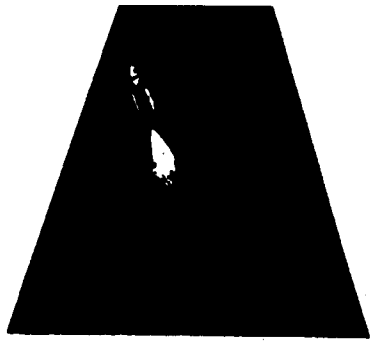
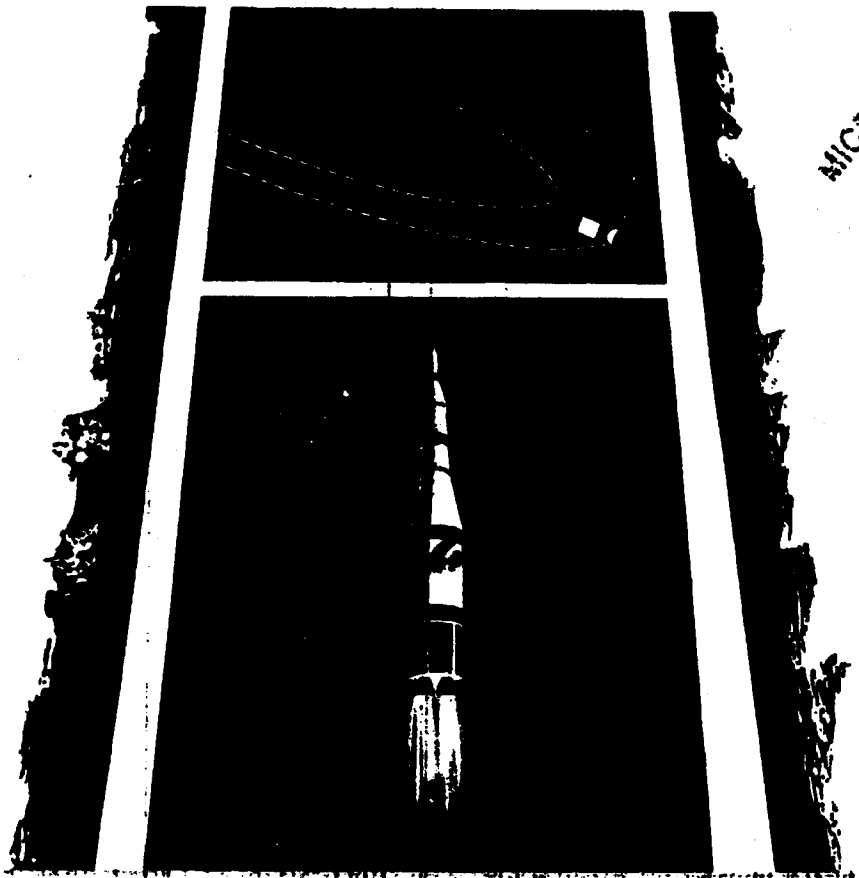
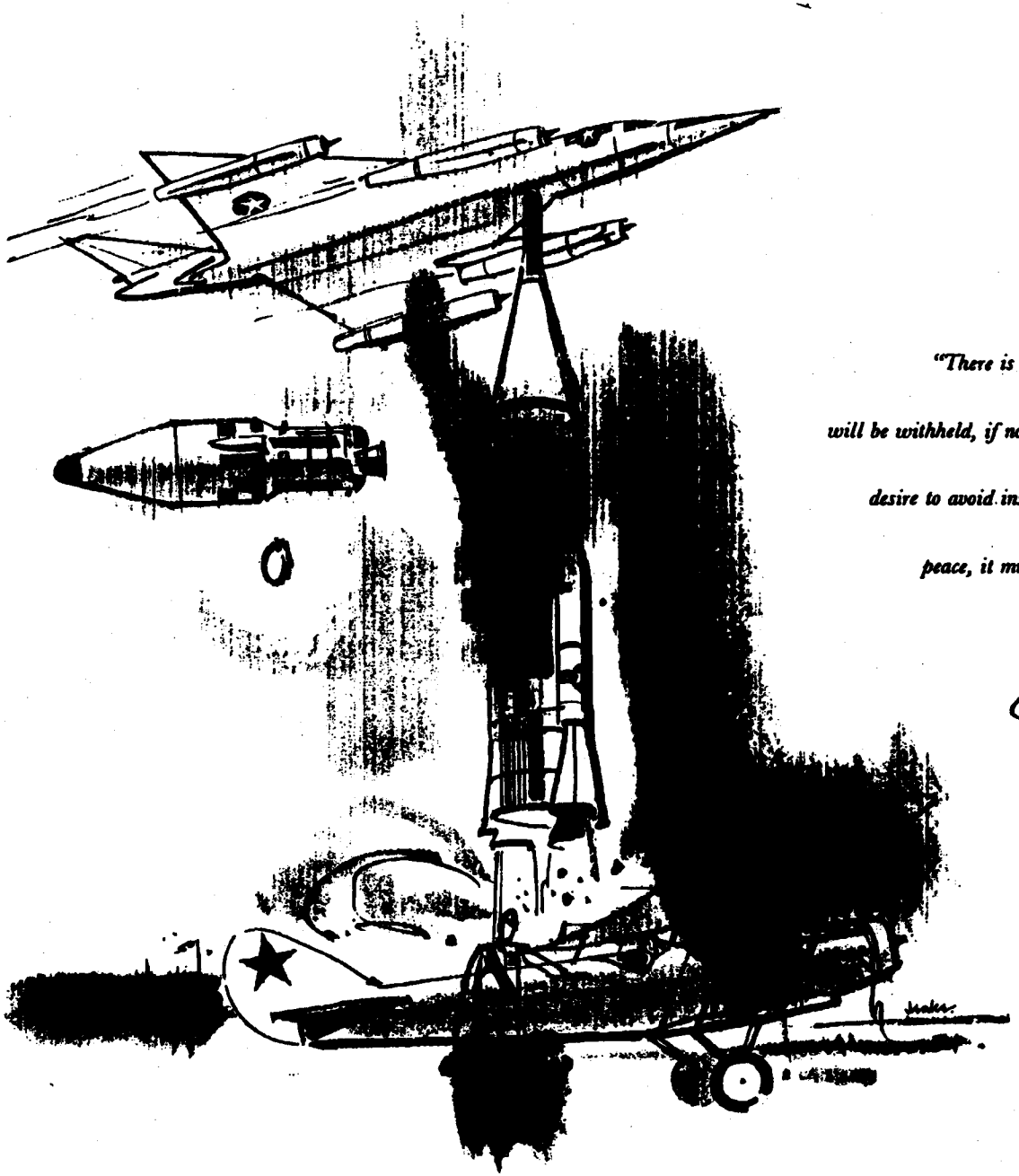


