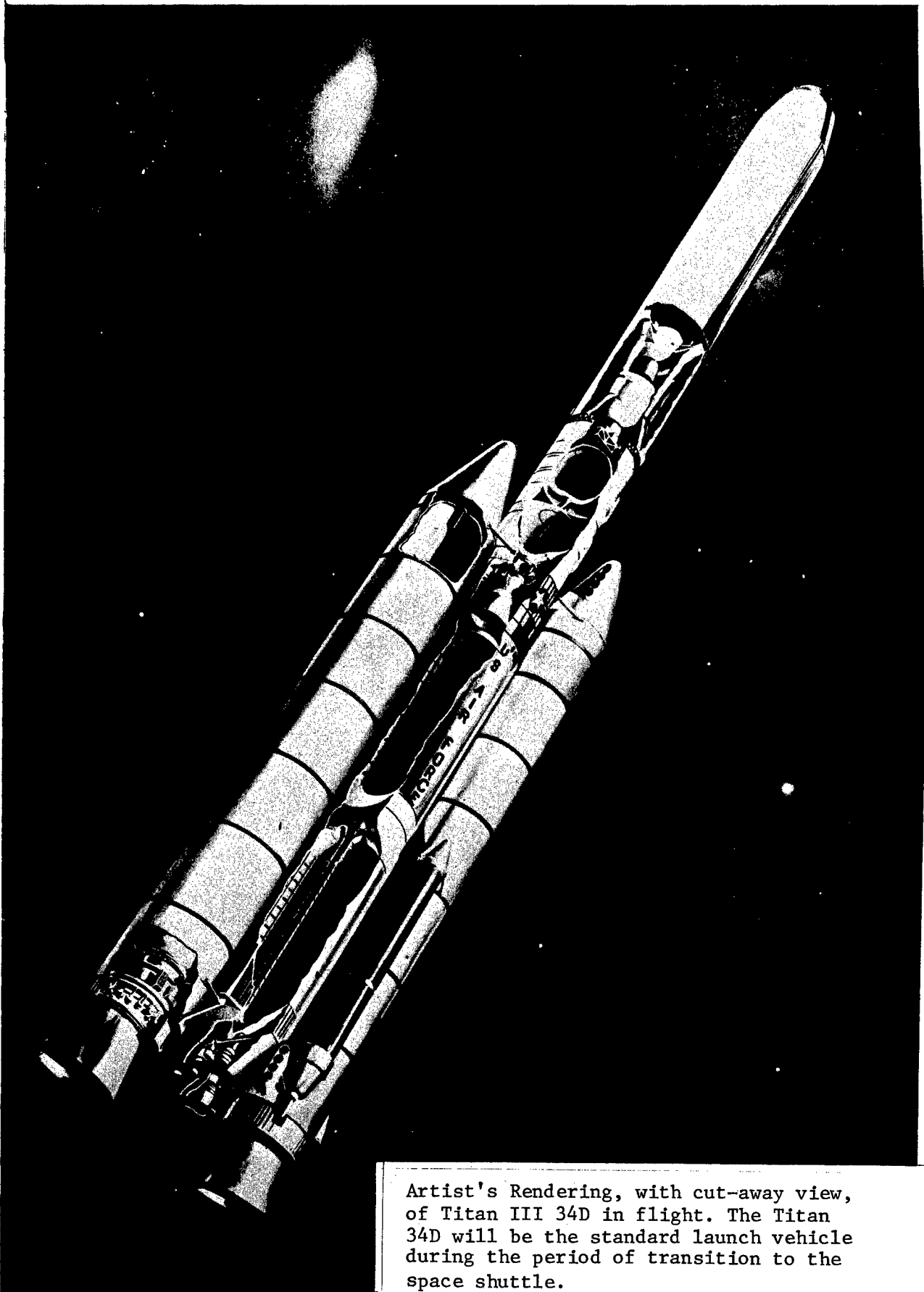
1977

- 4 June An LV-2F booster launched the second DMSP Block 5D satellite into orbit from Vandenberg AFB, California. The launch was marred by a series of anomalies which put the satellite in a retrograde orbit and a spinning condition.
- 10 June A rocket nozzle for the IUS was subjected to an 85 second test firing at the Rocket Propulsion Laboratory. The test was successful. A second successful test took place on 15 July.
- 15-16 June The Program Management Responsibility Transfer Working Group met at SAMSO to discuss transfer of engineering responsibility for the Minuteman III system to AFLC.
- 16 June Special Test Missile 14W-1, a Minuteman III booster, was launched from Vandenberg AFB down the Western Test Range. It had been scheduled for launch on 5 May as STM 14W, but had been aborted because of a failure in the Stage I safe and arm device. The first stage motor was replaced for the launch on 16 June.
- 20 June HQ USAF directed AFSC to begin developing the Titan 34D/IUS launch vehicle.
- 22 June SAMSO awarded a FY 1977 contract to Bell Aerospace Company for the production of 59 Propulsion System Rocket Engines for the Minuteman III. The contract was partially terminated on 11 July, then revised on 15 November to procure a total of 40 motors for the FY 1977 purchase.
- 23 June An Atlas booster and a Global Positioning System Stage Vehicle launched Navigation Technology Satellite 2 into orbit from Vandenberg AFB, California. This was the first use of the GPS Stage Vehicle.
- 25 June An Air Force/contractor team completed recovery of the second DMSP Block 5D satellite, which had gone into a spin following its launch earlier in the month.

1977

- July A joint DOD/NASA committee was formed to find an economical method of securing NASA's Johnson Space Center so that it could be used for mission control when classified DOD missions were flown on the space shuttle. The committee handed in its final report in November, recommending that the Johnson Space Center be secured through what it called the "controlled mode" of operation.
- July Work started on development of microcircuit chips for the spaceborne fault-tolerant computer.
- July An authorization bill passed by Congress reduced the amount of funds to be spent on validation of Missile X basing concepts to \$69 million, forbade expenditure of funds on silo basing or air mobile basing, and ordered \$35.1 million to be spent on MAP (ground mobile basing) validation.
- July The Aerojet ElectroSystems Company delivered the first flight model of the SSM/T, a microwave temperature sounder that would be flown on DMSP Block 5D satellites.
- 11 July SAMS0 terminated production of Minuteman III components in compliance with a directive from Secretary of Defense Brown limiting Minuteman III production under FY 1977 procurement funds to ten missiles. Sixty missiles had originally been planned for FY 1977 procurement.
- 15 July SAMS0 Detachment 35, the SATAF at Grand Forks AFB, North Dakota, was deactivated following the completion of the integrated program at Wing VI.
- 18 July The Global Positioning System's monitor station, master control station, and upload station at Vandenberg AFB began giving operational support to Navigation Technology Satellite 2.
- 29 July SRK-11, the first of two sounding rocket flights designated HAVE JEEP IV, was launched from Roi-Namur Island in the Kwajalein missile range on an Honest John-Nike Hydac booster. It conducted experiments with CDM (Continuously Dispensed Masker). The experiments were a qualified success. A

TITAN III 34D/IUS



Artist's Rendering, with cut-away view, of Titan III 34D in flight. The Titan 34D will be the standard launch vehicle during the period of transition to the space shuttle.

1977

failure in the booster attitude control system caused the next flight (SRK-12), scheduled for November, to be postponed to CY 1978.

29 July

HQ USAF decided that AFSC should assume responsibility for providing logistic support to the Thor launch vehicle.

August

The ICBM program office submitted to HQ AFSC and HQ USAF the results of a study of possible ways to verify compliance of trench- or shelter-based ICBM systems with a Strategic Arms Limitations Agreement.

August

Rockwell International was awarded a contract to perform a system design and capabilities study for a satellite attitude reference and navigation system utilizing a star sensor.

August

A draft environmental impact statement on STS facilities and operations at Vandenberg AFB was submitted to the Council for Environmental Quality.

August

Sverdrup and Parcel began designing the launch complex to be used by the space shuttle at Vandenberg AFB, California.

August

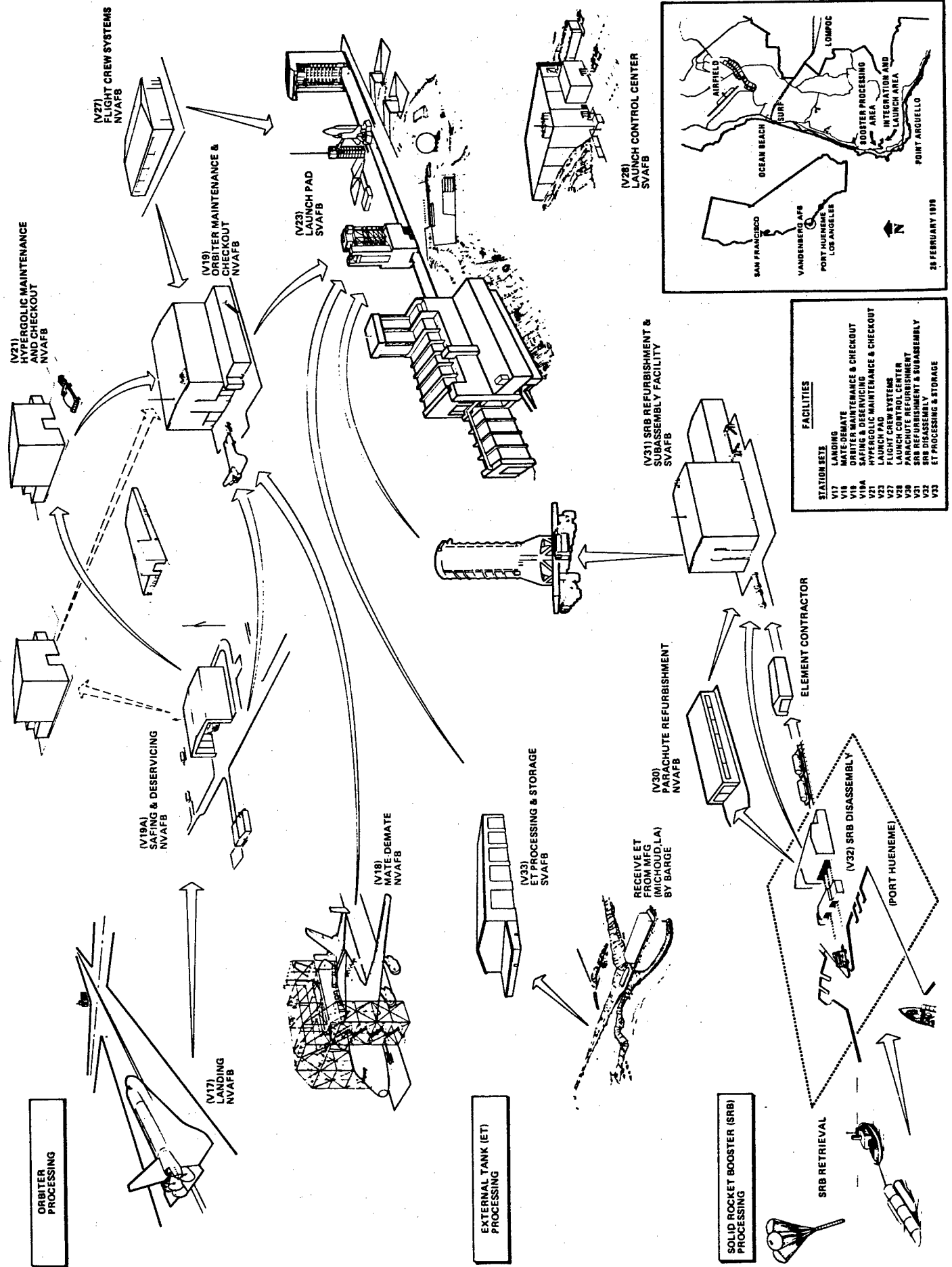
The Reentry Systems program office held a Preliminary Design Review of the design by Honeywell, Incorporated for the DINS (Dormant Inertial Navigation System). The guidance and navigation system was to be flight-tested on the second AMaRV.

August

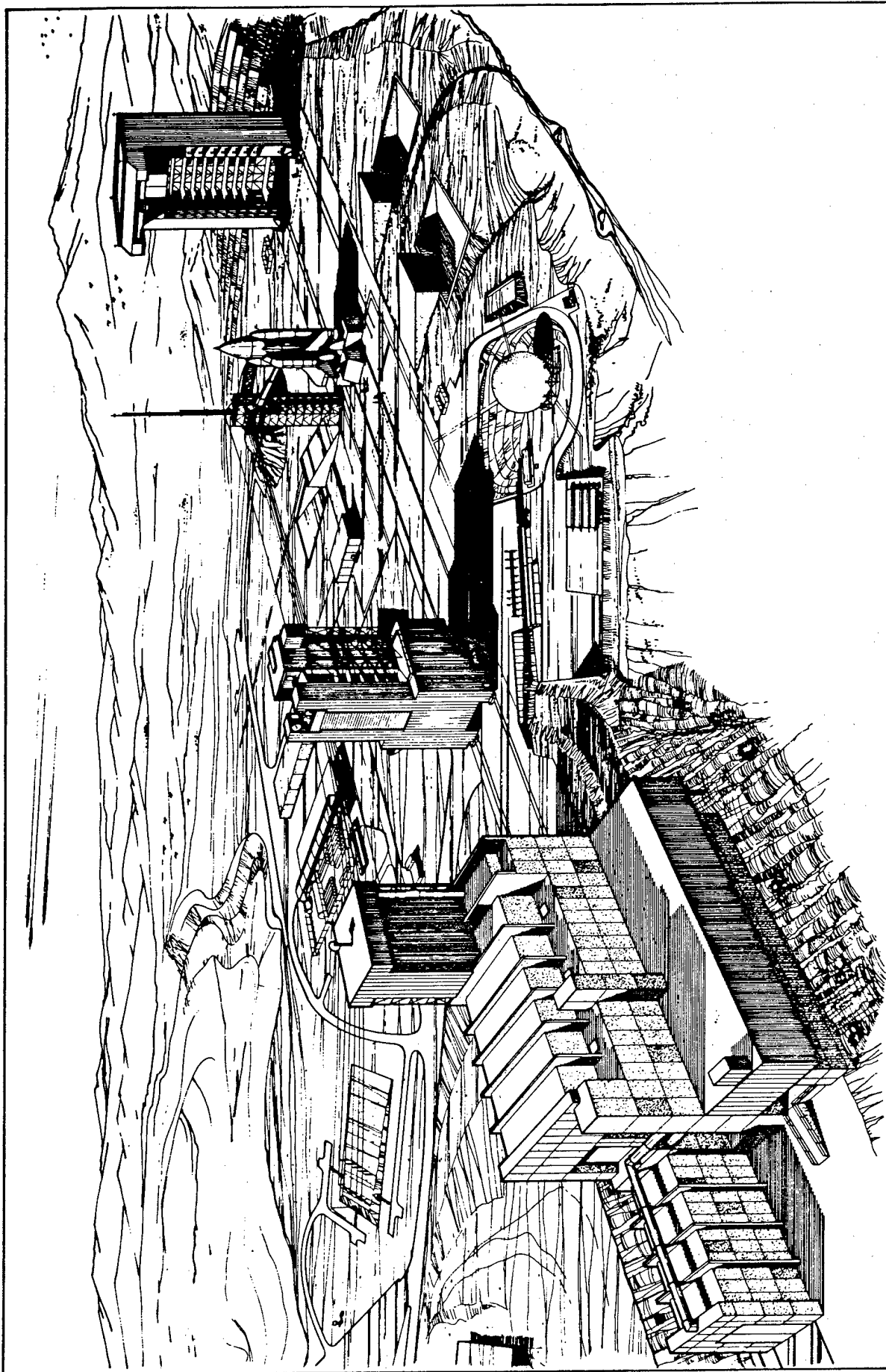
The Reentry Systems program office held a System Design Review of the Avco Corporation's design concept for advanced ballistic reentry vehicles employing Almendro and Muenster warheads.

12 August

The space shuttle made its first free flight. After being carried aloft by a Boeing 747, it was released and made an unassisted landing at Edwards AFB, California. This was part of a series of approach and landing tests carried out at Edwards from February to October.



Flow Chart for Processing of Space Shuttle at Vandenberg AFB



Artist's Conception of SLC-6, Launch Pad for the Space Shuttle at Vandenberg AFB

1977

- 15 August The integrated program of improvements to the Minuteman system was completed at Squadron 20, Malmstrom AFB, Montana, and the last flight was turned back over to SAC.
- 15 August The Air Force Systems Acquisition Review Council was briefed on the Global Positioning System program. The Council decided to stretch out the GPS schedule, eliminate plans to give the system a two-dimensional operating capability by the end of the development phase, and postpone procurement of three satellites and 600 user sets. These decisions were ratified by the Defense Systems Acquisition Review Council on 4 October.
- 19 August Production Verification Missile 14, a Minuteman III, was launched from Vandenberg AFB down the Western Test Range. It successfully tested two Mark 12A reentry vehicles.
- 20 August A Titan IIIE launched NASA's Voyager 2 spacecraft from Cape Canaveral, Florida.
- September The Reentry Systems program office authorized the Harry Diamond Laboratories to conduct a six-month study of techniques and hardware available for developing a surface proximity fuze to replace contact fuzes in certain environments. General Electric was authorized to conduct a study on a proposed integrated airburst fuze.
- September The Ralph M. Parsons Company and the C.F. Braun Company submitted final reports on how much it would cost to build a Missile X shelter-based system and how rapidly the construction could be accomplished.
- September The Air Force came up with \$95,000 to initiate the development of the SSM/I, a microwave imager to be flown on DMSP Block 5D satellites. Development of the imager had previously been jeopardized when the Director of Defense Research Engineering had withdrawn funding from the project.

1977

- September The qualification model of the Navigation Development Satellite finished system testing.
- September The Sacramento Air Logistics Center began procuring tracking systems that would be used to convert DMSP Mark I and II ground terminals to an upgraded configuration called the Mark IIA.
- September A contract was awarded to Collins Radio Group of Rockwell International for the production of 119 airborne terminals and two ground terminals for the AFSATCOM program. This was the second contract that Collins had received for the production of AFSATCOM terminals.
- September NATO personnel visited the U.S. to discuss NATO participation in the Global Positioning System program. The NATO representatives met with SAMSO and contractor personnel and visited GPS test facilities.
- 3 September TDV-2, the second of three technology development vehicle flights in CY 1977, was successfully launched from Vandenberg AFB to the Kwajalein missile range on a Minuteman I booster. It successfully conducted complex experiments dealing with nosetip materials, aerodynamics, and electronics. A P 06-L star traffic decoy was successfully tested on the same flight.
- 5 September A Titan IIIE launched NASA's Voyager I spacecraft from Cape Canaveral, Florida.
- 28 September A redesigned Missile X lower stage movable nozzle was ground tested on a rocket motor at the AFRPL. The nozzle failed when the exit cone broke away from the nozzle.
- 30 September Martin Marietta was awarded a contract to develop plans, procedures, analytical tools and models, and general expertise that would be required to integrate payloads into the space shuttle.
- October The Air Force and the Defense Advanced Research Projects Agency signed a memorandum of agreement providing that the mosaic sensor experiment and the mini-HALO experiment would be test flown on the same spacecraft.

1977

October Global Positioning System monitor stations were deployed in Hawaii, Alaska, and Guam, completing deployment of the Phase I control segment.

October Linkabit was awarded a contract for 168 dual modems to be used in AFSATCOM terminals.

October Competitive contracts were awarded to the Denver Division of Martin Marietta and the Convair Division of General Dynamics to design a large structure that could be carried into orbit aboard the space shuttle and assembled in space.

October Rocketdyne Division of Rockwell International went on contract to provide two MB-3 propulsion systems for the Thor launch vehicle.

October Work on the SHIP inertial measurement unit for the AMaRV was completed by the Kearfott Division of the Singer Company. The guidance and navigation subsystem was to be flown on the first AMaRV.

4 October The International Association of Machinists went on strike against the Boeing Company, affecting plant production and deployment activities of the Minuteman system.

6 October The primary sensor failed on DMSP satellite F-33.

7 October A rocket nozzle for the IUS was subjected to a 145 second test firing at the Rocket Propulsion Laboratory. The test was successful.

12 October SAMSO was directed by AFSC to prepare plans for reestablishing FY 1977 Minuteman III procurement. Production had been halted in July by order of the Secretary of Defense, but Congress had ordered that production be resumed.

1977

13 and 20 October

The balloon to be used in the Balloon Altitude Mosaic Measurements Program was test flown from the municipal airport at Chico, California. Both tests failed--the first when the balloon's dummy payload separated from the balloon prematurely and the second when the balloon itself developed leaks.

14 October

SAMSO released requests for proposals for systems definition and full scale development of the Missile X system, following delegation of source selection authority by HQ AFSC.

14 October

The ICBM Program Office released requests for proposals on systems definition of Missile X booster stages I, II, III, and IV.

20 October

A trapped-ball movement nozzle for the Missile X lower stage was successfully ground tested by the Wasatch Division of Thiokol Corporation.

21 October

SAMSO released a request for proposals for system definition of Missile X guidance and control integration. Proposals were received from contractors on 21 December.

28 October

The PDMM (Pulse Doppler-MAP Match) terminal sensor for the AMaRV was flight-tested for the first time on board a C-141 aircraft over Cape Cod. By the end of the year, it had completed five flight tests on the C-141.

November

Design work by Ford Aerospace and Communications Corporation began on an advanced graphite plug nosetip subsystem for ABRES small reentry vehicles.

November

The McDonnell Douglas Astronautics Company went on contract to provide logistic support to the Thor launch vehicle.

1977

- November HQ USAF directed AFSC to initiate the Lifetime Extension Program for the DMSP Block 5D satellite.
- November The Raytheon Company and the Hughes Aircraft Company started work on competitive design concepts for a signal processor suitable for use on board satellites.
- 3 November Production Verification Missile 15, a Minuteman III, was launched from Vandenberg AFB down the Western Test Range. It successfully tested two Mark 12A reentry vehicles.
- 11 November Chemical Systems Division of United Technologies Corporation was awarded a contract to provide launch services for Titan III solid rocket motors.
- 11 November The first launch in the Multi-spectral Measurements Program took place at the White Sands Missile Range, New Mexico. During the experiment, the sensor module did not obtain the necessary data and was later destroyed when its parachute failed to deploy properly.
- 14 November SAMSO reinstated Minuteman III production with FY 1977 procurement funds. Production had been halted in July by order of the Secretary of Defense after production of ten missiles.
- 16 November The Aerojet Liquid Rocket Company was awarded a contract to provide launch services for Titan III liquid rocket engines.
- 17 November The strike by the International Association of Machinists against the Boeing Company ended. The strike caused a delay of 35 workdays in the integrated program of Minuteman modifications at Wing I/Squadron 20, Malmstrom AFB, Montana.
- 23 November General Electric Company submitted a revised proposal for initial production of the Mark 12A reentry system.

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- 28 November Amendment 6 to the Minuteman III Engineering Transfer Package, the instrument for the approval of the upgrading of Wing I, was given to Ogden ALC for formal approval.
- 31 November TDV-3, the third of three technology development vehicle flights in CY 1977, was successfully launched from Vandenberg AFB to the Kwajalein missile range on a Minuteman I booster. It successfully conducted complex experiments dealing with nosetip materials, aerodynamics, induced early transition, and electronics.
- December HQ USAF restored funding to the laser communications program, allowing the program to escape cancellation. However, the objectives of the program were scaled down and its schedule stretched out.
- December A final environmental impact statement on STS facilities and operations at Vandenberg AFB was submitted to HQ USAF.
- December The Reentry Systems program office held a preliminary design review for the first two reentry vehicles designed by the Avco Corporation for use with the Almendro warhead.
- December Fugro International Corporation delivered its final report on the intermediate screening of potential sites for deployment of Missile X.
- 1 December The Air Weather Service decided that it no longer required support from DMSP Block 5C satellites, and the two remaining Block 5C satellites were turned off permanently. This ended the Block 5C era.
- 3 December The first flight model of the FLTSATCOM satellite was shipped to Cape Canaveral. Launch was scheduled for February 1978.
- 12-15 December The Preliminary Design Review for the IUS was held.

1977

- 13 December The Deputy for Launch Vehicles reorganized the STS Program Office to support expanding STS programs.
- 13-20 December Proposals from contractors were due at SAMSO for work on Missile X propulsion motor stages, assembly test and system support, and guidance and control integration.
- 15 December An extendible nozzle exit cone developed by Chemical Systems Division of United Technologies was successfully tested over a rocket motor plume at the AFRPL.
- 15 December The Program Management Responsibility Transfer Working Group met at SAMSO to discuss transfer of engineering responsibility for the Mark 12A reentry system to AFLC.
- 15 December The status of the IUS program was briefed to the Air Force Systems Acquisition Review Council. The Council requested additional information on funding, requirements and costs, and program alternatives.
- 16 December SAMSO submitted its first POM using zero-base budgeting.
- 19 December A full scale IUS motor was successfully test fired at the Arnold Engineering Development Center.

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- January The Advanced Maneuvering Reentry Vehicle underwent a successful critical design review.
- January The Boeing Company and SAC completed the initial operational test and evaluation of the Guidance Improvement Program at Vandenberg AFB.
- January SAMSO awarded a contract to Martin Marietta for the production of two Titan IIIB airframes and five Titan III 34D airframes.
- 1 January SAMSO's ICBM Program Office began a Multiple Aimpoint Basing Study for Missile X basing. The study had been requested by the Defense Science Board after briefings by SAMSO late in CY 1977 on the subject of alternate basing modes. The study was concluded in April, and the results were presented in a briefing to the Air Force Scientific Advisory Board and the Defense Science Board. The study recommended the vertical shelter basing mode, with the horizontal shelter basing mode as a second choice.
- 3 January Lockheed Missiles and Space Company was awarded a \$34 million contract to build a spacecraft for the Satellite Infrared Experiment (SIRE), which was designed to measure long wave infrared signatures of space objects against the stellar background. The spacecraft would also carry two secondary payloads--a space sextant and a sensor that would measure the isotopic composition of solar flares.
- 6 January Standard Test Missile 15W, a Minuteman III carrying three Mark 12A reentry vehicles, was successfully launched from Vandenberg AFB. The test provided data on the performance of experimental nosetip and heatshield materials and was the first to use complete Guidance Improvement Program software.
- 17 January The Director of the STS Program Office briefed HQ AFSC and HQ USAF on the budget deficit of \$265 million in the STS program for FY 1978-1983.

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- 24 January The upgrading of Wing I was approved by SAMSO and Ogden ALC by Amendment 6 to the Minuteman III Engineering Transfer Package.
- 7 February The final version of the space shuttle environmental impact statement was released to the Council on Environmental Quality. The statement described how the construction and operation of space shuttle facilities would affect the environment of Vandenberg AFB.
- 9 February An Atlas booster was launched from Cape Canaveral carrying the first FLTSATCOM satellite. The launch was successful, and the satellite functioned normally once in orbit. It was declared operational on 4 April.
- 13 February SAMSO instructed McDonnell Douglas to reorient the Laser Communications Program and work toward an air-to-ground demonstration rather than a space-to-ground demonstration. This reorientation was caused by severe funding cutbacks that had occurred in 1977.
- 15 February Navigation Technology Satellite 2 (NTS-2) lost its L-band navigation signal. This loss put the satellite out of action and ended its role in the Global Positioning System test program.
- 18 February Rockwell International was awarded an \$18.9 million contract to build a spacecraft to carry the Teal Ruby experiment. The Teal Ruby payload, which was also being built by Rockwell, consisted of a downward-looking infrared sensor with a mosaic focal plane; it was designed to measure aircraft signatures and background flux at infrared wavelengths.
- 20 February Construction began on the Missile X Buried Trench Construction and Test Project under a contract previously awarded to the Ralph M. Parsons Company. The contractor was to demonstrate its recommended construction method with test trenches in the San Cristobal Valley of the Luke Bombing and Gunnery Range in Arizona.

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- 22 February An Atlas booster was launched from Vandenberg AFB carrying the first NAVSTAR Satellite. The launch was successful, and the satellite functioned normally once in orbit. It was declared operational on 31 March.
- March The initial production contract for the Mark 12A reentry system was formally awarded to General Electric. It was a cost-plus-incentive-fee contract worth \$45,354,036.
- 17 March AFSC directed that the Advanced Space Defense SPO be established under the Deputy for Space Defense Systems.
- 23 March SAMSO briefed the Defense Systems Acquisition Review Council (DSARC) on the results of the validation phase of the development of the space shuttle's Inertial Upper Stage. The DSARC recommended that the program be allowed to continue into full scale development.
- 25 March A Titan IIIIC was launched from Cape Canaveral carrying DSCS II satellites F-9 and F-10. The vehicle suffered a failure in its second stage hydraulic system about eight minutes after liftoff, and both the vehicle and its payload were lost.
- April Ford Aerospace and Communications Corporation was put under contract to design, build, and test an Advanced Plug Nosetip (APN). The APN would be flown on small reentry vehicles to gather data on nosetip recession and ablation. In contrast to previous experimental nosetips, the design and hardware of the APN would be standardized.
- April SAMSO awarded a contract to Martin Marietta Aerospace for system definition of Missile X assembly, test, and system support. The contract also contained an option for full-scale engineering development to be performed between 1 January 1979 and 30 September 1983. Under the contract, Martin Marietta began studies to prepare for system definition of Missile X reentry systems.

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- April A group of independent welding experts, asked by SAMSO to evaluate criteria and workmanship of defective welds in Wing I and Squadron 20, reported that SAMSO's acceptance standards had been realistic, that the welding done at Squadron 20 had been below normal industry standards, and that revised methods of welding and inspection should ensure a satisfactory product.
- 5 April The integrated program of modifications to Minuteman launch facilities began at Wing IV (Whiteman AFB, Missouri) with the training facility.
- 6 April A balloon carrying two mosaic sensors was launched from Holloman AFB, New Mexico, as part of the Balloon Altitude Mosaic Measurements program. When the balloon was only six feet off the ground, a shaft broke and allowed the payload to fall to earth, thus bringing the flight to a premature end.
- 6 April NASA withdrew its requirement for a Titan III 34D/IUS to be used as backup for a space shuttle launch of a Tracking and Data Relay Satellite in 1980.
- 7 April SAMSO awarded a contract for the system definition phase of the development program for Missile X Stage IV to the Rocketdyne Division of Rockwell International Corporation.
- 9 April A fire occurred in the FLTSATCOM assembly area of the TRW facility in Redondo Beach, California. Many pieces of FLTSATCOM hardware were damaged by soot and smoke, and some suffered water damage. The fire caused a two-month delay in the testing of the second FLTSATCOM satellite and a four-month delay in the integration of the third satellite.
- 14 April A contract for full-scale development of the space shuttle's Inertial Upper Stage was distributed to the Boeing Aerospace Company.
- 15 April The AFSATCOM space segment was declared operational.

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- 20-21 April SAMSO representatives briefed HQ AFSC officials on possible alternatives to deal with the cost growth problem in the Titan III 34D/IUS development program.
- 21 April The UnderSecretary of Defense for Research and Engineering asked the Navy and Air Force to conduct a joint study to define a common missile which could be used in place of both Trident II and Missile X, which were under separate development by the respective services. The study was also to formulate a management plan for development of the common missile and to estimate the potential savings from such a joint development.
- 21 April SAMSO issued a request for technical proposals for production of carbon-carbon nosetips for the Mark 12A reentry system.
- 24-25 April SAMSO briefed HQ AFSC and HQ USAF on its plan for dealing with the budget deficit in the STS program. The plan called for a slow-down in the construction of STS launch facilities at Vandenberg AFS so that the facilities would attain a limited launch capability in 1983 and a full launch capability later on. SAMSO revised its plan twice during the summer of 1978 at the request of HQ USAF.
- 25 April The U.S. and eight other NATO countries signed a Memorandum of Understanding that opened the way for NATO participation in the Global Positioning System program.
- 25-26 April The results of a Multiple Aimpoint Basing Study for Missile X basing, conducted by SAMSO's ICBM Program Office, were briefed to the Air Force Scientific Advisory Board.
- 26 April The Secretary of the Air Force announced that Los Angeles AFS along with other Air Force facilities, was a candidate for base closure and realignment.

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- 26 April Fortuna AFS, North Dakota, was selected as the site for the NAVSTAR Control Center. The Center was to control the NAVSTAR satellites used in the Global Positioning System program.
- 30 April A Thor LV-2F was launched from Vandenberg AFB carrying the third DMSP Block 5D-1 satellite. The launch was successful, and the spacecraft and its sensors functioned normally once in orbit.
- May Assembly of the Minuteman III boosters scheduled for delivery in CY 1978 was begun by the Boeing Aerospace Company at Hill AFB.
- May A successful critical design review was held for the Dormant Inertial Navigation System (DINS). The DINS, which employed a laser gyro, was intended to function as the navigation subsystem in a maneuvering reentry vehicle and was to be flight tested aboard the second Advanced Maneuvering Reentry Vehicle in 1979.
- May Space Shuttle Orbiter 101 began undergoing vibration tests at the Marshall Space Flight Center in Huntsville, Alabama.
- May A contract for integration of payloads into the space shuttle's Inertial Upper Stage was distributed to the Boeing Aerospace Company. The value of the contract was \$10.72 million and the period of performance ran from March 1978 to February 1981.
- 1 May The period of performance began on contracts awarded by SAMSO for the system definition phase of the development program for three Missile X propulsion stages. The contracts were awarded to Thiokol Corporation for Stage I, Aerojet Solid Propulsion Company for Stage II, and Hercules Incorporated for Stage III.
- 2 May The AFSC Missile Mishap Investigation Board, investigating the failure of a Titan IIIC launch of DSCS II satellites on 25 March, submitted its final report.

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- 2-3 May The results of a Multiple Aimpoint Basing Study for Missile X basing, conducted by SAMSO's ICBM Program Office, were briefed to the Defense Science Board.
- 10 May SAC turned over the first launch facility at Wing IV (Whiteman AFB, Missouri) to SAMSO. SAMSO was to conduct an integrated program of improvements at the Wing.
- 10 May Modifications to the main engine of the space shuttle orbiters began to be evaluated in a series of test firings.
- 13 May An Atlas booster was launched from Vandenberg AFB with the second NAVSTAR satellite. Launch was successful and the satellite functioned normally once in orbit. It began operating at its final station on 27 June.
- 17 May The Air Force Audit Agency issued a report on the Mark 12A acquisition program.
- 26 May A carbon-carbon nozzle, manufactured for the space shuttle's Inertial Upper Stage propulsion system by a new low-cost process, underwent a test firing at the Air Force Rocket Propulsion Laboratory. The nozzle held up successfully.
- June SAMSO awarded a \$4.72 million contract to the Harris Corporation to develop and produce the Mark IV transportable terminal for the Defense Meteorological Satellite Program.
- June Martin Marietta was awarded a follow-on contract to perform systems integration during the acquisition of the ground support system for the space shuttle at Vandenberg AFB.
- 6 June SAMSO was authorized by the Office of the Secretary of the Air Force to develop a radio guidance system for Titan III34Ds launched from Vandenberg instead of the IUS inertial guidance system to be used at Cape Canaveral. This program change would reduce development costs for the Titan III34D program.

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13-15 June

SAMSO held a successful preliminary design review with Martin Marietta on the radio guidance system equipment for Titan III34Ds launched from Vandenberg AFB.

15 June

A Missile X Milestone II Draft Environmental Impact Statement, prepared by Henningson, Durham and Richardson, Ecosciences Division, was delivered to SAMSO. It dealt with the impact of full-scale engineering development of the Missile X system.

16 June

Four small reentry vehicles were successfully launched down the Western Test Range in an effort to evaluate the performance of several nosetip materials in clear weather. The launch was referred to as Advanced Nosetip Test III (A.N.T. III).

22 June

Standard Test Missile 16W, a Minuteman III carrying two Mark 12A reentry vehicles, was successfully launched from Vandenberg AFB. The test provided data on the performance of experimental nosetip and heatshield materials.

26 June

An Atlas booster launched SEASAT-A, a NASA satellite. The purpose of the mission was to evaluate the use of microwave instruments to obtain oceanographic data. The launch was successful, but the satellite ceased functioning because of an electrical short after 99 days of operation.

July

Aerojet Liquid Rocket Company delivered the first three Titan IIIC Transtage engines fitted with improved transtage injectors.

July-August

The results of the joint Navy-Air Force study to define a common missile which could be used in place of both the Trident II and Missile X were briefed to the Undersecretary of Defense for Research and Engineering. The study concluded that some cost savings could result from development of a "common" or "mostly common" missile, and that a common missile was technically feasible and would meet the requirements for the Trident II. However, no common or mostly

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common missile could approach the performance of the baseline Missile X.

1 July

SAMSO exercised contract options to extend the system definition phase of development programs for Missile X propulsion stages. At the same time, SAMSO postponed the missile design review three months, to 27 March 1979.

4 July

Four small reentry vehicles were successfully launched down the Western Test Range in an effort to evaluate the performance of various nosetip materials in severe weather. The launch was referred to as Advanced Nosetip Test II (A.N.T. II).

