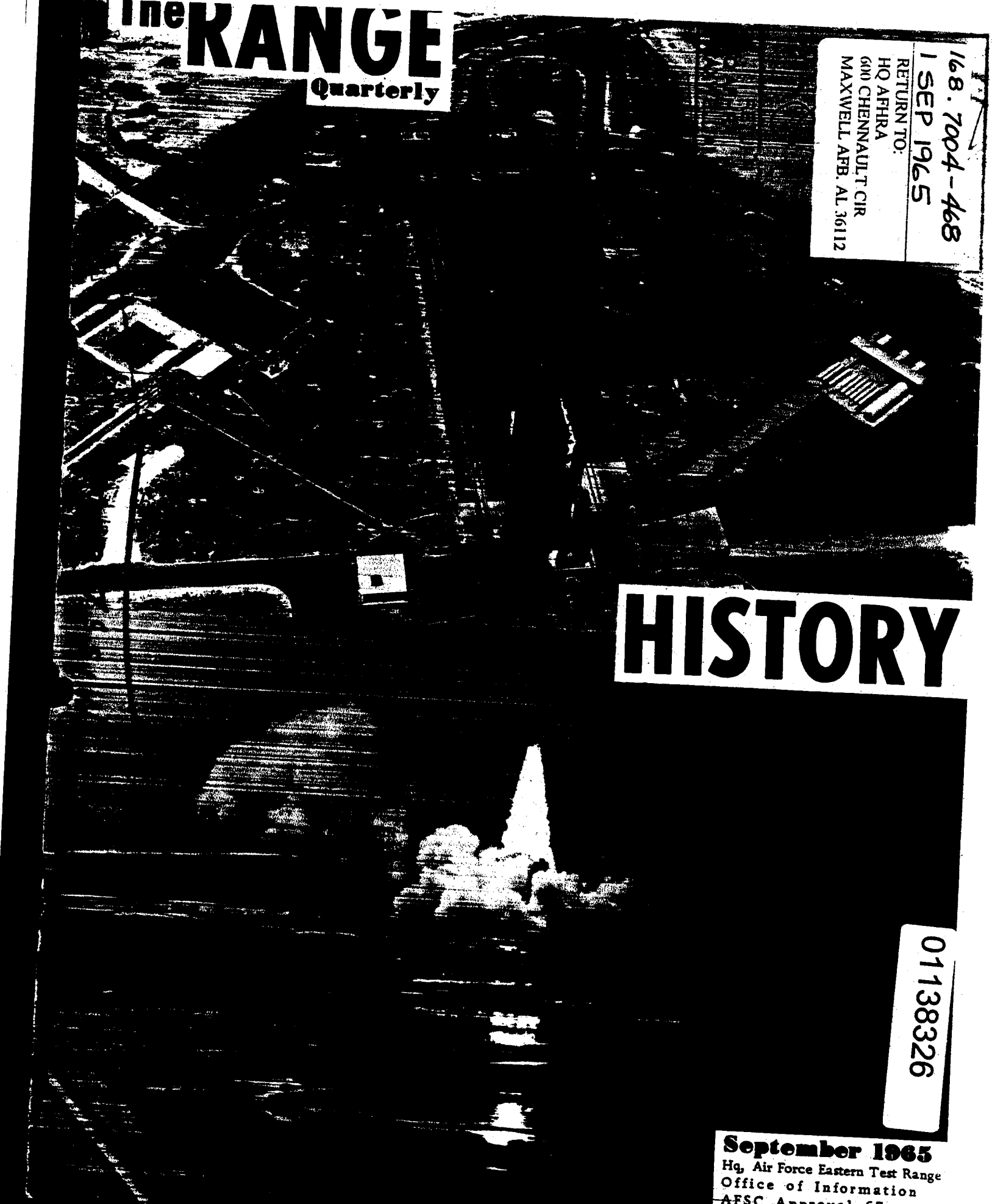
The RANGE Quarterly



HISTORY

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Vol. 1, No. 2

Cover Photos-(Top) Checkout of Titan IIIC at Pad 40. (Bottom) Launch of Titan IIIC. (Back) Bumper launch-July 24, 1950

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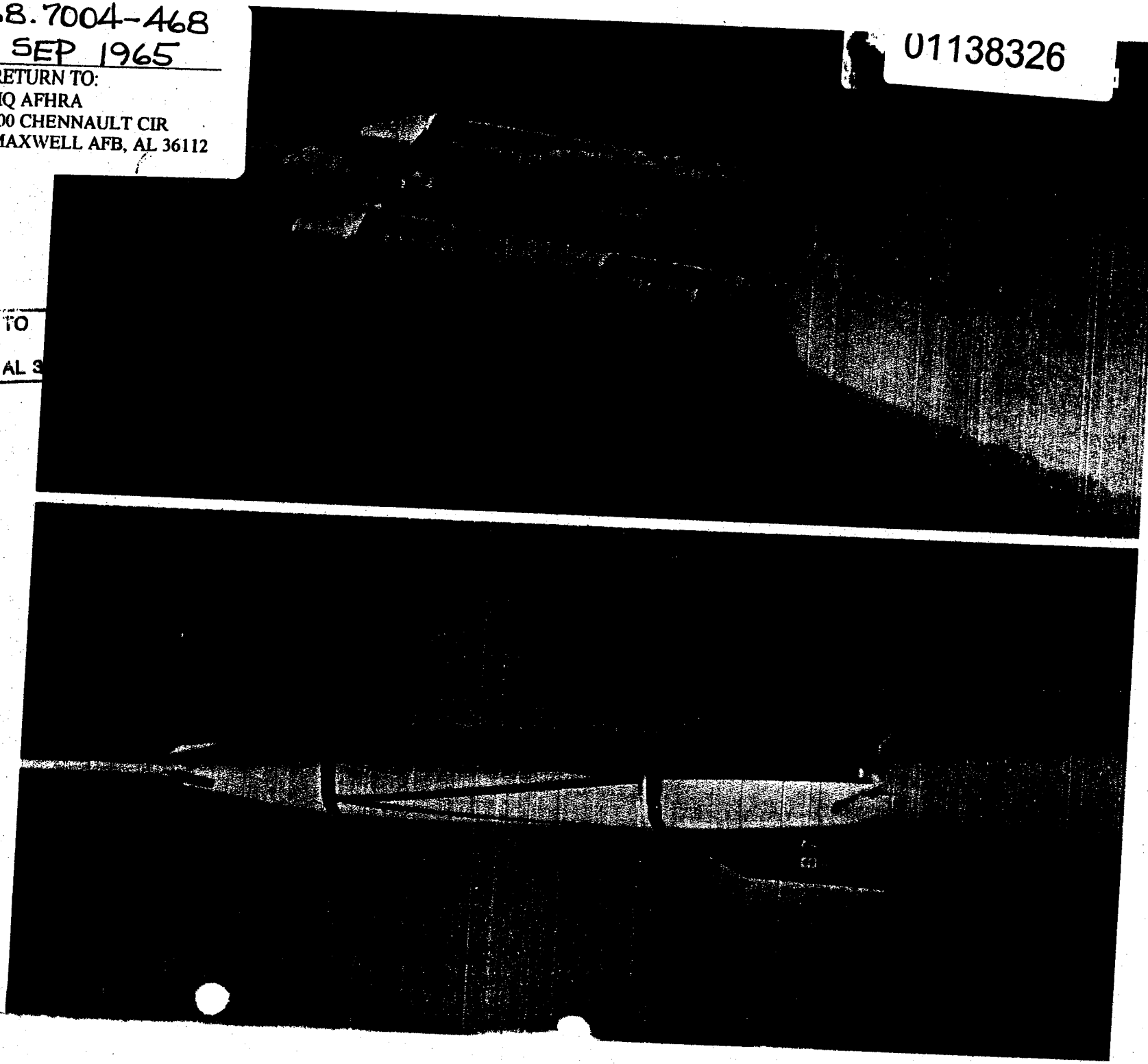
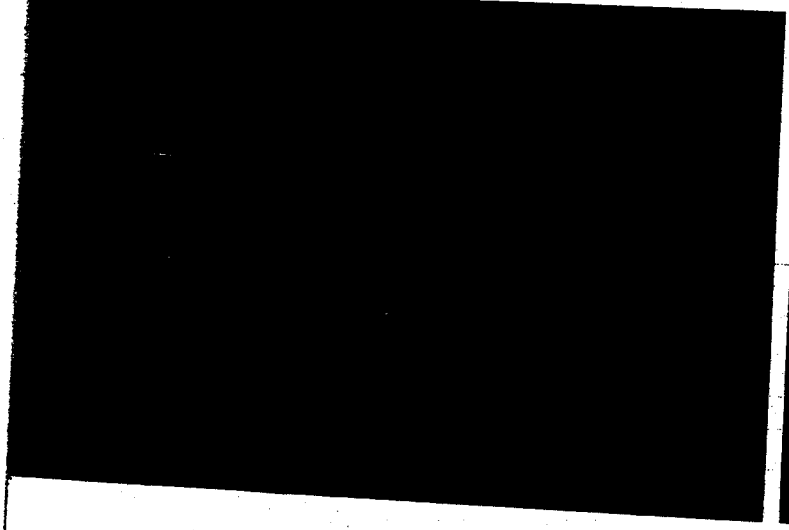
BUMPER TO TITAN III