BALLISTIC MISSILES AND THE REACH INTO SPACE

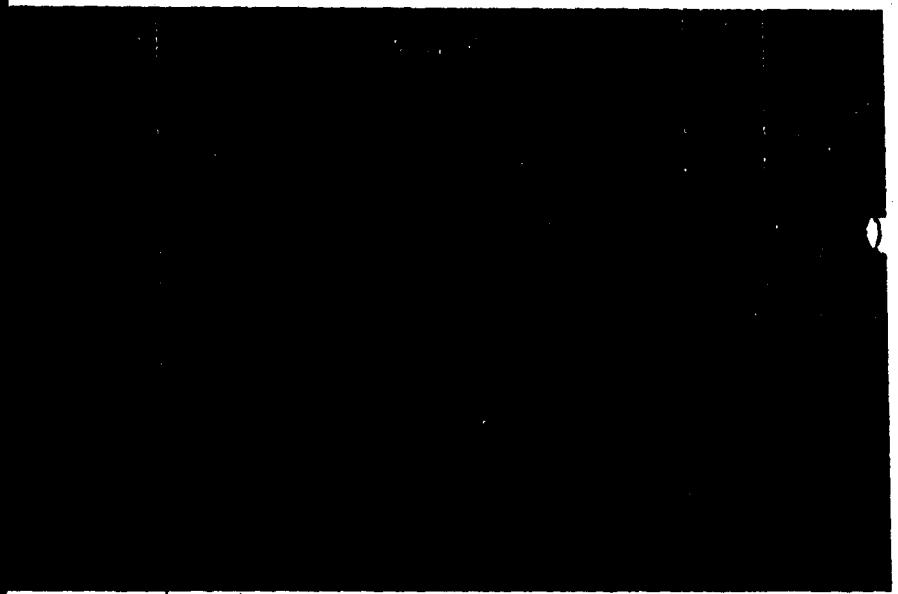


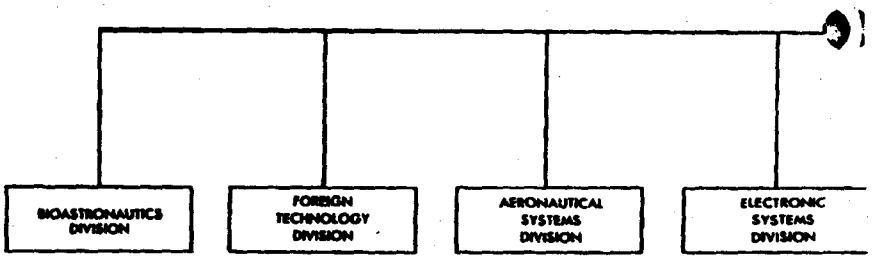
UNITED STATES AIR FORCE



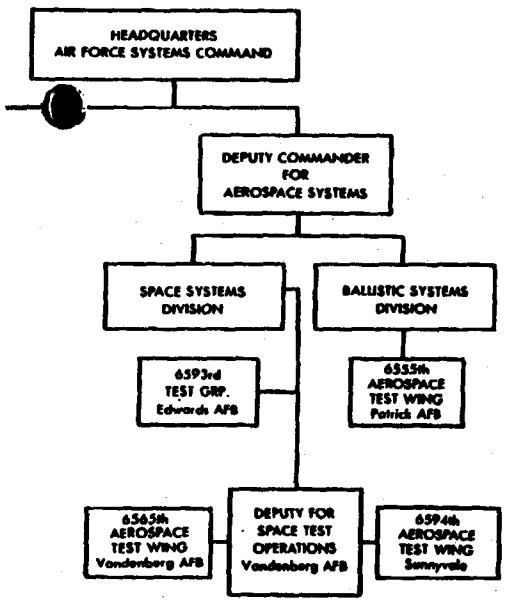
"There is a rank due to the United States among nations which will be withheld, if not absolutely lost, by the reputation of weakness. If we desire to avoid insult, we must be able to repel it; if we desire to secure peace, it must be known that we are at all times ready for war."

George Washington



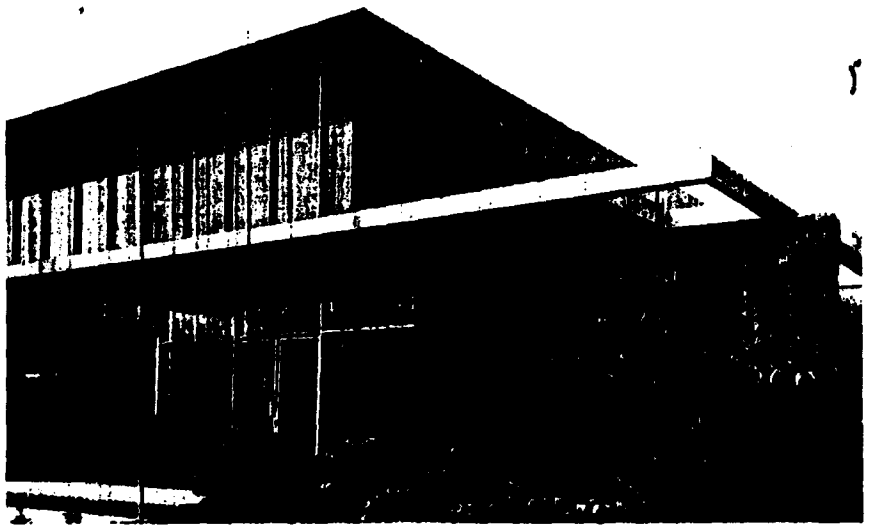


General Bernard A. Schriever . . . *pioneering force behind the development of ballistic missile and space systems . . . first commander of the former Ballistic Missile Division . . . a command pilot of vast experience . . . an able planner and a facile thinker . . . graduate of two universities . . . distinguished Air Force Leader . . . Commander of the Air Force Systems Command (formerly ARDC) since April 1959.*



Lt. Gen. Howell M. Estes Jr. ... *West Point Graduate ... experienced pilot ... during the formative years, commander of a B-47 Division of the Strategic Air Command ... veteran of 25 Korean combat missions ... as weapon systems director at the Wright Air Development Center (1954-57), instrumental in shaping the modern strategic aerospace structure of the USAF ... former Assistant Deputy Chief of Staff for Operations at Headquarters USAF ... named Deputy Commander (AFSC) for Aerospace Systems in April 1961.*

IMAGINATION IN MANAGEMENT



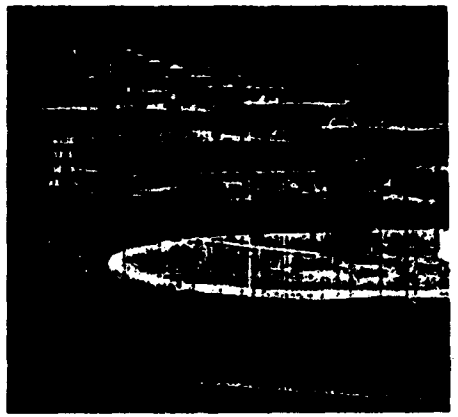
Management has been called the pacing factor in our national effort to compress time and accelerate technology. Efficient, effective, streamlined, productive management has been a paramount objective of the Air Force since 1954, when the Atlas ICBM weapon system development program was undertaken in earnest.

A bold departure from the traditional, step-by-step sequence of development – testing – production – facilities construction was adopted, based on confidence in the operational effectiveness of the engineers' designs and in their ability to extend scientific state of the art on schedule. Applied on such a total scope to all aspects of acquiring a complex new weapon system, the *concept of concurrency* was revolutionary, incurred grave calculated risks, and required unprecedented integration of fast-reacting management authority. The pay-off has been the invaluable shortening of the development time cycle in the introduction of critical weapon systems, and high compression of normal lead-time. First applied strictly to the Atlas project, the practices of *concurrency* and *management by exception* extended to the Thor, to Titan, to Minuteman and, in spurring these systems to operational status, ushered in the age of space.

"No single weapon system contractor . . . can have the breadth of vision, the alertness to national defense needs, the degree of access of information, the choice of alternative systems, the decision-making responsibility, and the dedication to the public interest, expected and required of a government agency."