10 July

SAMSO awarded a contract for the system definition phase of a Missile X flight computer to Autonetics Group of Rockwell International Corporation. The contract contained an option for full-scale engineering development.

15 July

Air Force Chief of Staff General Allen directed AFSC to develop and deploy a vertical shelter engineering prototype to obtain data on construction, operations, and cost, and to provide a test bed for demonstration of verification and concealment methods. Both the vertical shelter and the hybrid in-line trench concepts were to be developed as options for full-scale engineering development, and information on these was to be presented at AFSARC II in preparation for DSARC II.

17 July

The SAMSO Commander established a permanent Resource Utilization Committee.

18 July

Testing of modifications to the main engine of the space shuttle orbiters was suspended when a high pressure oxygen pump failed.

20 July

General Electric informed SAMSO that there would be a serious cost overrun in the DSCS III program. The contractor estimated that the cost of completing full-scale development would exceed the ceiling price by \$21.5 million.

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21 July

The Office of Command Mission Assessment was established under the SAMSO Vice Commander to coordinate corporate planning and mission assessment activities.

August

Installation of the Vandenberg Launch Processing System began at Vandenberg AFB. The system was made up of data processing equipment that would be used in conducting launch operations for the space shuttle.

1 August

The Directorate of Logistics and Acquisition Support was formed by a consolidation of the Directorate of Acquisition Support and AFALD's Directorate of Aerospace Logistics.

12 August

Testing of the main engine of the space shuttle orbiters was resumed after a failure of the high pressure oxygen pump was determined to have been caused by test instrumentation.

14 August

The Weld Reentry Program, to inspect and correct defective welds in launch facilities, began at Squadron 20.

16 August

The Boeing Company successfully demonstrated its Missile X buried trench breakout erection system at the Luke Bombing and Gunnery Range in Arizona.

28 August

A public hearing was held at Lompoc, California, on the revised Missile X Milestone II Draft Environmental Impact Statement, which had been filed with the Environmental Protection Agency on 24 July and released for public review and comment.

31 August

Martin Marietta successfully demonstrated its Missile X buried trench breakout erection system at the Luke Bombing and Gunnery Range in Arizona.

September

The Wasatch Division of Thiokol Corporation successfully tested a "trapped ball" moveable nozzle for Missile X stage I.

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- September Deployment of the Guidance Improvement Program tapes containing software changes to Minuteman III guidance programs was successfully completed in all Minuteman III wings.
- September Delivery of the last Minuteman III stage II motors brought the total number of Minuteman III operational stage II motors delivered to 792.
- 7 September The second launch in the Multispectral Measurements Program was attempted at White Sands Missile Range, New Mexico. During the pre-launch countdown, some squibs fired prematurely and separated the payload from the booster while it was still on the launch pad. This accident forced cancellation of the launch.
- 12 September SAMSO awarded a contract to Avco Systems Division for production of carbon-carbon nosetips for the Mark 12A reentry system. A small business set-aside contract to Fiber Materials, Incorporated was subsequently voided. A total of 1,071 nosetips were to be produced by Avco for a total price of \$11,998,739.
- 18 September Minuteman Program Management Directive 0-02047(26) and Titan PMD X-08071(1) provided direction for a restructured command and control communications integration program for several types of communications systems in ICBM launch control centers.
- 26 September SAMSO initiated production of a new rocket motor test set for the Titan III. The rocket motor test set was developed by Chemical Systems Division.
- 28 September A balloon carrying a mosaic sensor was successfully launched from Holloman AFB, New Mexico. This was the second launch in the Balloon Altitude Mosaic Measurements program; the first launch, on 6 April, had ended in failure.
- 28 September SAMSO's request for an increase in its leased housing program for military personnel at Los Angeles AFS was

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approved by HQ USAF.

October

SAMSO awarded a contract for definition of vertical shelter operational requirements for Missile X basing to the Boeing Company. Besides performing studies, Boeing was to conduct a test program to validate key vertical shelter concepts beginning in mid-CY 1979.

October

A report by the General Accounting Office to the Secretary of Defense criticized concurrent development and production in the Mark 12A program.

October

Delivery of the last Minuteman III stage III motors produced brought the total number of such motors delivered by Thiokol and Aerojet to 794. Delivery of the last Minuteman III Propulsion System Rocket Engines brought the total number of such engines delivered by the Bell Aerospace Company to 794.

October

SAMSO awarded a contract for Titan III launch support to Martin Marietta's Denver Division.

October

HQ USAF directed the implementation of the so-called controlled mode at the Johnson Space Center. The controlled mode was a special method of operation that would allow the Center to support space shuttle missions involving classified payloads.

1 October

SAMSO awarded contracts for the installation of the 616A communications system in Minuteman launch control centers as the first phase of the restructured Command and Control Communications program.

1 October

The Airborne Launch Control System Phase III program, to provide a Minuteman post-attack command and control system, was formally initiated with the award of contracts by SAMSO for system requirements analysis.

1978

- 6 October The third NAVSTAR satellite was launched from Vandenberg AFB on board an Atlas booster. Both the booster and the satellite itself functioned normally, and the satellite began operating at its final station on 31 October.
- 10 October Responsibility for the Warning Information Correlation program was transferred from SAMSO to the Electronic Systems Division.
- 11 October Space Shuttle Orbiter 99, the Structural Test Article, began undergoing structural bending tests.
- 13 October An Atlas booster launched a TIROS-N prototype weather satellite designed and funded by NASA for the National Oceanic and Atmospheric Administration. The launch took place at Vandenberg AFB and was successful.
- 19 October A test was conducted on the Kevlar case used to hold propellant in the space shuttle's large Inertial Upper Stage motor. The case burst at a pressure lower than the predicted pressure, and the test was considered a failure.
- 1-2 November SAMSO held a successful critical design review of Titan III 34D structures with Martin Marietta.
- 3-8 November SAMSO negotiated the second and third year production contract for the Mark 12A reentry system with General Electric.
- 6 November The Director of the Space Test Program briefed HQ AFSC on a budgetary deficit that the program was facing. The deficit amounted to \$8.8 million in FY 1979 and was caused by cost overruns affecting four different Space Test Program spacecraft.

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- 10 November Design work was completed on Titan III 34D launch facilities at Cape Canaveral. The design work for east coast facilities was done by the firm of H.J. Ross in Miami, Florida.
- 11 November The final checkout of Programmable Aerospace Control Equipment (PACE) installed at Cape Canaveral took place. PACE was developed by Martin Marietta to replace obsolete Titan III ground control computer equipment.
- 14 November The Ralph M. Parsons Company completed construction of the Missile X Buried Trench Construction and Test Project at the Luke Bombing and Gunnery Range in Arizona.
- 17 November SAMSO formed a source selection board in preparation for the award of a contract for the System Definition Phase of the Missile X reentry system.
- 18 November A Delta 2914 booster was launched from Cape Canaveral carrying the NATO IIIC satellite. The launch was successful, and the satellite performed satisfactorily in orbit.
- 21 November Air Force Systems Acquisition Review Council II for Missile X was held. As a result, the Air Force recommended development of a 92-inch-diameter Missile X moved among multiple vertical shelters with the earliest possible initial operational capability for such a completed system.
- 27 November-8 December An inspection team from the office of the Inspector General of AFSC visited SAMSO's Deputy for ICBMs, the Boeing AFPRO in Seattle, and the SATAFs at Wings I and IV. The purpose of the visit was to review plans which had been made to avoid at Wing IV the construction quality deficiencies experienced at Wing I. The inspection team concluded that the precautions taken were adequate.
- 30 November Assembly of the last Minuteman III missile to be produced was completed by personnel of the Boeing Aerospace

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Company at Air Force Plant 77, Hill AFB, Utah.

December

SAMSO cancelled plans for flight-testing the Transpiration Cooled Nosetip (TCNT). The TCNT, which was an actively cooled reentry vehicle nosetip, had been under development as part of the Advanced Ballistic Reentry Vehicle program. Flight-test of the TCNT was cancelled due to funding and design problems that had plagued the development effort.

December

SAMSO formed a Traveling Wave Tube Amplifier (TWTA) Action Group within its Deputy for Space Communications. The Group was to recommend ways of improving the reliability of the TWTAs used in military communication satellites.

December

NASA decided to augment the thrust of the space shuttle orbiter by attaching a single strap-on solid rocket motor to each of the orbiter's two solid rocket boosters.

1 December

HQ USAF issued a Program Management Directive for the STS program which provided for a four-year launch facilities construction program at Vandenberg AFB, with an initial launch capability of six per year in 1983 and growth to 20 per year by mid-1985. The PMD constituted the final solution to the budgetary problems that SAMSO had briefed to HQ AFSC and HQ USAF in January.

5 December

The Defense Systems Acquisition Review Council II (DSARC II) for Missile X was held. The DSARC asked the Air Force to conduct an intensive study of an air-mobile basing system as an alternative to the shelter system before making a final decision.

5-6 December

SAMSO held a successful critical design review of Titan III 34D avionics with Martin Marietta.

6-7 December

SAMSO held a successful critical design review of Titan III 34D ground equipment with Martin Marietta.

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- 8 December Standard Test Missile 17W, a Minuteman III carrying three Mark 12A reentry vehicles, was successfully launched from Vandenberg AFB. The test provided data on the performance of experimental nosetip and heatshield materials.
- 11 December The fourth NAVSTAR satellite was successfully launched from Vandenberg AFB on board an Atlas booster. The satellite was due to begin operating at its final station in early January 1979.
- 12 December SAMSO released a draft RFP for a more powerful stage vehicle to be used on the Atlas F in launching GPS satellites.
- 13 December A Titan IIIC was launched from Cape Canaveral carrying DSCS II satellites F-11 and F-12. The vehicle placed the satellites in the proper orbit, and the satellites performed normally once there. They were expected to go into operation in mid-January 1979, at which point the DSCS II system would have a full, four-satellite constellation at its disposal for the first time in its history.
- 21 December SAMSO awarded contracts to three companies to prepare preliminary designs of the Global Positioning System Phase II/III control segment. The companies were General Dynamics/Electronics Division, IBM/Federal System Division, and Martin Marietta/Denver Division.
- 27 December Testing of the main engine of the space shuttle orbiters was suspended when the engine failed, apparently because of a malfunctioning of its main oxidizer valve. This and previous test failures caused the scheduling of the first orbiter test flight to slip from March 1979 to the end of CY 1979 or the beginning of CY 1980.
- 27 December SAMSO began a study of air-mobile basing for Missile X as a result of direction from DSARC II on Missile X. SAMSO began the study by meeting with representatives of the Aeronautical Systems Division and contractors selected to conduct the study.

1978

31 December

The final transfer of engineering responsibility for the Minuteman III system from SAMSO to the Air Force Logistics Command took place.

31 December

The development phase of the Mark 12A program was completed except for the contractor's reports. The development contract with General Electric had been valued at approximately \$70 million but experienced a cost overrun of approximately \$10 million.

1979

January-June

The ABRES program office participated in a Mark 500 Penetration Aid Concept Selection Study involving the Aerospace Corporation, MIT Lincoln Laboratory, and other contractors. Participants in the study selected a penetration aid concept for the Navy's Trident C4/Mark 500 system.

1 January-15 April

A transmitter and a receiver for a laser communications system were ground tested at the White Sands Missile Range in New Mexico. This was the second of three rounds of ground testing that was to take place. The ground testing was to pave the way for flight-testing of the equipment, and ultimately for development of a space-based laser communications system.

2 January

Stanford Telecommunications, Incorporated, was awarded a contract to study the utility of a Satellite Control and Data Relay System. The system would use a space-based network to track and control satellites and relay data to ground stations in the continental U.S.

10-12 January

DSCS II satellites 9441 and 9442 completed testing and were turned over to the Defense Communications Agency. This brought the DSCS II space segment up to full strength--four operational satellites--for the first time in its history.

17 January

A contract to define a Stored Telemetry Processing System for the DMSP program was awarded to Systems and Applied Sciences, a minority small business.

18 January

The Defense Systems Acquisition Review Council recommended that the Air Force be allowed to initiate the validation phase of the Strategic Satellite System (SSS) program. The Deputy Secretary of Defense implemented this recommendation in a memorandum dated 20 April. However, Congress failed to appropriate money for the system, and the validation phase could not be started.

1979

19 January

The Army Corps of Engineers awarded a \$3.8 million contract to Morrison-Knudsen, Inc., for site preparation at the space shuttle launch facility, Vandenberg AFB. Site preparation was the first phase of a three-phase construction effort at the launch facility. Ground-breaking took place on 24 January.

20 January

STREP-1, an ABRES flight test conducted in support of the Army's System Technology Reentry Experiments Program, was launched on a Minuteman I booster from Vandenberg AFB to Kwajalein missile range. The primary mission was successful, but a secondary payload, the advanced Star decoy sponsored by ABRES, deployed improperly because of improper loading, and data on its performance could not be collected.

27 January

A probe was launched from the White Sands Missile Range to take background measurements needed for development of a space-based space surveillance system. The probe's radiometer failed to deploy, and its parachute malfunctioned as it was returning to earth. As a result, no data was gathered, and the payload was severely damaged.

30 January

Flight P78-2 was successfully launched by SAMSO's Space Test Program. The mission was designated SCATHA (Spacecraft Charging at High Altitudes) and gathered data on the build-up of electrical charges on satellites operating at geosynchronous altitude. It was sponsored jointly by NASA and the Air Force.

February

Two million dollars were released to the Air Force for studies of a tactical version of the Longbow medium to intermediate range ballistic missile. Work on the strategic version of the missile had been terminated because it seemed incompatible with SALT.

1979

- February A successful Critical Design Review of the Space Sextant was held. The Space Sextant was under contract to Martin Marietta. It would permit satellites to determine their position, velocity, and attitude without help from the ground.
- 6 February The integrated program of improvements to Minuteman ground systems was completed at Wing I and the sites were returned to the custody of SAC.
- 13-28 February A Critical Design Review was held for the Inertial Upper Stage. SAMSO felt that the design presented at this Review was not really complete, and it directed the contractor, Boeing, to do further work in the areas of software, rocket motors, and interface with the space shuttle and the Satellite Control Facility. Boeing was to present the results of its efforts at a follow-on design review to be held later in the year.
- 14 February HQ USAF stretched out the schedule for construction of space shuttle launch facilities at Vandenberg AFB, and it changed the Initial Operational Capability date for those facilities from mid-1983 to March 1984. The extra time was needed because NASA was adding strap-on solid rocket motors to the shuttle to augment its performance, and the launch facilities had to be modified to accommodate those motors.
- 15 February A Minuteman III production verification missile (PVM-16) was launched from Vandenberg AFB to the Kwajalein missile range. It successfully deployed three Mark 12A reentry vehicles.
- 24 February Atlas booster 27F successfully launched Space Test Program Flight P78-1 from Space Launch Complex 3W, Vandenberg AFB, California. The primary payload on the spacecraft was a gamma spectrometer sponsored by the Defense Advanced Research Projects Agency (DARPA).

1979

- March Spacetac, Inc., one of Rockwell's major subcontractors for the Teal Ruby program, went bankrupt. The bankruptcy contributed to a further delay in the projected launch date.
- March A C-141 aircraft completed data collection flights using the Pulse Doppler MAP Match (PDMM) system, a candidate position-fixing system for the AMaRV.
- 6 March A change order was added to the IUS contract, directing the contractor to take various steps to improve the performance of the vehicle. The most important of these steps involved the addition of an extendible exit cone to the small motor of the IUS.
- 13 March Program Management Directive 0-02047(30) advised of an OSD-approved budget for the Minuteman airborne launch control system (ALCS) which was far below SAMSO's estimated minimum funding requirements.
- 16 March The large rocket motor for the Inertial Upper Stage was test fired at the Arnold Engineering Development Center. The firing lasted 145 seconds and generated more than 50,000 pounds of thrust. This was the first development test firing of the large motor, and it was entirely successful.
- 20 March A joint military/civilian board completed a draft study recommending that the DOD and the Department of Commerce utilize common weather satellites. However, DOD and Commerce were unable to agree on who should manage acquisition of these common satellites, and by the end of FY 1979, it appeared that the two agencies might go on using separate satellites.
- 21 March SAMSO awarded the Harris Corporation a \$10.3 million contract to develop a Satellite Data Handling System for the DMSF program. The system would be installed at the Air Force Global Weather Central at Offutt AFB, Nebraska, and would allow forecasters to analyze and distribute weather data obtained from DMSF satellites.

1979

- 23 March The final version of the environmental impact statement on Missile X air-mobile basing was filed with the Environmental Protection Agency.
- 23-24 March NASA brought space shuttle orbiter 102 from Edwards AFB, California, to Cape Canaveral, Florida. Orbiter 102 be the first orbiter to go into space, and Cape Canaveral would be the launch site.
- 27 March SAMSO awarded IBM a \$4.9 million contract to provide the Simplified Processing Station with the capability to receive health and status data as well as mission data from the DSP satellites.
- 27 March A missile design review (MDR) for all four stages of Missile X was held at the Martin Marietta Corporation's facilities in Denver, Colorado. Available technologies and transition to full-scale engineering development were assessed.
- 29 March DOD announced that Los Angeles AFS would remain open and continue to serve as SAMSO headquarters.
- 29 March DOD announced that the Army would leave Fort MacArthur by FY 1982.
- 31 March Missile X DSARC IIB met to consider studies of alternative Missile X configurations and basing modes, particularly the air-mobile option developed by SAMSO at the direction of DSARC II in December 1978. The DSARC IIB rejected the air-mobile option.
- April The SAMSO Commander asked for a review by AFSC of the financial and managerial relationship between DARPA and Air Force agencies. In May, the Commander of AFSC authorized such a review at the level of AFSC.
- April Although Congress had eliminated most of the funds for the Mosaic Sensor Development Program, HQ USAF directed that the development effort be continued in such a way as to skip development of an experimental sensor and go directly to fabrication and

1979

launch of a prototype sensor with some operational utility.

April

Avco successfully completed a physical configuration audit (PCA) for production of Mark 12A carbon-carbon nosetips, and delivery of the nosetips proceeded on schedule.

April

SAMSO released a request for proposal (RFP) to General Electric, asking for a bid on production of 120 additional Mark 12A reentry systems.

19 April

A Minuteman III production verification missile (PVM-17) was launched from Vandenberg AFB to the Kwajalein missile range. It successfully deployed two Mark 12A reentry vehicles.

24 April

The Program Management Responsibility Transfer Working Group (PMRTWG) extended the completion dates of seven residual tasks related to the Minuteman Wing IV Update Program.

25 April

SAMSO awarded \$200,000 contracts to five companies--RCA, GE, Rockwell International, Lockheed, and Hughes--to do conceptual studies on a DMSP Block 6 satellite. The studies were finished in September, but by that time there were indications that the White House might disapprove the development of Block Six and order development of a shuttle-compatible Block 5D instead.

26 April

SAMSO terminated the SIRE (Satellite Infrared Experiment) contract with Lockheed because of large cost overruns. The SIRE payload was to have been launched on flight P80-2 and was to have measured the long wave infrared signatures of space objects against the stellar background. SAMSO began to develop a program to fly the SIRE sensor on space shuttle sortie missions around the mid-1980s.

May

The Secretary of the Air Force recommended that the DOD develop and deploy a tactical medium to intermediate range ballistic missile.

1979

- May SAMS0's Deputy for ICBMs created a Multiple Protective Structure Deployment Area Selection Working group to coordinate site selection and land acquisition for deployment of Missile X.
- May-June NATO's Infrastructure Committee held a series of meetings to decide who would manage acquisition of the NATO IV spacecraft. The committee passed up SAMS0 and opted for the United Kingdom's Royal Aircraft Establishment.
- 1 May The Deputy for Technology was created through the merger of the Deputy for Reentry Systems and the Deputy for Advanced Space Programs.
- 4 May The second FLTSATCOM satellite was successfully launched from Cape Canaveral, Florida, on board an Atlas/Centaur booster.
- 7 May DSCS II satellite 9437 lost its #2 narrow coverage high level travelling wave tube amplifier (TWTA). Since the #1 narrow coverage high level TWTA had already failed, the satellite became unable to provide narrow coverage communications support and had to be placed in on-orbit storage.
- 22 May The Electronic Systems Division finished installing AFSATCOM terminals in fifteen B-52 bombers, four EC-135 command post aircraft, and one ground command post. This allowed the terminal segment of the AFSATCOM system--and by extension, the system as a whole--to attain Initial Operational Capability.
- 29 May The second successful flight was made in the Balloon Altitude Mosaic Measurements Program. The balloon was launched from Holloman AFB, New Mexico, carrying two types of mosaic sensors which gathered data before the balloon landed after eleven hours in the New Mexico desert.
- 31 May Avco received a contract for an Instrumented Test Vehicle (ITV) that would be used in testing anti-satellite weapons. The basic contract, valued at \$15.162 million, covered the development of the vehicle; a \$22.9 million option covered production.

1979

- June President Jimmy Carter announced his decision to authorize full-scale engineering development (FSED) of the 92-inch Missile X. However, he deferred a decision on the basing mode until further studies could be performed.
- June A procurement contract with Goodyear Aerospace Corporation for the Range Only Correlation System (ROCS), a candidate position-fixing system for the AMaRV, was initiated.
- June HQ USAF directed the configuration of the installation of Minuteman C³ integration equipment.
- June-September A DMSP shipboard terminal was installed on the aircraft carrier USS Midway.
- 1 June SAMSO Det 2 was established at NASA's Johnson Space Center to train AF officers to become space shuttle mission controllers.
- 5 June The Defense Systems Acquisition Review Council recommended that the Air Force be allowed to undertake full-scale development of the Global Positioning System. The Secretary of Defense implemented this recommendation in a memorandum dated 24 August. The same memorandum authorized the Air Force to integrate IONDS packages into the GPS satellites.
- 6 June A Thor LV-2F booster successfully launched the fourth DMSP Block 5D-1 satellite into low earth orbit. The launch site was Space Launch Complex 10, Vandenberg AFB, California.
- 14 June SAMSO awarded the McDonnell Douglas Astronautics Company a contract for two SGS-II upper stage vehicles, with an option for five more. The vehicles would be used with Atlas boosters to launch Global Positioning System satellites.
- 24 June Atlas booster 25F successfully launched NASA's NOAA-A satellite from Vandenberg AFB, California.

1979

- 25 June The small rocket motor for the Inertial Upper Stage was test fired at the Arnold Engineering Development Center. This was the first development test firing of the small motor, and it was entirely successful.
- July The Minuteman Airborne Launch Control System (ALCS) Phase III underwent a successful system design review (SDR) at the Boeing facility. The system's maintenance support equipment also passed an SDR in September.
- July A successful technical acceptance demonstration (TAD) of the Mark 12A reentry system was held at Minot AFB, North Dakota with a newly installed Mark 12A trainer.
- July Installation of Mark IIA terminals for the DMSP Program was completed. The Mark IIA terminals had been created by reconfiguring and improving the Mark I and II transportable terminals and installing them in permanent locations.
- 3 July SAMSO awarded the Hughes Aircraft Company a \$21.3 million contract to develop a microwave imager for the DMSP Block 5D-2 satellite. The imager would measure the intensity of precipitation over land and water, the temperature of the sea surface, the speed of the wind over the ocean, the thickness and extent of sea ice, and the moisture content of the soil.
- 5 July The Reentry Systems Program Office (ABRES) was transferred to the Deputy for ICBMs at Norton AFB, California.
- 5 July The final physical configuration audit of the Advanced Maneuvering Reentry Vehicle (AMaRV) flight test vehicle was completed preparatory to a flight test scheduled for November 1979.
- 6 July The Large Ballistic Recovery Vehicle (LBRV) was launched from Vandenberg AFB to Kwajalein lagoon on a Minuteman I booster. The purpose of the experiment was to recover the external shell of a Mark 12A reentry vehicle intact after reentry in order to assess the performance of staple-fiber heatshields. The LBRV was successfully

1979

recovered intact. A secondary payload, the advanced Star decoy sponsored by ABRES, was successfully deployed and tracked after a previous failure on 20 January.

12 July

A special working group with HQ USAF finished a concept of operations for the Consolidated Space Operations Center (CSOC). CSOC would serve both the space shuttle program and the Air Force Satellite Control Facility, functioning as a Shuttle Operations and Planning Center and a Satellite Operations Center.

17 July

The Data Multiplexing System was declared operational. The system had been installed at various DMSP ground sites, and it allowed payload data and telemetry to be transmitted from one site to another over the same satellite link. It also opened up a communication link between the Kaena Point Tracking Station, in Hawaii, and the Air Force Global Weather Central in Nebraska, thereby allowing the Global Weather Central to receive stored weather data from Hawaii as well as from Washington and Maine.

20 July

Magnavox and Rockwell International were awarded contracts for prototype operational models of Global Positioning System user equipment. The contracts were valued at \$63.7 million and \$68.1 million respectively and were to run for 50 months.

25 July

An Ad Hoc AFSC Task Force ("Project Action" Team) was established to study the shortage of R&D officers.

31 July

SAMSO's NATO III Program Office was abolished, bringing the NATO III program to an end. Three satellites had been built and launched during the program, which had cost a total of \$79.1 million.

1979

- August
At a Missile X horizontal shelter kickoff meeting, SAMSO's ICBM program office directed associate contractors to reorient their activities from vertical to horizontal shelters.
- August
SAMSO completed a successful system design review (SDR) of the WS-133A-M Minuteman C³ system and the common hardware developed by Boeing.
- 16 August
Technology Development Corporation, a minority small business, was awarded a contract to upgrade the Ground Communications Network for the DSP program. The basic contract was valued at \$5.251 million, and it carried options valued at \$8.555 million. This was the largest contract ever awarded under the federal government's Disadvantaged Business Program.
- 20-24 August
Members of an Ad Hoc AFSC Task Force ("Project Action" Team) visited SAMSO to study the shortage of R&D officers.
- 21-22 August
SAMSO's Deputy for Space Defense held a survivability workshop in Santa Barbara, California. At the workshop, various SAMSO program offices presented plans for making their space systems more survivable.
- 25 August
Chemical Systems Division of United Technologies Corporation test fired a 5½ segment solid rocket motor at its Coyote Test Facility at San Jose, California. This was the first test of the motor, and it was entirely successful. The 5½ segment motor was to be used with the new Titan III 34D launch vehicle.
- 30 August
A Minuteman III standard test missile (STM 18-W) was launched from Vandenberg AFB to the Kwajalein missile range. This was the last of ten Minuteman III test flights designed to verify Mark 12A design objectives and the first operational test and evaluation demonstration for the operational Mark 12A system. The test was partially successful.

1979

- September Under Secretary of Defense William J. Perry decided that Teal Ruby would be built and flown on the space shuttle in November 1982. His decision was made in response to earlier suggestions within DOD that the program be cancelled because of cost overruns.
- September The first Dormant Inertial Navigation System (DINS) flight unit, built by the Avionics Division of Honeywell, Inc., was delivered to McDonnell Douglas Astronautics Company for installation in the second scheduled AMaRV flight test vehicle. DINS was a laser-gyro-based strapdown inertial navigation system intended for use on maneuvering reentry vehicles.
- September AFSC relieved local commands from further participation in the Civilian Average Grade Control Program.
- September A Civil Engineering office environmental impact study which identified no adverse environmental impact from housing construction at Fort MacArthur was completed.
- 7 September President Jimmy Carter authorized full-scale engineering development (FSED) of a basing mode for Missile X. The basing mode would involve multiple horizontal protective structures placed around the periphery of a circular road.
- 10 September The transfer of Fort MacArthur from Army to Air Force jurisdiction was approved after the completion of Title 10 hearings.
- 13 September SAMS0 exercised contract options to enter full-scale engineering development of all four stages of Missile X, and system development contracts were allowed to terminate on 30 September.
- 16 September DMSP Satellite F-1 was declared non-operational after the second of its two computers went off-line due to a failure in the power subsystem.

1979

21 September

SAMSO signed a \$24.1 million letter contract for two DMSP spacecraft (F-8 and F-9) and long lead parts for a third (F-10). The contract incorporated the toughest negative incentives ever inserted into a spacecraft contract up to that time. It was structured in that manner in obedience to new procurement guidelines issued by the AFSC commander, General Slay.

25 September

The first of two secondary rocket flight tests designated HAVE LENT IV successfully demonstrated the use of aerosol masking dispensers as a penetration aids. The vehicle was a Sergeant-Hydac rocket launched from Barking Sands, Hawaii. Data collection was limited because of erratic behavior of the rocket. The mission was sponsored by ABRES.

26 September

A launch of the Multispectral Measurements Program (MSMP) at White Sands Missile Range in Nex Mexico was aborted 30 seconds before lift-off when a sensor falsely reported that the booster's rocket nozzle was unable to vector. The launch was postponed until the booster could be recertified.

27 September

Hughes started work on the development of gallium arsenide solar cells to be used in high efficiency solar panels for satellite power subsystems.

30 September

All work on the Minuteman Airborne Launch Control System (ALCS) Phase III halted while SAMSO waited for further direction and funding.

APPENDIX 1

LINEAGE

WESTERN DEVELOPMENT DIVISION (WDD) AND AIR FORCE BALLISTIC MISSILE DIVISION (AFBMD)

The Western Development Division was constituted, activated, and assigned to HQ ARDC and organized at Los Angeles (Inglewood), California, effective 1 July 1954.

ARDC GO 42
15 Jul 1954

This General Order confirmed Lt Gen Thomas S. Power's verbal orders of 1 July 1954. Gen Power was Commander of ARDC.

The Western Development Division was redesignated the Air Force Ballistic Missile Division (AFBMD), HQ ARDC, without change of station, effective 1 June 1957.

ARDC GO 19
21 May 1957

Det 2, HQ ARDC (Air Force Ballistic Missile Division) designated and organized at Los Angeles (Inglewood), California, effective 17 February 1958.

ARDC GO 8
4 Feb 1958

The Air Force Ballistic Missile Division was discontinued as Detachment 2, HQ ARDC and HQ AFBMD was constituted and activated at Los Angeles effective 16 November 1959.

ARDC GO 231
13 Nov 1959

Personnel and equipment reassigned to HQ AFBMD. This was part of an overall reorganization and decentralization of ARDC.

HQ Air Force Ballistic Missile Division was discontinued effective 1 April 1961.

AFSC SO G-2
1 Apr 1961
AFSC SO G-3
1 Apr 1961

Personnel and equipment reassigned to the Space Systems Division and the Ballistic Systems Division.

BALLISTIC MISSILES CENTER

The Special Aircraft Project Office (SAPO) was constituted, activated, and assigned to HQ Air Materiel Command and organized at Los Angeles (Inglewood), California, effective 15 August 1954.	AFLC Study 302, pp 130-31	This office was to perform all procurement and contracting functions for the Western Development Division.
The Special Aircraft Project Office was redesignated the Ballistic Missiles Office (BMD), without change of station, effective 15 March 1956.	AMC Daily Staff Digest 6 Mar 1956; AFLC Study 302 p. 142	The mission of the office remained unchanged.
The Ballistic Missiles Office was redesignated the Ballistic Missiles Center (BMC) as part of an overall Air Materiel Command restructuring effective 12 September 1958 without a change of station.	AMC GO 97 15 Sep 1958	The mission of the office remained unchanged.
The Ballistic Missiles Center moved from the Arbor Vitae Complex in Los Angeles to Norton AFB, California, beginning in November 1960.	AMC MO 60-7 1 Nov 1960	
The Ballistic Missiles Center of the Air Materiel Command was reassigned to the Air Force Systems Command and immediately discontinued effective 1 April 1961.	AFSC SO G-2 1 Apr 1961 AFSC SO G-3 1 Apr 1961	Personnel and equipment were reassigned to HQ, Office of the Deputy Commander AFSC for Aerospace Systems for concurrent reassignment to HQ Ballistic Systems Division.

DEPUTY COMMANDER AFSC FOR AEROSPACE SYSTEMS (DCAS)

Deputy Commander AFSC for Aerospace Systems, constituted, activated, and assigned to AFSC, organized at Los Angeles effective 1 April 1961.

AFSC SO G-3
1 Apr 1961

Personnel reassigned from Air Force Ballistic Missile Division to DCAS for concurrent reassignment, as appropriate, to HQ Ballistic Systems Division and HQ Space Systems Division.

Deputy Commander AFSC for Aerospace Systems discontinued, effective 10 October 1962.

AFSC SO G-166
27 Sep 1962

BSD and SSD reassigned from DCAS to AFSC and continued functioning in their specific capacity until their discontinuance, effective 1 July 1967.

SPACE SYSTEMS DIVISION (SSD)

Space Systems Division constituted, activated and assigned to Office of the Deputy Commander AFSC for Aerospace Systems, organized at Los Angeles, effective 1 April 1961.

AFSC SO G-3
1 Apr 1961

Comprised of elements of the former Air Force Ballistic Missile Division and components of the former Air Materiel Command.

Space Systems Division reassigned from Deputy Commander AFSC for Aerospace Systems to AFSC, effective 10 October 1962.

AFSC SO G-166
27 Sep 1962

Discontinuance of DCAS.

Space Systems Division discontinued, effective 1 July 1967.

AFSC SO G-85
26 May 1967

Personnel reassigned to Space and Missile Systems Organization (SAMSO).

BALLISTIC SYSTEMS DIVISION (BSD)

Ballistic Systems Division constituted, activated and assigned to Office of the Deputy Commander AFSC for Aerospace Systems (DCAS), organized at Los Angeles, effective 1 April 1961.	AFSC SO G-3 1 Apr 1961	Comprised of elements of the former Air Force Ballistic Missile Division and components of the former Air Materiel Command.
Ballistic Systems Division moved to Norton AFB, effective 10 October 1962.*	AFSC MO 1 30 Apr 1962	Move commencing on or about 1 May, with completion on or about 30 Sep 1962.
Ballistic Systems Division reassigned from DCAS to AFSC, effective 10 October 1962.	AFSC SO G-166 27 Sep 1962	Discontinuance of DCAS.
Ballistic Systems Division discontinued, effective 1 July 1967.	AFSC SO G-85 26 May 1967	Personnel reassigned to Space and Missile Systems Organization (SAMSO).

* No order was published as to the actual effective date of the movement. The effective date was in conjunction with the reassignment of BSD from DCAS to AFSC.

SPACE AND MISSILE SYSTEMS ORGANIZATION (SAMSO)

Western Development Division designated and organized at Inglewood, California, effective 1 July 1954.	ARDC GO-42 15 Jul 1954	
Western Development Division redesignated Air Force Ballistic Missile Division (AFBMD) effective 1 June 1957.	ARDC GO-19 21 May 1957	
Det 2, HQ ARDC (Air Force Ballistic Missile Division) designated and organized at Inglewood, California, effective 17 February 1958.	ARDC GO-8 4 Feb 1958	No order to discontinue AFBMD.
Det 2, HQ ARDC (Air Force Ballistic Missile Division) discontinued, effective 16 November 1959.	ARDC GO-231 13 Nov 1959	Personnel and equipment reassigned to AFBMD.
Air Force Ballistic Missile Division constituted and activated at Inglewood, California, and assigned to ARDC, effective 16 November 1959.	ARDC GO-231 13 Nov 1959	
Air Force Ballistic Missile Division discontinued, effective 1 April 1961.	AFSC SO G-3 1 Apr 1961	Personnel reassigned to Deputy Commander AFSC for Aerospace Systems for concurrent reassignment, as appropriate, to HQ Ballistic Systems Division and HQ Space Systems Division. (BSD and SSD were assigned to DCAS until its discontinuance on 10 October 1962 (see DCAS chronology) and were then assigned to AFSC until 1 July 1967.)

Space and Missile Systems
Organization (SAMSO)
constituted, activated,
and organized at Los
Angeles, and assigned to
AFSC, effective 1 July
1967.

AFSC SO G-85 Assumed the functions of
26 May 1967 BSD and SSD.

SPACE AND MISSILE TEST CENTER (SAMTEC)

Pacific Missile Range established and assigned to the Navy, effective 16 June 1958.

Hist of AFWTR
May-Dec 1964, I,
17

HQ Air Force Western Test Range constituted and activated, organized at Vandenberg AFB and assigned to HQ National Range Division, effective 15 May 1964.

AFSC SO G-43
5 May 1964

HQ Air Force Western Test Range inactivated at Vandenberg AFB, effective 1 April 1970.

AFSC SO G-34
30 Mar 1970
Amended by
AFSC SO G-49
1 May 1970

The Air Force Western Test Range, itself, continued to function as a test range.

Space and Missile Test Center constituted and activated, organized at Vandenberg AFB, assigned to AFSC and further reassigned to the Space and Missile Systems Organization (SAMSO), effective 1 April 1970.

AFSC SO G-34
30 Mar 1970

Personnel reassigned from HQ AFWTR in accordance with instructions furnished by HQ AFSC and HQ SAMSO.