Bumper in route to pad

Meillewagon used for transporting and erecting Bumper

Bumper

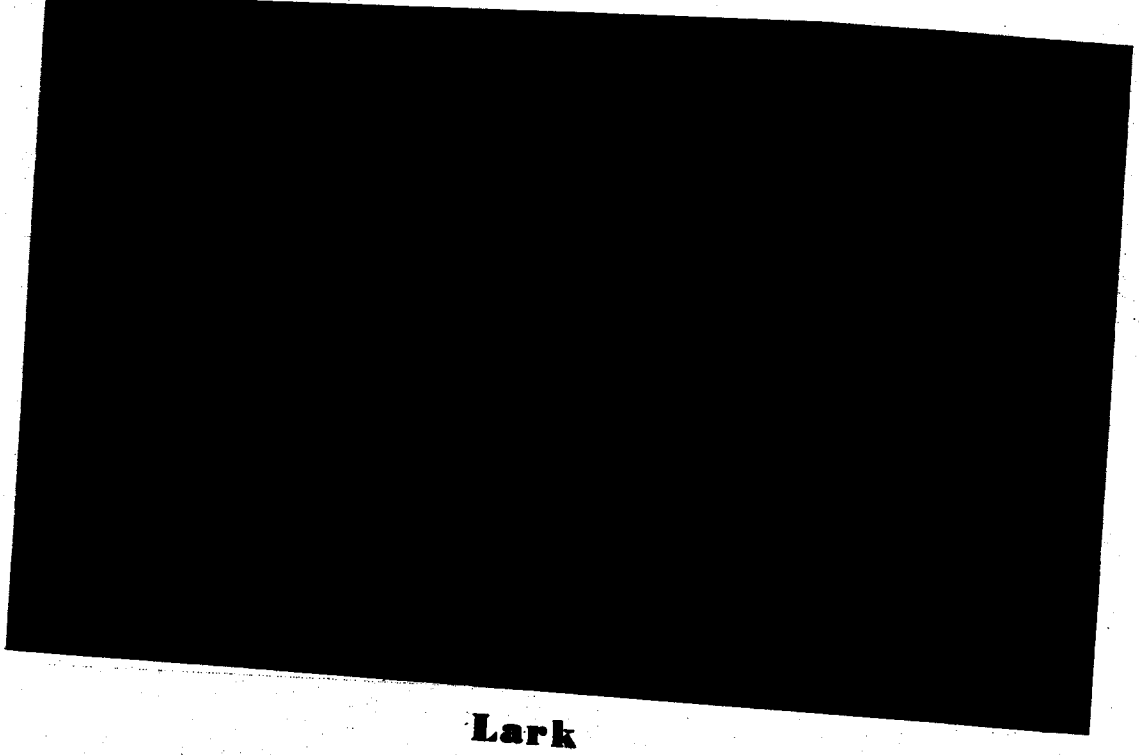
In 15 years, 1950-1965, many changes have taken place at Cape Kennedy. Names, faces, facilities and launch vehicles have all changed. However, the job of testing new missiles and space vehicles continues.

Testing at Cape Kennedy began in July 1950 with the Bumper launches. Bumper was a combination of a captured German V-2 and an Army WAC Corporal. Bumper stood 56 feet high and developed over 50,000 pounds of thrust.

The purposes of testing Bumper were to prove the separation technique of the V-2 and Corporal at missile altitudes approaching the horizontal and to determine high velocity, low altitude temperature, pressure and heat transfer characteristics of the Teflon nose cone.

Stringent security precautions were taken

Historic Bumper launch-July 24, 1950



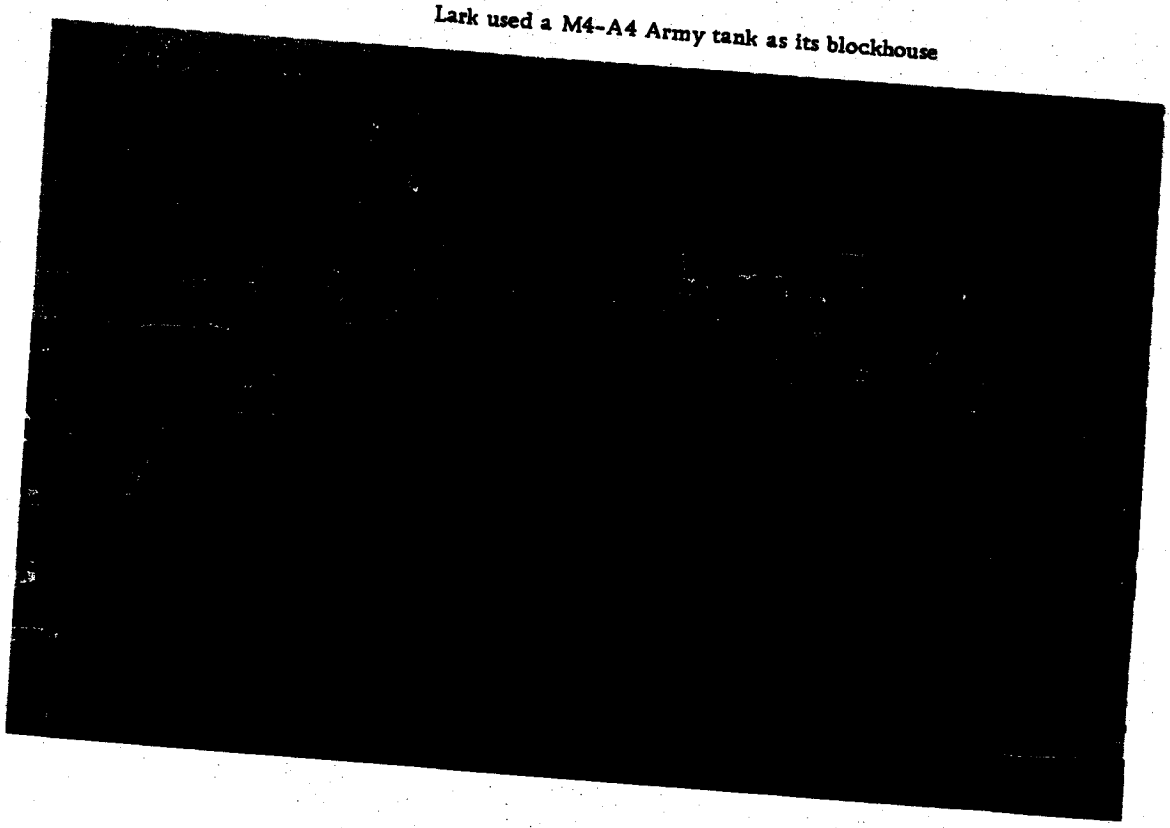
Lark

The next vehicle to climb into the Florida sky was a strange looking creature named Lark. It was an interceptor missile used by the Navy during World War II for counter-air attack against the Japanese. Following WW II, both the Air Force and Army used Lark as a training vehicle for antiaircraft missiles. It was brought to the Cape in Oct. 1950 to train crews in preparation for the Bomarc program.

Lark, at the Cape, was also a test bed for guidance systems, such as the Fairchild developed semiactive homing guidance system.

The Lark program was concluded in July 1953.

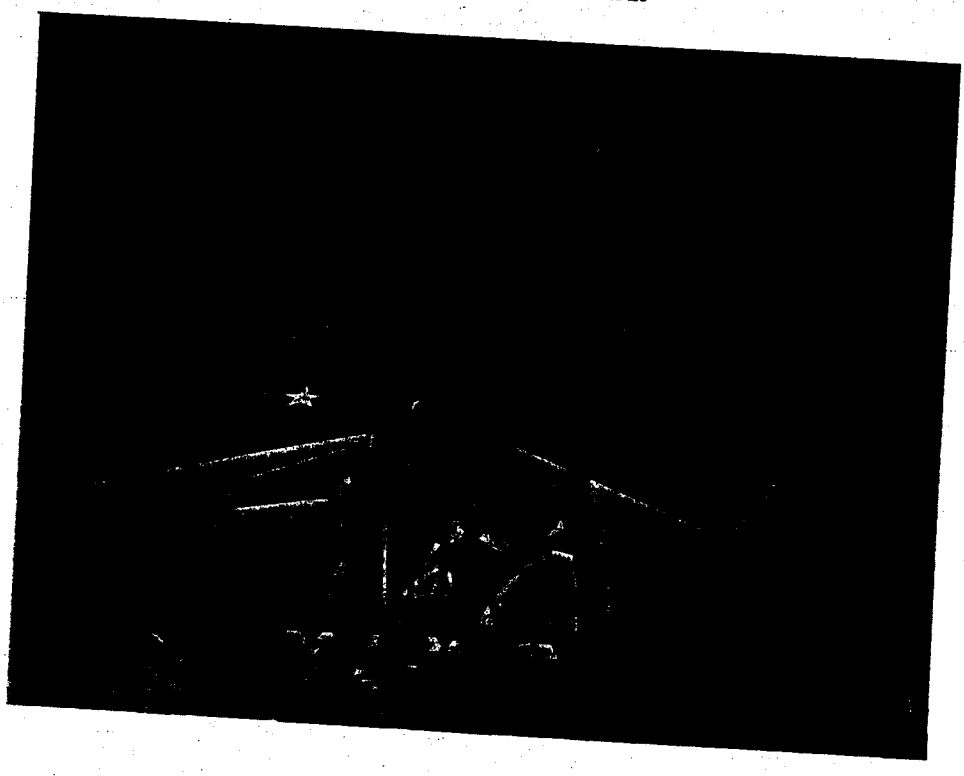
Lark used a M4-A4 Army tank as its blockhouse