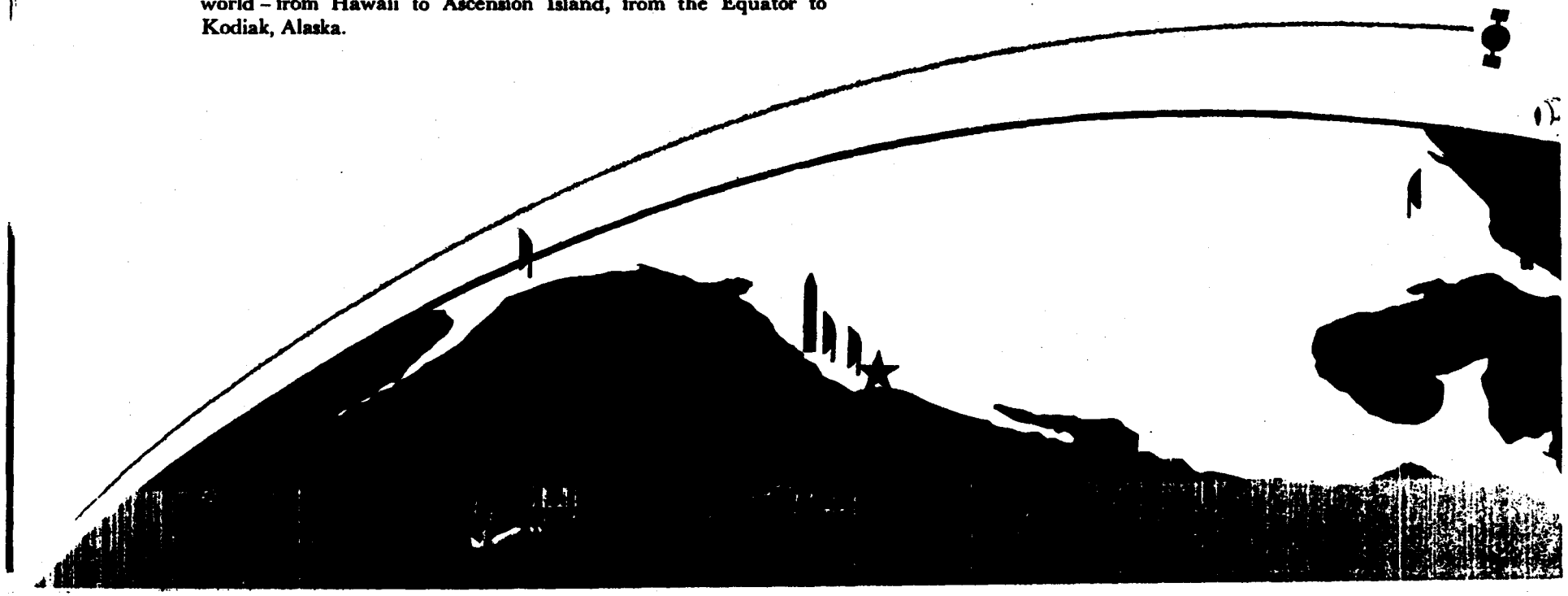
So said the House Committee on Government Operations in its third report in that same vein. The Committee observed: "Consider the responsibilities of the systems engineer in a complex weapon system such as the ICBM. His organization must be specially competent in a wide range of technologies to understand the problems in each field and to make appropriate compromises among conflicting requirements for optimum results. These fields embrace rocket engines, structures for fuel tanks, engine mounts and payload supports, guidance technology, aerodynamics and structural dynamics of propulsion and control, radars, computers and general electronics for guidance, thermonuclear warhead designs for the payload, and whole new industry techniques for the new concepts . . . [illegible]

The Aerospace Corporation was established in June 1960 as a non-profit corporation, chartered to engage in research and development in the support of scientific activities and projects for the United States Government. In summary, the unique and widely diversified competence of the Aerospace Corporation objectively complements the Air Force in discharging its responsibilities in the immense arena of aerospace technology, for discriminating selection and planning of advanced systems, for technical steering of a broad industrial base in the execution of approved development programs, and for supporting laboratory operations to ensure prompt, valid application of the latest scientific advances.



VERSATILITY IN OPERATIONS

Testing – exhaustive and comprehensive – is critical to successful aerospace research and development. It is a pyramiding process, beginning with tests of the smallest component, and progressing to subsystems, systems, and complete assemblies – to static tests and, finally, to flight tests. To take the measure of missiles and space systems, the Aerospace Systems Headquarters includes several uniquely functional wings, their elements extending half-way around the world – from Hawaii to Ascension Island, from the Equator to Kodiak, Alaska.



CANAVERAL

Home of the Air Force Missile Test Center . . . familiar date-line on thousands of stories reporting America's progress with ballistic missiles and space vehicles. Canaveral . . . missile-spawning Florida sand bar.

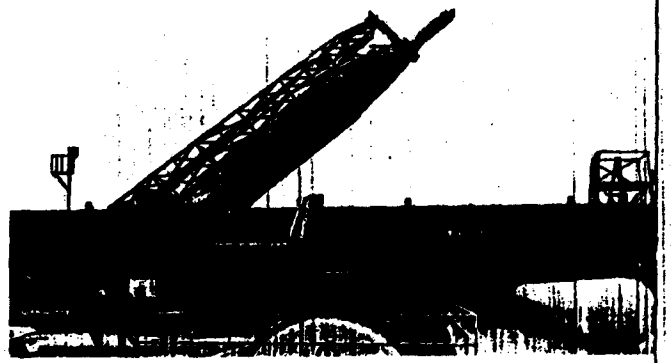
At the Cape, at nearby Patrick AF Base, and on the instrumented islands of the Atlantic Missile Range, the concentration of U.S. blue-suit and white-collar missile-age talent is high. Prominent among these groups of space seers are the industry representatives and the members of the 6555th Aerospace Test Wing, the human links between program management and program product.

Ballistic missile flight test launchings now number in the hundreds. The U.S. sorties into space are climbing toward the century mark. The majority of these – America's stepping stones to space – depend heavily on the guidance and the skills of those who work at Canaveral.

SUNNYVALE

. . . First facility completely equipped to monitor the launch, conduct the tracking, acquire the data, and command and control the progress of satellites on orbit. The 6594th Aerospace Test Wing operates from a modern, windowless, equipment-packed building. Information from tracking stations at Vandenberg, Point Mugu, on ocean vessels, in Alaska, New Hampshire and Hawaii is funneled into the Satellite Test Annex by instantaneous voice lines and by teletype. Processed through computers and evaluated by scientists, data is displayed via closed-circuit television directly onto consoles in the control room.

The long reach of the Satellite Test Annex extends not only into space, but around the Earth as well. Elements of the 6594th Test Wing include the 6594th Recovery Control Group, the 6593rd Test Squadron, and the 6593rd Instrumentation Squadron, all in Hawaii; the 6593rd Launch Squadron and the 6596th Instrumentation Squadron at Grenier AF Base, New Hampshire.