6594TH TEST WING
and
AIR FORCE SATELLITE CONTROL FACILITY (AFSCF)

Air Force Ballistic Missile Division (AFBMD), ARDC, activated a Field Office at the Lockheed Missile and Space Division facility, Palo Alto, California, effective 15 August 1958.

AFMB Ops Ord 2-58
1 Aug 1958

HQ 6594th Test Wing was designated and organized at the Lockheed facility, Palo Alto, effective 6 April 1959, with assignment to ARDC and administrative/operational control to be exercised by Det 2, HQ ARDC.

ARDC GO 38
3 Apr 1959

AFBMD disestablished its Field Office at Palo Alto and transferred all Field Office personnel to HQ 6594th Test Wing, effective 1 June 1959.

Ltr, AFMB (WDSPP) to All Personnel, AFMB and Comdr, 6594th TW, subj: "Organizational Announcement," 22 Jun 1959.

ARDC reassigned the 6594th Test Wing from HQ ARDC to HQ AFBMD, effective 15 November 1959.

ARDC GO 231
13 Nov 1959

ARDC redesignated HQ 6594th Test Wing as HQ 6594th Test Wing (Satellite) on 15 January 1960, without change in station or assignment.

ARDC SO 2
4 Jan 1960

On 1 March 1960, HQ 6594th Test Wing (Satellite) moved from Palo Alto to the Lockheed Missile and Space Division Facility, Sunnyvale, California.

Hist of 6594th Test Wg (Satellite), 1 Jul-31 Dec 1960, p 1

6594th Test Wing (Satellite) was reassigned from AFBMD to Space Systems Division of AFSC (formerly ARDC), effective 1 April 1961.

AFSC SO G-3
1 Apr 1961

AFSC redesignated the 6594th Test Wing (Satellite) as the 6594th Aerospace Test Wing, effective 1 November 1961.

AFSC SO G-174
25 Oct 1961

Effective 1 July 1965, the 6594th Aerospace Test Wing was discontinued; the AFSCF was designated and organized with HQ at Los Angeles AFS, California, and was assigned to Space Systems Division, AFSC; Det 1, AFSCF, and the 6594th ABSq were designated and organized at Sunnyvale.

AFSC SO G-52
21 Jun 1965

AFSCF was reassigned from Space Systems Division to the Space and Missile Systems Organization (SAMSO) which was formed by merging Space Systems Division and Ballistics Systems Division, effective 1 July 1967.

APPENDIX 2

COMMANDERS

SPACE AND MISSILE SYSTEMS ORGANIZATION (SAMSO) COMMANDERS

Western Development Division

Maj Gen Bernard A. Schriever 2 Aug 1954-31 May 1957

Air Force Ballistic Missile Division

Maj Gen Bernard A. Schriever 1 Jun 1957-24 Apr 1959

Maj Gen Osmond J. Ritland 25 Apr 1959-31 Mar 1961

Deputy Commander for Aerospace Systems

Lt Gen Howell M. Estes, Jr. 1 Apr 1961-10 Oct 1962

Space Systems Division

Maj Gen Osmond J. Ritland 1 Apr 1961-13 May 1962

Lt Gen Howell M. Estes, Jr. 14 May 1962- 2 Oct 1962

Maj Gen Ben I. Funk 3 Oct 1962-31 Aug 1966

Brig Gen Paul T. Cooper 1 Sep 1966-30 Jun 1967

Ballistic Systems Division

Maj Gen Thomas P. Gerrity 1 Apr 1961-30 Jun 1962

Maj Gen W. Austin Davis 1 Jul 1962-18 Jul 1964

Maj Gen Harry J. Sands, Jr.* 19 Jul 1964-19 Jul 1966

Maj Gen John L. McCoy 20 Jul 1966-30 Jun 1967

Space and Missile Systems Organization

Lt Gen John W. O'Neill 1 Jul 1967-31 Aug 1969

Lt Gen Samuel C. Phillips 1 Sep 1969-24 Aug 1972

Lt Gen Kenneth W. Schultz 25 Aug 1972-28 Aug 1975

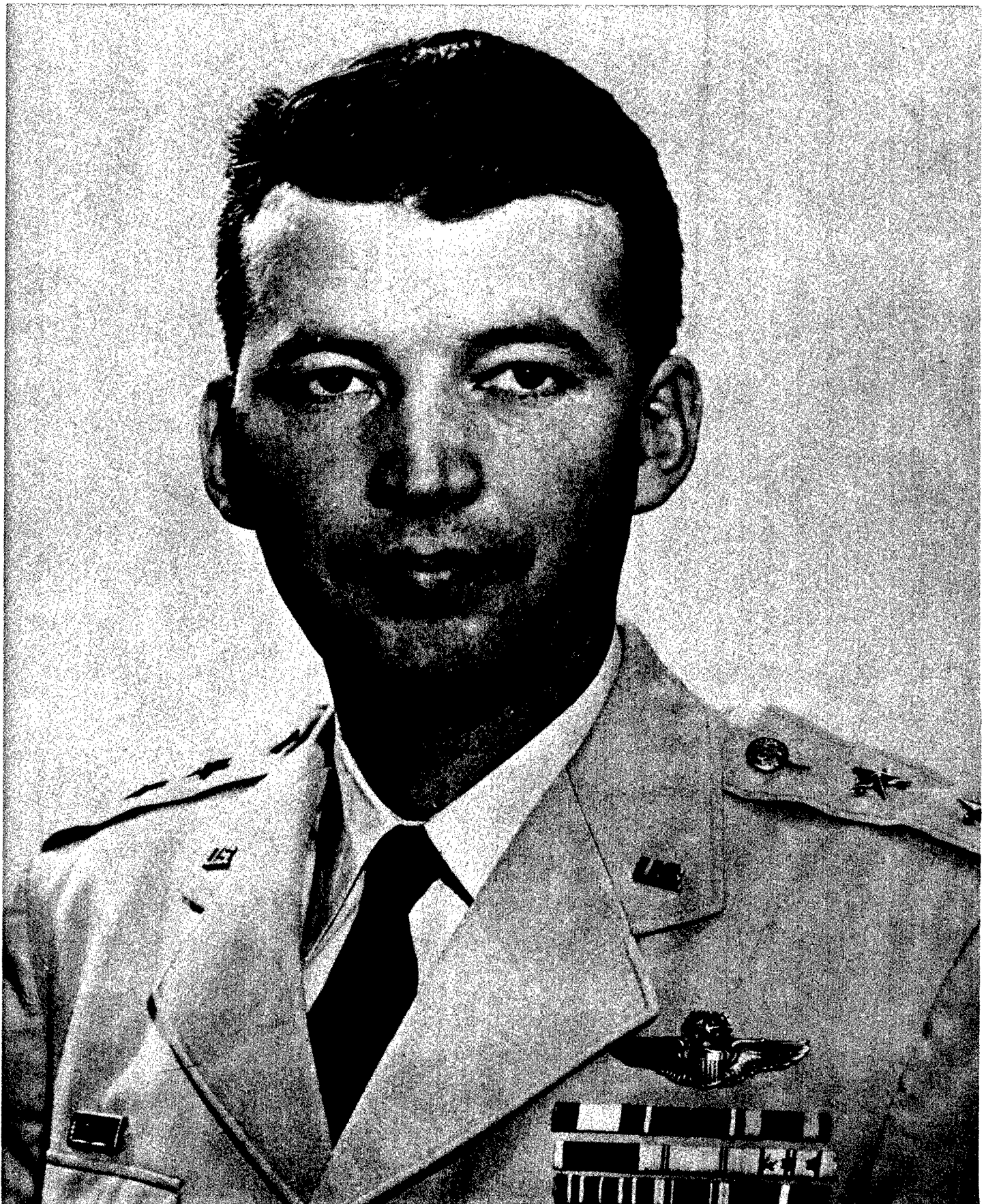
Lt Gen Thomas W. Morgan 29 Aug 1975-28 Apr 1978

*Brig Gen John L. McCoy, Vice Commander, served as Acting Commander between 15 October 1965 and 14 May 1966 while General Sands served as Senior Member of the United Nations Truce Supervisory Commission.

Space and Missile Systems Organization (continued)

Lt Gen Richard C. Henry

28 Apr 1978- 1 Oct 1979



Maj General Bernard A. Schriever
Commander, Western Development Division, 2 August 1954-31 May 1957
Commander, Air Force Ballistic Missile Division, 1 June 1957-24 April 1959



Maj General Osmond J. Ritland
Commander, Air Force Ballistic Missile Division, 25 April 1959-31 March 1961
Commander, Space Systems Division, 1 April 1961-13 May 1962



Lt General Howell M. Estes, Jr.
Deputy Commander for Aerospace Systems, 1 April 1961-10 October 1962
Commander, Space Systems Division, 14 May 1962-2 October 1962



Maj General Ben I. Funk
Commander, Space Systems Division, 3 October 1962-31 August 1966



Brig General Paul T. Cooper
Commander, Space Systems Division, 1 September 1966-30 June 1967



Maj General Thomas P. Gerrity
Commander, Ballistic Systems Division, 1 April 1961-30 June 1962
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Maj General W. Austin Davis
Commander, Ballistic Systems Division, 1 July 1962-18 July 1964



Maj General Harry J. Sands, Jr.
Commander, Ballistic Systems Division, 19 July 1964-19 July 1966



Maj General John L. McCoy
Commander, Ballistic Systems Division, 20 July 1966-30 June 1967



Lt General John W. O'Neill
Commander, Space and Missile Systems Organization
1 July 1967-31 August 1969



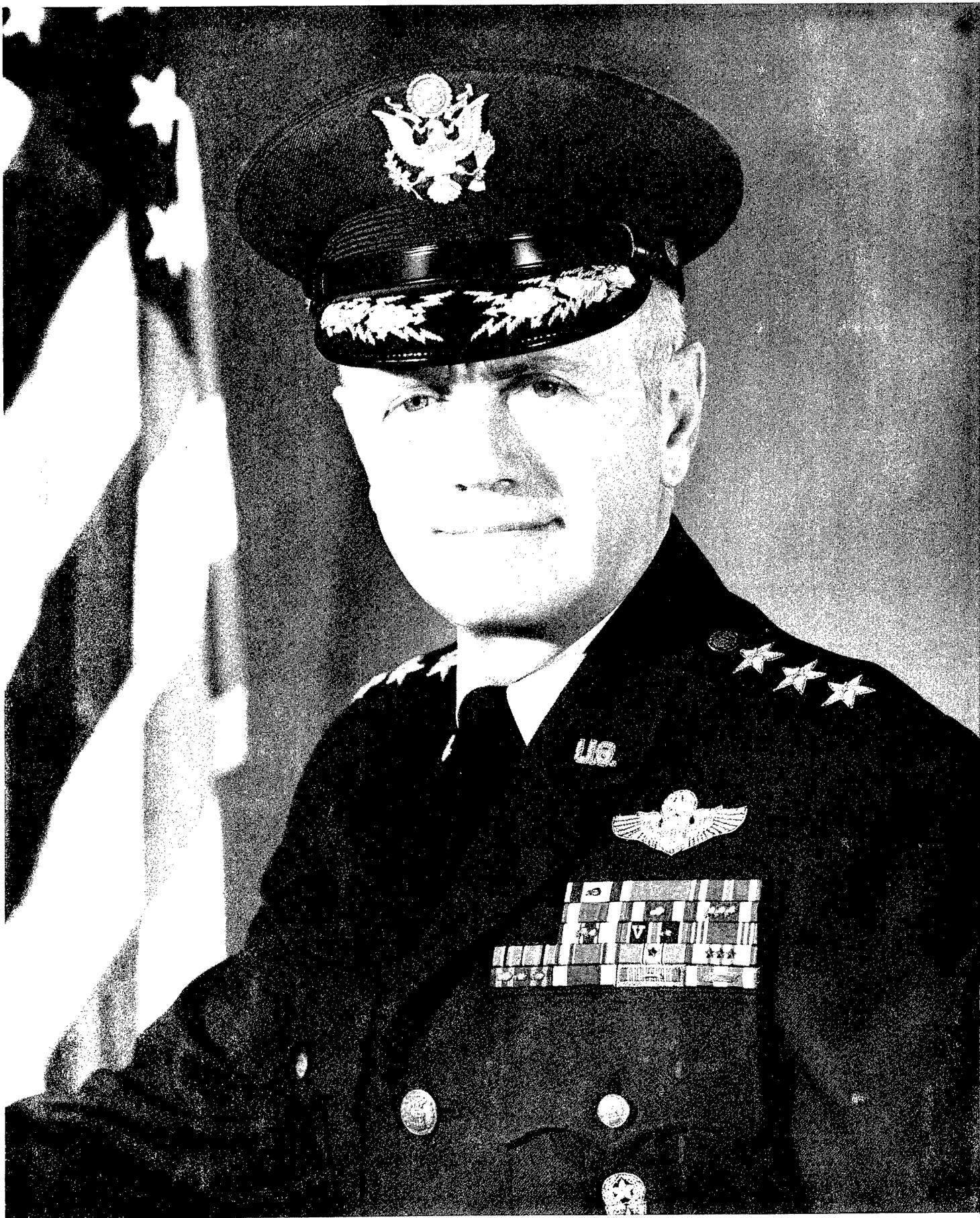
Lt General Samuel C. Phillips
Commander, Space and Missile Systems Organization
1 September 1969-24 August 1972



Lt General Kenneth W. Schultz
Commander, Space and Missile Systems Organization
25 August 1972-28 August 1975



Lt General Thomas W. Morgan
Commander, Space and Missile Systems Organization
335 29 August 1975-28 April 1978



Lt General Richard C. Henry
Commander, Space and Missile Systems Organization
28 April 1978-1 October 1979

SPACE AND MISSILE TEST CENTER (SAMTEC) COMMANDERS

Air Force Western Test Range

Brig Gen Jewell C. Maxwell	15 May 1964- 1 Oct 1965
Maj Gen Joseph S. Bleymaier	2 Oct 1965-25 Jul 1967
Maj Gen Clifford J. Kronauer, Jr.	26 Jul 1967- 1 Apr 1970

Space and Missile Test Center

Maj Gen Clifford J. Kronauer, Jr.	2 Apr 1970-15 Jul 1970
Maj Gen Louis L. Wilson, Jr.	16 Jul 1970-17 Aug 1971
Maj Gen Jessup D. Lowe	18 Aug 1971-29 Mar 1974
Maj Gen Herbert A. Lyon	30 Mar 1974-29 Apr 1975
Maj Gen Warner E. Newby	30 Apr 1975-31 Jan 1977
Brig Gen Don M. Hartung	1 Feb 1977-31 Jul 1978
Brig Gen James H. Marshall	31 Jul 1978- 1 Oct 1979

6594th TEST WING AND AFSCF COMMANDERS

6594th

Col Charles G. Mathison	6 Apr 1959-20 Aug 1960
Col Alvin N. Moore	21 Aug 1960-30 Aug 1962
Col William K. Kincaid	31 Aug 1962-30 Jun 1965

Air Force Satellite Control Facility

Col Walter H. Hedrick, Jr.	1 Jul 1965-31 Aug 1966
Col William G. King, Jr.	1 Sep 1966-30 Jul 1967
Brig Gen Jessup D. Lowe	31 Jul 1967-28 Jul 1969
Brig Gen Lewis S. Norman, Jr.	29 Jul 1969-31 May 1971
Col John J. Schmitt, Jr.	1 Jun 1971-31 Jul 1974
Col Robert A. Van Arsdall	31 Jul 1974-30 Jun 1976
Col Ralph A. Jacobson	1 Jul 1976- 1 Mar 1979
Col Joe E. Sanders	1 Mar 1979-

APPENDIX 3

SAMSO VICE COMMANDERS

Western Development Division

Brig Gen Osmond J. Ritland 23 Apr 1956-31 May 1957

Air Force Ballistic Missile Division

Brig Gen Osmond J. Ritland 1 Jun 1957-24 Apr 1959

Brig Gen Charles H. Terhune, Jr. 25 Apr 1959-22 Jun 1960

Brig Gen Harvard W. Powell 23 Jun 1960-31 Mar 1961

Assistant to the Deputy Commander for Aerospace Systems

Brig Gen Harvard W. Powell 1 Jul 1961-10 Oct 1962

Space Systems Division

Maj Gen Robert E. Greer 1 Apr 1961-30 Jun 1962

Brig Gen Harvard W. Powell 1 Jul 1962- 9 Jun 1963

Brig Gen Joseph J. Cody 10 Jun 1963-31 Jul 1964

Brig Gen Paul T. Cooper 1 Aug 1964-31 Aug 1966

Brig Gen David V. Miller 1 Sep 1966-30 Jun 1967

Ballistic Systems Division

Brig Gen Don Coupland 1 Apr 1961-10 Sep 1961

Maj Gen Donald R. Ostrander 11 Sep 1961-21 Sep 1962

Vacant 22 Sep 1962- 6 Mar 1963

Brig Gen Harold K. Kelley 7 Mar 1963- 4 Aug 1963

Brig Gen Samuel C. Phillips 5 Aug 1963- 9 Jan 1964

Vacant 10 Jan 1964-11 Aug 1964

Col Ray E. Soper 12 Aug 1964-31 Oct 1966

Col Robert I. Barrowclough 1 Nov 1966-30 Jun 1967

Space and Missile Systems Organization

Maj Gen Paul T. Cooper (Dep Commander for Space)	1 Jul 1967- 1 Nov 1967
Maj Gen John L. McCoy	1 Jul 1967- 4 Oct 1967
Maj Gen Paul T. Cooper	2 Nov 1967-31 Jul 1968
Brig Gen Louis L. Wilson, Jr.	1 Aug 1968-31 Jul 1970
Brig Gen Robert A. Duffy	1 Aug 1970-31 Jul 1971
Brig Gen Thomas W. Morgan	1 Aug 1971-12 Nov 1972
Brig Gen Herbert A. Lyon	13 Nov 1972-29 Mar 1974
Vacant	30 Mar 1974-15 Aug 1974
Maj Gen Richard C. Henry	16 Aug 1974-31 Aug 1976
Maj Gen Howard E. McCormick	1 Sep 1976- 1 Jul 1978
Maj Gen Gerald K. Hendricks	1 Jul 1978- 1 Oct 1979

APPENDIX 4

CHIEFS OF STAFF FOR SAMSO AND ITS PREDECESSORS

Western Development Division

Executive Officer *
1954-1957

LtCol Beryl L. Boatman
LtCol Joseph L. Hamilton

1954-May 1956
Jun 1956-30 Apr 1957

Air Force Ballistic Missile Division

Executive Officer
1 May 1957-31 Dec 1960
Chief of Staff
1 Jan-31 Mar 1961

Col Joseph L. Hamilton
Col Strother B. Hardwick, Jr.
Col Russell A. Berg

1 May 1957-15 Nov 1959
16 Nov 1959-25 Jul 1960
26 Jul 1960-31 Mar 1960

Space Systems Division

Chief of Staff
1 Apr-30 Jun 1961
Assistant Vice Commander
1 Jul 1961-24 Apr 1962
Assistant for Staff Support
25 Apr 1962-1 Oct 1966
Chief of Staff
2 Oct 1966-30 Jun 1967

Col Russell A. Berg
Vacant
Col Norman C. Appold
Col Richard E. Sims
Col Joseph L. Hamilton
Col Edgar R. Jackson, Jr.

1 Apr 1961-Aug 1962
Sep 1962-28 Jan 1963
29 Jan 1963-May 1963
Jun 1963-31 Aug 1964
1 Sep 1964-14 Aug 1966
15 Aug 1966-30 Jun 1967

Ballistic Systems Division

Chief of Staff
1 Apr-30 Jun 1961
Assistant Vice Commander
1 Jul 1961-24 Apr 1962
Assistant for Staff Support
25 Apr 1962-1 Oct 1966
Chief of Staff
2 Oct 1966-30 Jun 1967

Col Jack H. Alston
Col Ray E. Soper
Col Carl W. Robbins, Jr.
Col Hyme A. Budd

1 Apr 1961-25 Nov 1963
26 Nov 1963-11 Aug 1964
12 Aug 1964-9 Jun 1966
10 Jun 1966-30 Jun 1967

Space and Missile Systems Organization

Chief of Staff

1 Jul 1967- 1 Oct 1979

Col James O. Cobb	1 Jul 1967-30 Sep 1968
Col Donald G. Nunn	1 Oct 1968-14 Jul 1970
Col William P. Wood	15 Jul 1970-28 Feb 1971
Col Howard C. Mitchell	1 Mar 1971-14 Jul 1972
Col Richard G. Rumney	15 Jul 1972-30 Jun 1974
Col Michael J. Steger	1 Jul 1974-22 Jul 1976
Col Lloyd R. Norris	24 Jul 1976-20 Mar 1977
Col Francis M. Shine	21 Mar 1977- 1 Jun 1979
Col Gerald K. Dahmen	1 Jun 1979- 1 Oct 1979

*The position of Chief of Staff underwent various title changes through the years. The title and dates of these titles are listed in the left column. The dates in the right column are the dates of tenure of the individuals in the center column.

APPENDIX 5 - PERSONNEL STATISTICS

ORGANIZATION	DATE	MILITARY				CIVILIANS		TOTAL	
		AUTH	ASGD	AUTH	ASGD	AUTH	ASGD	AUTH	ASGD
WDD *	Nov 1954	27	28			25	24	52	52
SAPO	Nov 1954	3	3			12	5	15	8
WDD	Ju1 1955	70	51			85	55	155	106
SAPO	Ju1 1955	4	4			36	18	40	22
WDD	Ju1 1956	212	207			171	169	383	376
BMD	Ju1 1956	29	30			96	60	125	90
AFBMD	Ju1 1957	428	364			224	202	652	566
BMD	Ju1 1957	54	45			124	112	178	157
AFBMD	Ju1 1958	619	520			408	317	1,027	837
BMD	Ju1 1958	118	100			274	236	392	336
AFBMD	Ju1 1959	876	898			436	412	1,312	1,310
BMC	Ju1 1959	162	127			419	342	581	469
AFBMD	Ju1 1960	1,259	1,143			588	588	1,847	1,731
BMC	Ju1 1960	204	183			533	521	737	704
AFBMD	Mar 1961	1,485	1,303			736	693	2,221	1,996
BMC	Mar 1961	193	223			132	129	325	352

*WDD=Western Development Center, SAPO=Special Aircraft Project Office, BMD=Ballistic Missiles Division, BMC=Ballistic Missiles Center, AFBMD=Air Force Ballistic Missile Division

ORGANIZATION	DATE	MILITARY				CIVILIANS		TOTAL	
		Officers AUTH	ASGD	Airmen AUTH	ASGD	AUTH	ASGD	AUTH	ASGD
DCAS*(Total)	31 Dec 1961	2,246	2,292	2,426	2,300	2,341	2,274	7,013	6,866
Staff	31 Dec 1961	28	29	-	-	5	4	33	33
SSD	31 Dec 1961	1,082	1,127	1,574	1,489	950	1,044	3,700	3,626
BSD	31 Dec 1961	981	986	631	589	978	931	2,590	2,506
DCAS (Total)	30 Jun 1962	2,269	2,241	2,422	2,398	2,302	2,297	6,993	6,936
Staff	30 Jun 1962	28	24	4	-	26	37	58	61
SSD	30 Jun 1962	1,187	1,233	1,793	1,884	1,241	1,228	4,221	4,345
BSD	30 Jun 1962	1,005	939	508	384	985	979	2,498	2,302
SSD	30 Jun 1963	1,580	1,290	2,167	1,804	892	897	4,639	3,991
BSD	30 Jun 1963	832	816	736	738	933	1,012	2,501	2,566
SSD	30 Jun 1964	1,517	1,539	2,247	2,161	1,036	1,002	4,800	4,702
BSD	30 Jun 1964	736	736	178	166	884	892	1,798	1,794
AFWTR	30 Jun 1964	-	89	-	51	50	-	50	140
SSD	30 Jun 1965	1,583	1,546	2,820	2,707	1,095	1,033	5,498	5,286
BSD	30 Jun 1965	593	599	138	149	760	790	1,491	1,538
AFWTR	30 Jun 1965	133	134	138	115	489	407	760	656

*DCAS=Deputy Commander AFSC for Aerospace Systems, SSD=Space Systems Division, BSD=Ballistic Systems Division, AFWTR=Air Force Western Test Range

ORGANIZATION	DATE	MILITARY				CIVILIANS		TOTAL	
		Officers AUTH	Officers ASGD	Airmen AUTH	Airmen ASGD	AUTH	ASGD	AUTH	ASGD
SSD	30 Jun 1966	1,633	1,386	2,828	2,693	1,166	1,139	5,627	5,218
BSD	30 Jun 1966	566	482	153	132	762	772	1,481	1,386
AFSCF*	30 Jun 1966	389	340	1,114	1,091	157	158	1,660	1,589
AFWTR	30 Jun 1966	146	128	149	101	475	450	770	679
SAMSO (Total)	15 Jul 1967	2,217	1,853	2,955	2,943	1,788	1,790	6,960	6,586
AFSCF	1 Jul 1967	451	348	1,305	1,101	172	167	1,928	1,616
AFWTR	15 Jul 1967	145	120	134	121	474	438	753	679
SAMSO (Total)	30 Jun 1968	2,295	2,094	2,520	2,599	2,030	1,773	6,845	6,466
AFSCF	30 Jun 1968	443	402	1,231	1,201	378	237	2,052	1,840
AFWTR	30 Jun 1968	134	143	124	100	487	499	745	742
SAMSO (Total)	30 Jun 1969	2,287	2,300	2,507	2,446	1,914	1,680	6,708	6,426
AFSCF	30 Jun 1969	467	472	1,263	1,196	355	259	2,085	1,927
AFWTR	30 Jun 1969	134	126	92	87	463	467	689	680
SAMSO (Total)	30 Jun 1970	1,958	2,081	2,292	2,408	2,236	2,107	6,486	6,596
SAMSO	30 Jun 1970	1,235	1,280	741	724	1,417	1,333	3,393	3,337
SAMTEC	30 Jun 1970	333	357	285	484	522	493	1,140	1,334
AFSCF	30 Jun 1970	386	444	1,266	1,200	298	281	1,950	1,925

AFSCF=Air Force Satellite Control Facility, SAMTEC=Space and Missile Test Center

ORGANIZATION	DATE	MILITARY				CIVILIANS		TOTAL	
		Officers		Airmen		AUTH	ASGD	AUTH	ASGD
		AUTH	ASGD	AUTH	ASGD				
SAMSO (Total)	30 Jun 1971	1,957	1,926	2,282	2,163	2,058	2,003	6,297	6,092
SAMSO	30 Jun 1971	1,253	1,219	740	708	1,234	1,193	3,227	3,120
SAMTEC	30 Jun 1971	320	303	259	259	330	311	909	873
AFSCF	30 Jun 1971	387	404	1,255	1,196	494	499	2,136	2,099
SAMSO (Total)	30 Jun 1972	1,758	1,796	1,984	2,242	1,842	1,844	5,584	5,882
SAMSO	30 Jun 1972	1,005	1,158	450	827	1,039	1,072	2,494	3,071
SAMTEC	30 Jun 1972	257	273	194	239	392	476	843	974
AFSCF	30 Jun 1972	352	365	1,097	1,176	318	296	1,767	1,837
SAMSO (Total)	30 Jun 1973	1,645	1,554	1,884	1,891	1,759	1,648	5,288	5,093
SAMSO	30 Jun 1973	1,011	945	348	339	1,010	917	2,369	2,201
SAMTEC	30 Jun 1973	257	241	195	205	395	398	847	844
AFSCF	30 Jun 1973	352	338	1,085	1,100	321	300	1,758	1,738
SAMSO (Total)	30 Jun 1974	1,696	1,577	1,969	1,891	1,785	1,664	5,450	5,099
SAMSO	30 Jun 1974	1,037	959	332	320	1,040	939	2,409	2,218
SAMTEC	30 Jun 1974	250	252	186	184	381	356	817	790
AFSCF	30 Jun 1974	384	361	1,195	1,495	321	300	1,900	1,795

ORGANIZATION	DATE	MILITARY				CIVILIANS		TOTAL	
		Officers		Airmen		AUTH	ASGD	AUTH	ASGD
		AUTH	ASGD	AUTH	ASGD				
SAMSO (Total)	30 Jun 1975	1,622	1,544	1,671	1,652	1,802	1,695	5,095	4,891
SAMSO	30 Jun 1975	1,036	964	282	287	1,074	995	2,392	2,246
SAMTEC	30 Jun 1975	226	229	183	173	337	333	746	735
AFSCF	30 Jun 1975	340	331	1,091	1,071	342	321	1,773	1,828
SAMSO (Total)	30 Jun 1976	1,587	1,514	1,620	1,655	1,755	1,683	4,982	4,852
SAMSO	30 Jun 1976	1,025	998	293	277	1,060	996	2,378	2,261
SAMTEC	30 Jun 1976	223	214	175	179	327	324	725	717
AFSCF	30 Jun 1976	332	309	1,063	1,125	344	329	1,739	1,763
SAMSO (Total)	30 Jun 1977	1,836	1,666	1,578	1,546	2,135	1,958	5,549	5,170
SAMSO	30 Jun 1977	1,068	977	307	310	1,094	990	2,469	2,277
SAMTEC	30 Jun 1977	303	282	198	195	613	596	1,114	1,073
AFSCF	30 Jun 1977	322	286	1,045	1,031	328	287	1,695	1,604
SAMSO (Total)	30 Jun 1978	1,761	1,624	1,526	1,475	2,211	2,082	5,498	5,181
SAMSO	30 Jun 1978	1,119	1,016	301	280	1,104	1,054	2,524	2,350
SAMTEC	30 Jun 1978	312	301	195	188	751	701	1,258	1,190
AFSCF	30 Jun 1978	330	307	1,030	1,007	330	308	1,690	1,622

ORGANIZATION	DATE	MILITARY				CIVILIANS		TOTAL	
		Officers		Airmen		AUTH	ASGD	AUTH	ASGD
		AUTH	ASGD	AUTH	ASGD				
SAMSO (Total)	30 Jun 1979	1,781	1,596	1,334	1,325	2,157	2,084	5,272	5,005
SAMSO	30 Jun 1979	1,113	977	303	273	1,092	1,058	2,508	2,308
SAMTEC	30 Jun 1979	342	307	198	201	726	699	1,266	1,207
AFSCF	30 Jun 1979	326	312	833	851	311	310	1,470	1,473

APPENDIX 6

BALLISTIC MISSILE CHARACTERISTICS

System	Contractor	Propulsion	Range (Miles)	Speed	Weight (lb)	Length Diameter	Dev Initiation-Ops Inventory	Remarks
Atlas ICBM CGM-16D (Atlas D) CGM-16E (Atlas E) HGM-16F (Atlas F)	Convair	Liquid	9,000 (Atlas F)	16,000 (Atlas F)	269,000 (Atlas F)	82' 10' (Atlas F)	Jun 1955-Aug 1960	Later, launch for military satellites and scientific launchings. In Use.
Thor IRBM PGM-17A	Douglas	Single-stage, liquid	1,650	11,000 mph	110,000	65' 8'	Nov 1955-Jun 1959	After 1962, weapon system space booster.
Titan I HGM-25A	Martin/ Denver	1st stage: LR 87 liquid, 300,000 lb. 2d stage: LR 91 liquid, 80,000 lb.	6,300	15,000 mph	220,000	98' 10'	Apr 1957-Mar 1962	Phased out in 1963.
Titan II LGM-25C	Martin/ Marietta	Same with 430,000 lb & 100,000 lb	9,000	17,000 mph	330,000	103' 10'	Oct 1959-Jun 1963	Thermonuclear in use.
Minuteman I LGM-30B SM-80	Boeing	3-stage, liquid	6,500	15,000 mph	69,000	56' 5'11"	Feb 1958-Dec 1962	Phased out in 1967.

System	Contractor	Propulsion	Range (Miles)	Speed	Weight (lb)	Length Diameter	Dev Initiation- Ops Inventory	Remarks
Minuteman II LGM 30F SM 80	Boeing	3-stage, solid	6,000	15,000 mph	70,000	59'10" 5' 6"	Apr 1962-Dec 1965	In Use.
Minuteman III LGM 30G SM 80	Boeing	3-stage, solid	7,000	15,000 mph	70,000	59'10" 5' 6"	Dec 1965-Jun 1970	MIRV. In use.