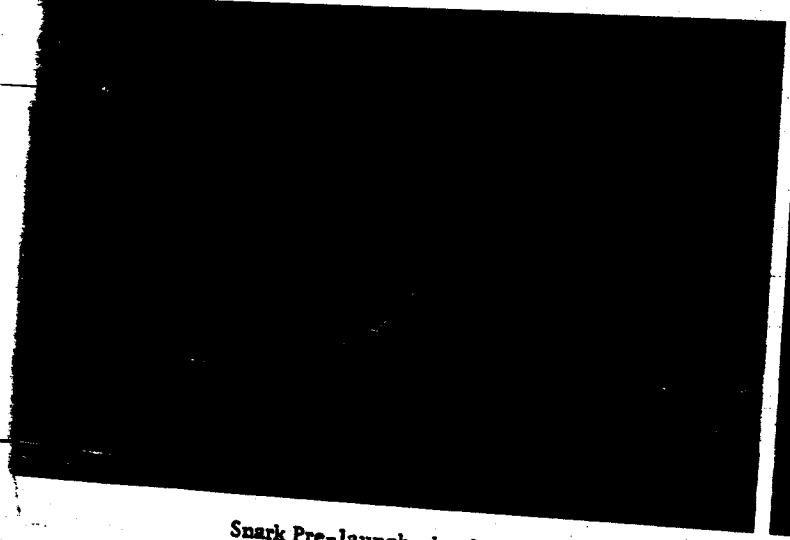


Matador

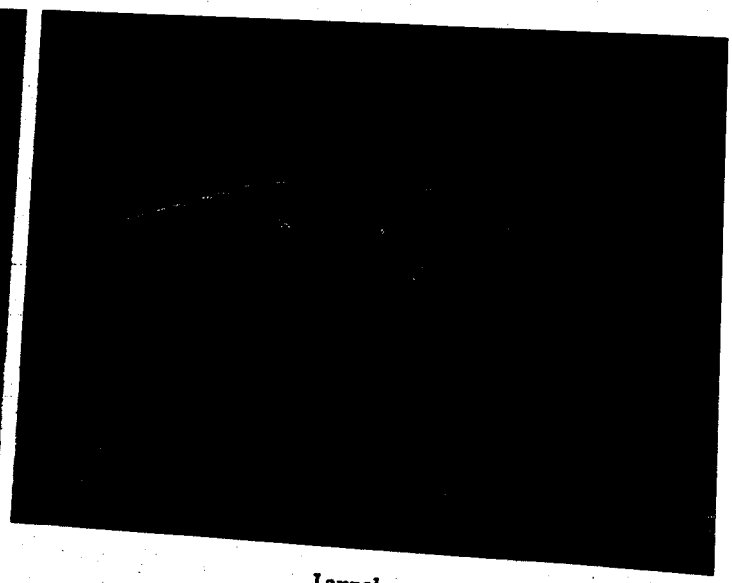
Matador, a winged cruise missile, was the first weapon system to be tested at Cape Kennedy. It was built by the Martin Company and was classed a surface-to-surface tactical missile. It was powered by an Allison J-33 jet engine and was ground launched by a rocket booster from a roadable launcher. It had a range of 600 nautical miles (n.m.) with a speed of 650 mph. and a ceiling of over 35,000 feet. It arrived at the Cape in June 1951 and was declared operational in March 1954. Matador was deployed with Tactical Air Command in Germany and Formosa.

Matador pre-launch checkout





Snark Pre-launch checkouts



Launch

Snark

The next missile to be tested was Snark. This vehicle was the first ICM-Intercontinental Missile. It looked very similar to a jet fighter with its long, slim fuselage and was classed a surface-to-surface pilotless bomber. It began its test program in August '52 and was operational by 1959.

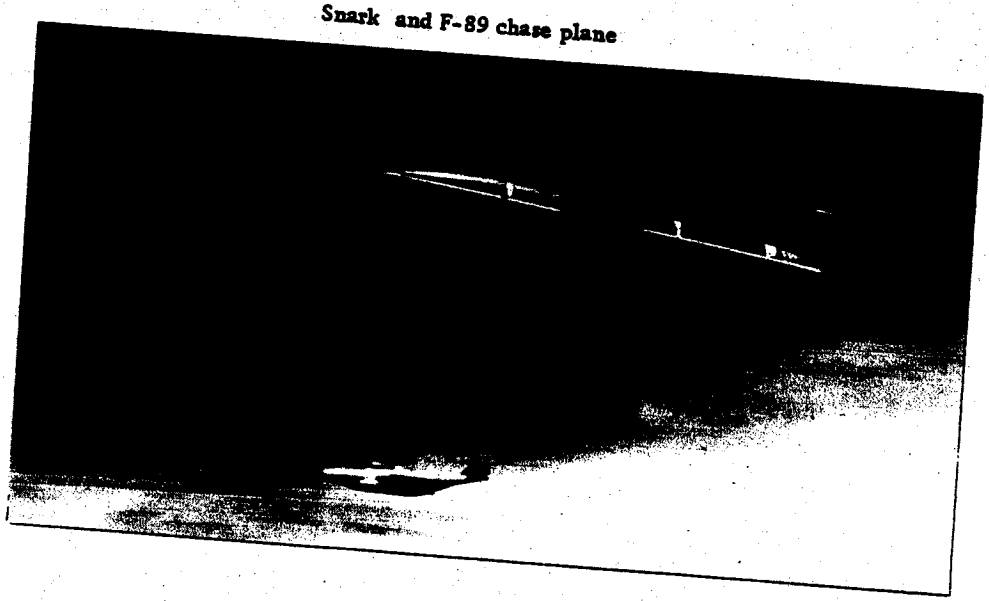
Snark was 69 feet long and had a wing span of 42 feet. Two 130,000 pound thrust booster rockets, attached to the fuselage, provided liftoff and acceleration until the turbojet cruise engine took over.

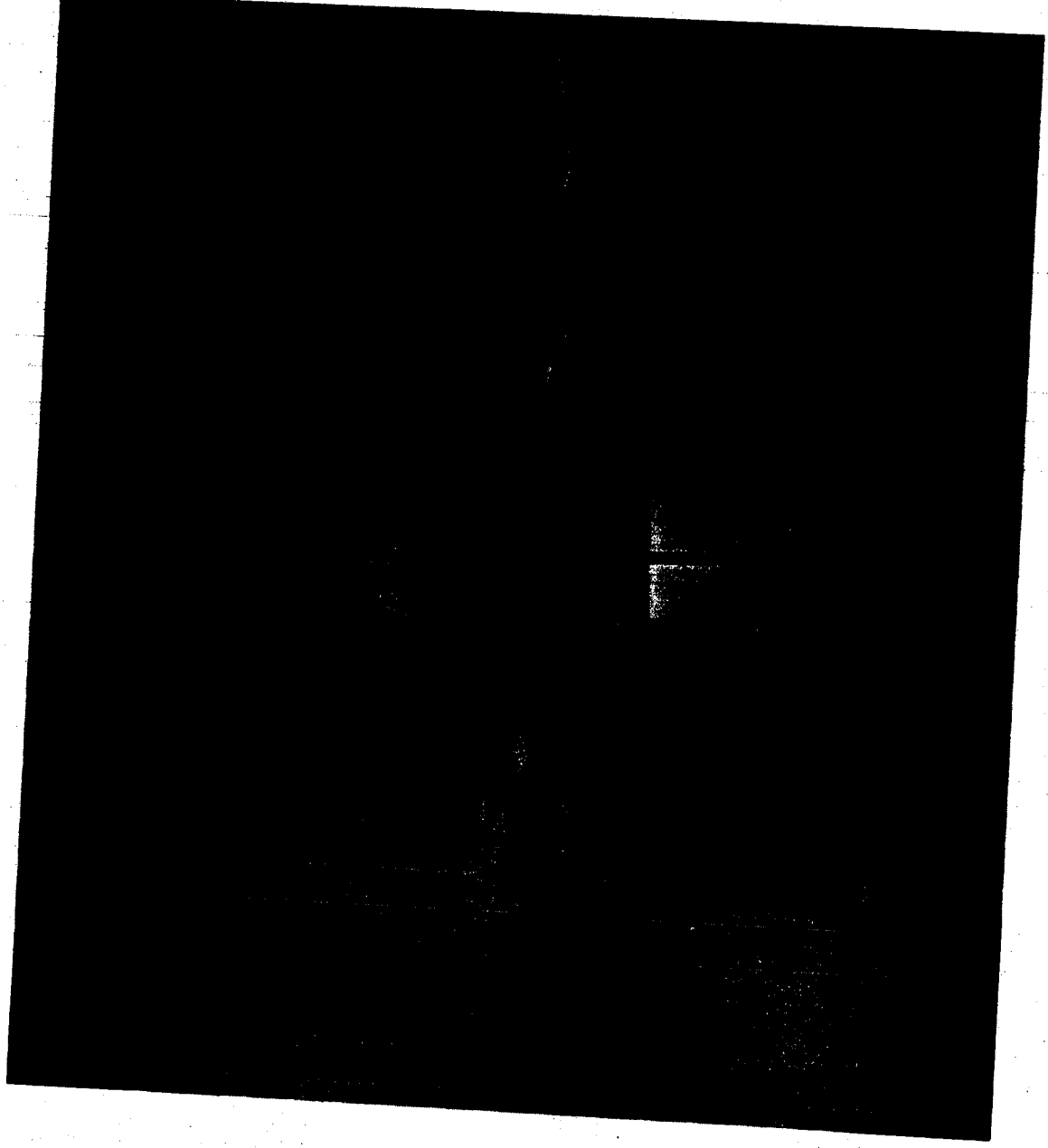
For economy of test operations, many Snarks were fitted with retractable gear to allow landing after test flights. However, some Snarks never made it back to the skid strip (the Cape's 10,000 foot runway), so the ocean around the Cape was called the "Snark infested waters."

Snark was a complementary weapon to the long range ballistic missiles. It had the capability to deliver a nuclear warhead at ranges up to 5,250 nautical miles (n.m.). It used a self-contained stellar monitored inertial guidance system to guide the vehicle on a high altitude penetration to its target.

Snark was stationed with the Strategic Air Command at Dow AFB, Maine.

Snark and F-89 chase plane





Bomarc

Bomarc, an operational interceptor missile, began its test program in Sept. 1952. It is designed to intercept enemy aircraft while they are far from American borders. It is supersonic, - Mach 2.7- (2,000 MPH), and has a ceiling of 100,000 feet. It uses rocket power for take-off and twin ram jet engines for cruising.

Bomarc is deployed with Air Defense Command and is tied in with the SAGE (Semi-Automatic Ground Equipment) system.

If an intercept with an enemy is necessary, SAGE will guide the Bomarc to the vicinity of the target at which time the missile's homing radar will take over. Bomarc is destroyed with its target.

Redstone

The U.S. Army Redstone missile, named for its place of development, the Army's Redstone Arsenal at Huntsville, Alabama, saw duty both as an operational surface-to-surface weapon and a man-rated booster.

Its development program began at the Cape in Aug. 1953 and by 1956, it was operational with the Army in Europe. It was used by the Army to extend and supplement the range and firepower of the artillery cannon.