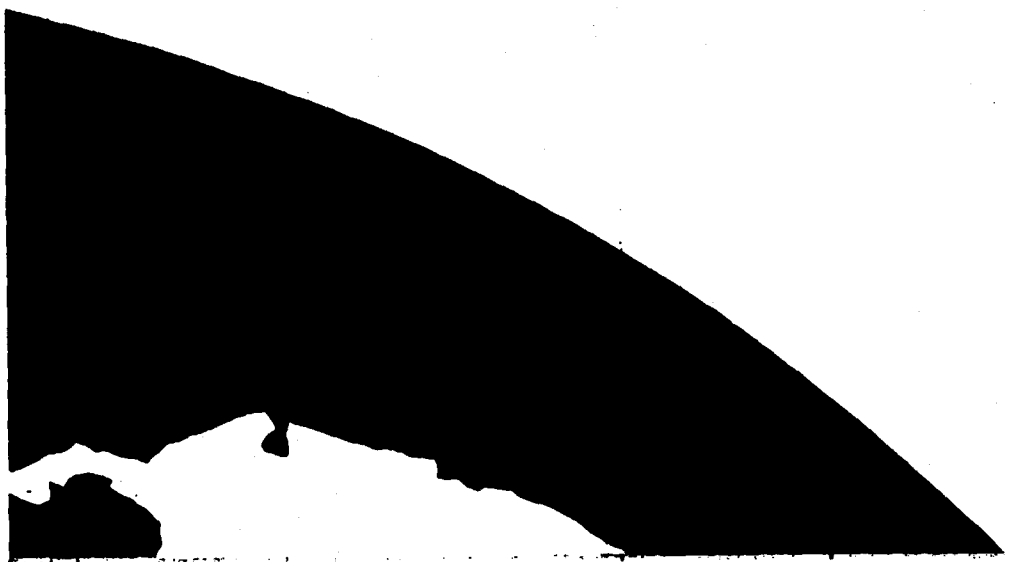


VANDENBERG

Jumping-off place for the Pacific Missile Range . . . West Coast proving center for the new breed of weapons and for the men who will watch, maintain, and–if necessary–launch them.

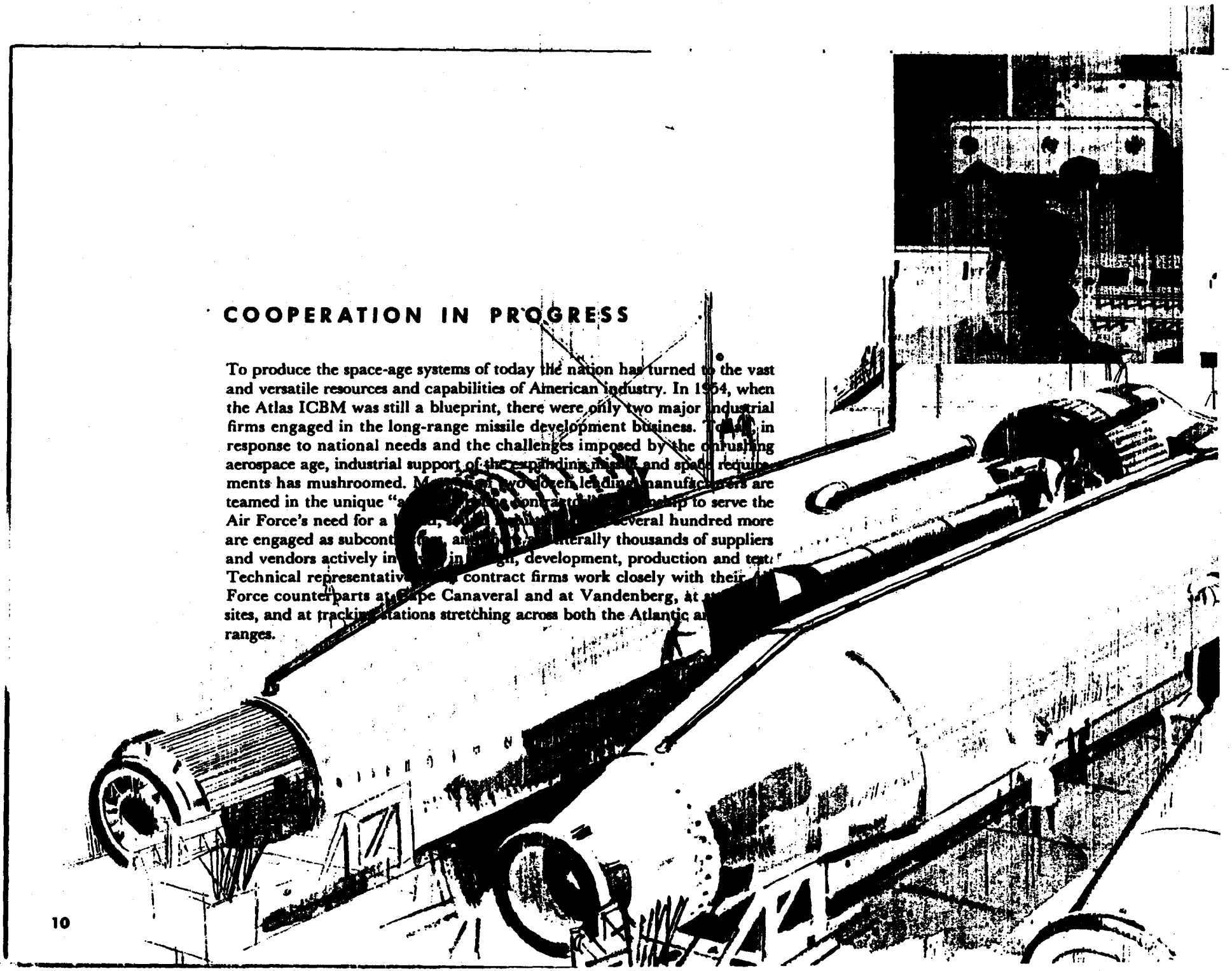
Prototype launch facilities . . . for Atlas, for Titan, and for Minuteman . . . full-scale working duplicates of operational ICBM structures complete with ground-support equipment . . . built and checked out for SAC's use under the direction of the people who know missiles best . . . the hard-hat members of the 6594th Aerospace Test Wing and the sharpshooting, hawk-eyed bird-watchers from the nation's missile-space industries.

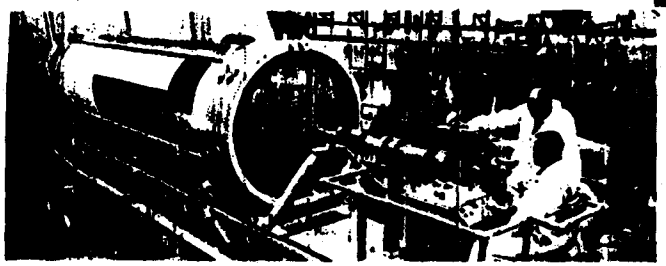
It is from Vandenberg AF Base, too, that the USAF satellites in the successful Discoverer series are assembled, inspected, checked out, and Thor-boosted into orbit . . . and the Vandenberg-Point Arguello location is the designated launching site for the Air Force's Atlas-boosted satellites.