APPENDIX 7

BALLISTIC MISSILE
RESEARCH AND DEVELOPMENTAL
FLIGHT TESTS

<u>Launch Vehicle</u>	<u>Missile Number</u>	<u>User Agency</u>	<u>Range</u>	<u>Operations Number</u>	<u>Launch Date</u>	<u>Program</u>	<u>Remarks</u>
<u>ATLAS</u>							
Series A	4A	USAF	ETR	N/A	11 Jun 1957	Research and Development	First launch attempt--failure
	12A	USAF	ETR	N/A	17 Dec 1957		First successful Atlas flight
	16A	USAF	ETR	N/A	4 Jun 1958		Last Atlas A flight--success
Series B	13B	USAF	ETR	N/A	19 Jul 1958		First launch attempt--failure
	4B	USAF	ETR	N/A	2 Aug 1958		Last Atlas B flight--success
Series C	3C	USAF	ETR	N/A	23 Dec 1958		First launch attempt--success
	11C	USAF	ETR	N/A	24 Aug 1959		Last Atlas C flight--success
Series D	3D	USAF	ETR		14 Apr 1959		First launch attempt--failure
	11D				28 Jul 1959		First successful flight
	90D			3505	23 Jan 1961		Last Atlas D R&D flight--success

<u>Launch Vehicle</u>	<u>Missile Number</u>	<u>User Agency</u>	<u>Range</u>	<u>Operations Number</u>	<u>Launch Date</u>	<u>Program</u>	<u>Remarks</u>
Series E	3E			2508	11 Oct 1960		First launch attempt--failure
	9E			3803	24 Feb 1961		First successful launch and flight
	40E			0101	13 Feb 1962		Last Atlas E R&D flight
Series F	2F			1805	8 Aug 1961		First launch attempt--success
	21F			1906	5 Dec 1962		Last Atlas F R&D launch and flight
	109F				18 Dec 1963		Last Atlas R&D launch
<u>THOR</u>							
	101	USAF	ETR	N/A	25 Jan 1957		First R&D flight test--failure
	105				20 Sep 1957		First successful flight test
	117				6 Aug 1958		Last R&D flight test
	263				29 Feb 1960		Thor R&D test program completed

<u>Launch Vehicle</u>	<u>Missile Number</u>	<u>User Agency</u>	<u>Range</u>	<u>Operations Number</u>	<u>Launch Date</u>	<u>Program</u>	<u>Remarks</u>
<u>TITAN</u>							
Titan I	A-3	USAF	ETR		6 Feb 1959	Research and Development	First flight test-- success
	M-7		ETR	0119	29 Jan 1962		Last R&D flight from ETR
	V-4		WTR	1061	1 May 1963		Last Titan I used in R&D program
<u>Titan II</u>							
	N-2		ETR	0120	16 Mar 1962		First flight test-- success
	N-8		WTR	1040	27 Apr 1963		First in-silo launch
	N-3A		ETR	0158	9 Apr 1964		Last R&D flight
<u>MINUTEMAN</u>							
<u>Minuteman I (LGM-30A)</u>							
	FTM 401	USAF	ETR	5103	1 Feb 1961		First flight test-- success
	FTM 404			2305	30 Aug 1961		First in-silo launch attempt--failure
	FTM 405			3755	17 Nov 1961		First successful in-silo launch
	FTM 518		WTR	1307	5 Jul 1963		Last Minuteman IA R&D flight test
<u>Minuteman I (LGM-30B)</u>							
	FTM 424		ETR	4230	7 Dec 1962		First Minuteman IB flight test
	FTM 445		ETR	1075	29 Sep 1964		Last Minuteman I flight test

<u>Launch Vehicle</u>	<u>Missile Number</u>	<u>User Agency</u>	<u>Range</u>	<u>Operations Number</u>	<u>Launch Date</u>	<u>Program</u>	<u>Remarks</u>
Minuteman II (LGM-30F)	FTM 449		ETR	3552	24 Sep 1964		First Minuteman II flight test
	FTM 2001		WTR	8338	18 Aug 1965		First flight R&D on WTR
	FTM 2033		WTR		16 Feb 1966		Last Minuteman II R&D flight test
Minuteman II Force Modernized	FTM 2022		WTR	2147	22 Jan 1966		First Force Modernized Minuteman II R&D flight test
	FTM 2095		WTR	7217	11 May 1967		Last R&D flight test
Minuteman III (LGM-30G)	FTM 201		ETR	1721	16 Aug 1968		First Minuteman III R&D flight test
	FTM 5008		WTR	8727	28 Jul 1970		Last Minuteman III basic R&D flight test

APPENDIX 8

ICBM OPERATIONAL DATES

<u>Weapon System</u>	<u>Strategic Missile Unit</u>	<u>Location</u>	<u>Operational Dates</u>	
			<u>Turnover/Operational</u>	<u>Inactivated</u>
<u>ATLAS</u>				
Atlas D	576A SMS (Complex 576A)	Vandenberg AFB, CA	3 Aug 1959	
	564 SMS (Complex 564A)	F.E. Warren AFB, WY	5 Aug 1960/9 Aug 1960	1 Sep 1964
	564 SMS, 706 SMW (389 SMW)	F.E. Warren AFB, WY	30 Aug 1960/2 Sep 1960	1 Sep 1964
	565 SMS, 706 SMW (389 SMW)	F.E. Warren AFB, WY	4 Mar 1961/7 Mar 1961	1 Dec 1964
	549 SMS	Offutt AFB, NE	30 Mar 1961/30 Mar 1961	15 Dec 1964
Atlas E	576C SMS (Complex 576C)	Vandenberg AFB, CA	30 Jun 1961	
	567 SMS	Fairchild AFB, WA	28 Sep 1961/28 Sep 1961	25 Jun 1965
	548 SMS	Forbes AFB, KS	10 Oct 1961/10 Oct 1961	25 Mar 1965
	566 SMS	F.E. Warren AFB, WY	20 Nov 1961/20 Nov 1961	25 Mar 1965
	576F SMS	Vandenberg AFB, CA		25 Jun 1965
Atlas F	550 SMS	Schilling AFB, KS	7 Sep 1962/9 Sep 1962	25 Jun 1965
	551 SMS	Lincoln AFB, NE	15 Sep 1962/15 Sep 1962	25 Jun 1965
	577 SMS	Altus AFB, OK	9 Oct 1962/9 Oct 1962	25 Mar 1965
	578 SMS	Dyess AFB, TX	4 Nov 1962/15 Nov 1962	25 Mar 1965
	579 SMS	Walker AFB, NM	30 Nov 1962/30 Nov 1962	25 Mar 1965
	556 SMS	Plattsburgh AFB, NY	7 Dec 1962/20 Dec 1962	25 Jun 1965
<u>TITAN</u>				
Titan I	395A SMS	Vandenberg AFB, CA		
	724 SMS, 703 SMW (451 SMW)			
	Complex A			
	724 SMS, 703 SMW (451 SMW)	Lowry AFB, CO	12 Apr 1962	25 Jun 1965
	725 SMS, 703 SMW (451 SMW)	Lowry AFB, CO	19 Apr 1962/20 Apr 1962	25 Jun 1965
	569 SMS	Lowry AFB, CO	4 May 1962/10 May 1962	25 Jun 1965
	851 SMS	Mountain Home AFB, ID	16 Aug 1962	25 Jun 1965
	568 SMS	Beale AFB, CA	8 Sep 1962	25 Mar 1965
850 SMS	Larson AFB, WA	26 Sep 1962	25 Mar 1965	
	Ellsworth AFB, SD	28 Sep 1962	25 Mar 1965	

<u>Weapon System</u>	<u>Strategic Missile Unit</u>	<u>Location</u>	<u>Operational Dates</u>	
			<u>Turnover/Operational</u>	<u>Inactivated</u>

Titan II	570 SMS, 390 SMW (Lead Complex)	Davis-Monthan AFB, AZ	30 Mar 1963	
	570 SMS, 390 SMW	Davis-Monthan AFB, AZ	25 Nov 1963	
	571 SMS, 390 SMW	Davis-Monthan AFB, AZ	29 Nov 1963	
	390 SMW	Davis-Monthan AFB, AZ		1 Dec 1963
	533 SMS, 381 SMW	McConnell AFB, KS	27 Nov 1963	
	532 SMS, 381 SMW	McConnell AFB, KS	4 Dec 1963	
	373 SMS, 308 SMW	Little Rock AFB, AK	8 Dec 1963	
	374 SMS, 308 SMW	Little Rock AFB, AK	28 Dec 1963/31 Dec 1963	

MINUTEMAN

Minuteman I (LGM-30A)	Flight A, 10 SMS, 341 SMW	Malmstrom AFB, MT	24 Oct 1962/11 Dec 1962	
	10 SMS, 341 SMW		28 Feb 1963	
	12 SMS, 341 SMW		15 May 1963	
	490 SMS, 341 SMW 341 SMW		3 Jul 1963	3 Jul 1963

Minuteman I (LGM-30B)	Flight B, 66 SMS, 44 SMW	Ellsworth AFB, SD	24 Jun 1963	
	66 SMS		16 Sep 1963	
	67 SMS		4 Oct 1963	
	68 SMS 44 SMW		23 Oct 1963	24 Oct 1963

Minuteman I (LGM-30C)	Flight A, 740 SMS, 455 SMW (91 SMW)	Minot AFB, ND	12 Oct 1963	
	740 SMS		24 Jan 1964	
	741 SMS		27 Feb 1964	
	742 SMS		21 Mar 1964	
	455 SMW (91 SMW)			21 Mar 1964

<u>Weapon System</u>	<u>Strategic Missile Unit</u>	<u>Location</u>	<u>Operational Dates</u>	
			<u>Turnover/Operational</u>	<u>Inactivated</u>
	Flight B, 508 SMS, 351 SMW 508 SMS 509 SMS 510 SMS 351 SMW	Whiteman AFB, MO	21 Feb 1964 30 Apr 1964 25 May 1964 30 Jun 1964	30 Jun 1964
	Flight A, 319 SMS, 90 SMW 319 SMS 320 SMS 321 SMS 400 SMS 90 SMW	F.E. Warren AFB, WY	24 Jul 1964 18 Sep 1964 18 Dec 1964 22 Mar 1965 15 Jun 1965	15 Jun 1965
Minuteman II (LGM-30F)	Flight G, 447 SMS, 321 SMW 447 SMS 446 SMS 448 SMS 321 SMW	Grand Forks AFB, ND	31 Oct 1965 25 Apr 1966 5 Aug 1966 22 Nov 1966	22 Nov 1966
Minuteman II (LGM-30F)	564 SMS, 341 SMW	Malmstrom AFB, MT	21 Apr 1967/	3 May 1967
Minuteman II (LGM-30F) Force Modernized	Flights G/L, 509 SMS 351 SMW 509 SMS 510 SMS 508 SMS 351 SMW	Whiteman AFB, MO	19 Nov 1966 7 Feb 1967 6 Jun 1967 3 Oct 1967	19 Oct 1967

<u>Weapon System</u>	<u>Strategic Missile Unit</u>	<u>Location</u>	<u>Operational Dates</u>	
			<u>Turnover/Operational</u>	<u>Inactivated</u>
Minuteman II (LGM-30F) Force Modernized	Flight B, 66 SMS, 44 SMW	Ellsworth AFB, SD	1 Mar 1972	
	66 SMS		23 Jun 1972	
	67 SMS		15 Nov 1972	
	68 SMS 44 SMW		13 Mar 1973	13 Mar 1973
Minuteman III (LGM-30G)	Flight H, 741 SMS, 91 SMW	Minot AFB, ND	19 Jun 1970	
	741 SMS		31 Dec 1970	
	740 SMS		26 May 1971	
	742 SMS 91 SMW		13 Dec 1971	13 Dec 1971
Minuteman III (LGM-30G)	Flight G, 447 SMS, 321 SMW	Grand Forks AFB, ND	29 Jan 1972	
	447 SMS		20 May 1972	
	446 SMS		13 Oct 1972	
	448 SMS 321 SMW		3 Mar 1973	3 Mar 1973
Minuteman III (LGM-30G) Force Modernization	Flight P, 400 SMS, 90 SMW	F.E. Warren AFB, WY	20 Jun 1973	
	400 SMS		15 Nov 1973	
	319 SMS		18 Apr 1974	
	321 SMS 320 SMS 90 SMW		10 Sep 1974 21 Jan 1975	21 Jan 1975
Minuteman III (LGM-30G)	Squadron 20	Malmstrom AFB, MT	8 Jul 1975/11 Jul 1975	

APPENDIX 9

LAUNCH VEHICLE CHARACTERISTICS

Vehicle	Contractor	Configuration	Dimensions ¹	Weight ²	Thrust at Liftoff ³	Guidance ³	Status at End of 1979
SLV-1 (Scout)	Ling-Temco-Vought Missiles & Space Co.	Three, four, or five stage solid fuel vehicle	3.75'x73' (four stage configuration)	47,500 lbs (four stage configuration)	130,000 lbs (four stage configuration)	Inertial	Still in inventory
SLV-2A (Thrust Augmented Thor)	McDonnell-Douglas Astronautics Co.	Single stage, liquid fuel vehicle with three strap-on solid rocket motors; used with Agena or Delta upper stage	8'x55.9'	135,396 lbs	330,000 lbs	Radio	No longer in inventory
LV-2D	McDonnell-Douglas Astronautics Co.	Single stage, liquid fuel vehicle; used with Burner II upper stage	8'x55.9'	105,884 lbs	172,000	Radio	No longer in inventory

1. Diameter is of the first stage and does not include any strap-on solid rocket motors. Height does not include payload or fairing.
2. Weight includes fuel but not payload.
3. Data on thrust and guidance is for the vehicle in its most advanced configuration.

Vehicle	Contractor	Configuration	Dimensions	Weight	Thrust at Liftoff	Guidance	Status at End of 1979
LV-2F	McDonnell-Douglas Astronautics Co.	Single stage, liquid fuel vehicle; used with Burner II or IIA upper stage	8'x55.9'	105,884 lbs	172,000	Radio	No longer in inventory
SLV-2H (Long-Tank, Thrust-Augmented Thor)	McDonnell-Douglas Astronautics Co.	Single stage, liquid fuel vehicle with three strap-on solid rocket motors; used with Agena upper stage	8'x70.3'	183,484 lbs	330,000 lbs	Radio	No longer in inventory
SLV-2J	McDonnell-Douglas Astronautics Co.	Similar to the SLV-2H, but used with Delta upper stage	8'x70.3'	183,484 lbs	330,000 lbs	Radio	No longer in inventory
Thor/Delta	McDonnell-Douglas Astronautics Co.	Three stage, liquid fuel vehicle; thrust-augmented version employs 3,6, or 9 strap-on solid rocket motors	8'x90' (with standard tank)	Varies with configuration	First stage engine provides 170,000 to 205,000 lbs; each strap-on solid rocket motor provides an additional 52,000 lbs.	Inertial	Still in inventory

Vehicle	Contractor	Configuration	Dimensions	Weight	Thrust at Liftoff	Guidance	Status at End of 1979
Atlas F	General Dynamics /Convair	One-and-a-half stage liquid fuel vehicle	10'x67.8'	266,000 lbs	388,000 lbs	Radio	Still in inventory
SLV-3A (Atlas/Agena)	General Dynamics /Convair	Two-and-a-half stage liquid fuel vehicle	10'x103.5'	Approximately 325,000 lbs	432,000 lbs	Radio	No longer in inventory
SLV-3C (Atlas/Centaur)	General Dynamics /Convair	Two-and-a-half stage liquid fuel vehicle	10'x98.9'	Approximately 321,000 lbs	395,000 lbs	Radio	No longer in inventory
SLV-3D (Atlas/Centaur)	General Dynamics /Convair	Two-and-a-half stage liquid fuel vehicle	10'x98.9'	Approximately 321,000 lbs	432,000 lbs	Inertial	Still in inventory
SLV-5A (Titan IIIA)	Martin Marietta Corp.	Three stage, liquid fuel vehicle	10'x106'	370,000 lbs	430,000 lbs	Inertial	No longer in inventory
SLV-5B (Titan IIIB/Agena)	Martin Marietta Corp.	Three stage, liquid fuel vehicle	10'x119.3' (with stretched core)	386,000 lbs (with stretched core)	453,000 lbs	Inertial guidance or combination of radio and inertial guidance	Still in inventory

Vehicle	Contractor	Configuration	Dimensions	Weight	Thrust at Liftoff	Guidance	Status at End of 1979
SLV-5C (Titan IIIC)	Martin Marietta Corp.	Three stage, liquid fuel vehicle with two strap-on, solid rocket motors	10'x108.2' (solid rocket motors measure 10'x85' each)	1,400,000 lbs	2,920,000 lbs	Inertial	Still in inventory
SLV-5D (Titan IIID)	Martin Marietta Corp.	Two stage, liquid fuel vehicle with two strap-on, solid rocket motors	10'x96.3' (solid rocket motors measure 10'x85' each)	1,300,000 lbs	2,920,000 lbs	Radio	Still in inventory
Titan 34D	Martin Marietta Corp.	Two liquid-propellant stages with twin 10-foot diameter solid rocket motors (SRMs) attached to each side of the first stage.	First Stage: 78.6' long 10' in diameter; second stage: 32.9' long, 10' in diameter	760 tons (fully fueled with spacecraft)	532,000 lbs	West Coast: Radio; East Coast: Inertial guidance system contained in a third stage	Not yet in inventory
SLV-5E (Titan IIIE/ Centaur)	Martin Marietta Corp.	Three stage, liquid fuel vehicle with two strap-on solid rocket motors	10'x127.8' (solid rocket motors measure 10'x85' each)	1,412,000 lbs	2,837,000 lbs	Inertial	No longer in inventory

Vehicle	Contractor	Configuration	Dimensions	Weight	Thrust at Liftoff	Guidance	Status at End of 1979
Burner II	The Boeing Co.	Solid fuel upper stage	5.4'x5.7' (without nose shroud)	1,800 lbs	10,000 lbs	Inertial	No longer in inventory
Burner IIA	The Boeing Co.	Solid fuel upper stage	5.2'x6.25'	2,400 lbs	10,000 lbs (first motor); 7,800 lbs (second motor)	Inertial	No longer in inventory
Agena	Lockheed Missiles & Space Co.	Liquid fuel upper stage	Approximately 5'x20' (some configurations up to 40' long)	15,000 lbs	16,000 lbs	Inertial	Still in inventory
Transtage	Martin Marietta Corp.	Liquid fuel upper stage	10'x15'	28,000 lbs	16,000 lbs	Inertial	Still in inventory
Centaur	General Dynamics/Convair	Liquid fuel upper stage	10'x30'	37,000 lbs	30,000 lbs	Inertial	Still in inventory
Stage Vehicle System (SGS I)	Fairchild Space and Electronics Co.	Solid fuel upper stage	137" long. At the base, 55" wide; at the top, 42" wide. (The motor was 37" in diameter)	5,468 lbs	30,480 lbs	no guidance of its own, (spin-stabilized vehicle)	Still in inventory

Vehicle	Contractor	Configuration	Dimensions	Weight	Thrust at Liftoff	Guidance	Status at End of 1979
Inertial Upper Stage (IUS)	Boeing Aerospace Co.	Two solid fuel upper stages	Stage I: 14.8' long, 7.6' diameter; Stage II: 6.4' long, 9.5' diameter.	For use with the Titan III34D: 4,486.8 lbs (28,937.7 lbs fully fueled). For use with the Space Shuttle: 4,756.4 lbs (32,410 lbs fully fueled)	Stage I engine thrust: 62,000 lbs, Stage II engine thrust 26,000 lbs.	Inertial	Not yet in inventory
Space Shuttle Launch vehicle	Rockwell International	A single stage, liquid fuel external tank and two solid fuel rocket boosters	184.2' long, 76.6' wide (The orbiter alone was 122.2' long and 56.67' wide)	4.4 million lbs at take-off, 187,000 lbs. landing	58,375,000 lbs	Manned vehicle	Not yet in inventory

APPENDIX 10

SPACE LAUNCH VEHICLES:

THOR

Launch Vehicle	Missile Number	User Agency	Range	Operations Number	Launch Date	Program	Remarks
Thor	101	USAF	ETR		25 Jan 1957	Reentry Tests	First Thor IRBM research and development flight test -- failure
	105	USAF	ETR		20 Sep 1957	R&D	First successful Thor research and development launch
	151	USAF	WTR		16 Dec 1958	IOC	First missile launch from WTR and first Thor launch from WTR
Thor/Able	116	USAF	ETR	N/A	23 Apr 1958	Reentry Tests	First Thor/Able launch--vehicle destroyed at T + 46 seconds
	118	USAF	ETR	N/A	9 Jul 1958	Reentry Tests	First successful launch
	127	USAF	ETR	N/A	17 Aug 1958	Able 1 (Pioneer)	First Thor use as space booster --failure
	130	NASA	ETR		11 Oct 1958	Pioneer I	First Thor/Able space success
	148	NASA	ETR	0315	1 Apr 1960	TIROS	Last Thor/Able launch

Launch Vehicle	Missile Number	User Agency	Range	Operations Number	Launch Date	Program	Remarks
Thor/Ablestar	257	USAF	ETR	0303	13 Apr 1960	Transit IB	First launch--successful
	319/012	NAVY	ETR	3723	31 Oct 1962	Anna IB	Last ETR launch
	375/013	NAVY	WTR	1968	28 Sep 1963	Space	First WTR launch--successful
	455/020	NAVY	WTR	8465	13 Aug 1965	Space	Last launch--successful
Thor/Agena A	163/1022	USAF	WTR	1003	28 Feb 1959	Discoverer	First launch and first use of Agena upper stage
	246/1058	USAF	WTR	1038	13 Sep 1960	Space	Last Air Force use--successful
Thor/Agena B	253/1061	USAF	WTR	1041	26 Oct 1960	Space	First launch--failure due Agena B failure
	297/1062	USAF	WTR	1046	12 Nov 1960	Space	First successful launch
	367/1135	USAF	WTR	9201	24 Nov 1962	Space	Last Air Force use
	399/6201	NASA	WTR	5478	28 Aug 1964	Nimbus I	Last NASA use
Thor/Agena D	340/1151	USAF	WTR	7201	27 Jun 1962	Space	First Thor/Agena D launch

Launch Vehicle	Missile Number	User Agency	Range	Operations Number	Launch Date	Program	Remarks
SLV-2/Agena D	394/1169	USAF	WTR	1561	29 Aug 1963	Space	First Thor (SLV-2)/Agena D launch
	443/2704	USAF	WTR	5712	31 May 1967	Space	Last Air Force use of Thor (SLV-2)/Agena D
TAT/Agena D (SLV-2A/Agena D)	354/1159	USAF	WTR	0583	28 Feb 1963	Space	First launch of Thrust Augmented Thor (TAT)/Agena D--broke up at T + 127 seconds due to solid-rocket motor malfunction
	360/1164	USAF	WTR	0627	18 Mar 1963	Space	First successful launch -- Agena D failed to achieve orbit
	498/2733	USAF	WTR	1965	17 Jan 1968	Space	Last Air Force use of TAT/Agena D--also 150th Thor/Agena launched since 28 Feb 1959
	478/6802	NASA	WTR	2061	28 Jul 1967	OGO	Last NASA use

Launch Vehicle	Missile Number	User Agency	Range	Operations Number	Launch Date	Program	Remarks
TAT/Agena B	380/2314	USAF	WTR	1440	29 Jun 1963	Space	First and only Air Force use-- successful. Also last Agena B to be used by USAF with Thor
	456/6202	NASA	WTR	2402	15 May 1966	Nimbus II	Last use of TAT/Agena B
Thor/Altair (Burner I)	224	USAF	WTR	7040	18 Jan 1965	Space	First use of Altair (Burner I) upper stage with Thor
	147	USAF	WTR	0340	30 Mar 1966	Space	Last use of Burner I
Thor/Burner II	58-2278	USAF	WTR	6026	15 Sep 1966	Space	First use of Burner II with Thor
Thor/Burner IIA	58-2270/504	USAF	WTR	4311	14 Oct 1971	Space	First use of Burner IIA with Thor
	58-2293/ SV-7	USAF	WTR	5140	18 Feb 1976	Space	Last use of Burner IIA with Thor; launch failed when booster engine shut down prematurely

Launch Vehicle	Missile Number	User Agency	Range	Operations Number	Launch Date	Program	Remarks
Thorad/Agena D	506/1631	USAF	WTR	1545	9 Aug 1966	Space	First Long Tank Thrust Augmented Thor (LTTAT or Thorad) launch and first use of Castor II solid-rocket motor boosters
	170/1663	USAF	WTR	6371	25 May 1972	Space	Last Air Force use of Thorad/Agena D
Thor/Delta	144/D-1	NASA	ETR	618	13 May 1960	ECHO	First use of NASA Thor/Delta--failure due to second stage malfunction
	276/D-2	NASA	ETR	1506	12 Aug 1960	ECHO I	First successful launch of Thor/Delta
TAT/Delta	/D-25	NASA	ETR	0136	19 Aug 1964	Syncom III	First TAT/Delta launch--successful
	463/D-41	NASA	WTR	5374	2 Oct 1966	ESSA-3	First TAT/Delta launch from WTR--successful
TAID	D-34	NASA	ETR	6400	6 Nov 1965	Explorer 29	First use of Thrust Augmented Improved/Delta

Launch Vehicle	Missile Number	User Agency	Range	Operations Number	Launch Date	Program	Remarks
Thorad/Delta	D-59	NASA	ETR	7970	18 Sep 1968	Intelsat IIIA	First LTTAT (Thorad)/Delta failure due to guidance malfunction that caused structural failure and explosion
	528/D-58	NASA	WTR	8115	16 Aug 1968	ESSA-7	First successful Thorad/Delta launch and first from WTR
	D-63	NASA	ETR	1380	18 Dec 1968	Intelsat IIIB	First successful Thorad/Delta launch from ETR
	69-029/D-76	NASA	WTR	6522	23 Jan 1970	ITOS-I (TIROS-M)	First use of Thorad/Delta with six Castor II solid-rocket motors (Super Six)
	D-83	NASA	ETR	9135	13 Mar 1971	Explorer 43 (IMP I)	First ETR use of Thorad/Delta with six Castor II motors
	71-173/D-89	NASA	WTR	8050	23 Jul 1972	ERTS-A	First operational Thorad/Delta vehicle to use nine Castor II solid rocket motors
	D-92	NASA	ETR	2489	9 Nov 1972	TELESAT A (ANIK)	First use of Thorad/Delta with nine Castor II solid-rocket motors and 96-inch diameter configuration (Straight Eight)

APPENDIX 11

SPACE LAUNCH VEHICLES:

ATLAS

Launch Vehicle	Missile Number	User Agency	Range	Operations Number	Launch Date	Program	Remarks
Atlas B	10B	USAF	ETR	1729	18 Dec 1958	Project SCORE	First use of Atlas as space launch vehicle-- first communications repeater satellite in orbit
Atlas/Able IV	20D	NASA	ETR	4122	26 Nov 1959	Project Able IV	First Atlas/Able-- failure
Atlas D/Agona A	29D/1008	USAF	ETR	0304	26 Feb 1960	MIDAS	First launch--failure MIDAS I payload failed to achieve orbit
	45D/1007	USAF	ETR	619	24 May 1960	MIDAS	Last use from ETR-- MIDAS II
	57D/2101	USAF	WTR	1042	11 Oct 1960	SAMOS	First WTR use--failure SAMOS I payload failed to achieve orbit
	70D/2102	USAF	WTR	1051	31 Jan 1961	SAMOS	Last Air Force use-- SAMOS II

Launch Vehicle	Missile Number	User Agency	Range	Operations Number	Launch Date	Program	Remarks
Atlas D/Agena B	97D/1201	USAF	WTR	1062	12 Jul 1961	MIDAS	First use--MIDAS III
	111D/P32	NASA	ETR	5050	23 Aug 1961	Ranger	First ETR use
	75D/1207	USAF	WTR	1456	18 Jul 1963	Space	Last Air Force use
	5601/6502	NASA	ETR	6423	6 Jun 1966	OGO	Last use--OGO-3 satellite
Atlas D/Agena D	201D/4702	USAF	WTR	1467	12 Jul 1963	Space	First launch--Agena D 4702 was 100th Agena upper stage to be used
	216D/	USAF	ETR	2925	17 Jul 1964	Space	First ETR launch
Atlas/Agena D (SLV-3 7100 Series)	7101/4808	USAF	WTR	3802	14 Aug 1964	Space	First SLV-3/Agena D use
Atlas/Agena D (SLV-3 7200 Series)	7201/1351	USAF	WTR	1960	9 Jun 1966	Space	First SLV-3/Agena D 7200 Series vehicle
Atlas/Agena D (SLV-3A)	5602	NASA	ETR	3366	4 Mar 1968	OGO	First use of SLV-3A "stretched" Atlas/Agena D on ETR--OGO-E satellite
	5501	USAF	ETR	4920	6 Aug 1968	Space	First Air Force use of SLV-3A/Agena D

Launch Vehicle	Missile Number	User Agency	Range	Operations Number	Launch Date	Program	Remarks
Atlas/Burner II	7004/14	USAF	WTR	2918	16 Aug 1968	Space	First and only use of Atlas/Burner II-- failure
Atlas/Burner IIA	102F/	USAF	WTR	8180	2 Oct 1972	Space Test Program Flight P72-1	First use of Atlas F/Burner IIA
Atlas/Centaur	AC-1	NASA	ETR	5461	8 May 1962		First Atlas/Centaur launch--Centaur stage exploded at T + 55 seconds
	AC-2	NASA	ETR	5175	27 Nov 1963		First successful launch--spent Centaur stage placed in orbit
	AC-10	NASA	ETR	0184	30 May 1966	Surveyor	First operational mission--Surveyor I
	AC-30	NASA	ETR	8088	5 Apr 1973	Pioneer 11	First use of SLV-3D/Centaur combination
Atlas D	68D	USAF	WTR	7626	27 May 1965	Space	Failure--self-destruct at T + 229 seconds
	92D	USAF	WTR	1342	27 Jul 1967	Space	First successful use of Atlas D as space booster

Launch Vehicle	Missile Number	User Agency	Range	Operations Number	Launch Date	Program	Remarks
Atlas F	107F	USAF	WTR	6968	6 Apr 1968	Space	First use as space booster
Atlas F/GPS Stage Vehicle	65F	USAF	WTR	5580	23 Jun 1977	NTS-2 (Global Positioning System)	First use of GPS Stage Vehicle - Successful

APPENDIX 12

SPACE LAUNCH VEHICLES:

TITAN III

Launch Vehicle	Missile Number	User Agency	Range	Operations Number	Launch Date	Program	Remarks
Titan IIIA	A-2 65-210	USAF	ETR	4751	1 Sep 1964	Titan III	First Titan IIIA research and development flight test missile---successful launch but Transtage (Stage III) malfunctioned
	A-6 65-214	USAF	ETR	0130	6 May 1965	Titan III	Fourth and last Titan IIIA flight test---successful
Titan IIIC	C-7 65-215	USAF	ETR	0449	18 Jun 1965	Titan III	First Titan IIIC research and development flight test vehicle---successful
	C-15 66-008	USAF	ETR	3013	23 May 1969	Titan III	Last research and development flight---successful
	C-18 66-14824	USAF	ETR	4913	8 Apr 1970	Titan III	First launch of operational configuration SLV-5C---successful

Launch Vehicle	Missile Number	User Agency	Range	Operations Number	Launch Date	Program	Remarks
Titan IIIB/ Agena D	B-1 66-8131/4751	USAF	WTR	3014	29 Jul 1966	Titan III	First launch--successful
Titan IIID	D-1	USAF	WTR	8709	15 Jun 1971	Titan III	First launch--successful
Titan IIIIE/ Centaur	E-1	NASA	ETR	4016	11 Feb 1974	Titan III	First launch--partial failure due to malfunction in Centaur at staging
	E-2	NASA	ETR	3718	10 Dec 1974	Helios A	First operational launch--successful
	E-6	NASA	ETR	0777	5 Sep 1977	Voyager 1	Last launches of Titan IIIIE - Successful
	E-7	NASA	ETR	0808	20 Aug 1977	Voyager 2	

APPENDIX 13

SATELLITE CHARACTERISTICS

Satellite	Mission	Contractor	Program Go-Ahead	Dimensions	Weight	Power	Design Life	Orbit
Initial Defense Communications Satellite Program (IDCSP)	Communications	Philco-Ford Corp.	Oct 1964 (start of development contract)	36"x32"	100 lbs	40 watts	1.5 years	18,000 nm equatorial
Defense Satellite Communications System (DSCS II)	Communications	TRW Systems Group	Mar 1969	9'x13' (overall)	1150 lbs at lift-off	535 watts	5 years	Synchronous equatorial
Defense Satellite Communications System (DSCS III)	Communications	General Electric	Feb 1977	Main Structure: 76" wide, 77" deep, 81.5" and 110" long at panels. Solar ray: 457.7" long	1800 lbs (dry)	1100 watts (beginning power); 837 watts (EOL).	10 years	Synchronous equatorial

Satellite	Mission	Contractor	Program Go-Ahead	Dimensions	Weight	Power	Design Life	Orbit
Skynet I	Communications	Philco-Ford Corp.	Mar 1967	54"x61.8" (overall)	535 lbs at lift-off	113 watts	3 years	Synchronous equatorial
Skynet II	Communications	Marconi Space and Defense Systems, Ltd.	Oct 1970	75"x82.3" (overall)	960 lbs at lift-off	260 watts	5 years	Synchronous equatorial
NATO II	Communications	Philco-Ford Corp.	Apr 1968	54"x61.8" (overall)	535 lbs at lift-off	113 watts	3 years	Synchronous equatorial
NATO III	Communications	Philco-Ford Corp.	Mar 1973	86"x121.7" (overall)	1532 lbs at lift-off	533 watts	7 years	Synchronous equatorial
Tactical Communications Satellite (TACSAT)	Communications	Hughes Aircraft Co.	Jan 1967	9'x25" (overall)	1600 lbs	980 watts	5 years	Synchronous equatorial

Satellite	Mission	Contractor	Program Go-Ahead	Dimensions	Weight	Power	Design Life	Orbit
VELA	Nuclear detection	TRW Systems Group	Nov 1961	58"x45"	498 lbs at lift- off	99 watts	6 months	60,000 nm 38° inclination
Defense Metoro- logical Satellite Program (DMSP) Block 5A	Weather Observation	RCA Astro Electronics Division	Aug 1968	43"x36"	220 lbs		6 months	450 nm circular, sun- synchronous, near- polar orbit with 98.72° inclination
DMSP Block 5B/C	Weather Observation	RCA Astro Electronics Division	See entry for Block 5A	Diameter- 43" (top), 55" (bottom). Height - over 5'.	426 lbs	75 watts	6 months	450 nm circular, sun- synchronous near- polar orbit with 98.72° inclination
DMSP Block 5D-1	Weather Observation	RCA Astro Electronics Division	Mar 1972	16'x10' (overall dimensions when deployed)	5272 lbs	900 watts	approximate- ly 2½ years	450 nm circular, sun- synchronous near- polar orbit with 98.72° inclination

Satellite	Mission	Contractor	Program Go-Ahead	Dimensions	Weight	Power	Design Life	Orbit
DMSB Block 5D-2	Weather Observation	RCA Astro Electronics Division	12 Nov 1976 (Critical design review date. There was no formal program go-ahead date)	150.5" long, 57" in diameter	1477 lb to 1732 lb (varies with the payload)	550 watts at 28 volts	3 years (mean mission duration)	450 nm (circular), sun-synchronous polar orbit
NAVSTAR Phase I Satellite	Navigation positioning satellite	Rockwell International	Dec 1973	6' long and 6' in diameter while in launch configuration	950 lbs	410 watts (EOL)	6 year mean duration (limits 5-7)	altitude: 10,900 nm (circular), inclination 630, period: 12 hrs

APPENDIX 14

SATELLITE LAUNCHES:

COMMUNICATIONS SATELLITES

Program and Payload	Launch Site	Launch Vehicle	Launch Date	Evaluation of Launch	Operational Lifetime of Satellites
Initial Defense Communications Satellite Program (IDCSP)					
Flight 1	ETR	Titan IIIC	16 Jun 1966	Successful	(7 satellites)
Flight 2	ETR	Titan IIIC	26 Aug 1966	Unsuccessful	(8 satellites)
Flight 3	ETR	Titan IIIC	18 Jan 1967	Successful	(8 satellites)
Flight 4	ETR	Titan IIIC	1 Jul 1967	Successful	(3 satellites)
Flight 5	ETR	Titan IIIC	13 Jun 1968	Successful	(8 satellites)
Defense Satellite Communications System, Phase II (DSCS II)					
Flight 1	ETR	Titan IIIC	2 Nov 1971	Successful	Satellite 9431: 33½ mos Satellite 9432: 10 mos
Flight 2	ETR	Titan IIIC	13 Dec 1973	Successful	Satellite 9433: 33 mos Satellite 9434: Still in operation as of 30 Sep 1979

Program and Payload	Launch Site	Launch Vehicle	Launch Date	Evaluation of Launch	Operational Lifetime of Satellites
Flight 3	ETR	Titan IIIC	20 May 1975	Unsuccessful	-
Flight 4	ETR	Titan IIIC	12 May 1977	Successful	Satellite 9437: Still in operation as of 30 Sep 1979 Satellite 9438: Still in operation as of 30 Sep 1979
Flight 5	ETR	Titan IIIC	25 Mar 1978	Unsuccessful	-
Flight 6	ETR	Titan IIIC	13 Dec 1978	Successful	Satellite 9441: Still in operation as of 30 Sep 1979 Satellite 9442: Still in operation as of 30 Sep 1979
Skynet IA	ETR	Thor-Delta	21 Nov 1969	Successful	24 mos
Skynet IB	ETR	Thor-Delta	19 Aug 1970	Unsuccessful	-
Skynet IIA	ETR	Delta 2313	18 Jan 1974	Unsuccessful	-
Skynet IIB	ETR	Delta 2313	22 Nov 1974	Successful	Still operational as of 30 Sep 1979
NATO IIA	ETR	Thor-Delta	20 Mar 1970	Successful	24 mos
NATO IIB	ETR	Thor-Delta	3 Feb 1971	Successful	66½ mos

Program and Payload	Launch Site	Launch Vehicle	Launch Date	Evaluation of Launch	Operational Lifetime of Satellites
NATO IIIA	ETR	Thor-Delta	22 Apr 1976	Successful	Still operational as of 30 Sep 1979
NATO IIIB	ETR	Thor-Delta	27 Jan 1977	Successful	In on-orbit storage as of 30 Sep 1979
NATO IIIC	ETR	Thor-Delta	18 Nov 1978	Successful	In on-orbit storage as of 30 Sep 1979
Tactical Communications Satellite (TACSAT)	ETR	Titan IIIC	9 Feb 1969	Successful	46 mos
Fleet Satellite Communications (FLTSATCOM)					
Flight 1	ETR	Atlas	9 Feb 1978	Successful	Still operational as of 30 Sep 1979
Flight 2	ETR	Atlas/Centaur	4 May 1979	Successful	Still operational as of 30 Sep 1979

APPENDIX 15

SATELLITE LAUNCHES:

VELA (NUCLEAR DETECTION) SATELLITE PROGRAM

Payload	Launch Site	Launch Vehicle	Launch Date	Evaluation of Launch	On-Orbit Lifetime of Satellite
Flight 1 (Satellites 1801 and 1851)	ETR	Atlas/Agena	16 Oct 1963	Successful	68 months
Flight 2 (Satellites 3662 and 3674)	ETR	Atlas/Agena	17 Jul 1964	Successful	60 months
Flight 3 (Satellites 6564 and 6577)	ETR	Atlas/Agena	17 Jul 1965	Successful	66 months
Flight 4 (Satellites 6638 and 6679)	ETR	Titan IIIC	28 Apr 1967	Successful	46 months
Flight 5 (Satellites 6909 and 6679)	ETR	Titan IIIC	23 May 1969	Successful	Still operational as of 30 Sep 1979
Flight 6 (Satellites 7033 and 7044)	ETR	Titan IIIC	8 Apr 1970	Successful	Still operational as of 30 Sep 1979

APPENDIX 16

SATELLITE LAUNCHES:

DEFENSE METEOROLOGICAL SATELLITE PROGRAM

Flight Number and Type	Launch Site	Launch Vehicle	Launch Date	Evaluation of Launch	Operational Lifetime of Satellite
F-24 (Block 5A)	WTR	LV-2F/Burner II	11 Feb 1970	Successful	3 months
F-25 (Block 5A)	WTR	LV-2F/Burner II	3 Sep 1970	Successful	5½ months
F-26 (Block 5A)	WTR	LV-2F/Burner II	17 Feb 1971	Successful	24½ months
F-27 (Block 5B)	WTR	LV-2F/Burner IIA	14 Oct 1971	Successful	6½ months
F-28 (Block 5B)	WTR	LV-2F/Burner IIA	24 Mar 1972	Successful	23½ months
F-30 (Block 5C)	WTR	LV-2F/Burner IIA	9 Nov 1972	Successful	7½ months
F-29 (Block 5B)	WTR	LV-2F/Burner IIA	17 Aug 1973	Successful	39½ months
F-31 (Block 5C)	WTR	LV-2F/Burner IIA	16 Mar 1974	Successful	26 months
F-32 (Block 5C)	WTR	LV-2F/Burner IIA	9 Aug 1974	Successful	40 months
F-33 (Block 5C)	WTR	LV-2F/Burner IIA	24 May 1975	Successful	30 months
F-34 (Block 5C)	WTR	LV-2F/Burner IIA	18 Feb 1976	Unsuccessful	
F-1 (Block 5D-1)	WTR	LV-2F	11 Sep 1976	Successful	36 months