Because of its excellent reliability and performance record, it was chosen by NASA to be the booster for the manned suborbital phases of Project Mercury.

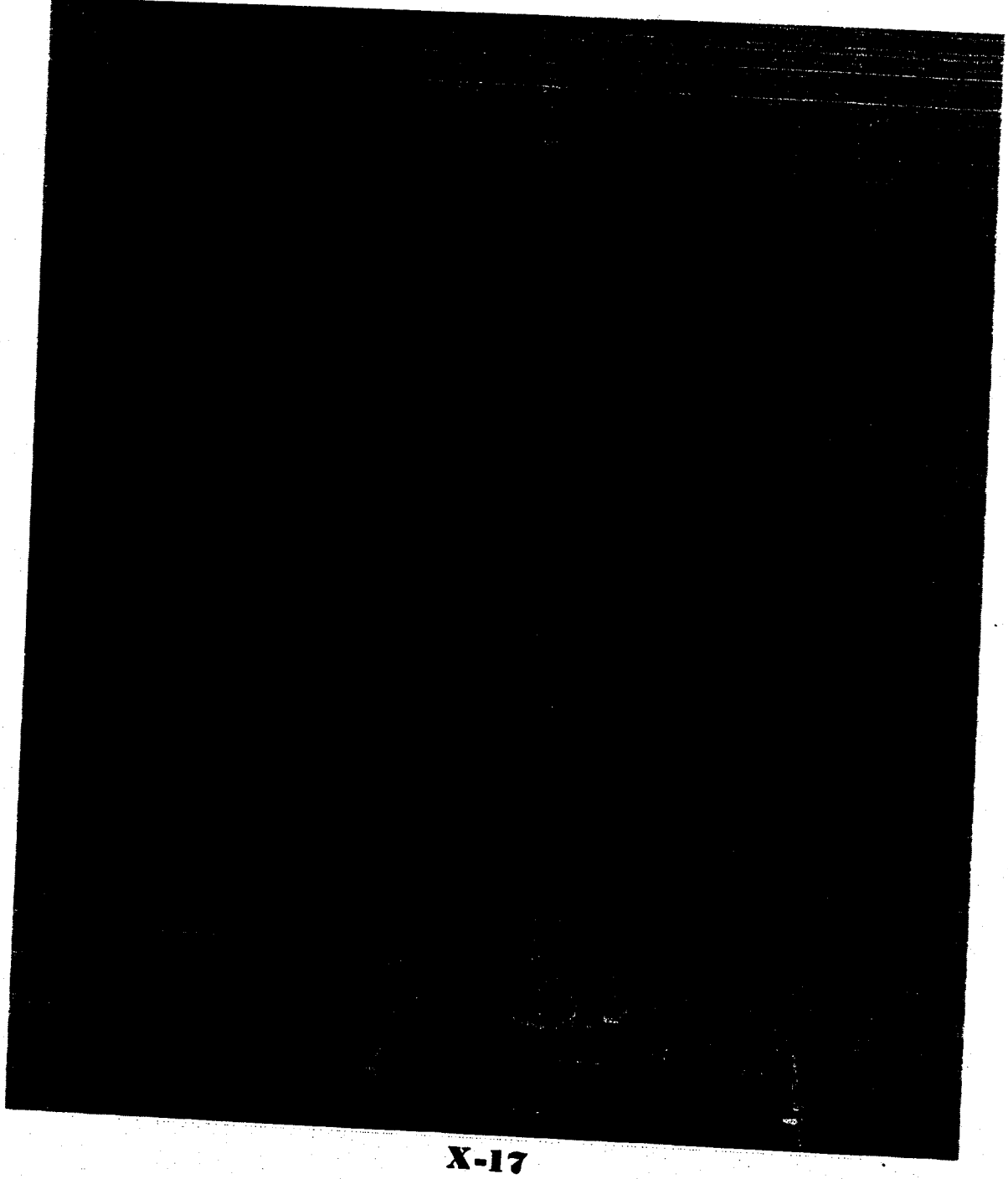
The Mercury-Redstone vehicle was a modified and elongated version of the Redstone missile. Over 800 changes were required to transform the Redstone into the Mercury-Redstone.

On May 5, 1961, at 9:34 a.m., the Mercury-Redstone lofted astronaut Alan Shepard to an altitude of 115 miles and a distance of 302 miles downrange.

The second manned suborbital flight was conducted on July 21, 1961 with astronaut Virgil I. "Gus" Grissom aboard.

After reviewing the data obtained from the two successful suborbital flights, a decision was made that further manned suborbital flights were unnecessary and to get on with the orbital flight phases.

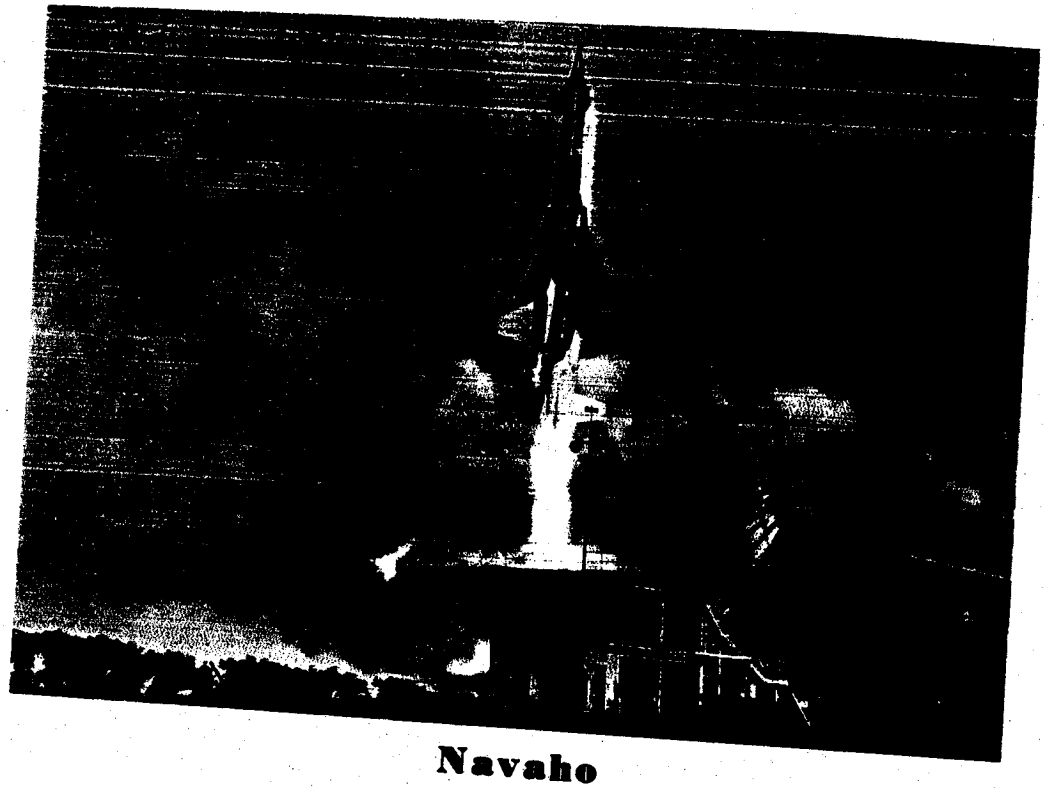
The Mercury-Redstone has been called "the booster that worked itself right out of a job."



X-17

X-17, tested 1955-57, was developed to answer a number of questions surrounding the reentry problem. It was a three-stage rocket, weighing about six tons and standing 41 feet high.

It was fired to 500,000 feet and then plunged at speeds up to Mach 15 back into the Earth's dense atmosphere to gather information on the problems arising when a warhead reenters. Telemetry equipment in the nose cone transmitted data on heat and other conditions to the ground stations for analysis. This was the first vehicle to obtain such information on the reentry phenomenon. Thirty-eight of these vehicles were tested. The results of this testing had a direct effect on the development of the Atlas ICBM.