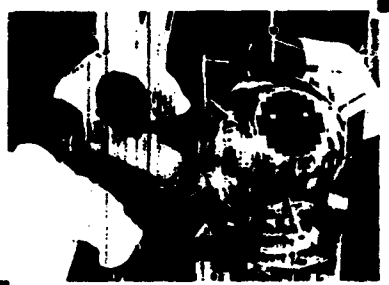
COOPERATION IN PROGRESS

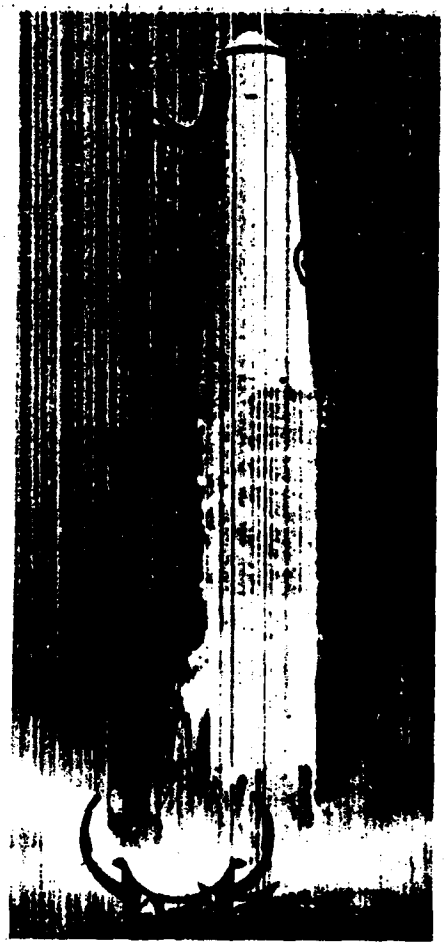
To produce the space-age systems of today the nation has turned to the vast and versatile resources and capabilities of American industry. In 1954, when the Atlas ICBM was still a blueprint, there were only two major industrial firms engaged in the long-range missile development business. Today, in response to national needs and the challenges imposed by the onrushing aerospace age, industrial support of the expanding missile and space requirements has mushroomed. Many of two dozen leading manufacturers are teamed in the unique "a[illegible] contractor" relationship to serve the Air Force's need for a [illegible], several hundred more are engaged as subcontractors and [illegible] literally thousands of suppliers and vendors actively in[illegible]n, development, production and test. Technical representatives of contract firms work closely with their Air Force counterparts at Cape Canaveral and at Vandenberg, at launch sites, and at tracking stations stretching across both the Atlantic and Pacific ranges.



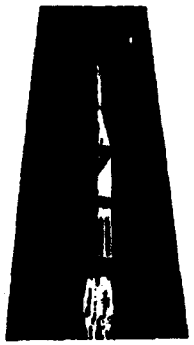


At drawing boards, in laboratories, and in research centers, the scientific and technical fraternity of industry and university experts join with military and civilian managers in fashioning the aerospace systems of the future.





THOR intermediate range ballistic missile . . . produced, proven and operational in four years' time . . . four 15-missile squadrons now on alert in the hands of the RAF in the United Kingdom . . . widely used, reliable space booster.



THE PRODUCTS

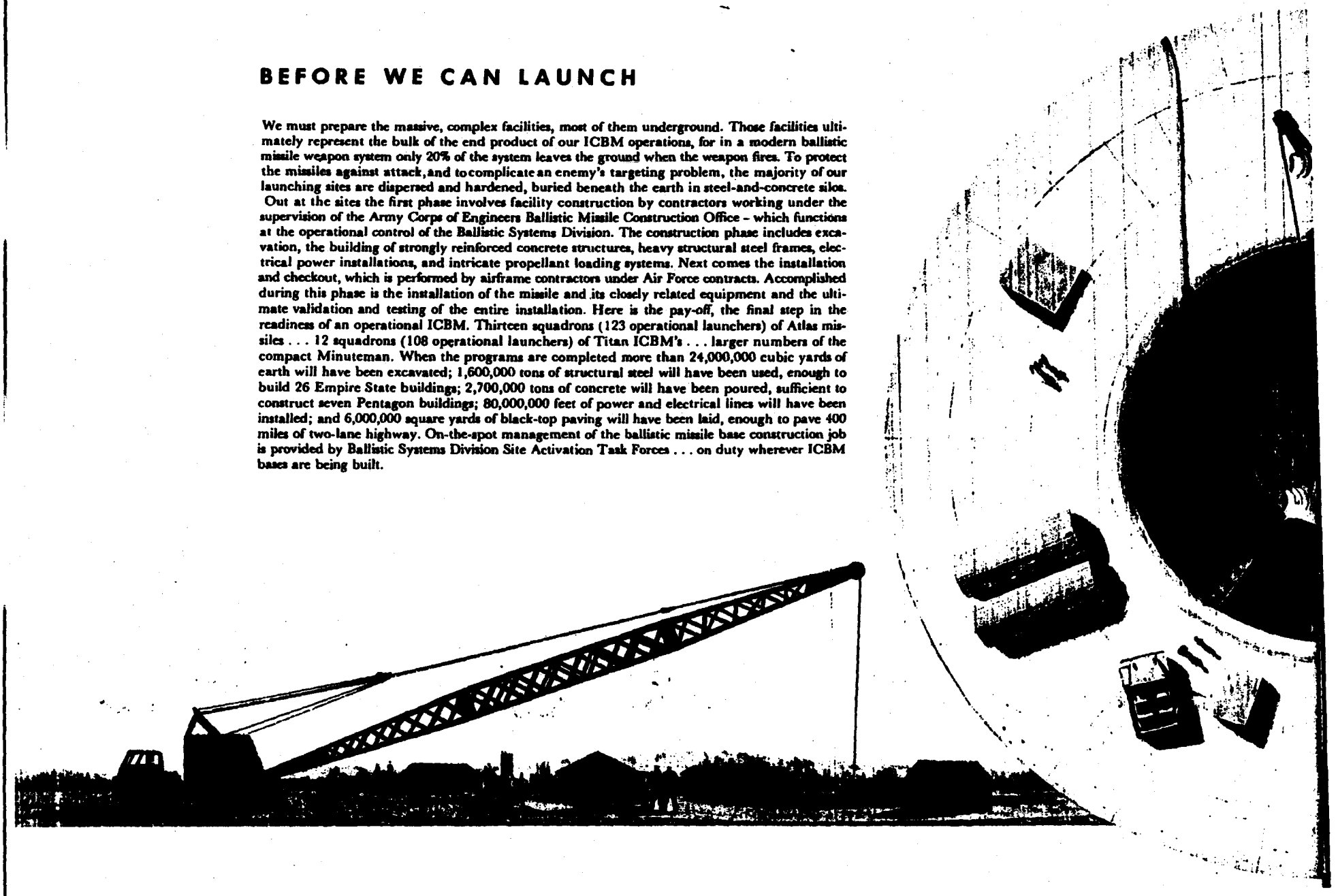
Out of the most intensive development programs in military history have come the Air Force's ballistic missiles, growing up to operational stature as America's new order in weaponry. Not the "ultimate weapon," but a cardinal element of positive deterrent power, blending with other forces into a comprehensive national military structure. In our defense inventory the ICBM's become a convincing argument against aggression, or a decisive counterforce if war should be thrust upon us. Thor . . . Atlas . . . Titan . . . Minuteman: strong names borrowed from the past out of respect for future needs . . . delivery systems without wings . . . electronic warriors on guard . . . capable of spanning oceans at lightning speeds . . . capable of carrying in one nuclear punch more destructive power than all the bombs dropped by all combatants in World War II. A new symbol of aerospace power . . . dedicated to the preservation of peace . . . fashioned from the talents and skills of a vast government-science-industry team.