Flight Number and Type	Launch Site	Launch Vehicle	Launch Date	Evaluation of Launch	Operational Lifetime of Satellite
F-2 (Block 5D-1)	WTR	LV-2F	5 Jun 1977	Partially Successful	Still operational as of 30 Sep 1979
F-3 (Block 5D-1)	WTR	LV-2F	30 Apr 1978	Successful	Still operational as of 30 Sep 1979
F-4 (Block 5D-1)	WTR	LV-2F	6 Jun 1979	Successful	Still operational as of 30 Sep 1979

APPENDIX 17

SATELLITE LAUNCHES:

GLOBAL POSITIONING SYSTEM (GPS)

Flight Number and Type	Launch Site	Launch Vehicle	Launch Date	Evaluation of Launch	Operational Lifetime of Satellite
Navigation Technology Satellite (NTS)-2	WTR	Atlas F/ Stage Vehicle	23 Jun 1977	Successful	8 months
NAVSTAR-1	WTR	Atlas F/ Stage Vehicle	22 Feb 1978	Successful	Still operational as of 30 Sep 1979
NAVSTAR-2	WTR	Atlas F/ Stage Vehicle	13 May 1978	Successful	Still operational as of 30 Sep 1979
NAVSTAR-3	WTR	Atlas F/ Stage Vehicle	6 Oct 1978	Successful	Still operational as of 30 Sep 1979
NAVSTAR-4	WTR	Atlas F/ Stage Vehicle	11 Dec 1978	Successful	Still operational as of 30 Sep 1979

APPENDIX 18

SPACECRAFT LAUNCHES:

SPACE TEST PROGRAM

Flight Number	Payload	Launch Site	Launch Vehicle	Launch Date	Evaluation of Launch
P67-1	Sequential Collation of Range (SECOR) Charged Particle and Auroral Measurements (AURORA)	WTR	Thor/Burner II	29 Jun 1967	Successful
P67-2	Lincoln Experimental Satellite 6 (LES 6) Sync Radiation Monitoring Satellite (OV2-5) Solar Particle Monitoring Satellites (OV5-2) Zero G Liquid Heat Transfer (OV5-4)	ETR	Titan IIIC	26 Sep 1968	Successful
S67-3	Radiometer 12 Radiometer 15 Solar X-ray	WTR	Thorad/Agena	7 Aug 1967	Successful
P68-1	Radar Calibration Target (RADCAT) Lincoln Calibration Sphere (LCS-3) Ultra-Violet Radiometer (UVR) Radiometer 18 Ionospheric RF Propagation Studies (ORBIS CAL I) Grid Drag Sphere Sequential Collation Of Range (SECOR) Sequential Collation of Range (SECOR) Geodetic and Gravitational Measurements - LIDOS Orbital Space Vacuum Friction Experiment	WTR	Atlas/Burner II	16 Aug 1968	Unsuccessful

Flight Number	Payloads	Launch Site	Launch Vehicle	Launch Date	Evaluation of Launch
S68-2	Sequential Collation of Range (SECOR)	WTR	Thorad/Agena	18 May 1968	Unsuccessful
S68-3	VLF Plasma Wave Detector (OV5-5) Solar Flare Particle and X-ray Satellite (OV5-6) Solar Flare Particle and X-ray Satellite (OV5-9)	ETR	Titan IIIC	23 May 1969	Successful
P69-1	Auroral and Atmospheric Studies Satellite (OV1-17) Auroral Effects Measurements Satellite (OV1-18) Radiation Belt Particle Monitoring Satellite (OV1-19) Ionospheric RF Propagation Studies (ORBIS-CAL II)	WTR	Atlas F/Tri OV1	17 Mar 1969	Successful
S69-2	Sequential Collation of Range (SECOR)	WTR	Thorad/Agena	14 Apr 1969	Successful
S69-4	Radar Calibration Cone/Cylinder	WTR	Thorad/Agena	30 Sep 1969	Successful
P70-1	Celestial IR Measurements-1 Spacecraft Attitude Sensing Devices	WTR	Thor/Burner II	8 Jun 1971	Successful

Flight Number	Payloads	Launch Site	Launch Vehicle	Launch Date	Evaluation of Launch
P70-2	Low Altitude Density Satellite - Cannonball II Energetic Proton Analyzer (OV1-20) Particle Energy and Flux (OV1-20) Radar Tracked Density Satellite-Musketball Lincoln Calibration Sphere (ICS-4) Grid Sphere Drag ELF/VLF Antenna Impedance and Plasma Effects (OV1-21) Atmospheric Neutral Composition (OV1-21) Velocity Mass Spectrometer (OV1-21)	ETR	Atlas F/Dual OVI	7 Aug 1971	Successful
S70-3	TOPO-A	WTR	Thorad/Agena	8 Apr 1970	Successful
S70-4	Radar Calibration and Drag Sphere	WTR	Thor/Burner II	16 Feb 1971	Successful
P71-2	Celestial Mapping Program Flexible Solar Array Ionospheric Effects of Energetic Particle Interaction Command and Control Interfaces	WTR	Thorad/Agena	17 Oct 1971	Successful
S71-3	Cold Cathode Ion Gauge Nightglow Photometer	WTR	Thorad/Agena	19 Apr 1972	Successful

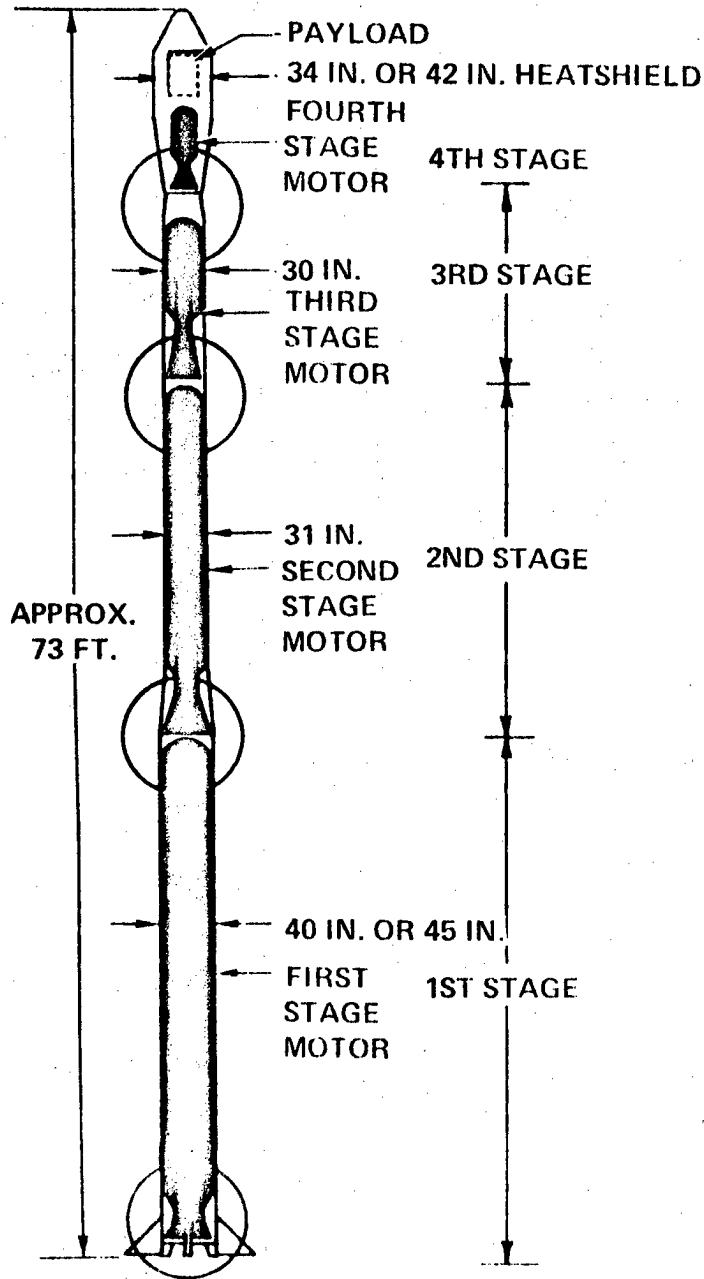
Flight Number	Payloads	Launch Site	Launch Vehicle	Launch Date	Evaluation of Launch
S71-5	Ionization Density Gauge Mapping of Atmospheric Density and Composition	WTR	Thorad/Agena	25 May 1972	Successful
P72-1	Gamma Spectrometer Extreme UV Ionospheric Radiation Flux and Spectra of Low Altitude Particles Thermal Control Coatings Radar Calibration Target (RADCAT)	WTR	Atlas F/Burner II	2 Oct 1972	Successful
P72-2	RM-20 IR Radiometers UV Radiometer Atmospheric Effects on Wideband Radio Signals Global Aerosol Monitor	WTR	Atlas F	12 Apr 1975	Unsuccessful
P73-3	Navigation Technology Satellite I (NTS-1)	WTR	Atlas F	13 Jul 1974	Successful
S73-5	Low Altitude Density Thermospheric Composition Atmospheric Heating	WTR		Oct 1974	Successful

Flight Number	Payloads	Launch Site	Launch Vehicle	Launch Date	Evaluation of Launch
S73-6	Dynamics of Polar Atmosphere Ionization Density Gauge Density and Composition Low Altitude Trapped Particle Environment Auroral Particles and Fields Piezoelectric Accelerometer	WTR		Dec 1975	Successful
S73-7	Calibration Satellite	WTR		Apr 1974	Failure
P74-1	Lincoln Experimental Satellites 8 and 9 (LES 8/9) Solar Radiation Satellites 11A and 11B (SOLRAD 11A/B)	ETR	Titan IIIIC	14 Mar 1976	Successful
S74-2	Trapped Proton Monitoring Electric Fields - Ion Drift ELF/VLF Antenna and Propagation Energetic Electron Environment Magnetospheric H ₂ , He Ion Abundance Polar DC Electric Fields Low Energy Particle Spectrometer	WTR		Jul 1976	Successful
S75-1	Velocity Vector Sensor Assembly	WTR		Dec 1975	Successful
P76-5	Wideband Radio Signal Propagation	WTR	Scout	22 May 1976	Successful

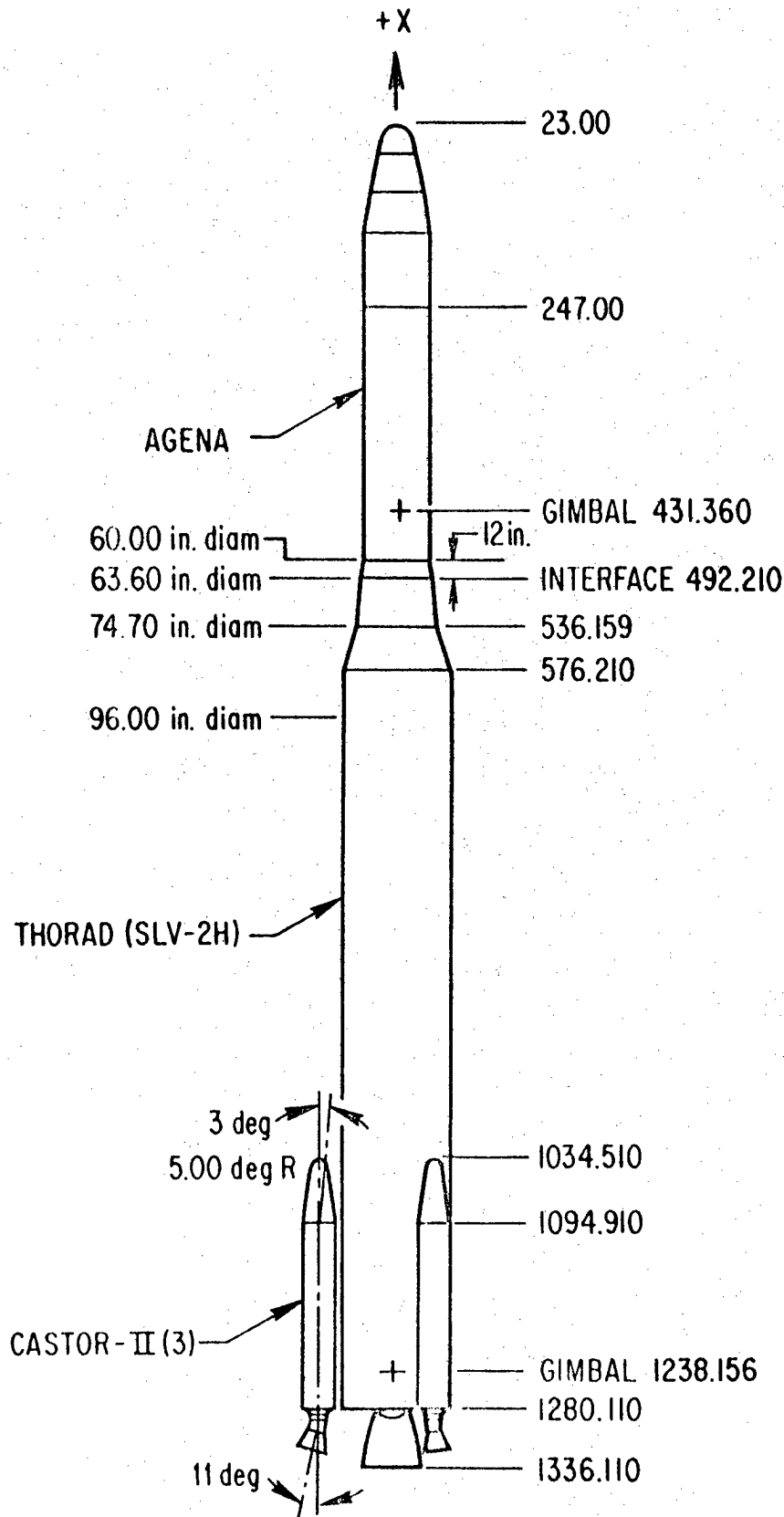
Flight Number	Payloads	Launch Site	Launch Vehicle	Launch Date	Evaluation of Launch
S76-1	DMA Geodetic Package			2nd quarter of 1977	Successful
S77-1	DMA Geodetic Package			1st quarter of 1978	Successful
S77-2	Pulsed Plasma Probe Vacuum Ultraviolet Background Experiment Global Atmospheric Structure Experiment Space Forecasting Experiment Classified Experiment			1st quarter of 1978	Successful
S78-1	DMA Geodetic Package			3rd quarter of 1979	Successful
P78-1	Gamma Ray Spectrometer High Latitude Particles Experiment Solar X-Ray Spectro-Heliograph Extreme Ultraviolet Spectrometer Solar Wind Experiment X-Ray Monitor Aerosol Monitor	WTR	Atlas F	24 Feb 1979	Successful
P78-2	SCATHA (Spacecraft Charging at High Altitudes) satellite: twelve experiments dealing with the build-up of electrical charges on the surfaces of spacecraft orbiting at geosynchronous altitude	ETR	Delta	30 Jan 1979	Successful

APPENDIX 19

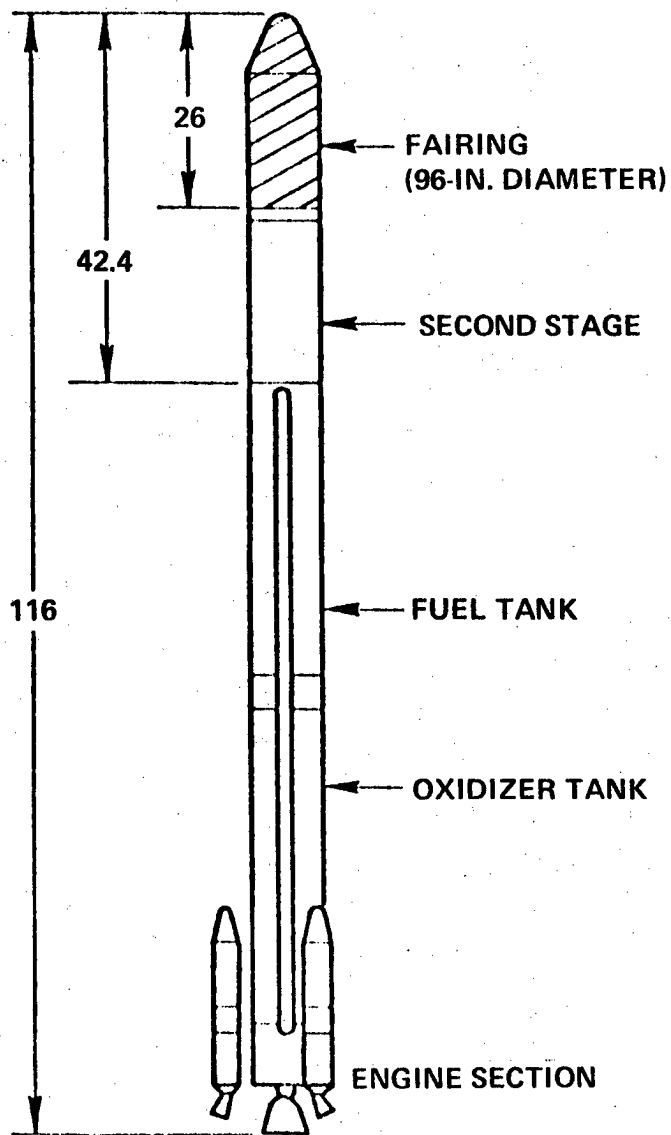
LAUNCH VEHICLE ILLUSTRATIONS



Scout D Major Assemblies

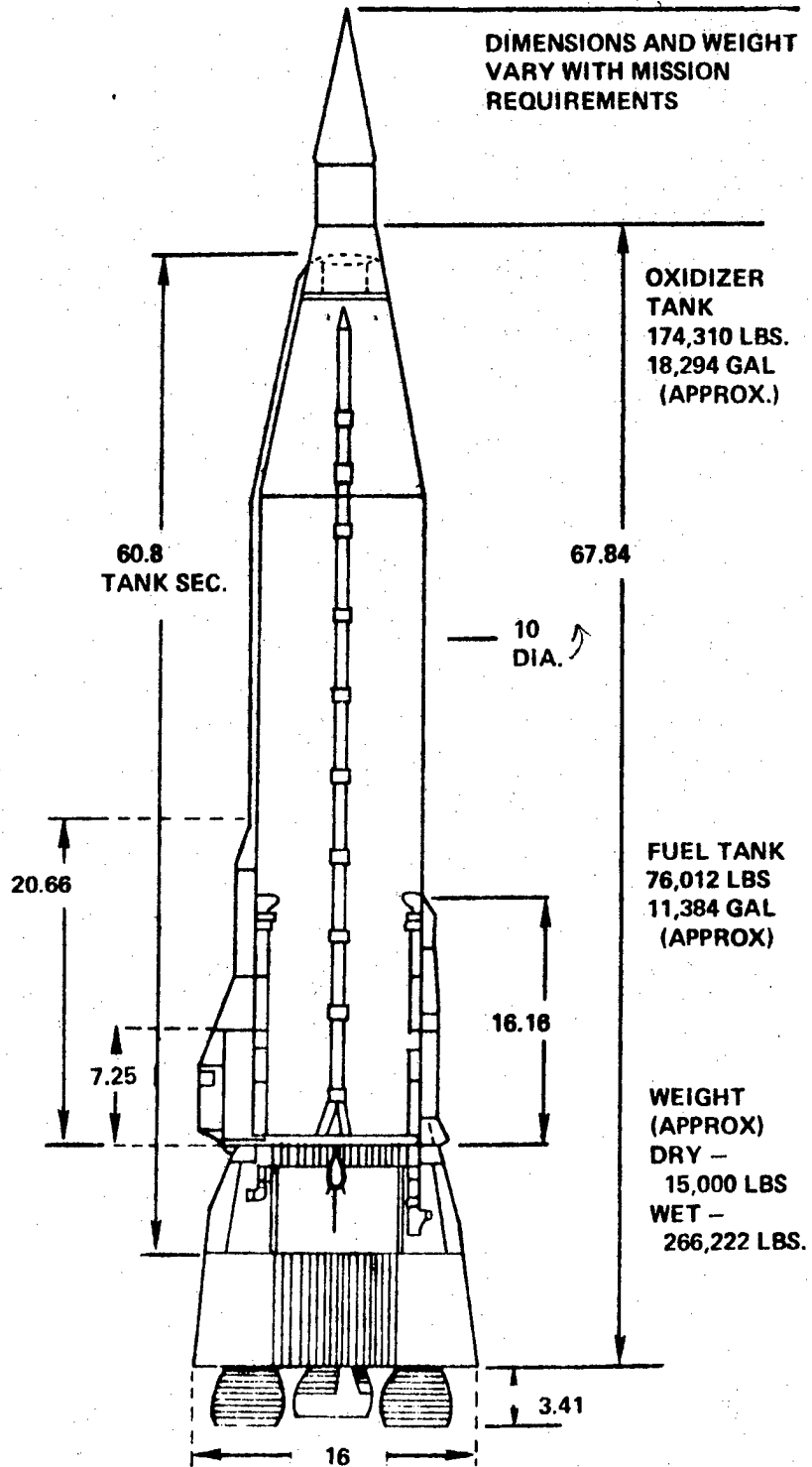


SLV-2H/Agena General Configuration
 (Station Numbers Are in Inches)