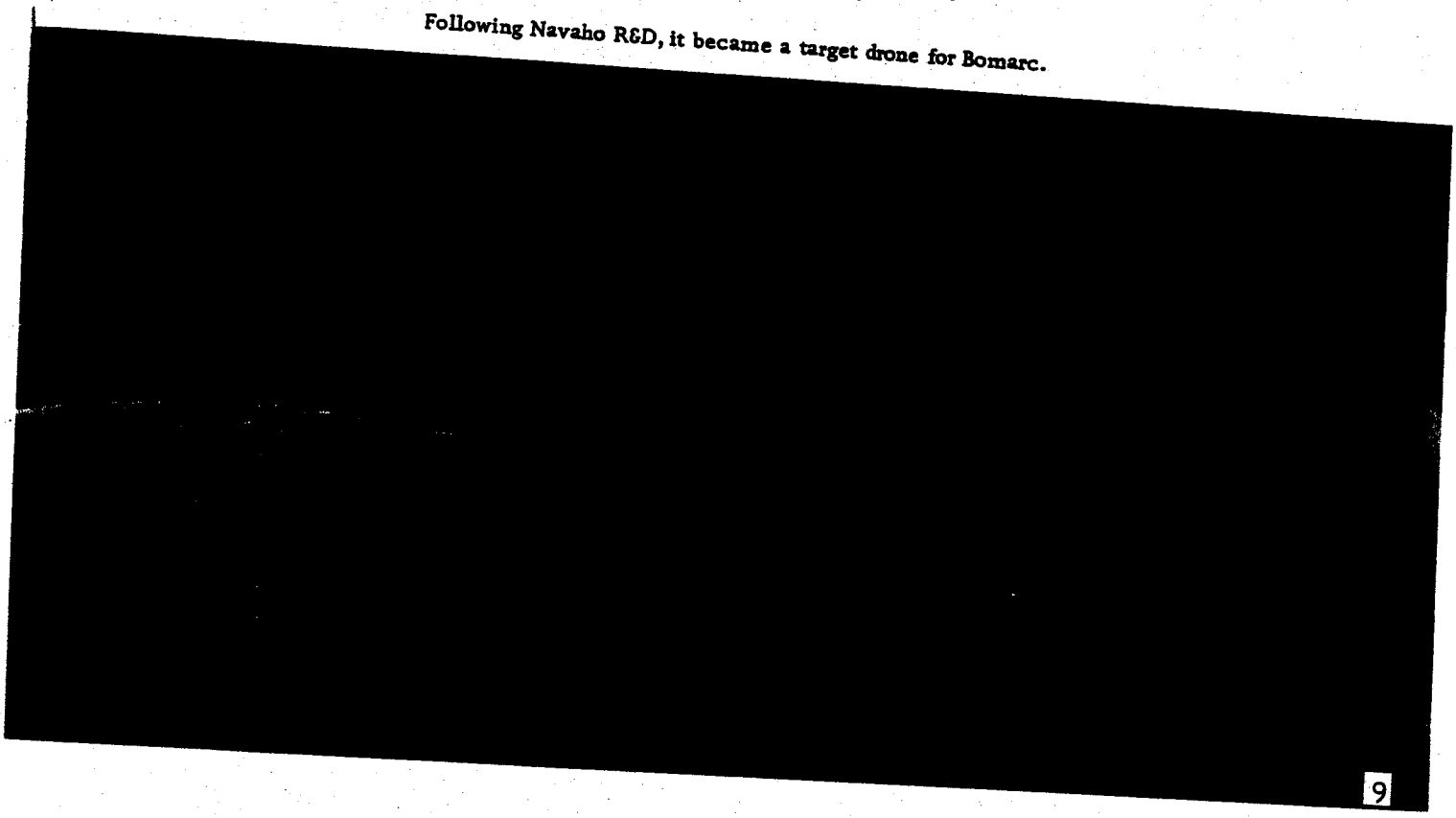


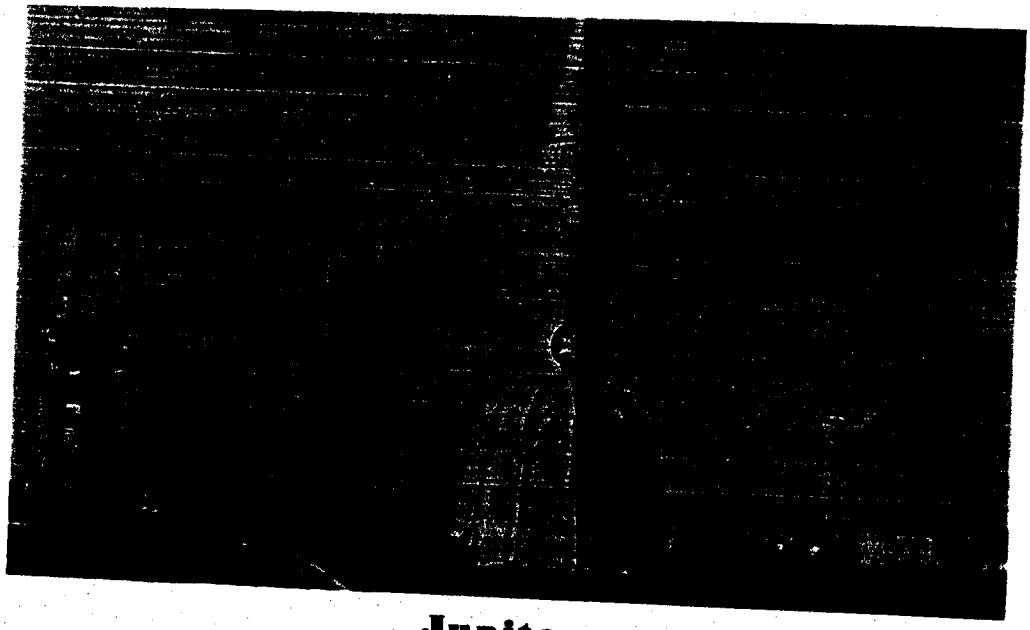
Navaho

Navaho was intended as a long range strategic missile. It was a supersonic, surface-launched, cruise missile powered by two ramjet engines. It was vertically launched and carried to its high cruise altitude by a liquid, rocket engine. The missile was designed to cruise at Mach 2 # and deliver a warhead 5,000 n. m. The Navaho program was concluded in Feb. 1958.

Navaho was an important test bed for the development of propulsion systems and the automatic inertial guidance system used on our former ICBMs.

Following Navaho R&D, it became a target drone for Bomarc.





Jupiter

The Army developed Jupiter was the first missile which served both as a weapon system and space booster.

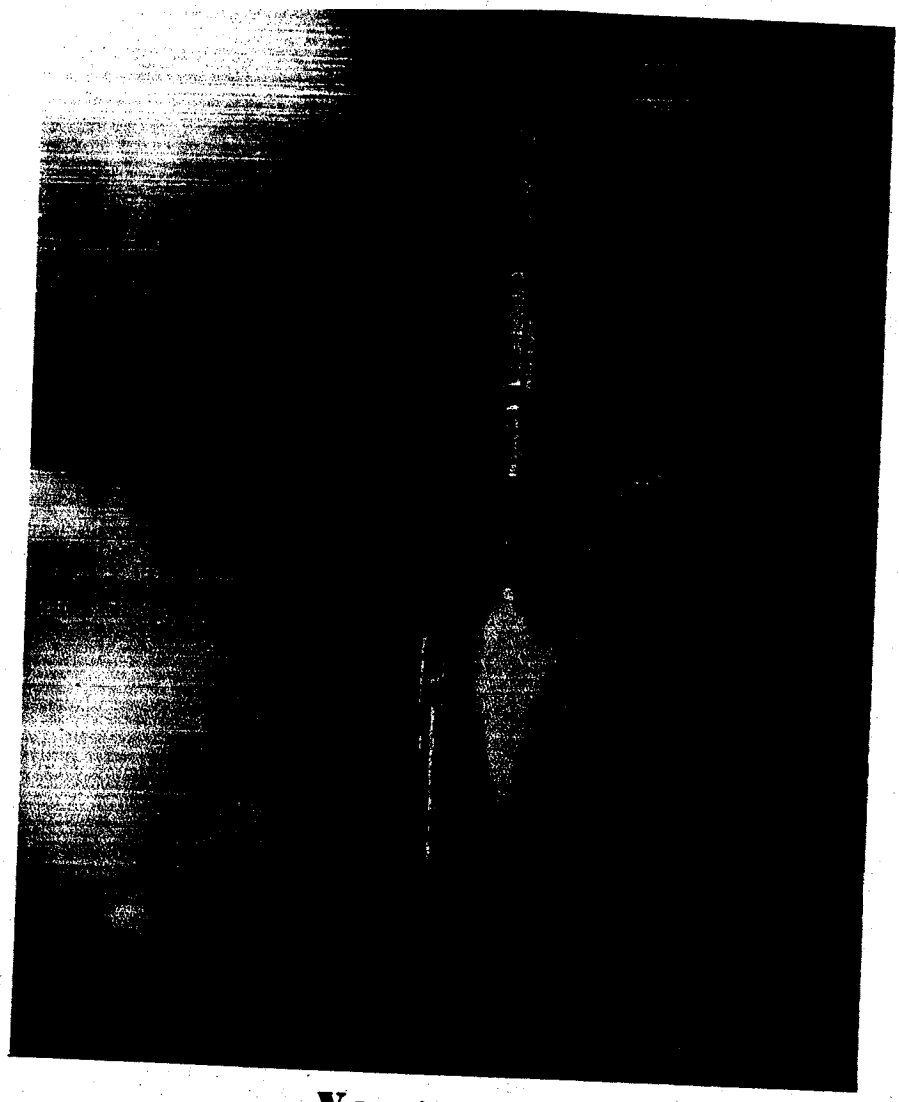
The first Jupiter, tested on March 14, 1956, was a modified Redstone missile with Jupiter components. One year later the first all-component Jupiter IRBM (Intermediate-Range Ballistic Missile) was tested.

By 1960, Jupiter was operational and stationed in Turkey and Italy. The Jupiter IRBM had a range of 1,500 miles, a speed of 10,000 mph., used an all-inertial guidance system and carried a nuclear warhead.

The testing of the Jupiter C, which was the space booster type, also began early. The first Jupiter C (short for Jupiter Composite Reentry Vehicle) was launched on Sept. 19, 1956. Jupiter C was a combination of the Redstone missile with three stages of clustered Sergeant rockets.

During 1958, six Jupiter C rockets were used as satellite boosters. They placed in orbit a total of three satellites, including the free world's first satellite Explorer I on January 31, 1958.