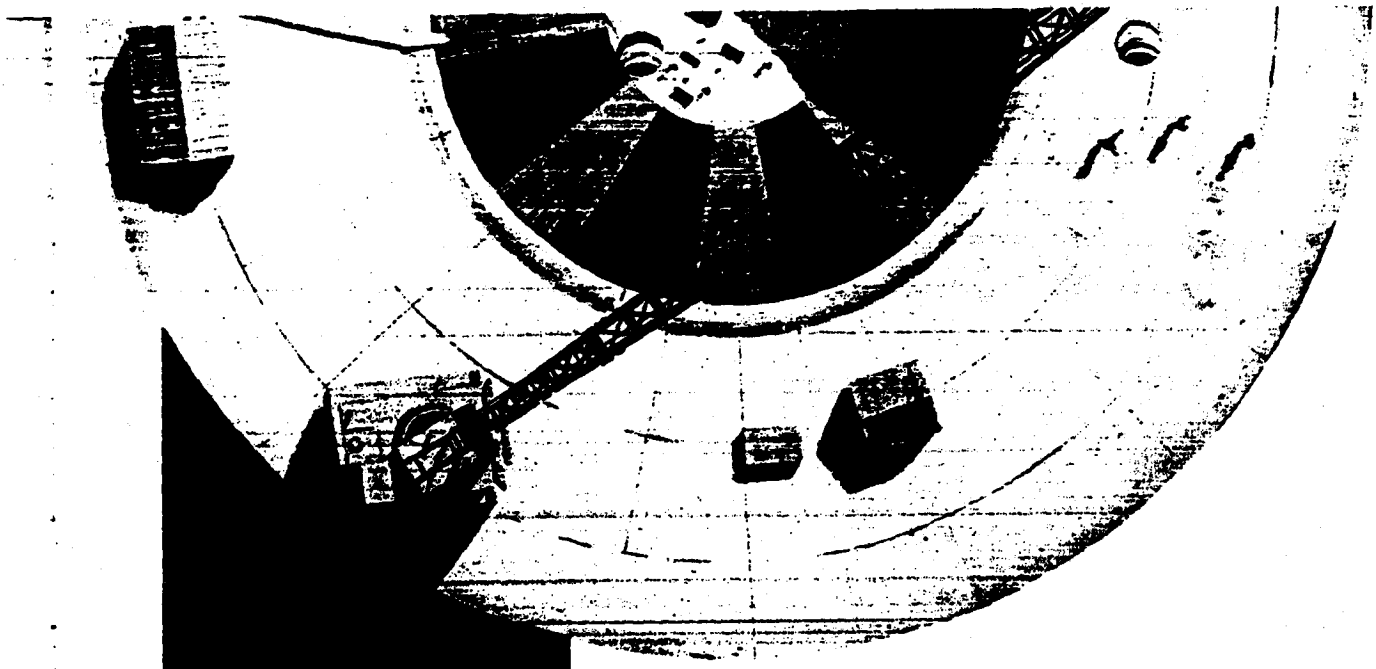
ATLAS pioneer intercontinental ballistic missile . . . the initial version now operational with the Strategic Air Command . . . being deployed in squadron strength at bases throughout the United States . . . serving double duty as a booster for various space payloads.

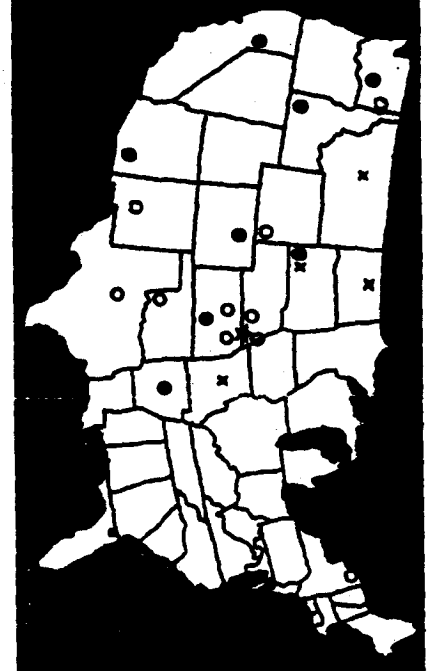
BEFORE WE CAN LAUNCH

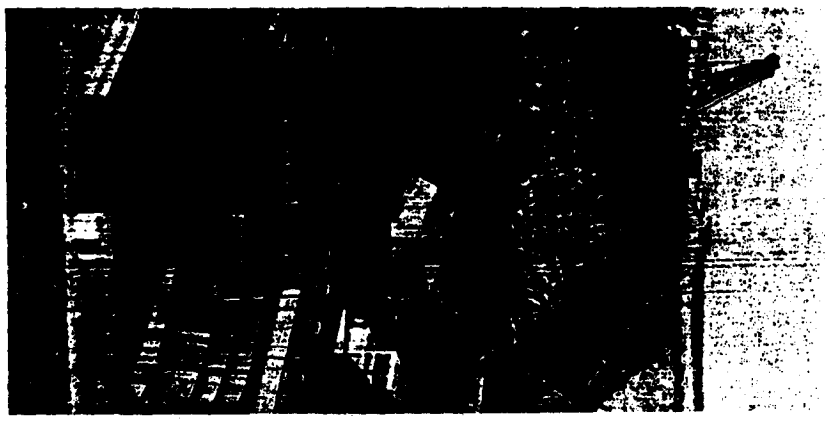
We must prepare the massive, complex facilities, most of them underground. Those facilities ultimately represent the bulk of the end product of our ICBM operations, for in a modern ballistic missile weapon system only 20% of the system leaves the ground when the weapon fires. To protect the missiles against attack, and to complicate an enemy's targeting problem, the majority of our launching sites are dispersed and hardened, buried beneath the earth in steel-and-concrete silos.

Out at the sites the first phase involves facility construction by contractors working under the supervision of the Army Corps of Engineers Ballistic Missile Construction Office – which functions at the operational control of the Ballistic Systems Division. The construction phase includes excavation, the building of strongly reinforced concrete structures, heavy structural steel frames, electrical power installations, and intricate propellant loading systems. Next comes the installation and checkout, which is performed by airframe contractors under Air Force contracts. Accomplished during this phase is the installation of the missile and its closely related equipment and the ultimate validation and testing of the entire installation. Here is the pay-off, the final step in the readiness of an operational ICBM. Thirteen squadrons (123 operational launchers) of Atlas missiles . . . 12 squadrons (108 operational launchers) of Titan ICBM's . . . larger numbers of the compact Minuteman. When the programs are completed more than 24,000,000 cubic yards of earth will have been excavated; 1,600,000 tons of structural steel will have been used, enough to build 26 Empire State buildings; 2,700,000 tons of concrete will have been poured, sufficient to construct seven Pentagon buildings; 80,000,000 feet of power and electrical lines will have been installed; and 6,000,000 square yards of black-top paving will have been laid, enough to pave 400 miles of two-lane highway. On-the-spot management of the ballistic missile base construction job is provided by Ballistic Systems Division Site Activation Task Forces . . . on duty wherever ICBM bases are being built.