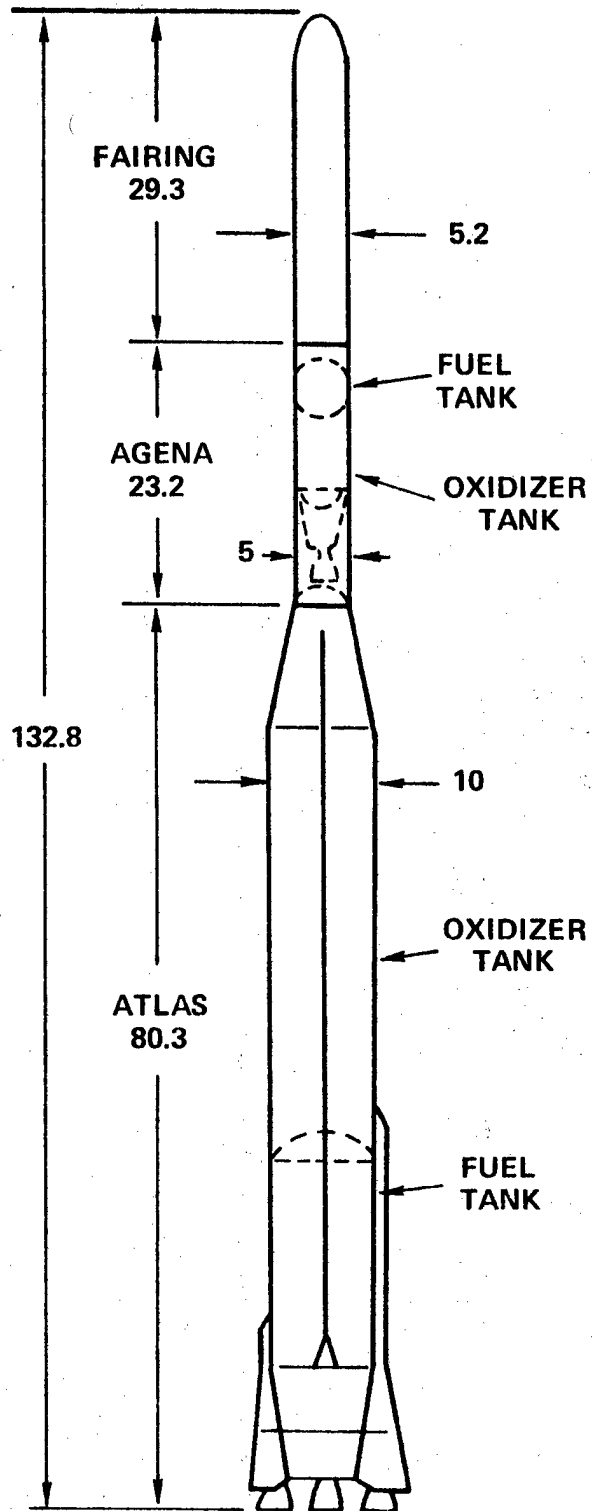
ALL DIMENSIONS ARE IN FEET

Delta Outboard Profile with 96-Inch Diameter Fairing



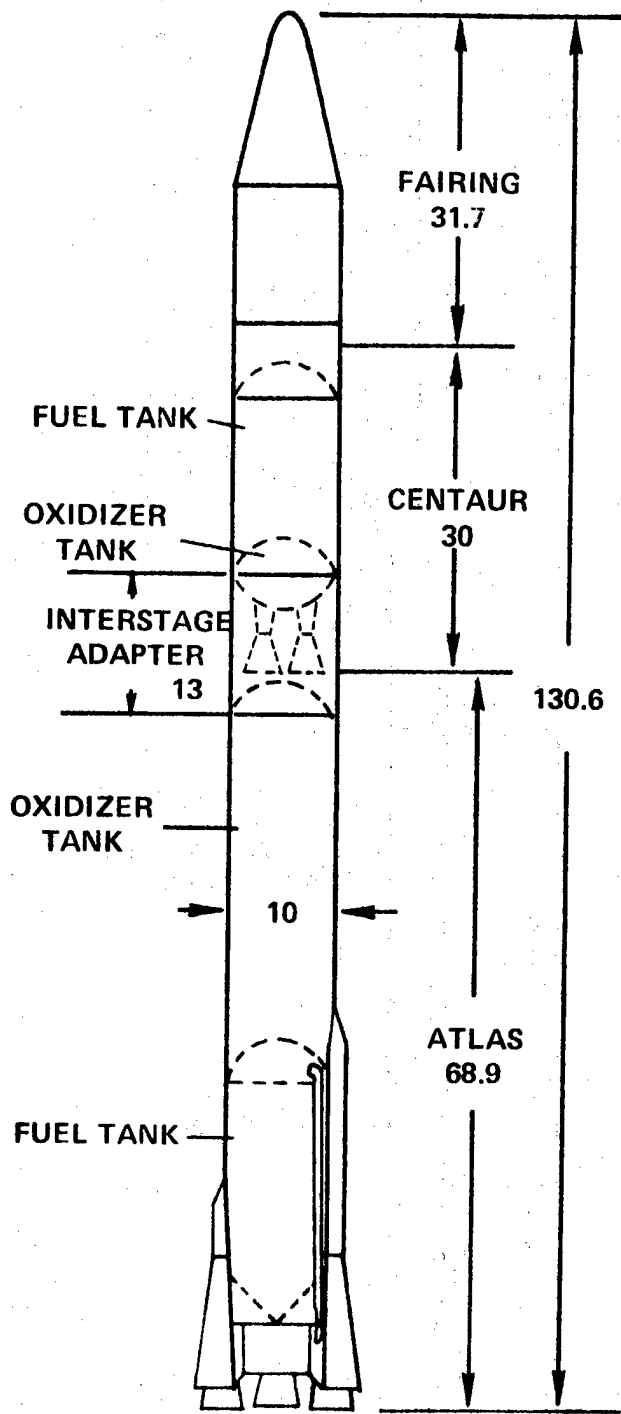
ALL DIMENSIONS ARE IN FEET

Atlas E/F Launch Vehicle



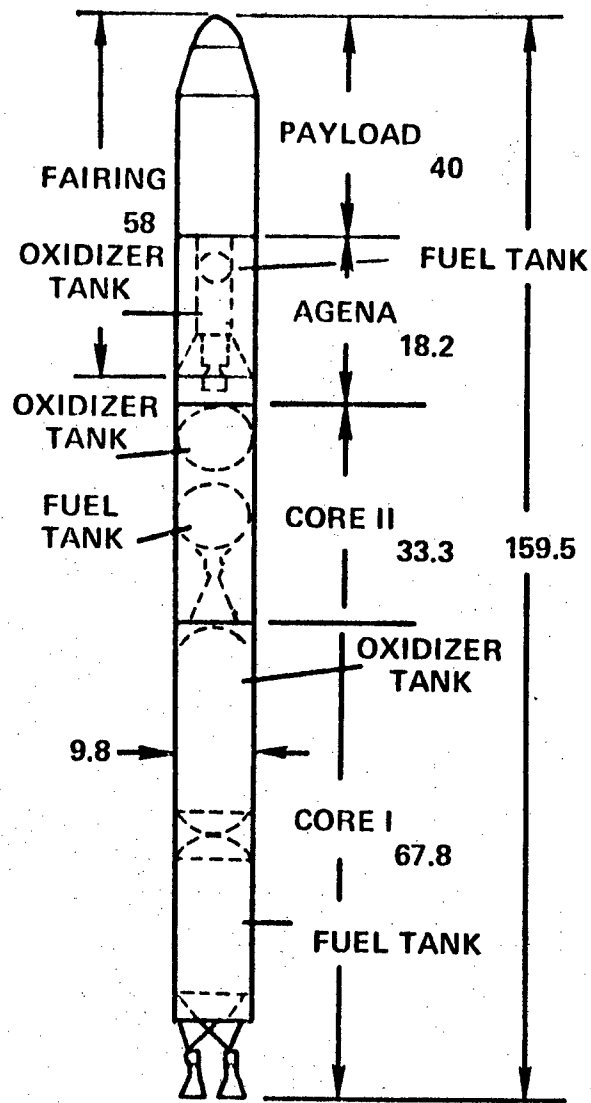
ALL DIMENSIONS ARE IN FEET

SLV-3A/Agena Configuration



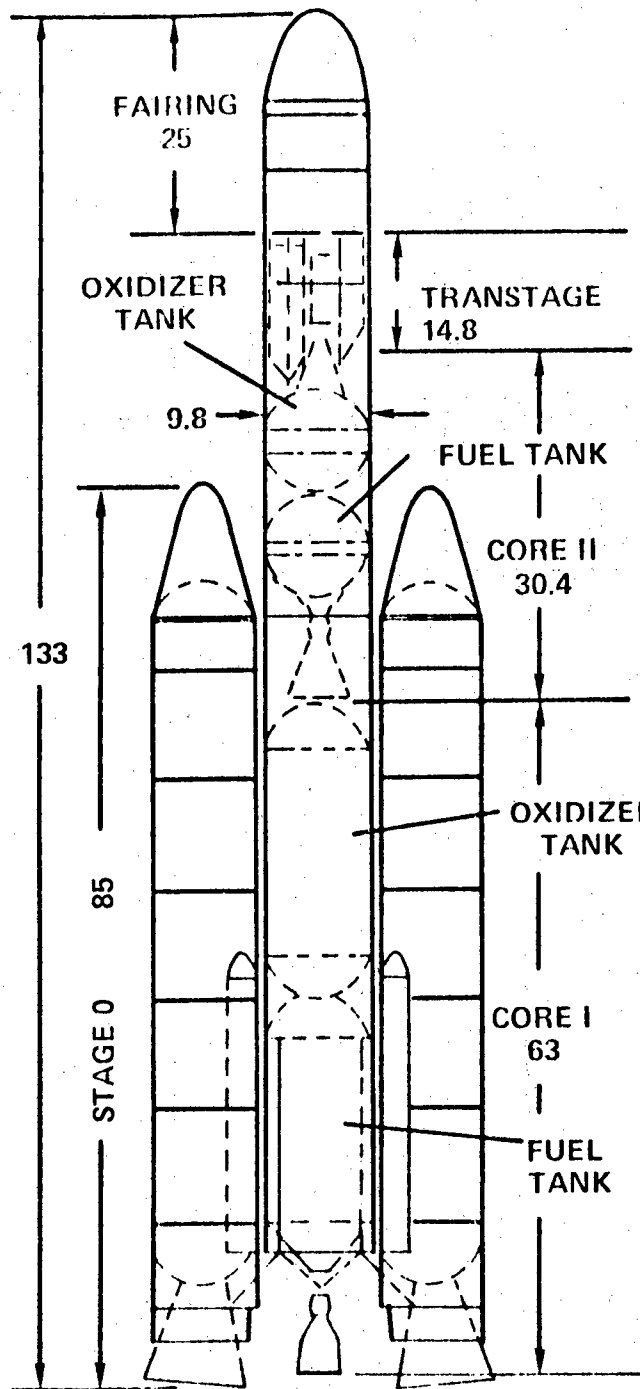
ALL DIMENSIONS ARE IN FEET

SLV-3D/Centaur Configuration



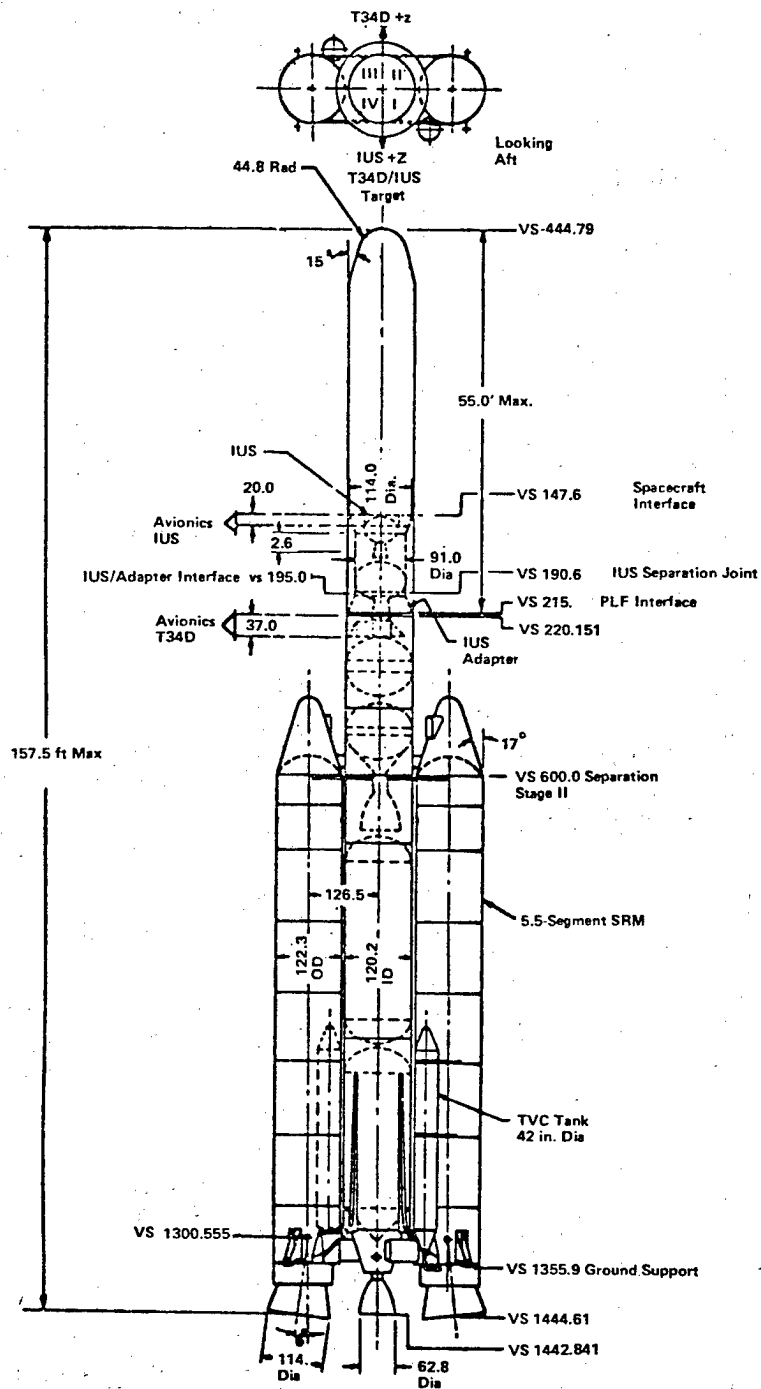
ALL DIMENSIONS ARE IN FEET

Titan IIIB/Agena Launch Vehicle

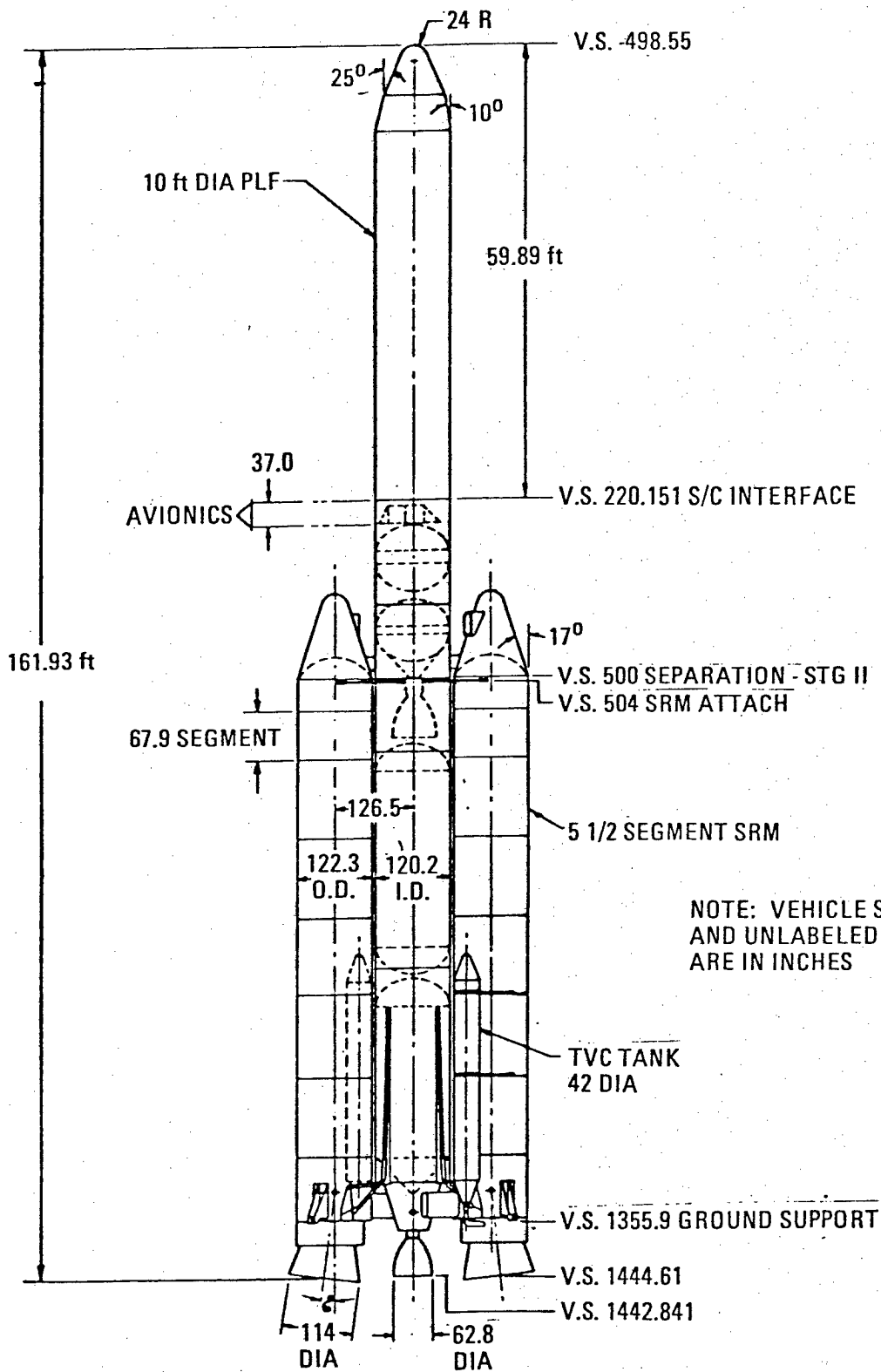


ALL DIMENSIONS ARE IN FEET

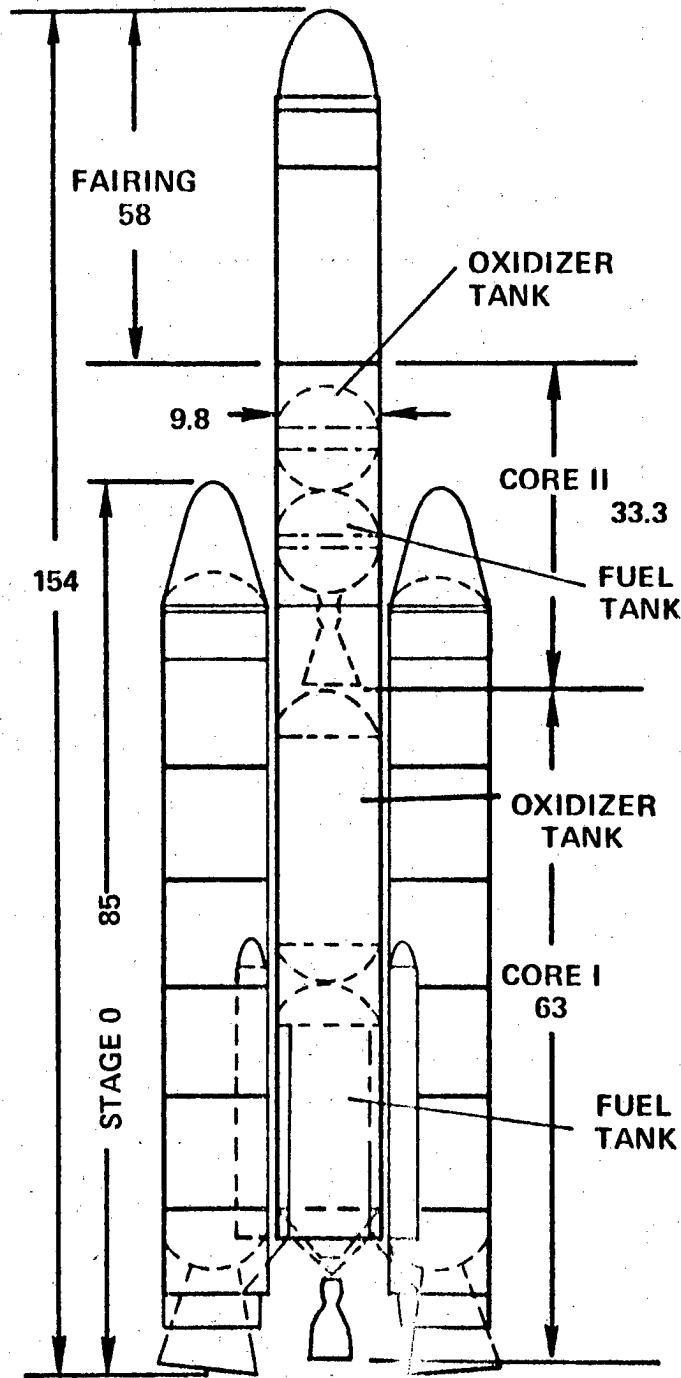
Titan IIIC Launch Vehicle



Titan III 34D with Inertial Upper Stage (East Coast Configuration)

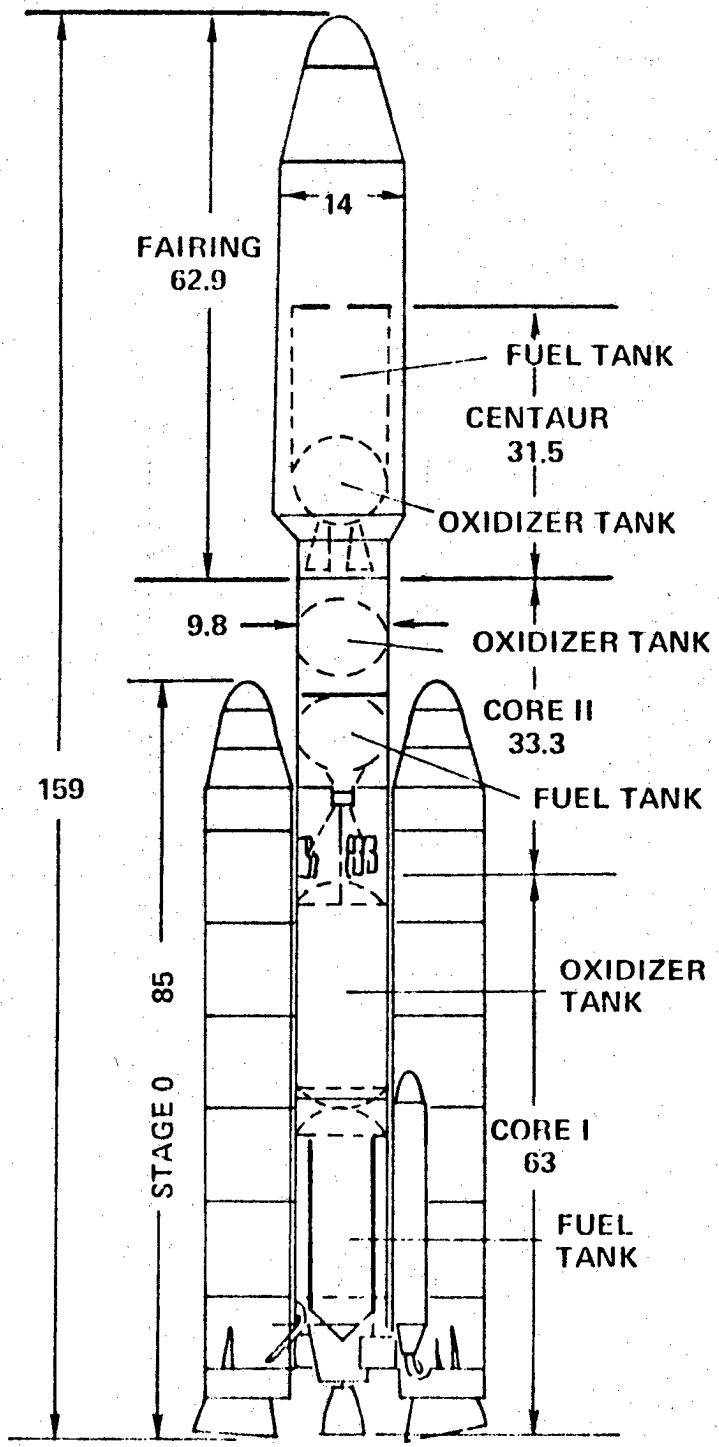


Titan III 34D with Radio Guidance System (West Coast Configuration)



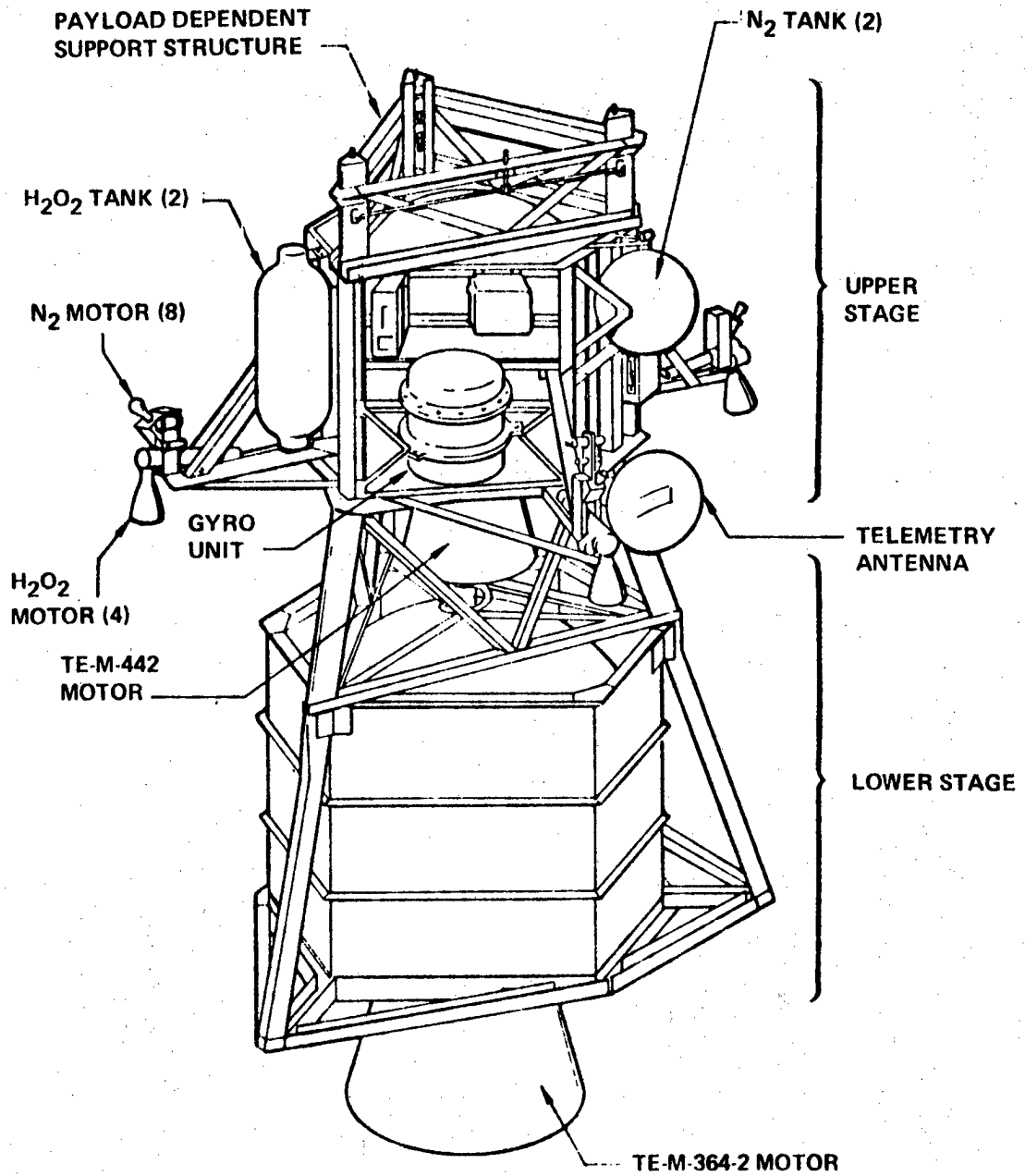
ALL DIMENSIONS ARE IN FEET

Titan IIID Launch Vehicle

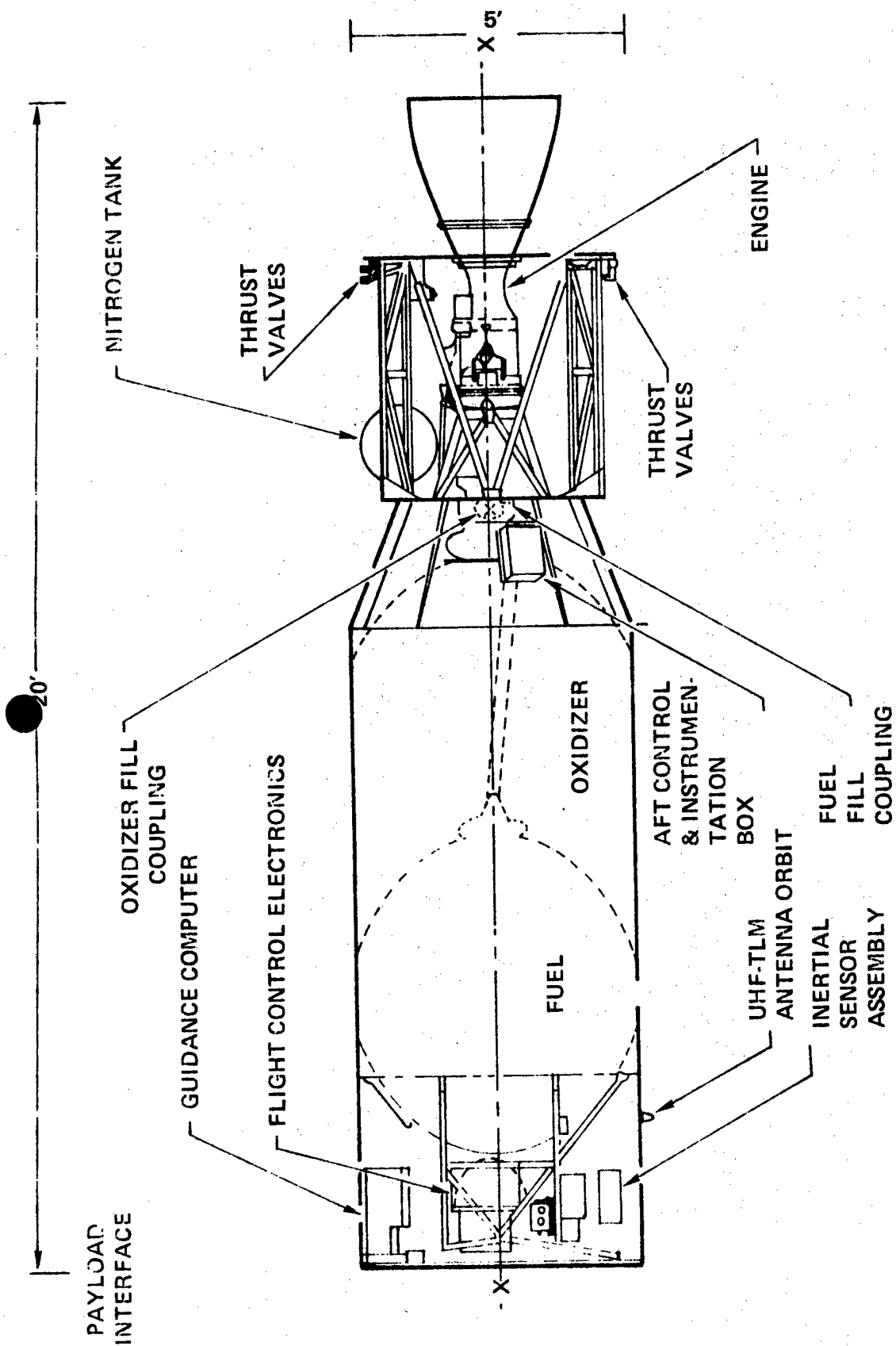


ALL DIMENSIONS ARE IN FEET

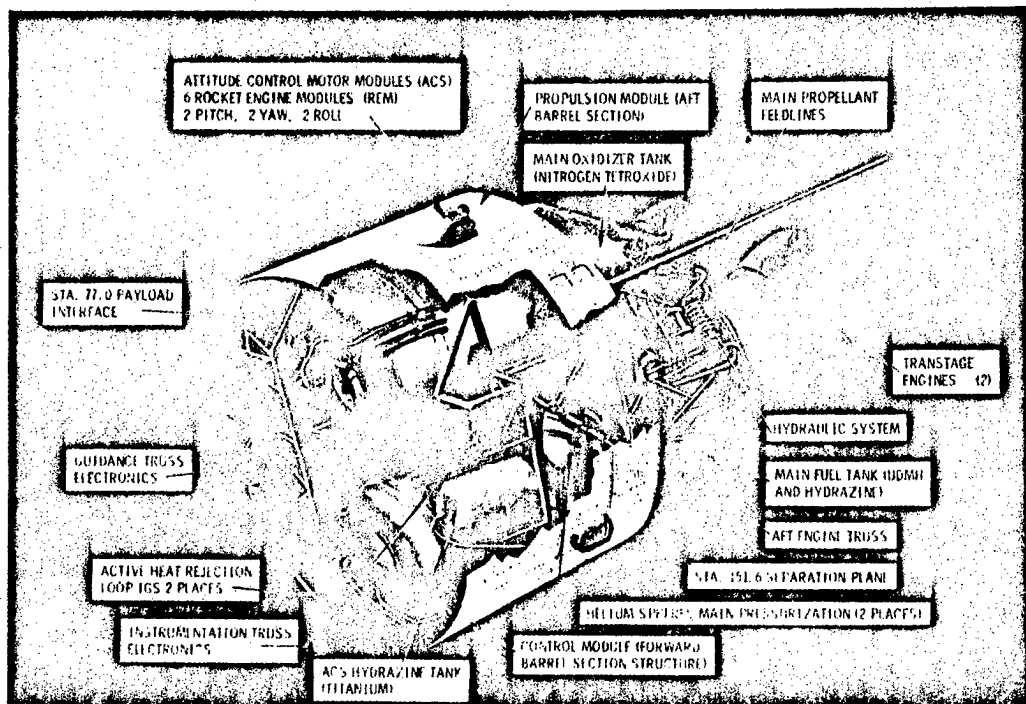
Titan IIIE/Centaur Launch Vehicle



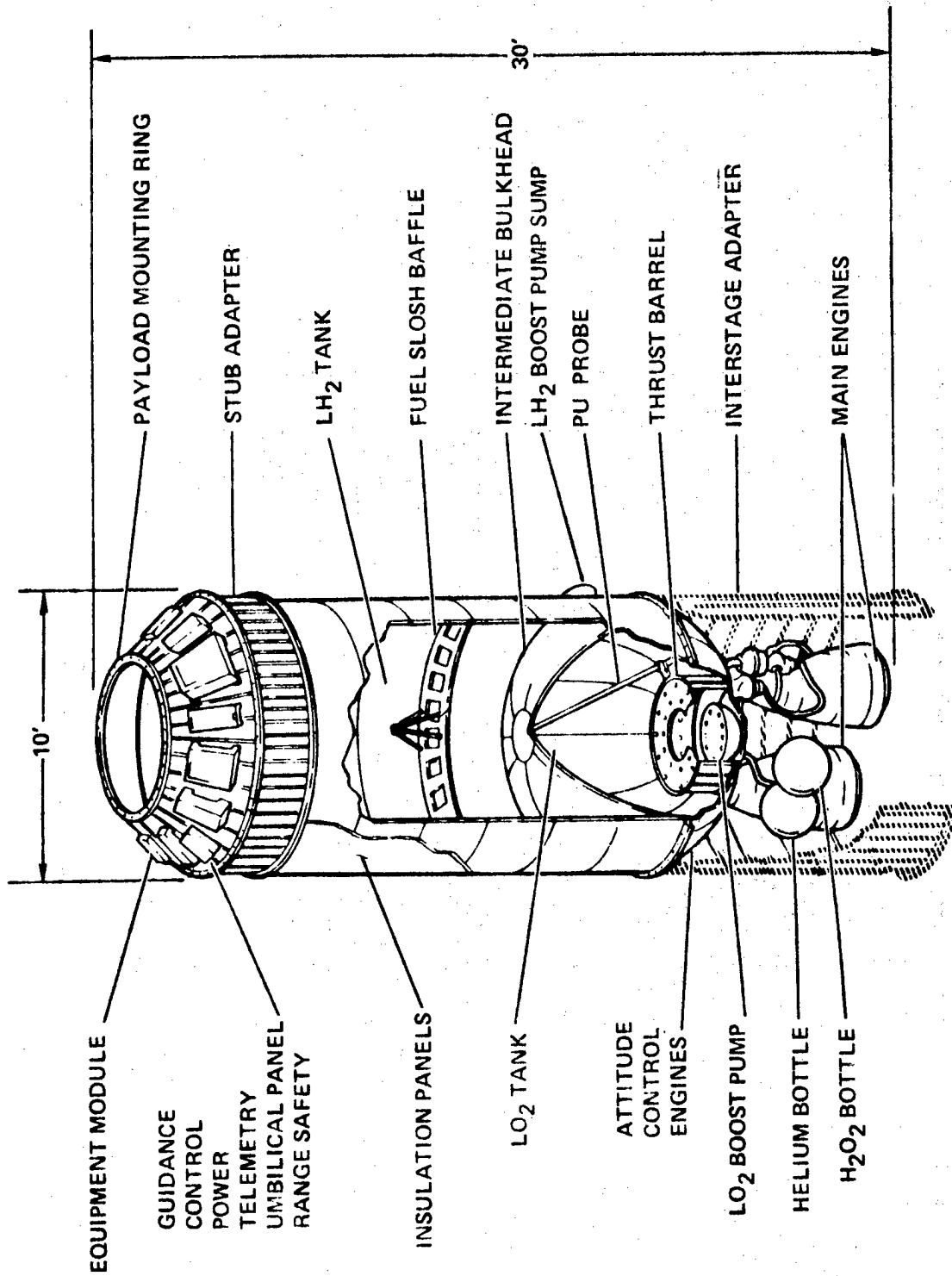
Burner IIA Upper Stage



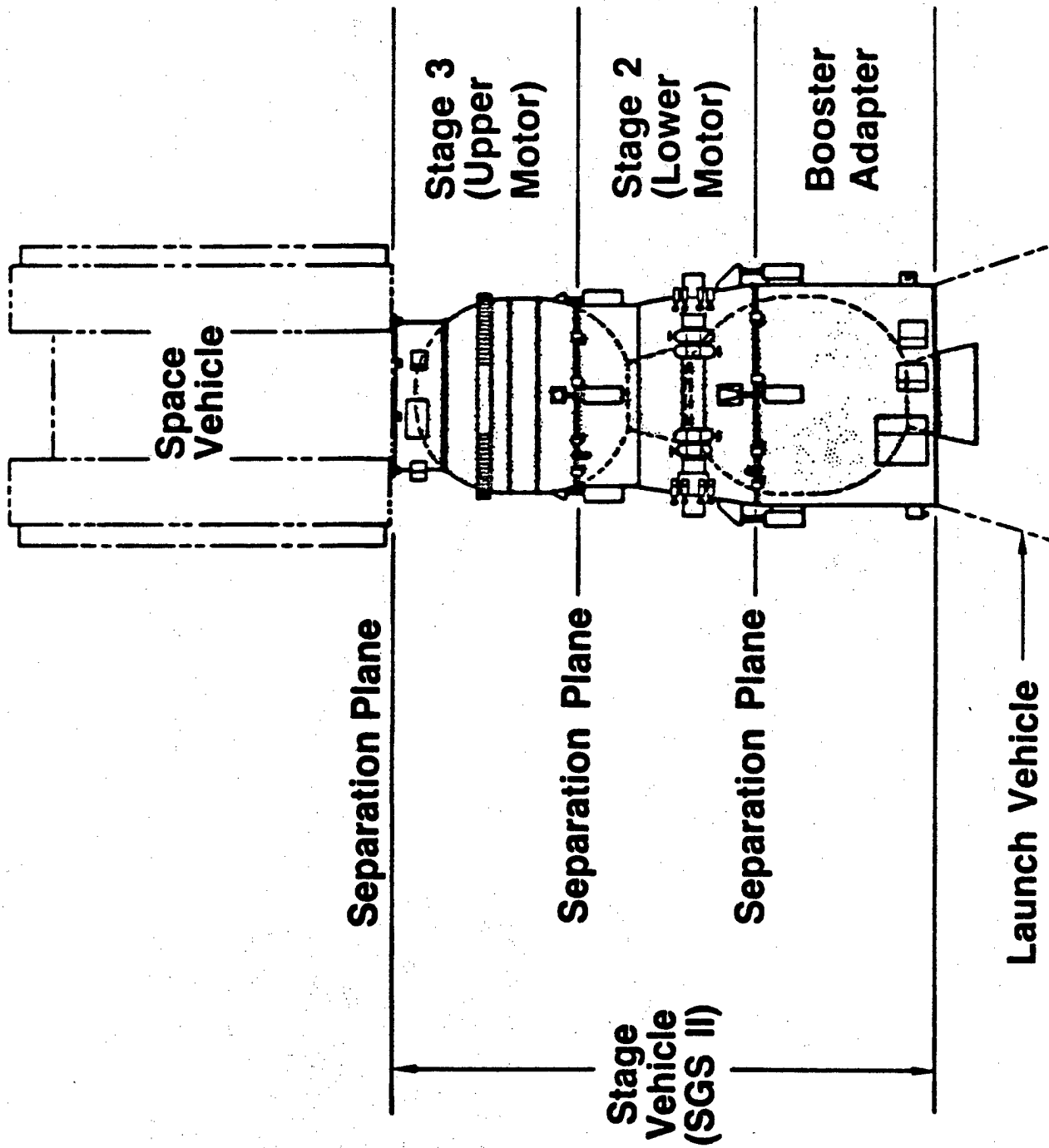
Ascent Agena Inboard Profile



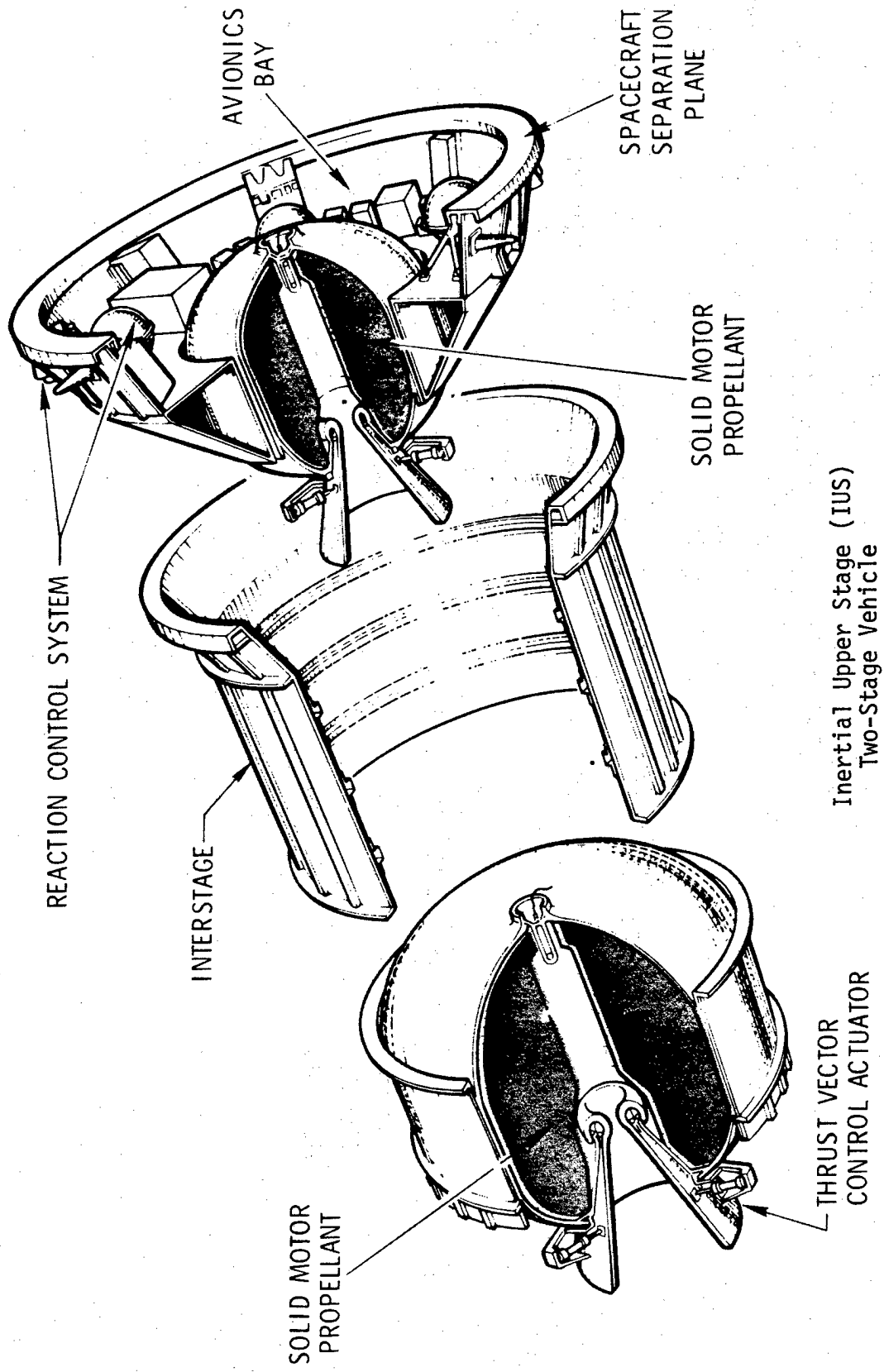
Titan IIIC Transtage



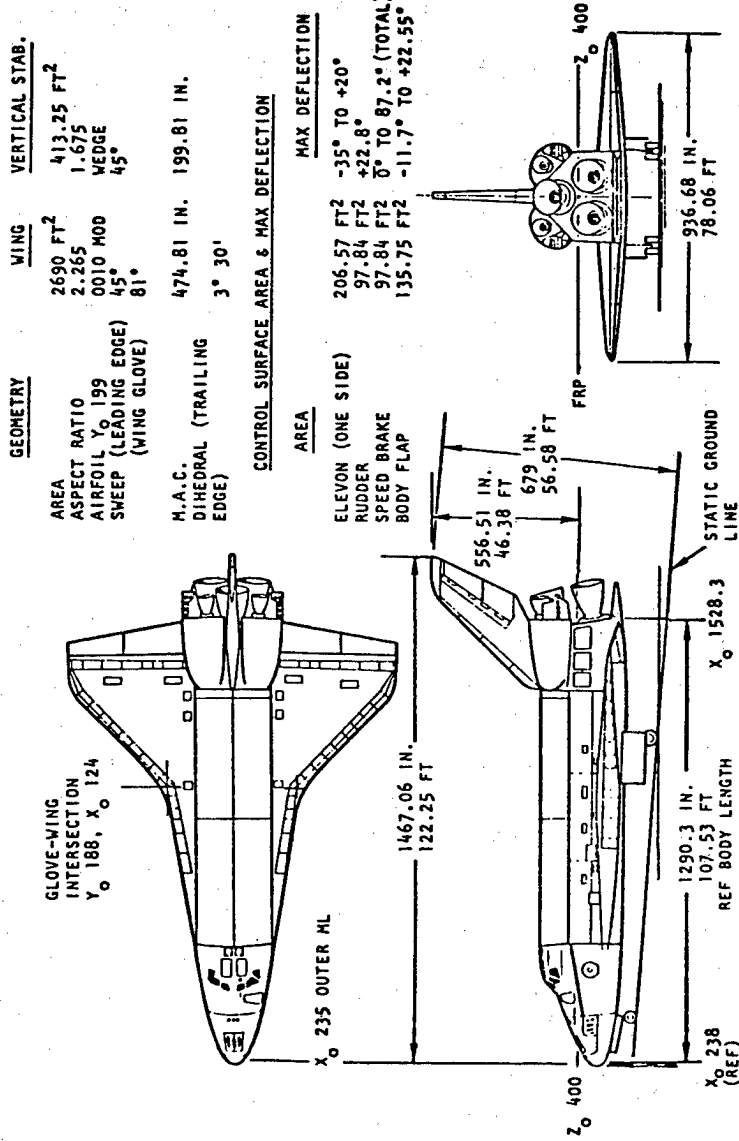
Centaur D-1 Systems



GPS Stage Vehicle System
SGS II



Inertial Upper Stage (IUS)
Two-Stage Vehicle



Space Transportation System
Orbiter Vehicle

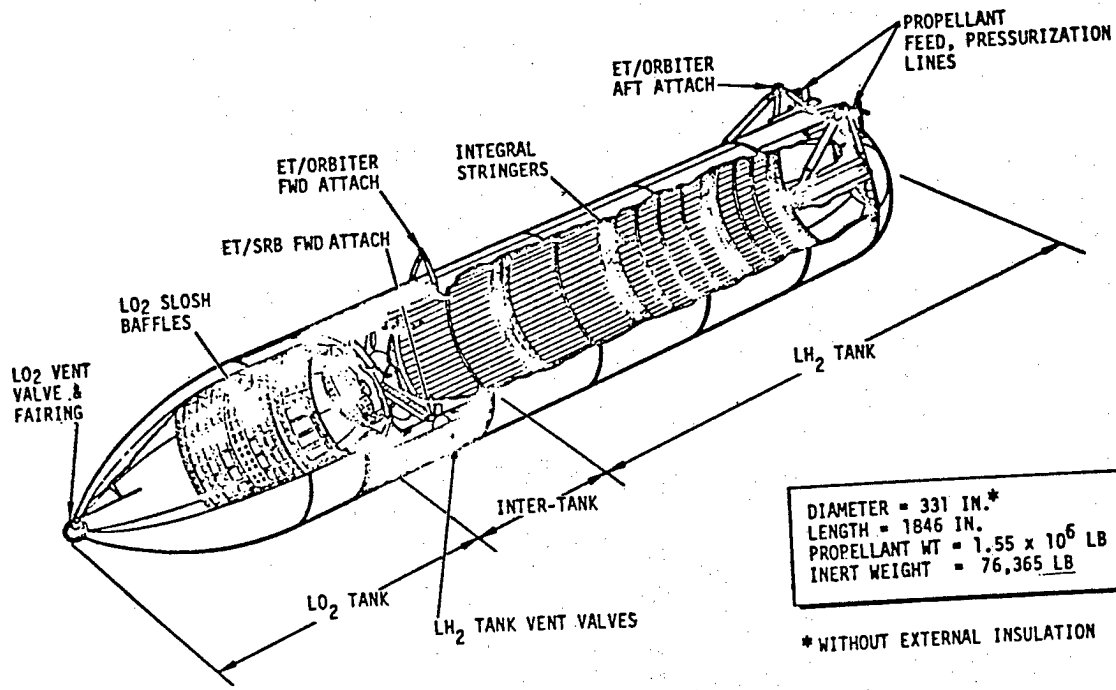
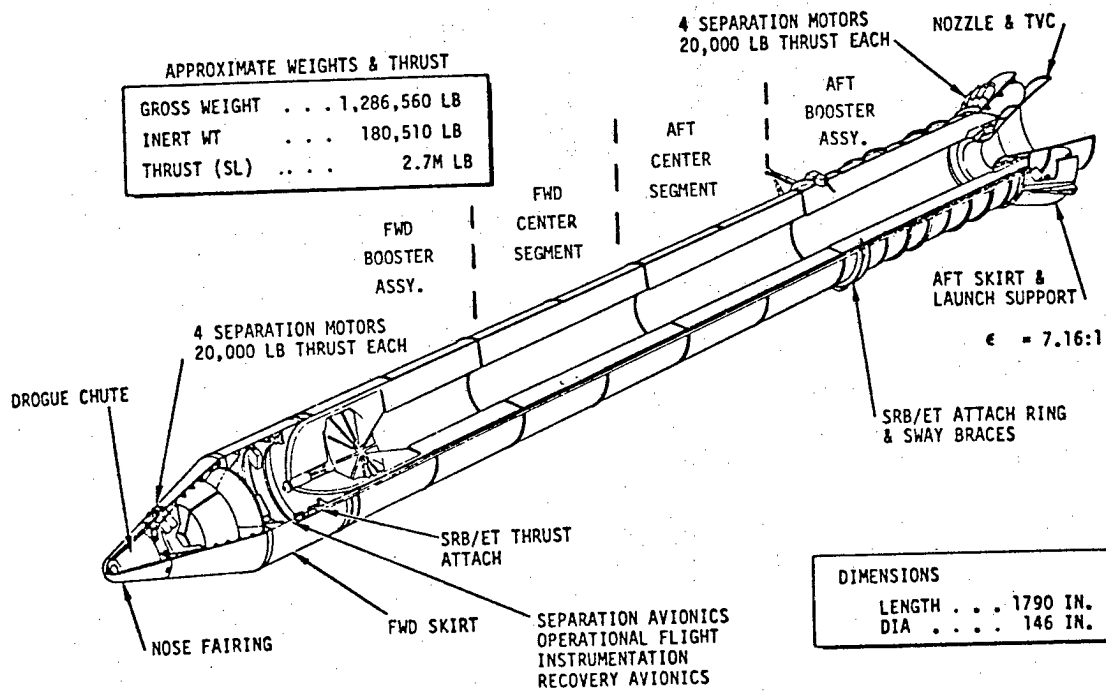
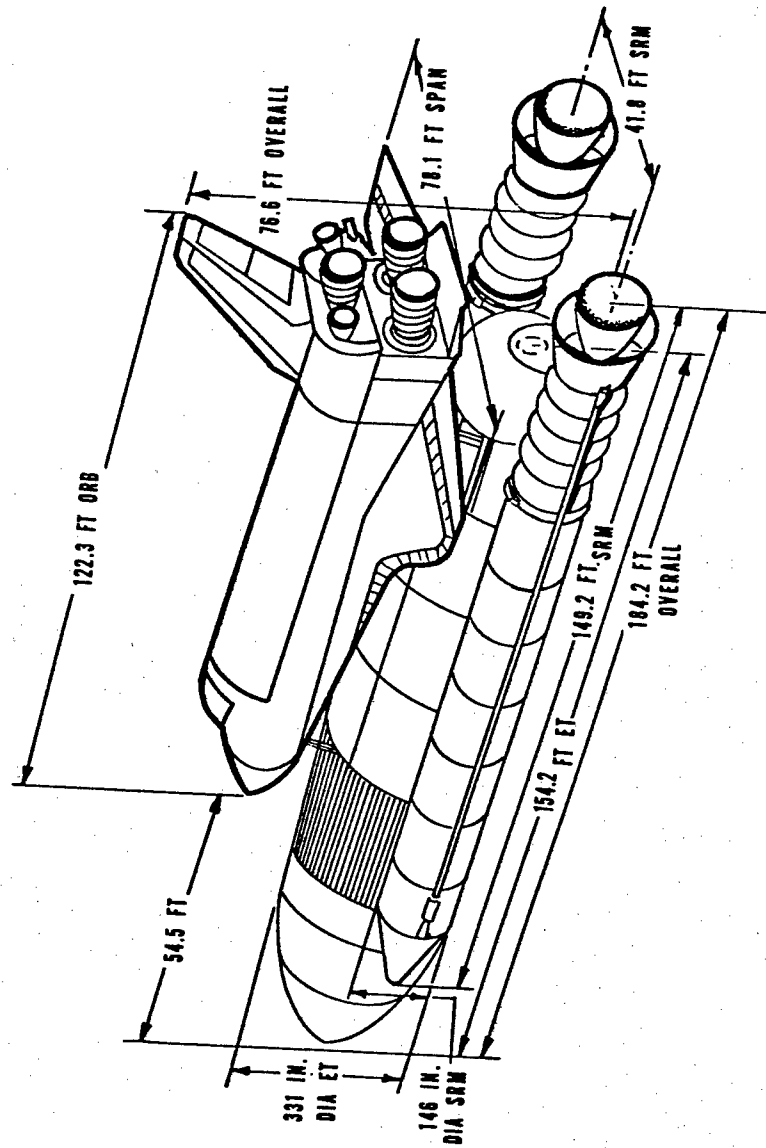


FIGURE VI- 2. Cutaway view of the STS External Tank (ET).