Jupiter as a satellite booster



Vanguard

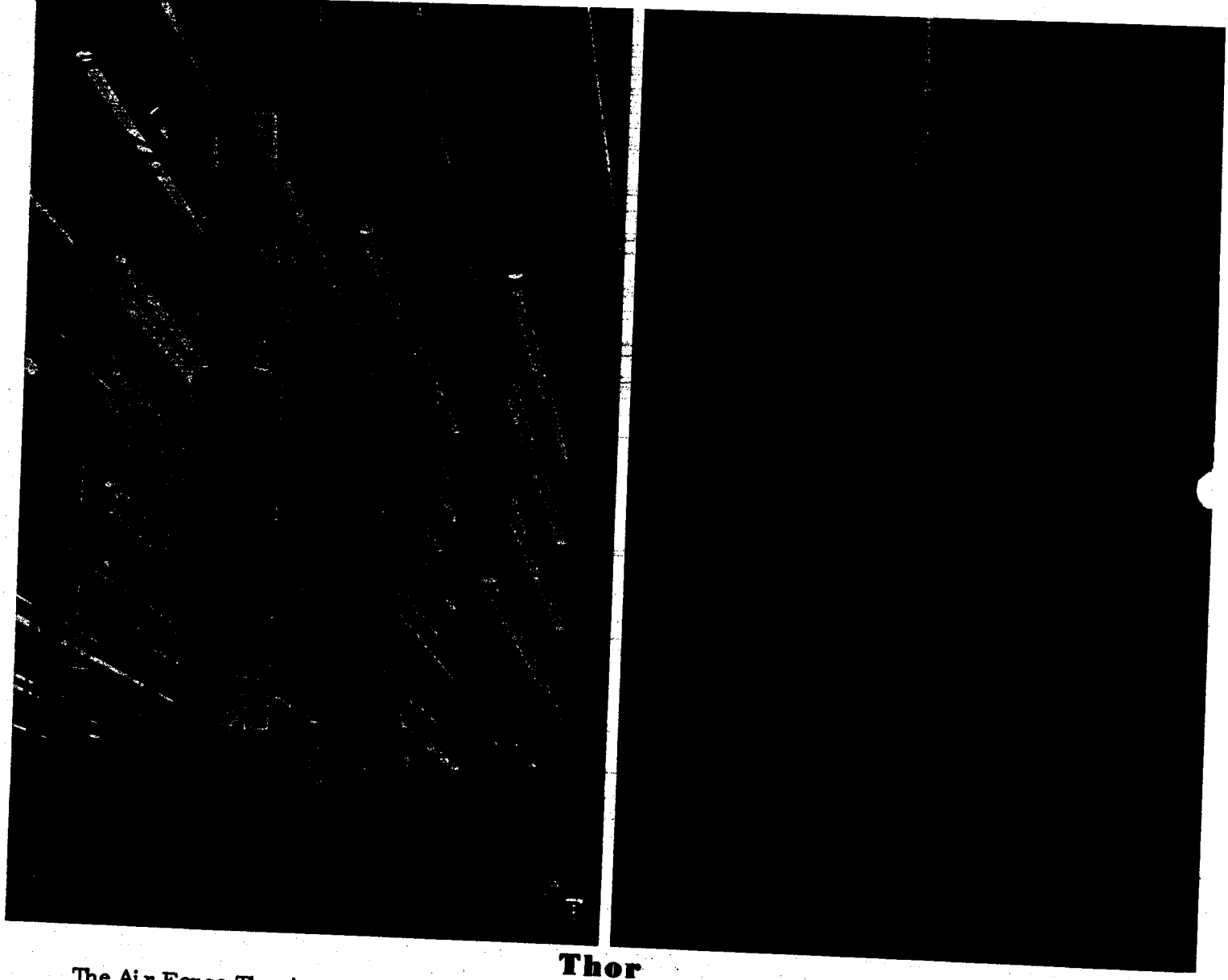
On July 29, 1955, President Eisenhower announced that the United States would launch "small unmanned Earth-circling satellites as part of the United States participation in the International Geophysical Year, which takes place between July 1957 and December 1958." This was the start of Project Vanguard and the Scientific Earth Satellite Program.

By December 1956, the first Vanguard was at the Cape and was readied for its first launch on Dec. 8. This vehicle was essentially the Navy Viking rocket with test instrumentation added. The first test and the two that followed were successful.

Then along came the Russian Sputniks. This placed increased pressure on the United States to loft a satellite. This was attempted on Dec. 6, 1957, with a development model Vanguard booster. Unfortunately, it exploded on the pad. The nation reacted to this event as though it were a national disaster. A backup Vanguard was readied for launch. But again disappointment was in store. Test vehicle 3 lifted off fine but exploded after a minute of flight.

At this time, Vanguard seemed destined for failure. However, the next Vanguard proved its worth. It lifted off at 7:15 a.m. on March 17, 1958 and after ten minutes of flight successfully placed its empty third stage and the second United States satellite "1958 Beta" into orbit.

Project Vanguard concluded in September 1959 after 14 launchings and orbiting three satellites.



Thor

Thor was a liquid fuel, single stage IRBM. It had a range of 1,500 n.m., used an all-inertial guidance system and carried a nuclear payload. It became operational in May 1959 and was deployed with the Royal Air Force in England.

Because of its reliability and versatility as a weapon system, Thor became our workhorse of space. Mated with upper stages, such as Able, Able-Star, Agena and Delta, Thor has successfully boosted payloads like Discoverer, Pioneer, Explorer, Transit, Courier, Echo, Telstar, Relay, Tiros, Allouette, OSO, Ariel, Anna, Syncom and Nimbus into orbit.

The Air Force Thor has also seen duty as a weapon system and space booster. Its test program began on January 25, 1957. This was just 13 months from the time the missile was approved and the production order issued.

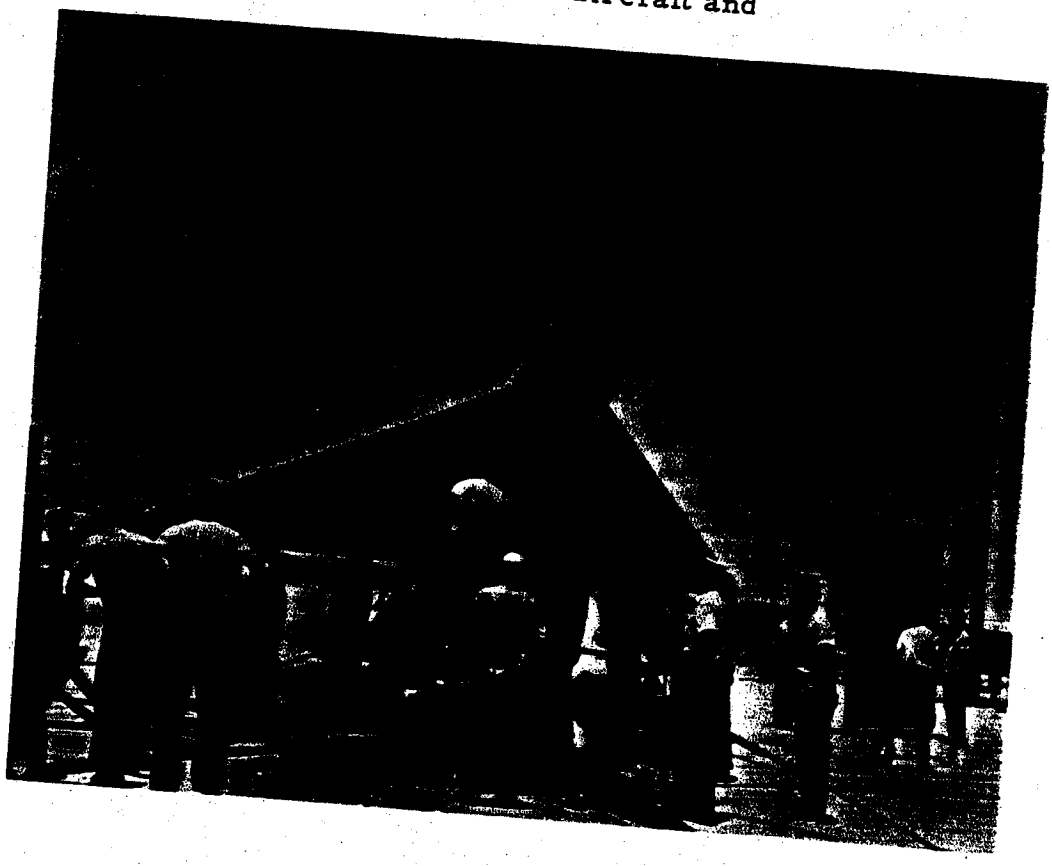
The first four tests were unsuccessful. However, much was learned from these early shots and modifications were made to the vehicle. The first successful Thor was launched on September 20, 1957.