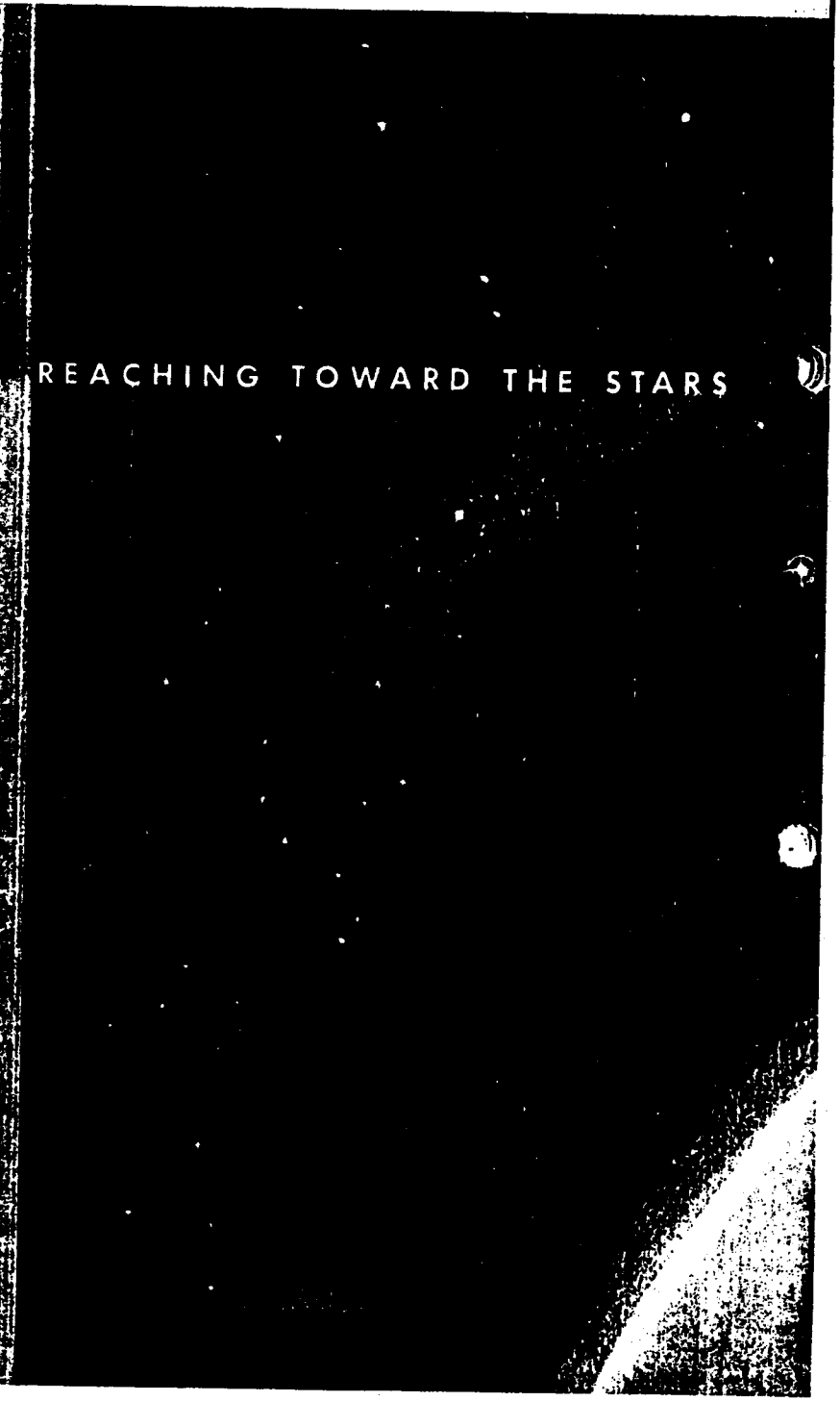


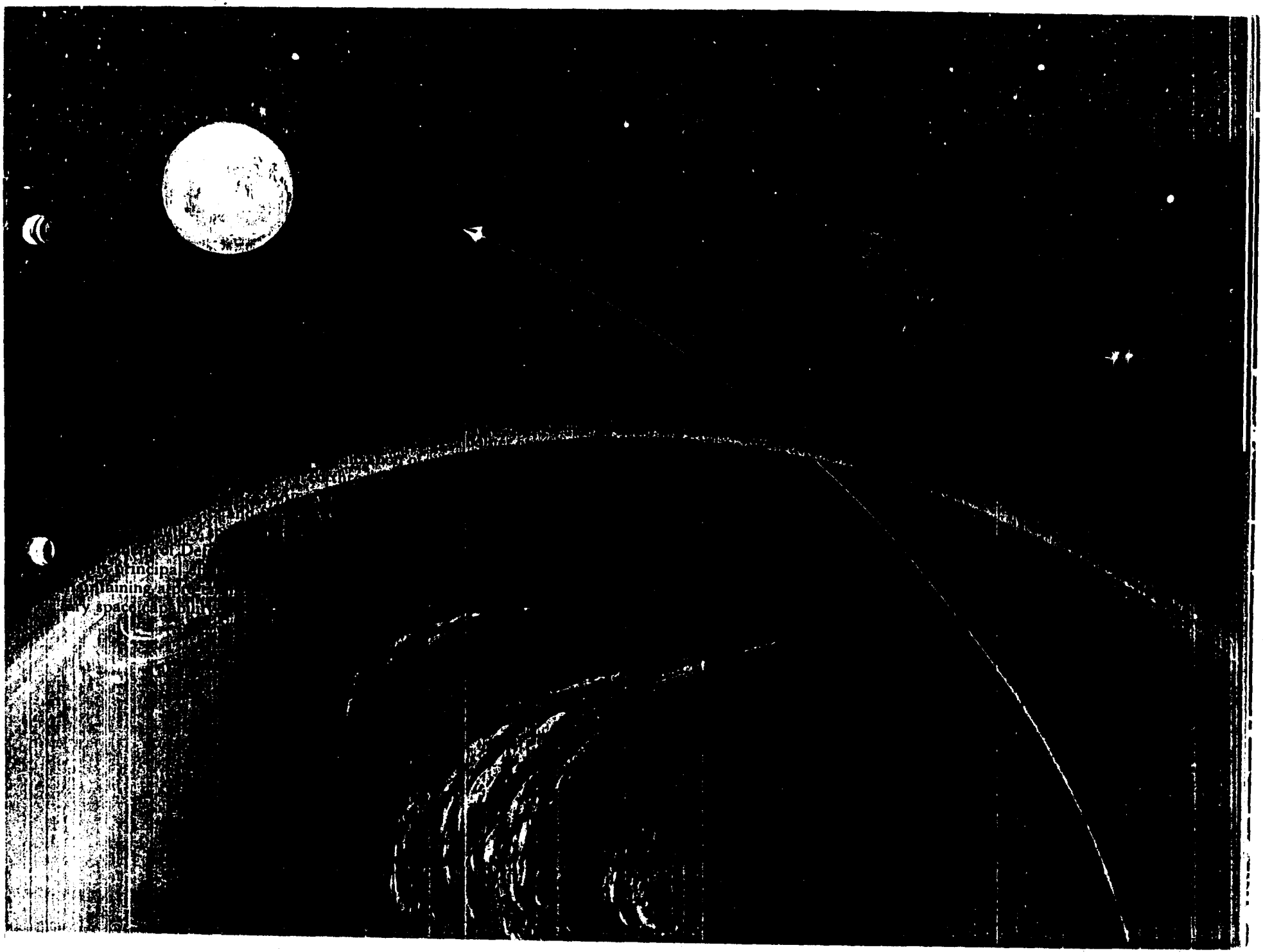


BUILDING FROM THESE SUCCESSES

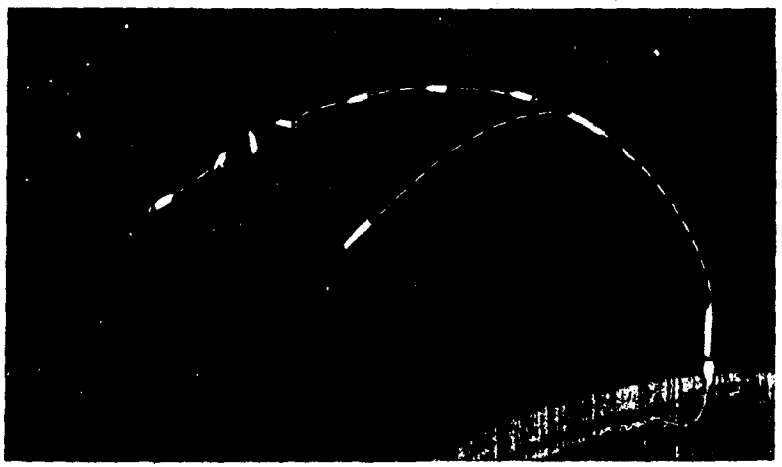
Our constantly accelerating growth of technology has brought space within reach of our technical fingertips. In this first generation of the space age we have already put together a foundation for space exploration and application based on ballistic missile technologies. From this it is possible to conceive myriad future uses of space. But only planned, deliberate exploration, soundly discriminately selected, and aggressively pursued avenues will tell us which of these myriad possibilities are economically practical and functionally effective. The Air Force has been assigned specific responsibilities by the Department of Defense for the development and implementation of military space systems. The Air Force maintains a working partnership with the National Aeronautics and Space Administration and with the other military services for the support of pioneering programs that push the United States further into space.