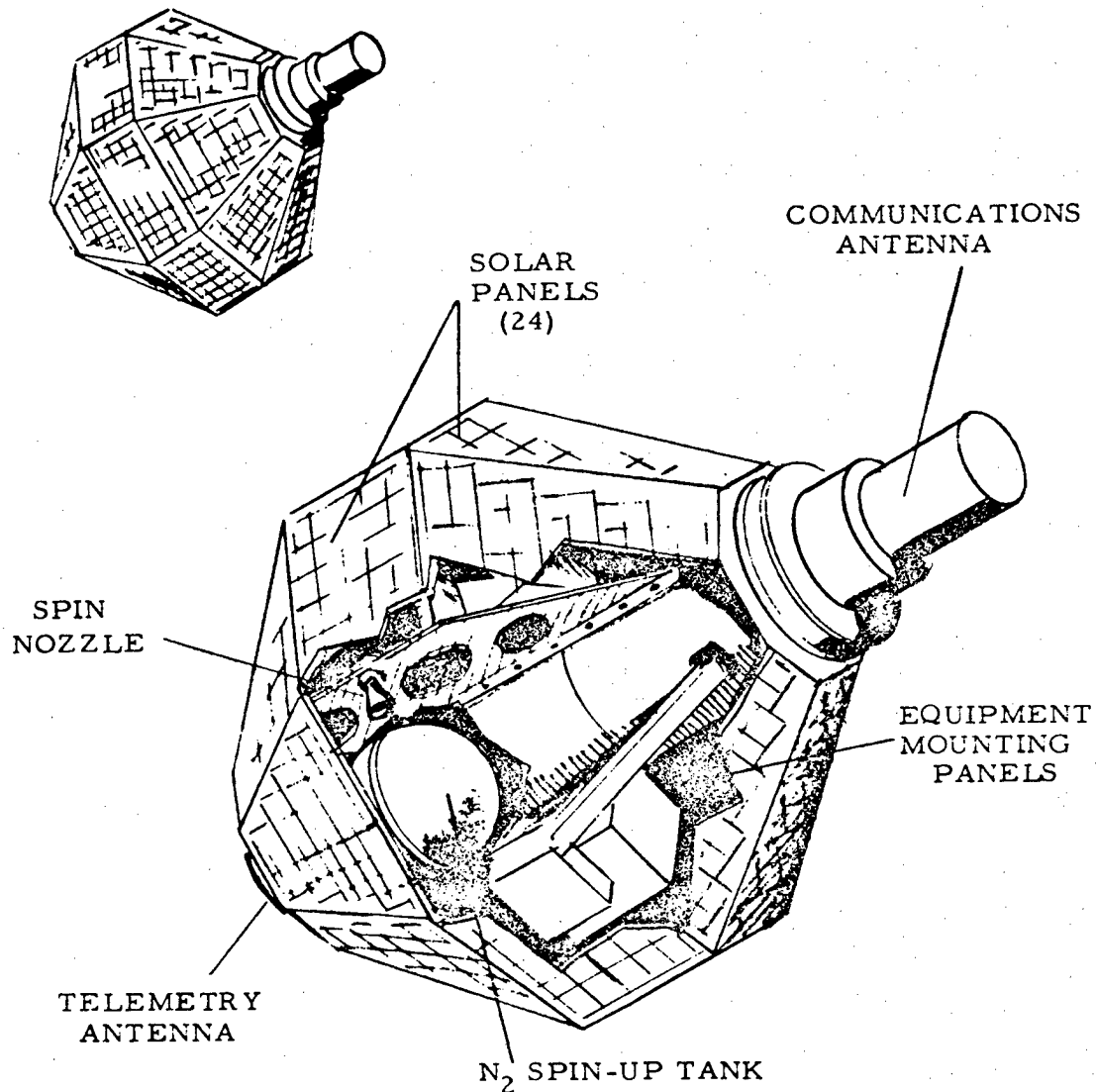
Space Transportation System
Solid Rocket Booster



The Space Shuttle Vehicle

APPENDIX 20

SATELLITE ILLUSTRATIONS



LAUNCH DATES

#1-7 - 16 JUNE 1966
 #8-15 - 18 JAN 1967
 #16-18 - 1 JULY 1967
 #19-26 - 13 JUNE 1968

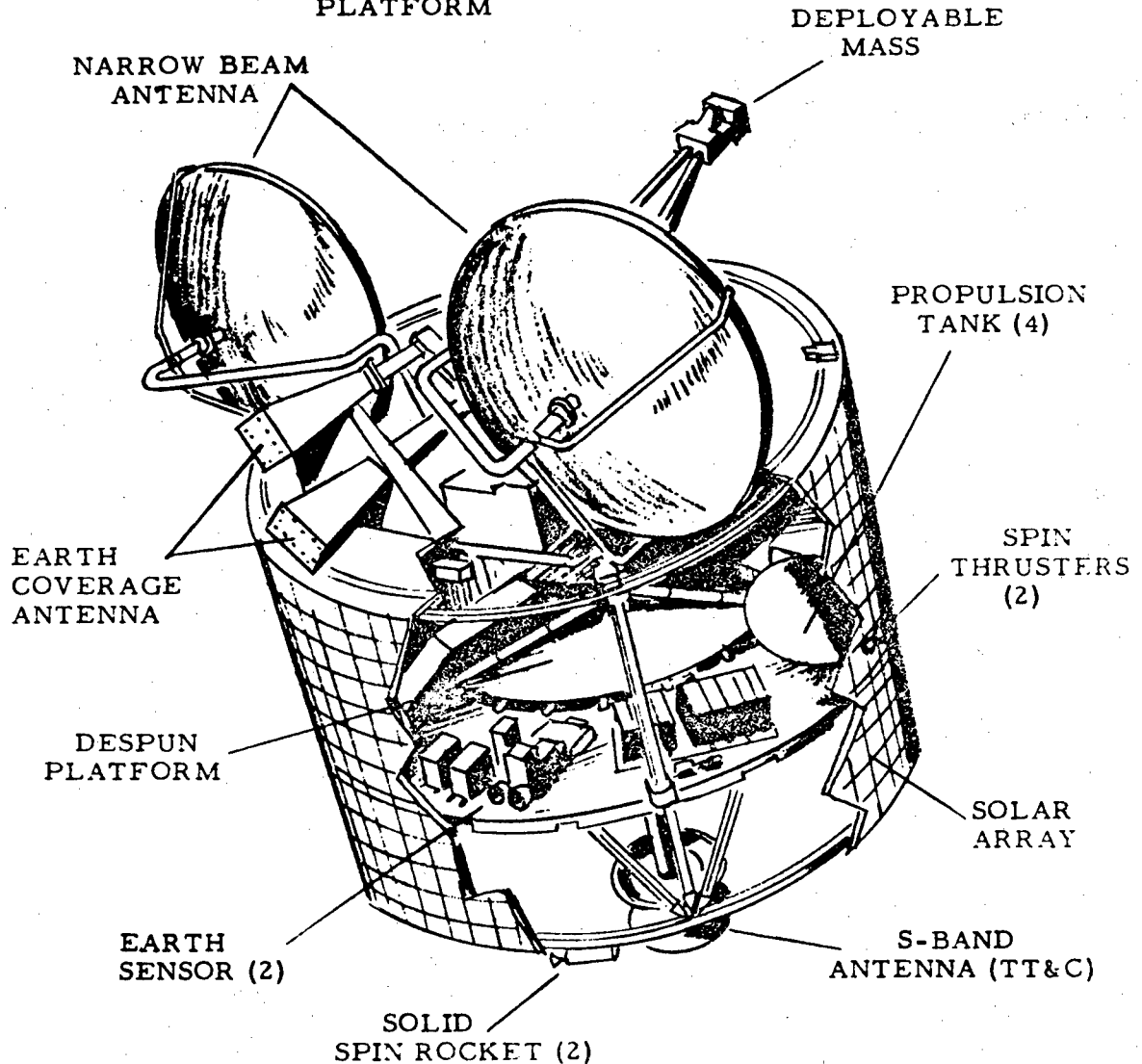
BOOSTER - TITAN III-C
 ORBIT - 18,000 NM EQUATORIAL

CHARACTERISTICS

DIAMETER - 36 IN
 HEIGHT - 32 IN
 WEIGHT - 100 LB
 POWER (BOL) - 40 WATT
 DESIGN LIFE - 1.5 YEAR

Initial Defense Communications Satellite
 Program (IDCSP)

MECHANICALLY DESPUN
ANTENNAS AND EQUIPMENT
PLATFORM



LAUNCHES

#9431 } - 2 NOV 71
 #9432 }
 #9433 } - 13 DEC 73
 #9434 }

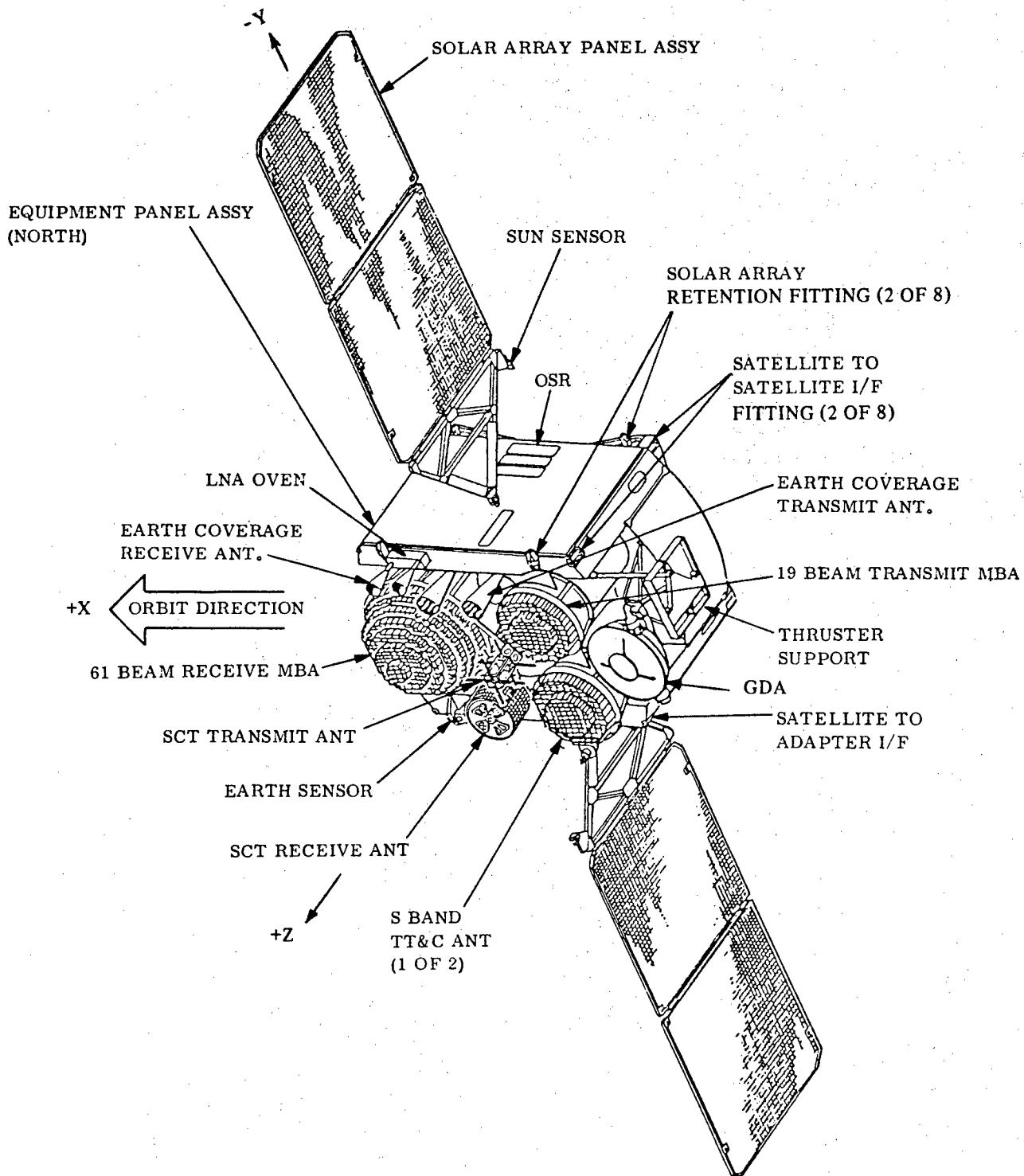
BOOSTER - T-III C

ORBIT - SYNC. EQUATORIAL

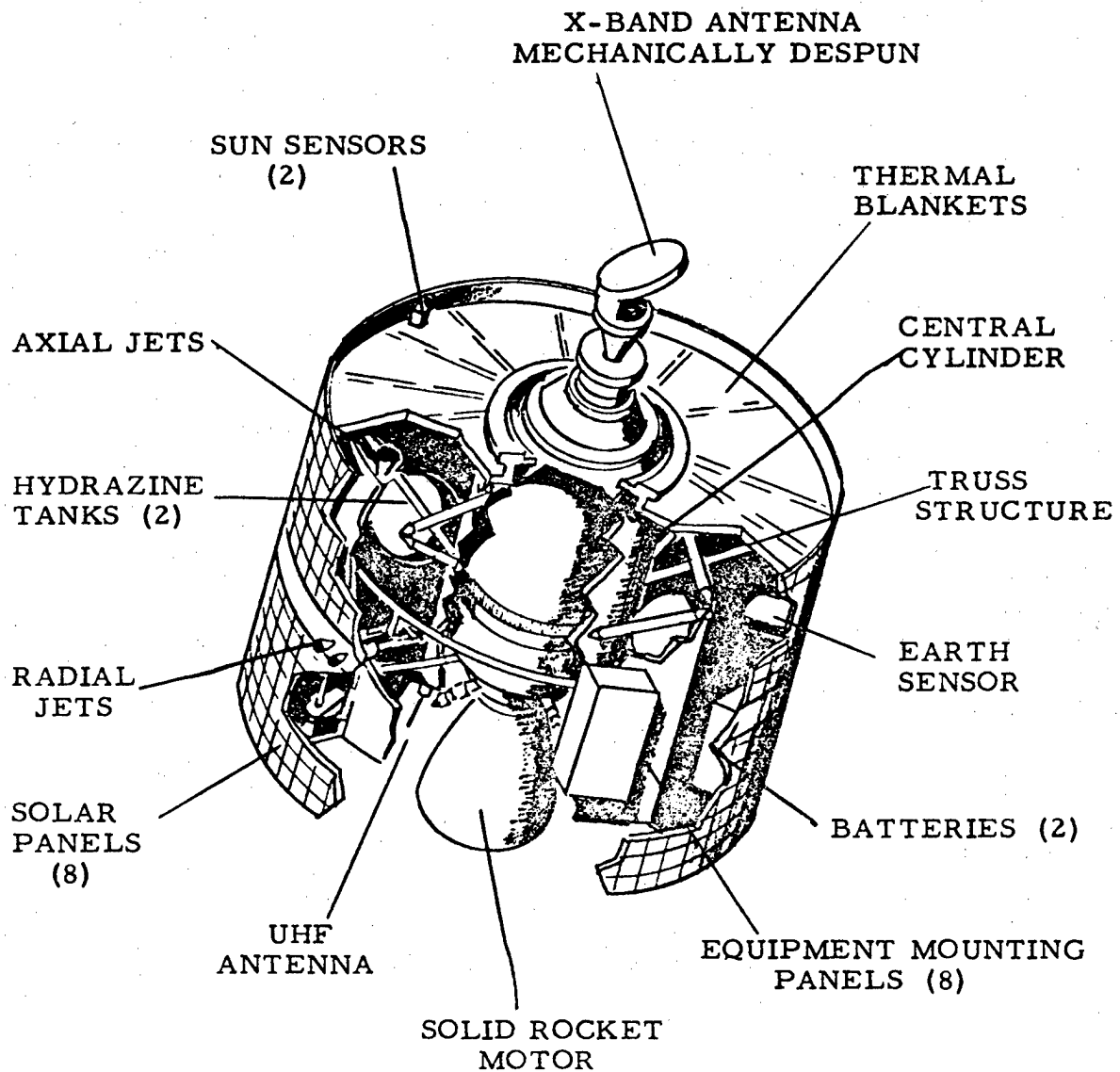
CHARACTERISTICS

DIAMETER - 9 FT
 HT. (OVERALL) - 13 FT
 WT. (LIFTOFF) - 1150 LB
 POWER (BOL) - 535 WATTS
 DESIGN LIFE - 5 YEARS

Defense Satellite Communications System
 DSCS II Satellite



Defense Satellite Communications System
 DSCS III Satellite



CHARACTERISTICS

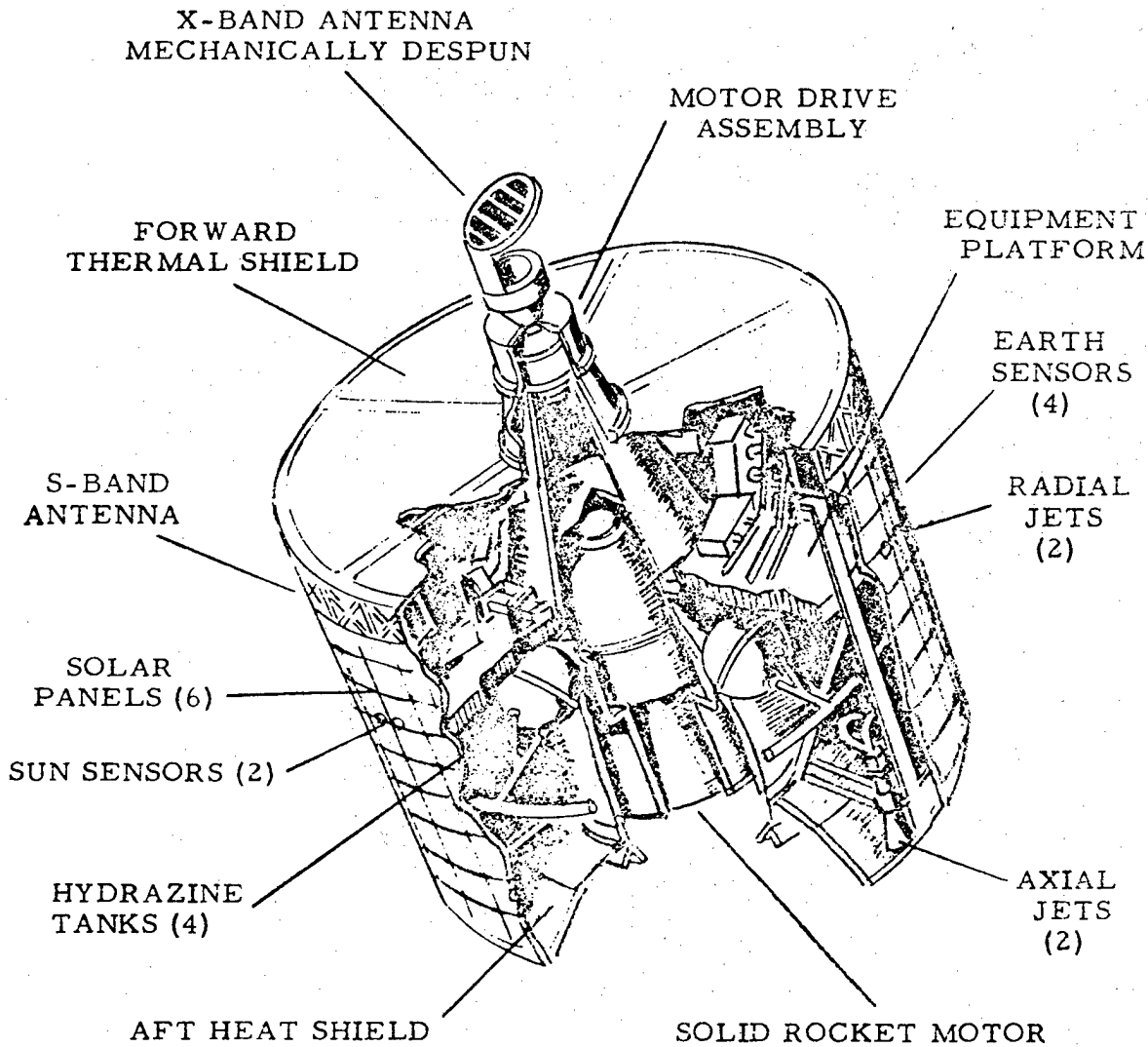
LAUNCHES

SK-1A - 21 NOV 1969
 SK-1B - 19 AUG 1970

BOOSTER - THOR DELTA
 ORBIT - SYNC. EQUATORIAL

DIAMETER - 54 IN
 HT. (OVERALL) - 61.8 IN
 WT. (LIFT OFF) - 535 LB
 POWER (BOL) - 113 WATTS
 DESIGN LIFE - 3 YEARS

Skynet I Communications Satellite



CHARACTERISTICS

LAUNCHES

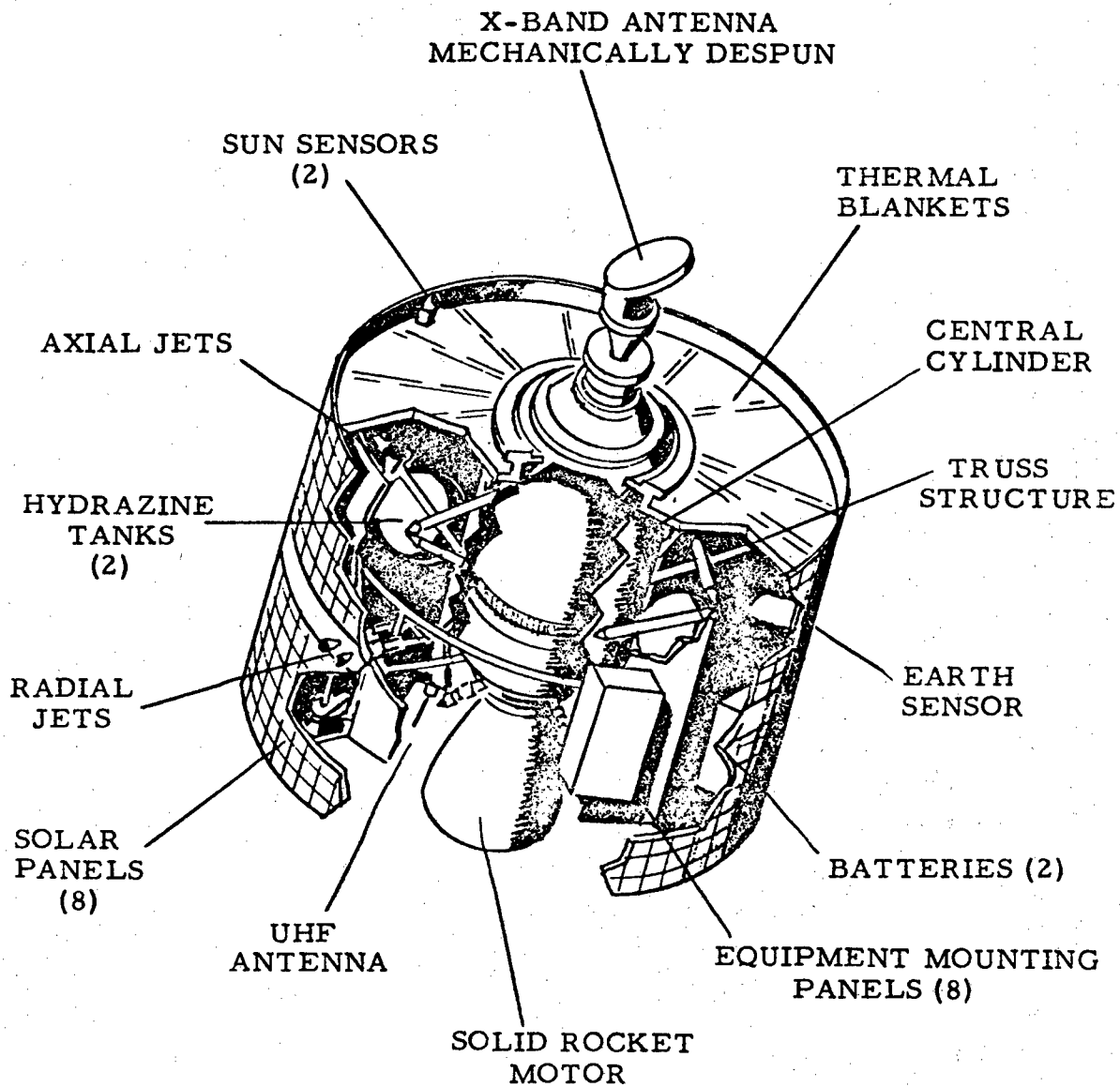
SK-IIA - 18 JAN 1974
SK-IIB - 22 NOV 1974

BOOSTER - DELTA 2313

ORBIT - SYNCH. EQUATORIAL

DIAMETER - 75 IN
HT. (OVERALL) - 82.3 IN
WT. (LIFT OFF) - 960 LB
POWER (BOL) - 260 WAT
DESIGN LIFE - 5 YEARS

Skynet II Communications Satellite



CHARACTERISTICS

LAUNCHES

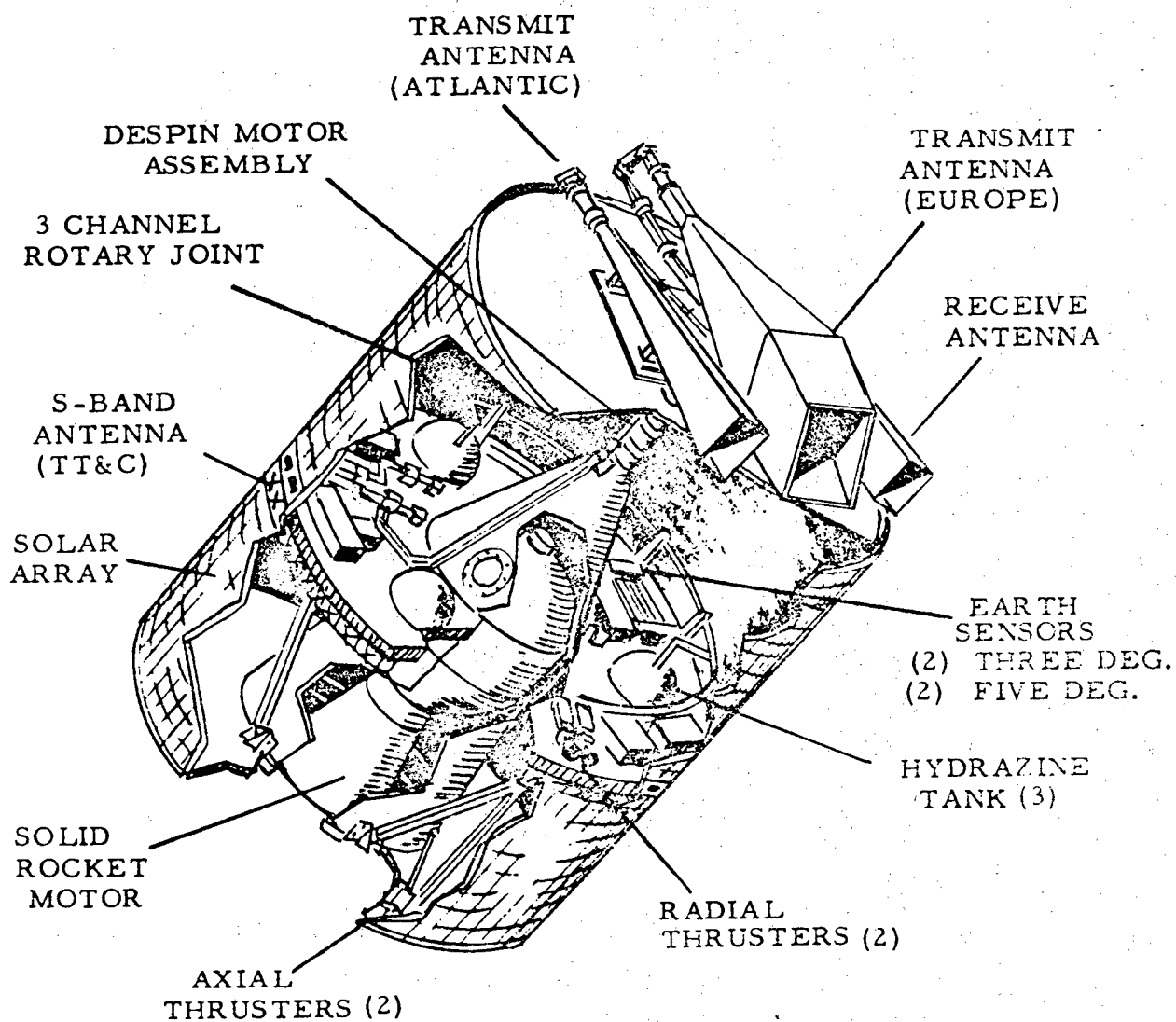
NATO IIA - 20 MAR 1970
 NATO IIB - 3 FEB 1971

BOOSTER - THOR DELTA
 ORBIT - SYNC. EQUATORIAL

DIAMETER - 54 IN
 HT. (OVERALL) - 61.8 IN
 WT. (LIFTOFF) - 535 LB
 POWER (BOL) - 113 WATTS
 DESIGN LIFE - 3 YEARS

NATO II Communications Satellite

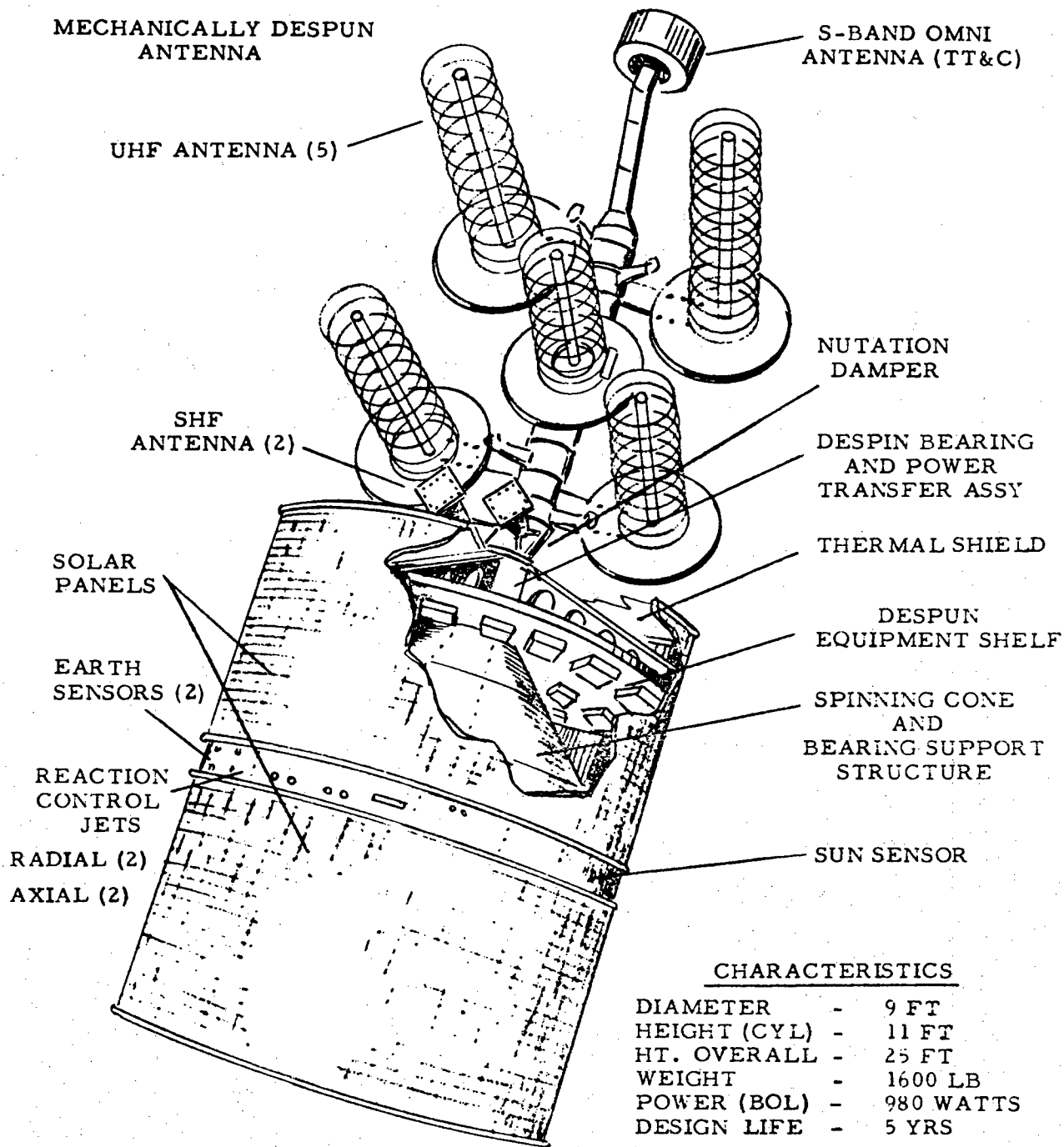
MECHANICALLY
DESPUN ANTENNAS



CHARACTERISTICS

LAUNCH DATE	- 22 APR 76	DIAMETER	- 86 IN
BOOSTER	- DELTA 2914	HT. (OVERALL)	- 121.7 IN
ORBIT	- SYNC. EQUATORIAL	WT. (LIFTOFF)	- 1532 LB
		POWER (BOL)	- 533 WATTS
		DESIGN LIFE	- 7 YEARS