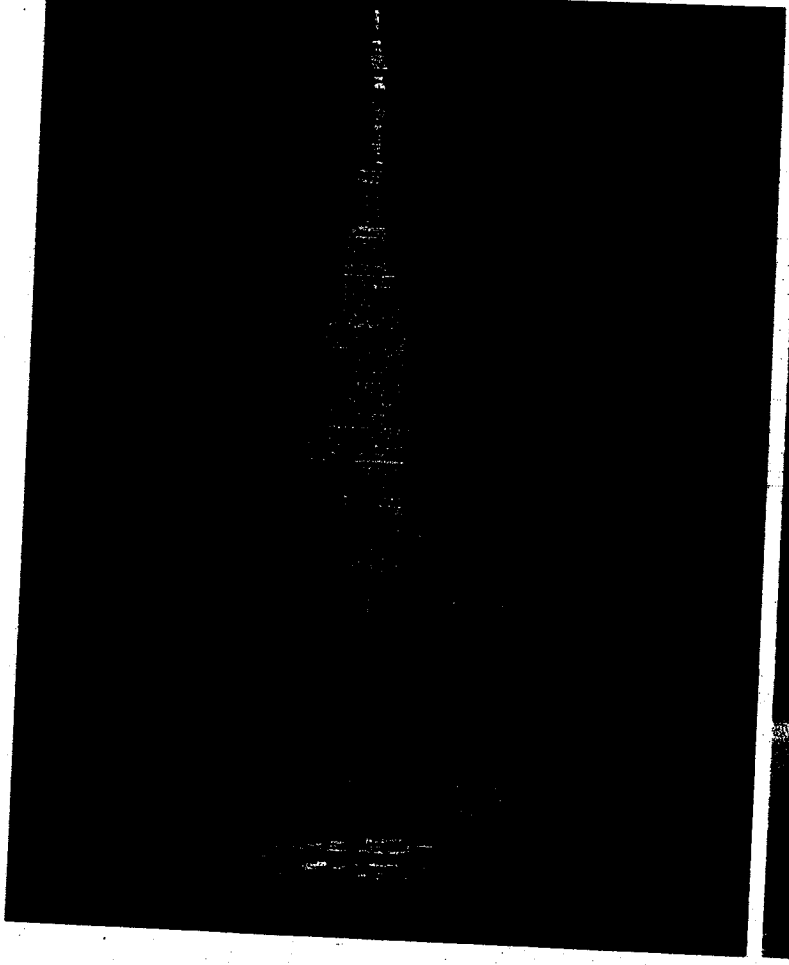
Bull Goose

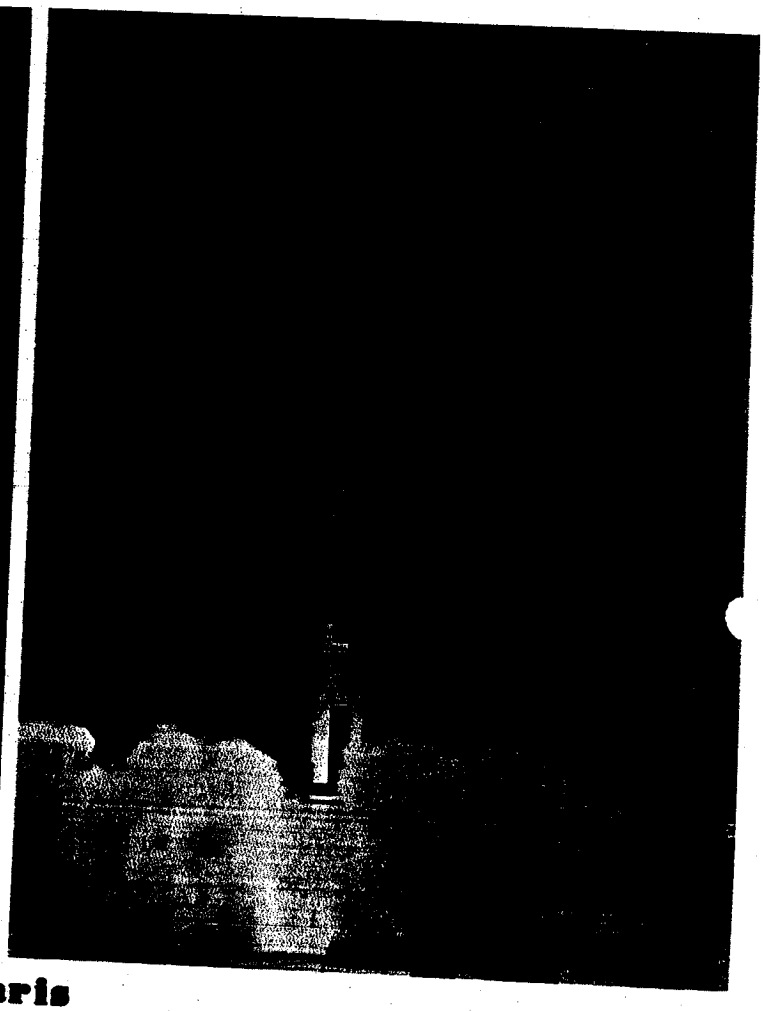
Bull Goose was a ground launched diversionary missile. It was tested at Cape Kennedy from March 13, 1957 - December 1958.

The Bull Goose was air-breathing and powered by a J-83 turbojet engine. It was subsonic, long range and had the capability to fly at high altitudes.

The purpose of this missile system was to decoy enemy air defense forces, thus allowing our Strategic Air Command aircraft and missiles to reach their targets. Although development and testing of this vehicle was successful, the Bull Goose program was canceled on Dec. 12, 1958.







Polaris

Polaris, the Navy's submarine launched ballistic missile, is an important deterrent in our nation's arsenal.

It began its test program at Cape Kennedy in April 1957. Three types of Polaris missiles have been tested here - A-1, A-2 and A-3. All three have gone through the same test sequence.

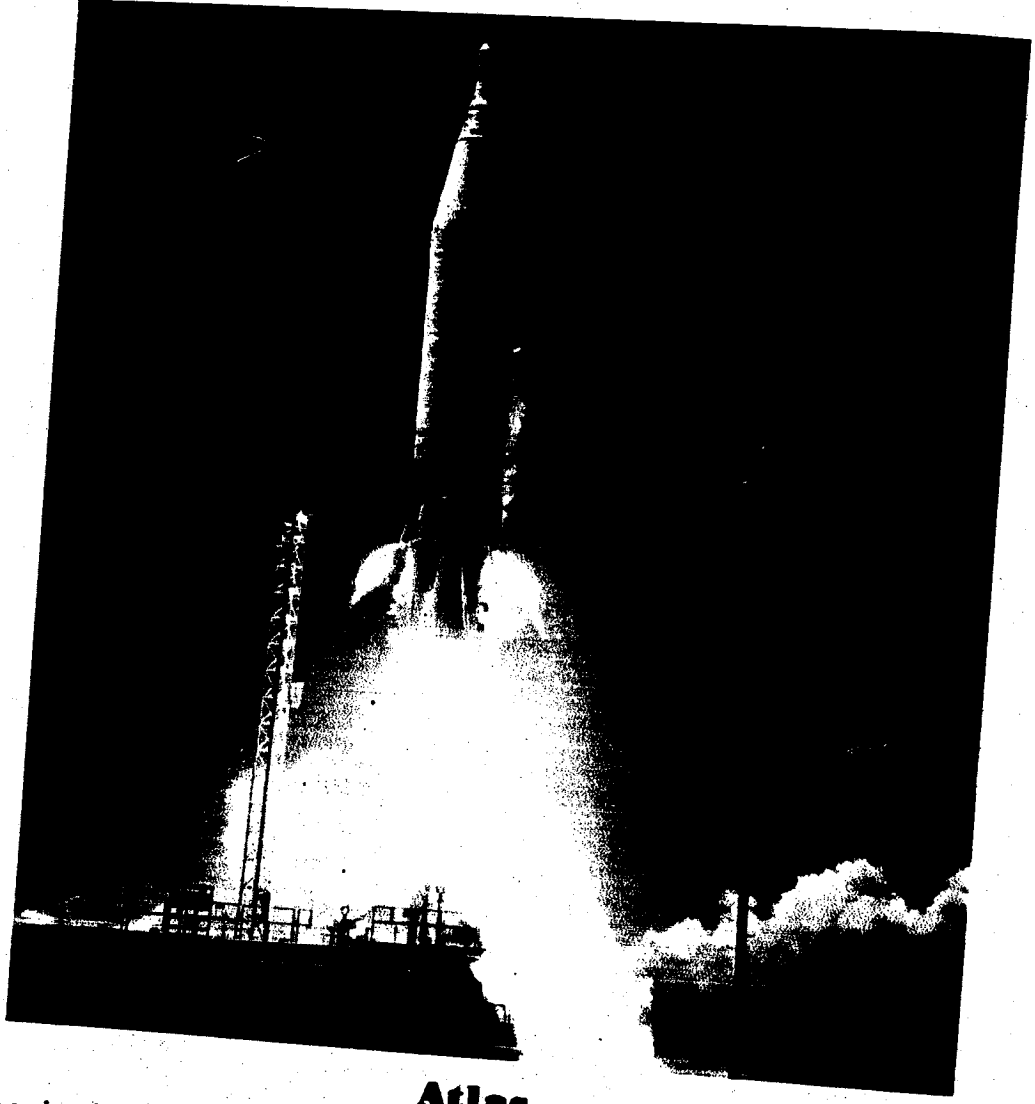
First, the Polaris was tested from the land pads at Cape Kennedy. When these tests proved successful, the missiles were launched from a converted cargo ship, known as the USS Observation Island. Finally, the missiles were fired from the nuclear powered submarine.

The first submarine to launch the Polaris was the George Washington on July 20, 1960. The George Washington was also the first submarine to go on operational patrol with the 1,200 n. m. A-1 in its tubes on Nov. 15, 1960.

While the George Washington and other Polaris subs were on patrol with the A-1, the longer range 1,500 n.m. Polaris A-2 was being tested. It completed its test program in 1962 and was operational on the Ethan Allen in June 1962.

Coincident with the A-2's testing, the 2,500 n.m. Polaris A-3 was being developed. It was first tested on Aug. 7, 1962, and by Sept. 1964, it was operational on the Daniel Webster.

Eventually, there will be 41 Polaris submarines on patrol with each carrying 16 missiles. Ready for instant retaliation in case of enemy attack, the Polaris is a significant deterrent.



Atlas

Atlas, America's first operational Intercontinental Ballistic Missile (ICBM), also has seen duty as a man-rated and space booster.

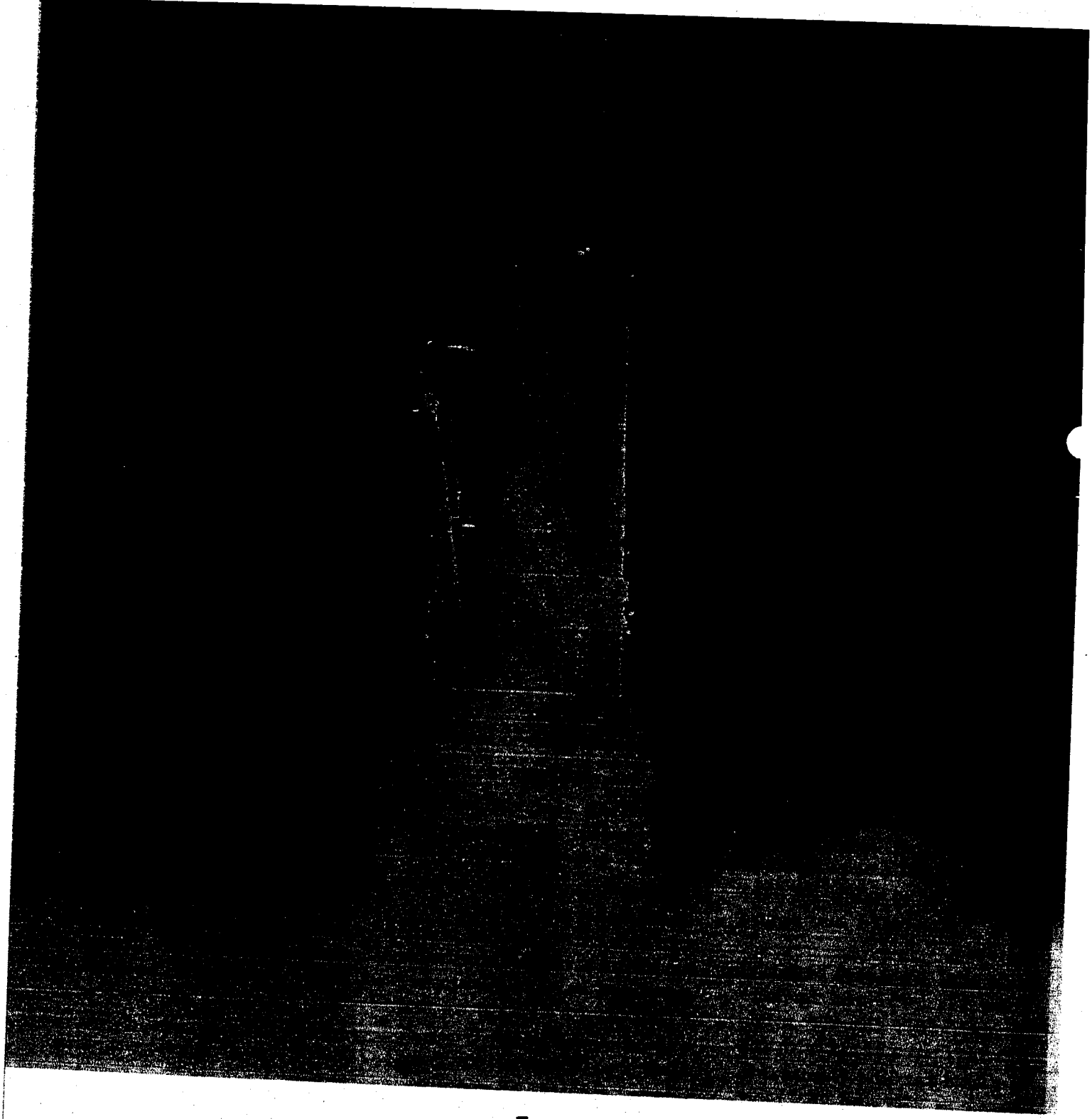
Its test program began on June 11, 1957 and by September 1961, the "D" model was operational with the Strategic Air Command. Models "E" and "F" have also stood operational guard with SAC. However, all Atlas ICBMs have now been phased out of the operational inventory. It's a tribute to Atlas and the men who manned it that it never had to be fired in retaliation.