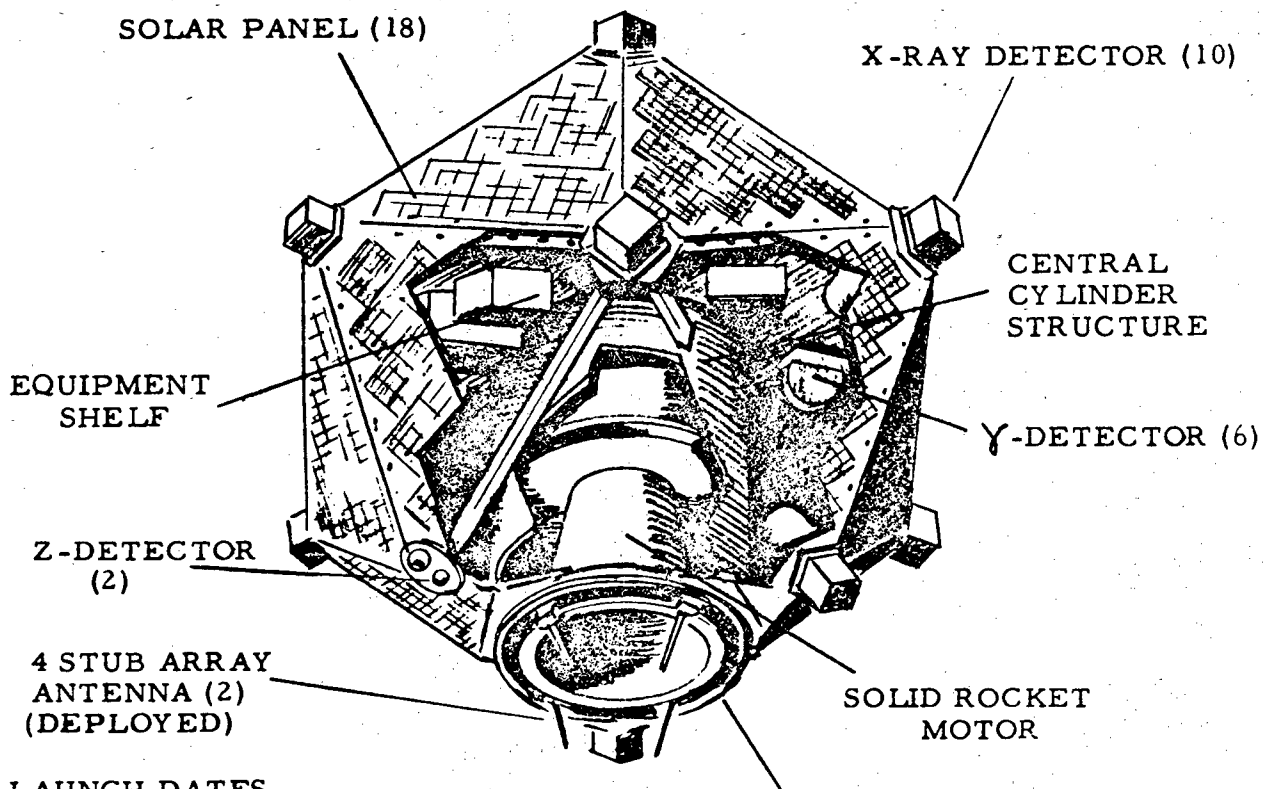
NATO III Communications Satellite



LAUNCHED - 9 FEB. 1969
 BOOSTER - T-III C
 ORBIT - SYNC. EQUATORIAL

Tactical Communications Satellite (TACSAT)

(VELA I ILLUSTRATED)



LAUNCH DATES -

- # 1801 - 16 OCT 1963
- 1851
- # 3662 - 17 JULY 1964
- 3674
- # 6564 - 20 JULY 1965
- 6577
- # 6638 - 28 APR 1967
- 6679
- # 6909 - 23 MAY 1969
- 6911
- # 7033 - 8 APR 1970
- 7044

BOOSTERS - FLTS 1, 2, 3 ATLAS/AGENA
 FLTS 4, 5, 6 T-IIIIC

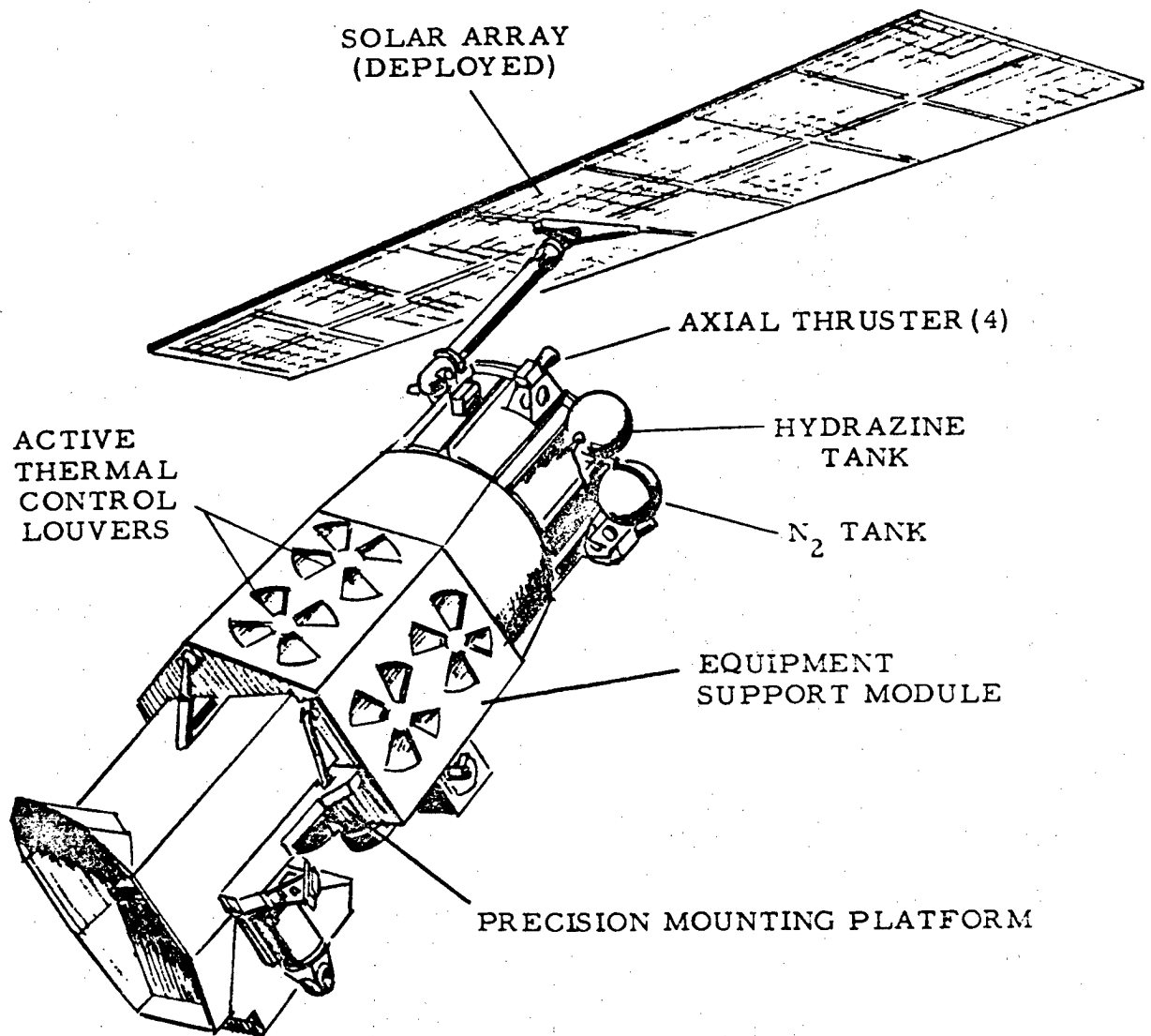
ORBIT - 60,000 NM
 38° INCLINATION

ADAPTER TO SPIN-UP
 INTERSTAGE

CHARACTERISTICS

WIDTH - 58 IN
 HEIGHT - 45 IN
 WT (LIFTOFF) - 498 LB
 POWER (BOL) - 99 WATTS
 DESIGN LIFE - 6 MO.

Vela Nuclear Detection Program Satellite



LAUNCH DATE - 11 Sep 76

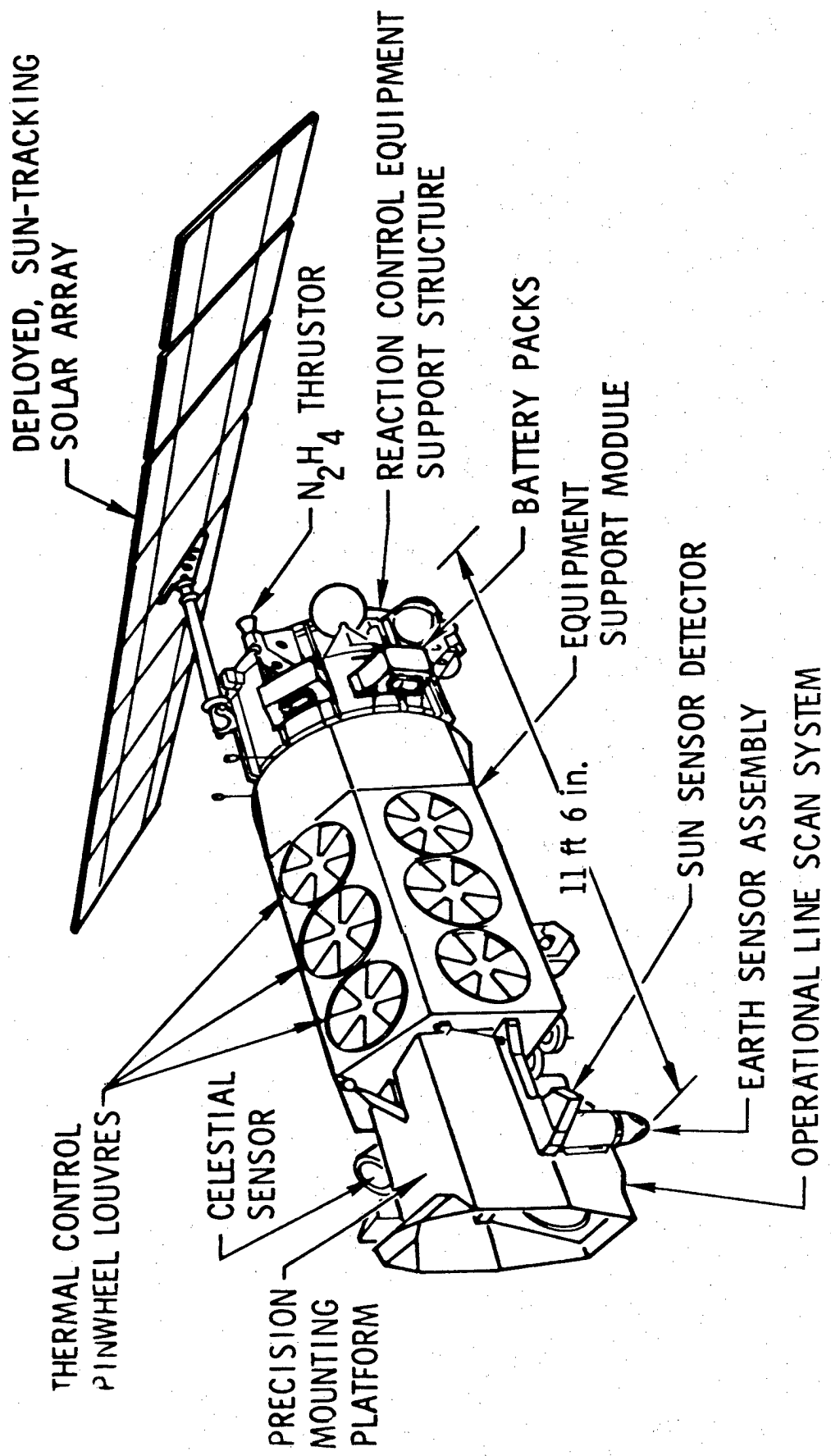
BOOSTER - THOR/5D STAGE

ORBIT - 450 NM
98.7 INCLINATION

CHARACTERISTICS

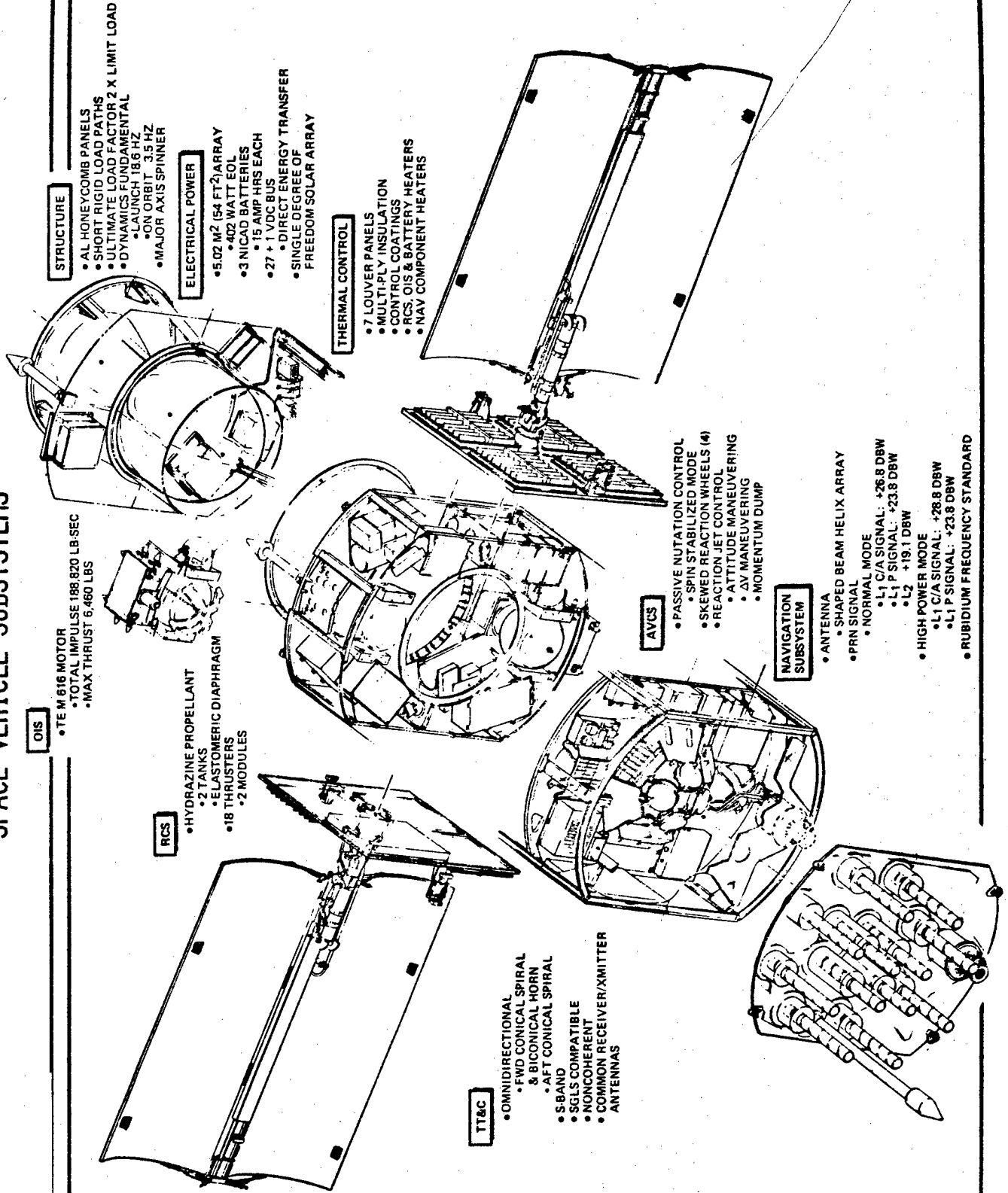
WIDTH (ASCENT) - 65 IN
 WIDTH (DEPLOYED) - 16 FT
 HT (OVERALL) - 10 FT
 WEIGHT - 5272 LB
 POWER (BOL) - 900 WATTS
 DESIGN LIFE - ~2 1/2 YEARS

Defense Meteorological Satellite Program
 DMSP Block 5D-1 Satellite



Defense Meteorological Satellite Program
 DMSP Block 5D-2 Satellite

GLOBAL POSITIONING SYSTEM SPACE VEHICLE SUBSYSTEMS



OIS

- TE M 616 MOTOR
- TOTAL IMPULSE 188,820 LB-SEC
- MAX THRUST 6,460 LBS

STRUCTURE

- AL HONEYCOMB PANELS
- SHORT RIGID LOAD PATHS
- ULTIMATE LOAD FACTOR 2 X LIMIT LOAD
- DYNAMIC LOAD FACTOR 1.5 X
- LAUNCH 18.6 HZ
- ON ORBIT 3.5 HZ
- MAJOR AXIS SPINNER

ELECTRICAL POWER

- 5.02 M² (54 FT²) ARRAY
- 402 WATT EOL
- 3 NICAD BATTERIES
- 15 AMP HRS EACH
- 27 + 1 VDC BUS
- DIRECT ENERGY TRANSFER
- SINGLE DEGREE OF FREEDOM SOLAR ARRAY

THERMAL CONTROL

- 7 LOUVER PANELS
- MULTI-PLY INSULATION
- CONTROL COATINGS
- RCS, OIS & BATTERY HEATERS
- NAV COMPONENT HEATERS

RCS

- HYDRAZINE PROPELLANT
- 2 TANKS
- ELASTOMERIC DIAPHRAGM
- 18 THRUSTERS
- 2 MODULES

AVCS

- PASSIVE NUTATION CONTROL
- SPIN STABILIZED MODE
- SKEWED REACTION WHEELS (4)
- REACTION JET CONTROL
- ATTITUDE MANEUVERING
- ΔV MANEUVERING
- MOMENTUM DUMP

NAVIGATION SUBSYSTEM

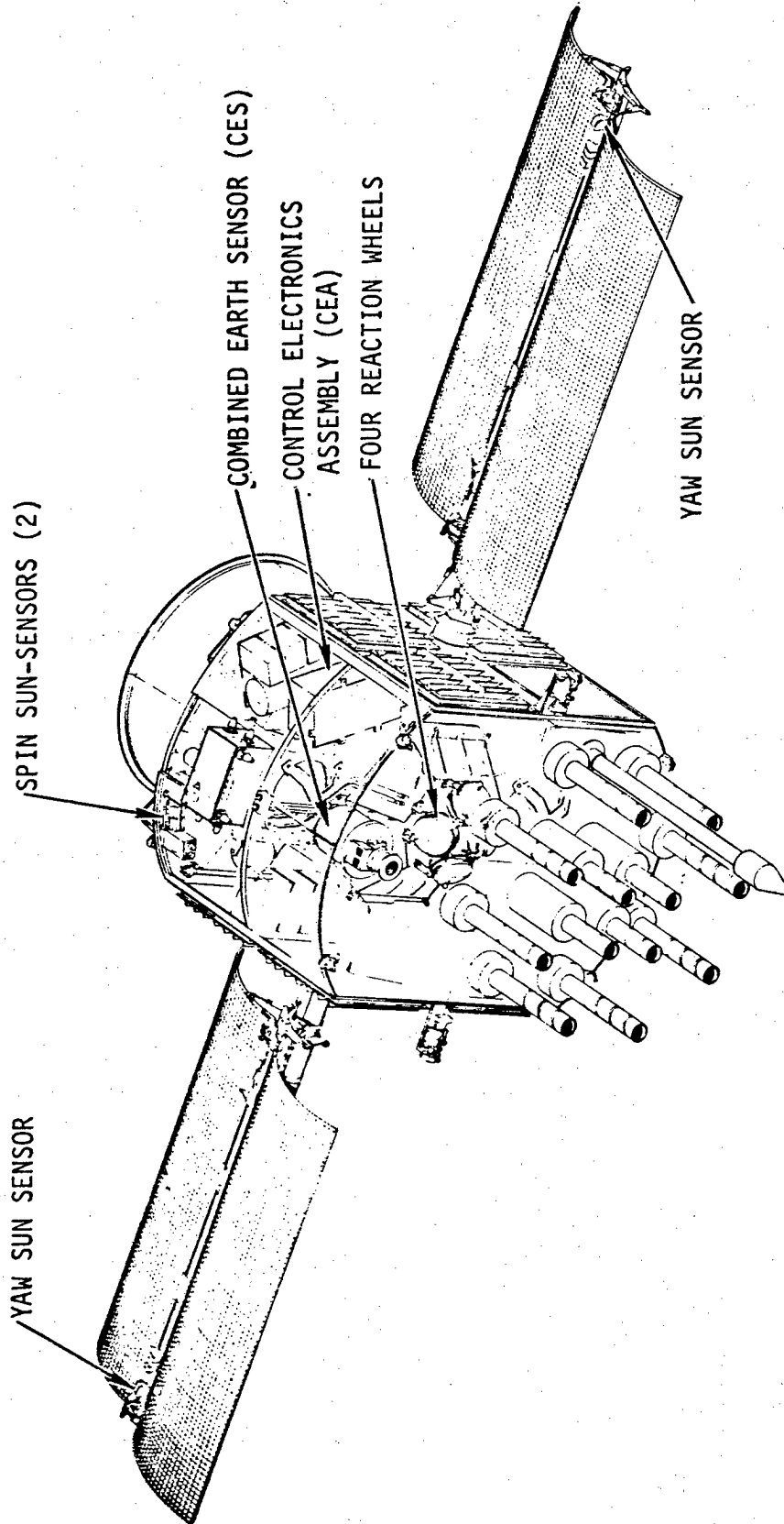
- ANTENNA
- SHAPED BEAM HELIX ARRAY
- PRN SIGNAL
- NORMAL MODE
 - L1 C/A SIGNAL: +26.8 DBW
 - L1 P SIGNAL: +23.8 DBW
 - L2 +19.1 DBW
- HIGH POWER MODE
 - L1 C/A SIGNAL: +28.8 DBW
 - L1 P SIGNAL: +23.8 DBW
- RUBIDIUM FREQUENCY STANDARD

TT&C

- OMNIDIRECTIONAL
- FWD CONICAL SPIRAL & BICONICAL HORN
- AFT CONICAL SPIRAL
- S-BAND
- SGLS COMPATIBLE
- NONCOHERENT
- COMMON RECEIVER/XMITTER ANTENNAS

Global Positioning System (GPS) Satellite (exploded view)

AVCS EQUIPMENT LOCATIONS
(FLIGHT CONFIGURATION)



Global Positioning System (GPS) Satellite
(flight configuration, avionics equipment
indicated)

GLOSSARY

AA	Attack Assessment (Deputy for)
AACB	Aeronautics and Astronautics Coordinating Board
ABM	Anti-ballistic missile
ABRES	Advanced Ballistic (Missile) Reentry Systems
ABRV	Advanced ballistic reentry vehicle
ACE	Advanced control experiment
AEC	Atomic Energy Commission
AFB	Air Force Base
AFBMD	Air Force Ballistic Missile Division
AFCCDD	Air Force Command Control Development Division
AFCGM	Assistant Chief of Staff for Guided Missiles
AFETR	Air Force Eastern Test Range
AFFTC	Air Force Flight Test Center
AFLC	Air Force Logistics Command
AFML	Air Force Materiels Laboratory
AFMTC	Air Force Missile Test Center
AFRPL	Air Force Rocket Propulsion Laboratory
AFSATCOM	Air Force Satellite Communications
AFSC	Air Force Systems Command
AFSCF	Air Force Satellite Control Facility
AFWTR	Air Force Western Test Range
AGE	Aerospace ground equipment
AIRS	Advanced inertial reference sphere
ALC	Air Logistics Center
ALCC	Airborne Launch Control Center
ALCS	Airborne Launch Control System
AMaRV	Advanced maneuvering reentry vehicle
AMC	Air Materiel Command
AMR	Atlantic Missile Range
AMU	Astronaut maneuvering unit
A.N.T.	Advanced nosetip test
APN	Advanced plug nosetip
ARDC	Air Research and Development Command
ARPA	Advanced Research Projects Agency
ASD/R&E	Assistant Secretary of Defense for Research and Engineering
ASGD	Assigned
ASRDL	Army Signal Research and Development Laboratory
ASSET	Aerothermodynamic/Elastic Structural Systems Environmental Tests
ATDA	Augmented target docking adapter
ATG	Aerospace Test Group
ATS	Applications technology satellite
ATW	Aerospace Test Wing
AUTH	Authorized

BAMM	Balloon Altitude Mosaic Measurements
BMC	Ballistic Missile Center
BMC	Ballistic Missile Committee
BMEWS	Ballistic Missile Early Warning System
BMO	Ballistic Missiles Office
BSD	Ballistic Systems Division
BTL	Bell Telephone Laboratories
CDB	Command data buffer
CDM	Continuously dispensed masker
CDR	Critical design review
C-E	Communications-electronics
CESO	Communications-Electronics Support Office
CFP	Concept formulation package
CINCSAC	Commander-in-Chief, Strategic Air Command
CSOC	Consolidated Space Operations Center
DARPA	Defense Advanced Research Projects Agency
DASO	Demonstration and shakedown operation
DATS	Despun Antenna Test Satellite
D/BMRS	Deputy for Ballistic Missile Reentry Systems
DCA	Defense Communications Agency
DCAS	Deputy Commander AFSC for Aerospace Systems
DCP	Development concept paper
DCS	Deputy Chief of Staff
DCS/S&L	Deputy Chief of Staff for Systems and Logistics
DDR&E	Director of Defense Research and Engineering
Deg	Degree
Dev	Development
Dia	Diameter
Diam	Diameter
DINS	Dormant Inertial Navigation System
DMSP	Defense Meteorological Satellite Program
DOD	Department of Defense
DODGE	Defense Department Gravity Gradient Experiment
DNSDP	Defense Navigation Satellite Development Program
DSARC	Defense Systems Acquisition Review Council
DSCS	Defense Satellite Communications System
DSMG	Designated Systems Management Group
DSP	Defense Support Program
DT&E	Development, test and evaluation
ELMS	Earth limb measurement satellite
ENEC	Extendable nozzle exit cone
ERTS	Environmental Resources Technology Satellite
ESD	Electronics Systems Division
ESSA	Environmental Science Services Administration
EVA	Extra vehicular activity
FFP	Firm-fixed-price
FLAME	Fighter Launched Advanced Materials Experiment

FLTSATCOM	Fleet Satellite Communications
FOT	Follow-on operational test
FSED	Full-Scale Engineering Development
FTM	Flight test missile
GAATV	Gemini/Atlas/Agena/target vehicle
GATV	Gemini Agena target vehicle
G&C	Guidance and Control
GE	General Electric Co.
GLV	Gemini launch vehicle
GMRD	Guided Missile Research Division
GO	General order
GOR	General operational requirement
GPS	Global Positioning System
GREB	Galactic radiation experiment background
GSE	General systems engineering
HALO	High Altitude Large Optics
H&D	Hardened and dispersed
HEAO	High energy astronomy observatory
HEST	High Explosive Simulation Test
HGM-25A	Titan I missile
HQ	Headquarters
HRS	Hard rock silo
IBMS	Intercontinental ballistic missile system
ICBM	Intercontinental ballistic missile
IDCSP	Initial Defense Communications Satellite Program
IDCU	Improved digital computer unit
IDSCS	Initial Defense Satellite Communication System
IG	Inspector General
IGS	Inertial guidance system
IGY	International Geophysical Year
IOC	Initial operational capability
IONDS	Integrated Operational Nuclear Detonation (NUDET) Detection System
IOT&E	Initial operational test and evaluation
IR	Infrared
IRBM	Intermediate range ballistic missile
ITL	Integrate-transfer-launch
ITOS	Improved TIROS Operational Satellite
ITS	Improved third stage
ITV	Instrumented test vehicle
IUS	Interim Upper Stage; Inertial Upper Stage
JCS	Joint Chiefs of Staff
JPASO	Joint Pacific Area Scheduling Office
JPL	Jet Propulsion Laboratory
KMR	Kwajalein Missile Range

Lb	Pounds
LBRV	Large Ballistic Recovery Vehicle
LCC	Launch control center
LCS	Lincoln calibration sphere
LeRC	Lewis Research Center
LES	Lincoln Experimental Satellite
LF	Launch facility
LGM-25C	Titan II missile designation
LGM-30B	Designation for improved Minuteman I missile
LGM-30F	Designation for Minuteman II missile
LGM-30G	Designation for the Minuteman III missile
LOX/RP-1	Liquid oxygen/hydrocarbon
LTTAT	Long Tank Thrust Augmented Thor (launch vehicle)
LV	Launch Vehicles (Deputy for)
MAP	Multiple Aimpoint
MaRV	Maneuvering reentry vehicle
MBRV	Maneuvering ballistic reentry vehicle
MHAT	Mechanical high altitude timer
MIDAS	Missile detection alarm system
MILSATCOM	Military satellite communications
MINT	Miniature Instrumented Noستip Test
MIPR	Military interdepartmental purchase request
MIRV	Multiple independently targetable reentry vehicles
MIT	Massachusetts Institute of Technology
MMRBM	Mobile mid-range ballistic missile
MN	Minuteman (Deputy for)
MOL	Manned Orbiting Laboratory
MOM	Modified operational missile
MOTP	Minuteman II Operational Targeting Program
Mph	Miles per hour
MSMP	Multispectral Measurements Program
MSS	Missile suspension system
MST	Mobile service tower
MSV	Materials screening vehicle
MX	Missile X
MX-1593	Project Atlas
N/A	Non-applicable
NACA	National Advisory Committee for Aeronautics
NASA	National Aeronautics and Space Administration
NATO	North Atlantic Treaty Organization
NOAA	National Oceanic and Atmospheric Administration
NRD	National Range Division
NSC	National Security Council
NTS	Navigation technology satellite
NUDET	Nuclear Detonation
OAMS	Orbital Attitude and Maneuvering System
OBL	Operational base launch
OBLSS	Operational Base Launch Safety System
ODDR&E	Office of the Director of Defense Research & Engineering

OL	Operating location
OOAMA	Ogden Air Materiel Area
Ops	Operations
OSAF	Office of the Secretary of the Air Force
OSD	Office of the Secretary of Defense
OT	Operational test
OTL	Operational test launch
OV	Orbiting vehicle
PACE	Programmable Aerospace Control Equipment
PAN	Polyacrylonitrile
PBCS	Post Boost Control System
PCA	Physical Configuration Audit
PDMM	Pulse doppler map matching
PILOT	Piloted Low-Speed Test
PIM	Performance improvement modification
PMD	Program management directive
PMOG	Pyrotechnic metal oxide generator
PMR	Pacific Missile Range
PMRTWG	Program Management Responsibility Transfer Working Group
POM	Program Objective Memorandum
PP	Procurement and production
PPS	Primary Propulsion System
PR	Purchase request
PRIME	Precision recovery including maneuvering reentry
psi	pounds-per-square-inch
PVM	Production verification missile
RAD	Requirements action directive
RADCAT	Radar calibration target
RAF	(British) Royal Air Force
RCA	Radio Corporation of America
R&D	Research and development
RFP	Request for proposal
RMP	Reentry Measurements Program
ROCS	Range Only Correlation System
RS	Reentry Systems (Deputy for)
RSO	Range Safety Officer
RTV	Reentry test vehicle
RVTO	Reentry vehicle technology and observables
s3	Small secondary satellite
SAC	Strategic Air Command
SAFSCOM	Safeguard Systems Command
SALT	Strategic Arms Limitation Treaty
SAMAST	Sandia ABRES Materials and System Test
SAMOS	Satellite and Missile Observation System
SAMS	Sandia ABRES Materials Study
SAMSO	Space and Missile Systems Organization
SAMTEC	Space and Missile Test Center

SAPO	Special Aircraft Project Office
SATAF	Site Activation Task Force
SBAMA	San Bernardino Air Materiel Area
SCATHA	Spacecraft Charging at High Altitudes
SCF	Satellite Control Facility
SCORE	Signal Communications Orbiting Relay Equipment
SDR	System Design Review
SECOR	Sequential collation of range
SED	Sensor evolutionary development
SESP	Space Experiment Support Program
SE/TD	Systems engineering and technical direction
SFT	Supplemental flight test
SHAFE	Supreme Headquarters Allied Forces Europe
SHIP	Small Hardened Inertial Platform
SIRE	Satellite infrared experiment
SK	Space Communications (Deputy for)
SLC	Space launch complex
SLV	Standard launch vehicle
SLV-1	Scout launch vehicle
SLV-2A	Thrust Augmented Thor launch vehicle
SLV-2G	Long Tank Thor launch vehicle
SLV-2H	Long Tank Thrust Augmented Thor launch vehicle
SLV-2J	Long Tank Thrust Augmented Thor/Delta launch vehicle
SLV-2K	Long Tank Thrust Augmented Thor/Delta launch vehicle
SLV-3A	Atlas/Agena launch vehicle
SLV-3C	Atlas/Centaur launch vehicle
SLV-3D	Atlas/Centaur launch vehicle
SLV-5A	Designation for Titan IIIA launch vehicle
SLV-5B	Titan IIIB/Agena launch vehicle
SLV-5C	Titan IIIC launch vehicle
SLV-5D	Titan IIID launch vehicle
SMD	System management directive
SMS	Strategic Missile Squadron
SMW	Strategic Missile Wing
SO	Special Order
SOLRAD	Solar radiation
SPD	System program directive
SPO	System program office
SPS	Simplified processing station
SRK	Sounding Rocket
SRM	Solid-rocket motor
SSD	Space Systems Division
SSM/I	Microwave Imager
SSM/T	Microwave Temperature Sounder
SSPO	Strategic System Program Office
SSS	Strategic Satellite System
SSTTP	Safeguard System Test Vehicles Program
SSV	Deputy for Launch Vehicles
SSVL	Gemini Launch Vehicle Directorate

START	Spacecraft Technology and Advanced Reentry Tests
STC	Satellite Test Center
STL	Space Technology Laboratories
STM	Special test missile
STP	Space Test Program
STRAD	Strategic Aerospace Division
STREP	System Technology Reentry Experiments Program
STS	Space Transportation System
STSS	SAC targeting support software
SZH	Defense System Applications Program System Program Office
TAC	Tactical Air Command
TACSAT	Tactical Communications Satellite
TACSATCOM	Tactical Satellite Communications
TAD	Thrust Augmented Thor/Delta (launch vehicle) and Technical Acceptance Demonstration
TAT	Thrust Augmented Thor (launch vehicle)
TATER	Talos-Terrier-Recruit (launch vehicle)
TBM	Tactical ballistic missile
TCNT	Transpiration Cooled Nosetip
TDV	Technology development vehicle
TIROS	Television Infrared Observation Satellite
TMRBM	Transportable mid-range ballistic missile
TRW	Thompson-Ramo-Wooldridge
TVC	Thrust vector control
TWTA	Traveling Wave Amplifier
UDMH	Unsymmetrical dimethylhydrazine
UHF	Ultra-high frequency
ULMS	Undersea Long-Range Missile System
USAF	United States Air Force
USSR	Union of Soviet Socialist Republics
UTC	United Technology Center
UVR	Ultra-violet radiometer
V-2	World War II German ballistic guided missile
WADC	Wright Air Development Center
WADD	Wright Air Development Division
WS 107A-1	Atlas missile designation
WS 107A-2	Titan missile designation
WS 107B	Titan I missile designation
WS 107C	Titan II missile designation
WS 117L	Designation for advanced satellite system
WS 133A	Minuteman I missile designation
WS 315A	Thor missile designation
WS 609A	Designation for Blue Scout launch vehicle
WSMR	White Sands Missile Range
WTR	Western Test Range
WWD	Western Development Division

XR Development Plans (Deputy for)
XRN Directorate for Defense Navigation Satellite
System
XSM-64 Navaho cruise guided missile
XSM-65 Atlas missile designation
XSM-68 Titan missile designation
XSM-68B Titan II missile designation
XSM-75 Thor missile designation
XSM-78 Jupiter missile designation

YD Defense System Applications Program
(Deputy for)

YE Deputy for Defense Navigation Satellite

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