Atlas has also had an active life as a space booster. In Project Score, it became the first complete missile to be placed in orbit and relayed President Eisenhower's 1958 Christmas message back from space. Atlas also served as the orbital booster for Project Mercury. Astronaut's John Glenn, Scott Carpenter, Wally Schirra and Gordon Cooper all rode the dependable Atlas into orbit.

It has also been combined with various upper stages, such as Able, Agena and Centaur. The most frequent combination has been the Atlas-Agena.

Using this combination, all the Ranger series, Mariner series and the Air Force Nuclear Detection Satellites have been launched.

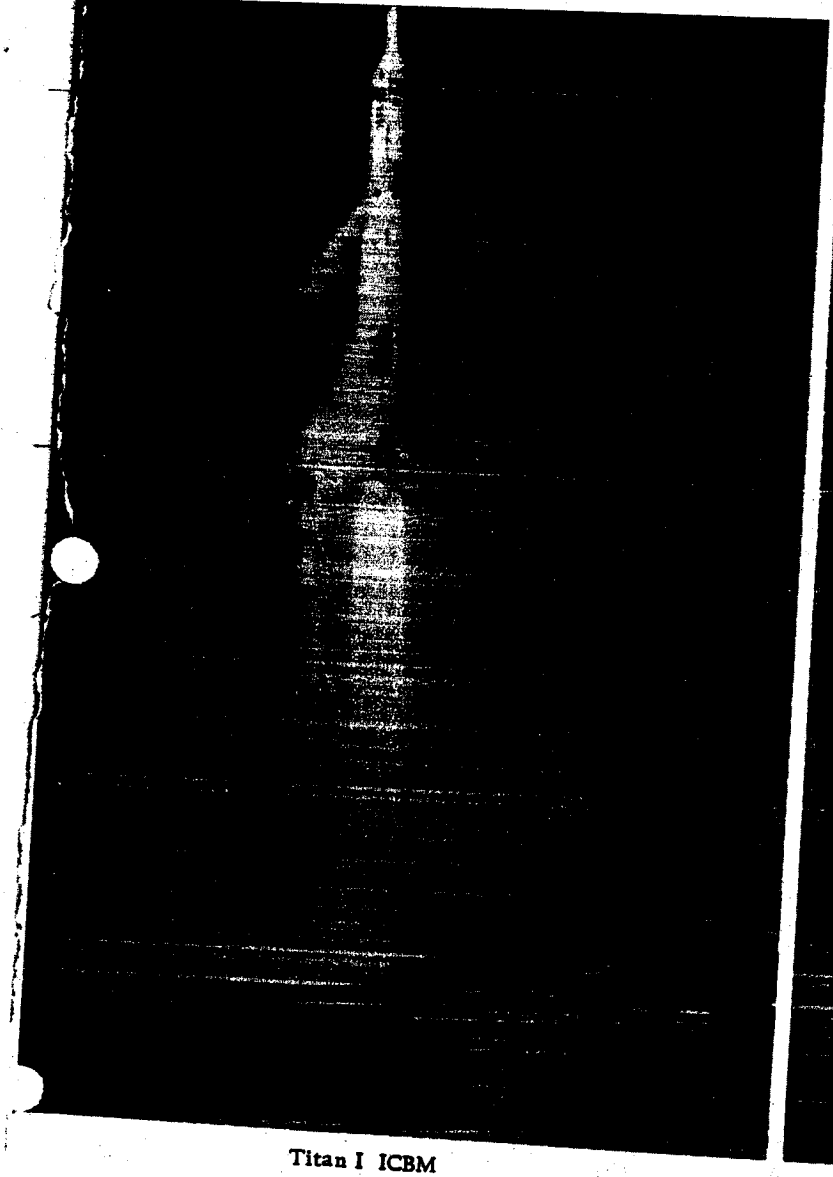
The Atlas-Centaur combination is a new vehicle being developed by NASA. The eventual payload will be Surveyor, designed to make a soft landing on the moon.



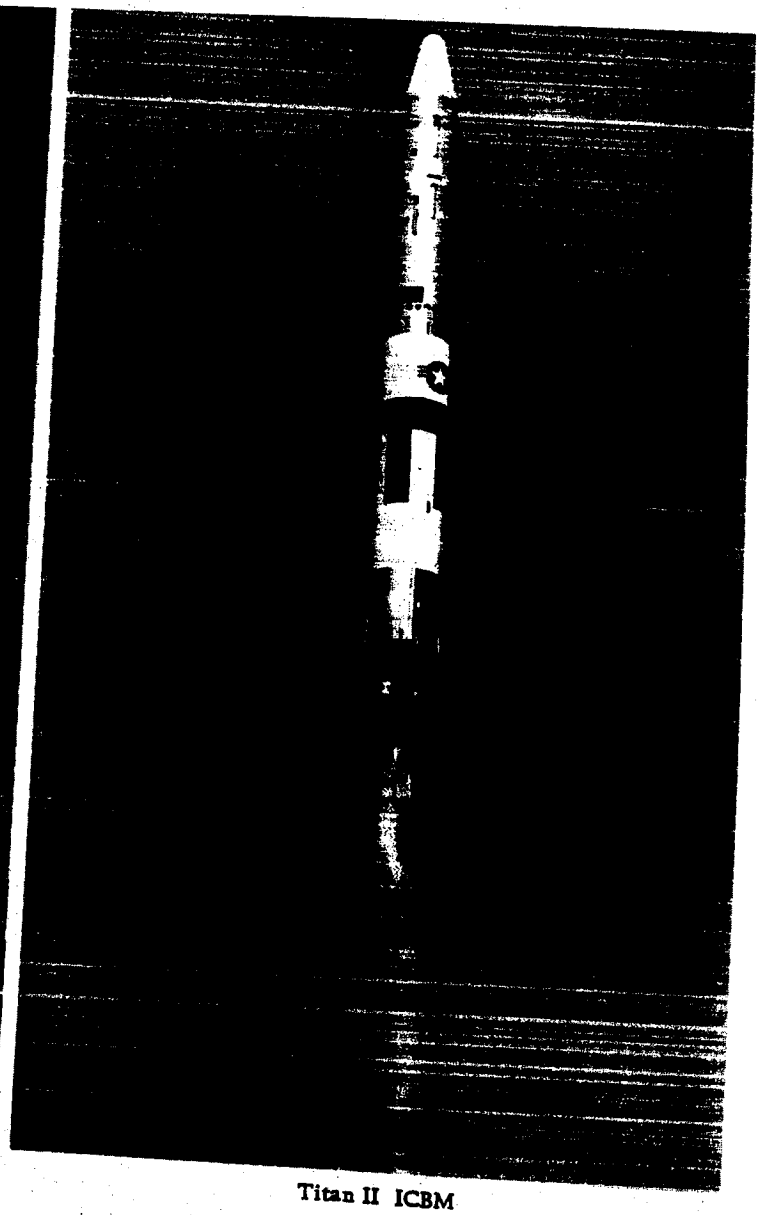
Juno

Juno II was another space workhorse. It used an elongated Jupiter IRBM as its first stage for increased burn time. The four stage Juno stood 76 feet high and developed 150,000 pounds of thrust; it was capable of placing 100 pounds into a 300-mile orbit.

Juno II boosted the Pioneer III and IV space probes and orbited Explorers VII, VIII and XI.



Titan I ICBM



Titan II ICBM

Titan

The Air Force developed Titan first flew from Cape Kennedy on Feb. 6, 1959, Soon, it had earned a reputation for reliability by scoring 20 completely successful missions in its first 25 flights. By December 1961, Titan I was declared operational and turned over to the Strategic Air Command at Lowry AFB, Colo.

Already under development by this time was an advanced version of the Titan, called Titan II. The most important advances of the Titan II were its capability of carrying a heavier payload, a greatly reduced reaction time and all inertial guidance system.

The first launch of Titan II took place on March 16, 1962. Twenty-two flights later, Titan II completed its research and development test program. This was well ahead of schedule and below cost. In fact, it required less than half the number of test flights than any previous ICBM.

Titan II is operational with SAC at McConnell AFB, Kansas; Davis-Monthan AFB, Arizona, and Little Rock AFB, Arkansas.

Titan II also has two other important roles in today's aerospace age, it is the booster for Project Gemini and is the core of the Titan III-C space booster.