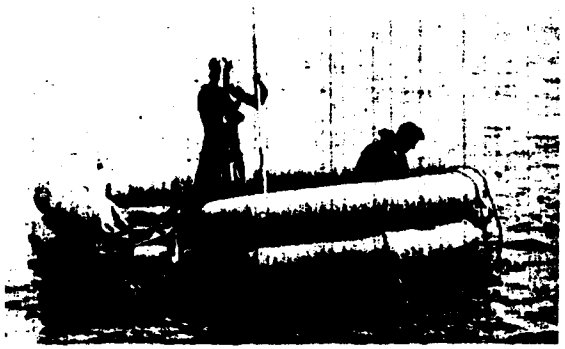
REACHING TOWARD THE STARS





THE SPACE SYSTEMS



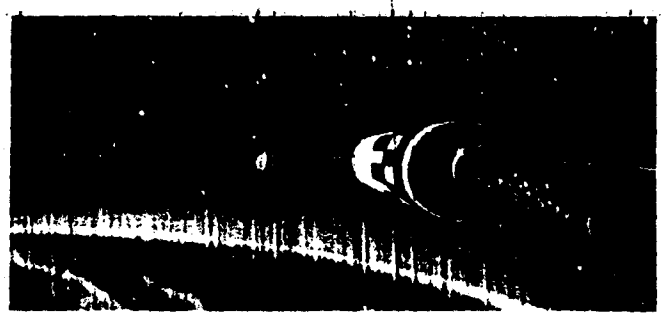


DISCOVERER With the Discoverer series, the Air Force has demonstrated that an educated satellite can be successfully launched, injected into a precise orbit, stabilized on that orbit, tracked from the Earth, controlled on command, and directed to eject an instrumented data capsule back through the atmosphere and into the hands of an airborne USAF recovery team.

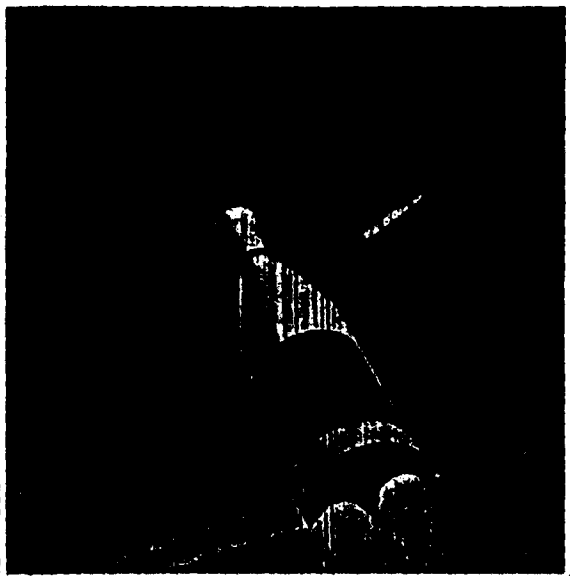
In the Discoverer, the Air Force has in-being a prototype functional space system complete with launch, tracking, command, control, data acquisition, and recovery facilities.

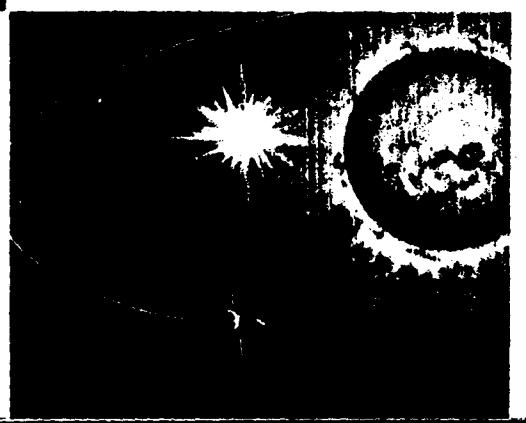
The business end of the Discoverer package, the 2400-pound Agena space voyager is a versatile vehicle adaptable for use in other passive military space missions.

MIDAS To lessen a hostile ICBM's imposing capability for decisive surprise attack, the Air Force has conceived a satellite system designed to provide maximum early warning against massive aggression. The system is Midas – missile defense alarm system. Outgrowth of the prototype vehicles being developed and flight tested by the Space Systems Division will be a series of polar orbiting satellites, positioned to cover the globe and flash the warning of a ballistic missile attack. The heart of the Midas system is the infra-red sensing equipment which can detect the heat generated by a ballistic missile during its period of powered flight. By reducing any aggressor's opportunity for surprise attack, Midas will contribute significantly to the effectiveness of the U.S. policy of deterrence.



AN INFINITE VARIETY OF SPACE MISSIONS





In the years of the near and long-range future, the number of satellites in the celestial traffic pattern will surely multiply, for the missions in space are almost as infinite as the medium itself.

From the defense point of view, two programs with intriguing potentials are being conducted against the background of space.

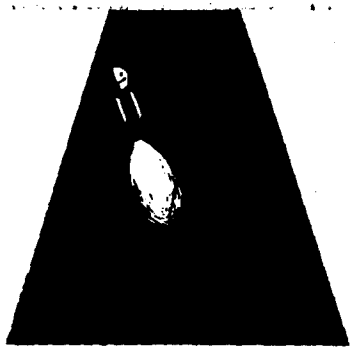
One is the satellite inspection program established to develop and demonstrate the feasibility of a co-orbital satellite inspector system capable of rendezvous with, and inspection of, foreign satellites which might be hostile. The rendezvous capability, essential to many future functional operations in space, will play a major part in the development of manned systems.

A project with definite defense overtones is the ARPA-sponsored Bambi orbital interceptor study, aimed at identifying a practical system to detect, intercept, and destroy aggressor ICBM's during the early phase of their powered flight.

Another advanced program now underway is Vela Hotel, a research and development project for surveillance equipment to be installed on space vehicles for detecting nuclear detonations above the sensible atmosphere.

USING SPACE FOR PEACE AND PROGRESS

"The National Aeronautics and Space Administration and the Air Force have the principal assignments in the nation's space program. Our efforts are complementary, not competitive. Together, we are building the technological foundation of the rapidly advancing space age."
—Eugene Zuckert, Secretary of the Air Force



ADVANCED SYSTEMS

MAN AND THE MOON

"Man can think abstrusely but to perform useful work he must have a goal before him. President Kennedy has stated a space objective in the form of a lunar expedition . . . an objective which, if vigorously pursued, will provide all of the fundamental capabilities essential to the development of both civil and military space applications for the near-term future."

—Lt. Gen. Howell M. Estes

MILEPOSTS TO SPACE

Just as the reach into space has been predicated on the expansion of technologies unloosed in the development of ballistic missile systems, so will this nation's aerospace progress in the next generation be paced by the advances staked out by government, science, and industry both in the fields of enlightened management and in technical accomplishment.

The evolution of ballistic missiles was marked by the solution of complex technological problems — problems of propulsion, of guidance, of re-entry, and electronic command and control. Today there are other stumbling blocks that must be transformed into stepping stones through the diligent application of professional skills and talents, hallmarks of American management and industry.

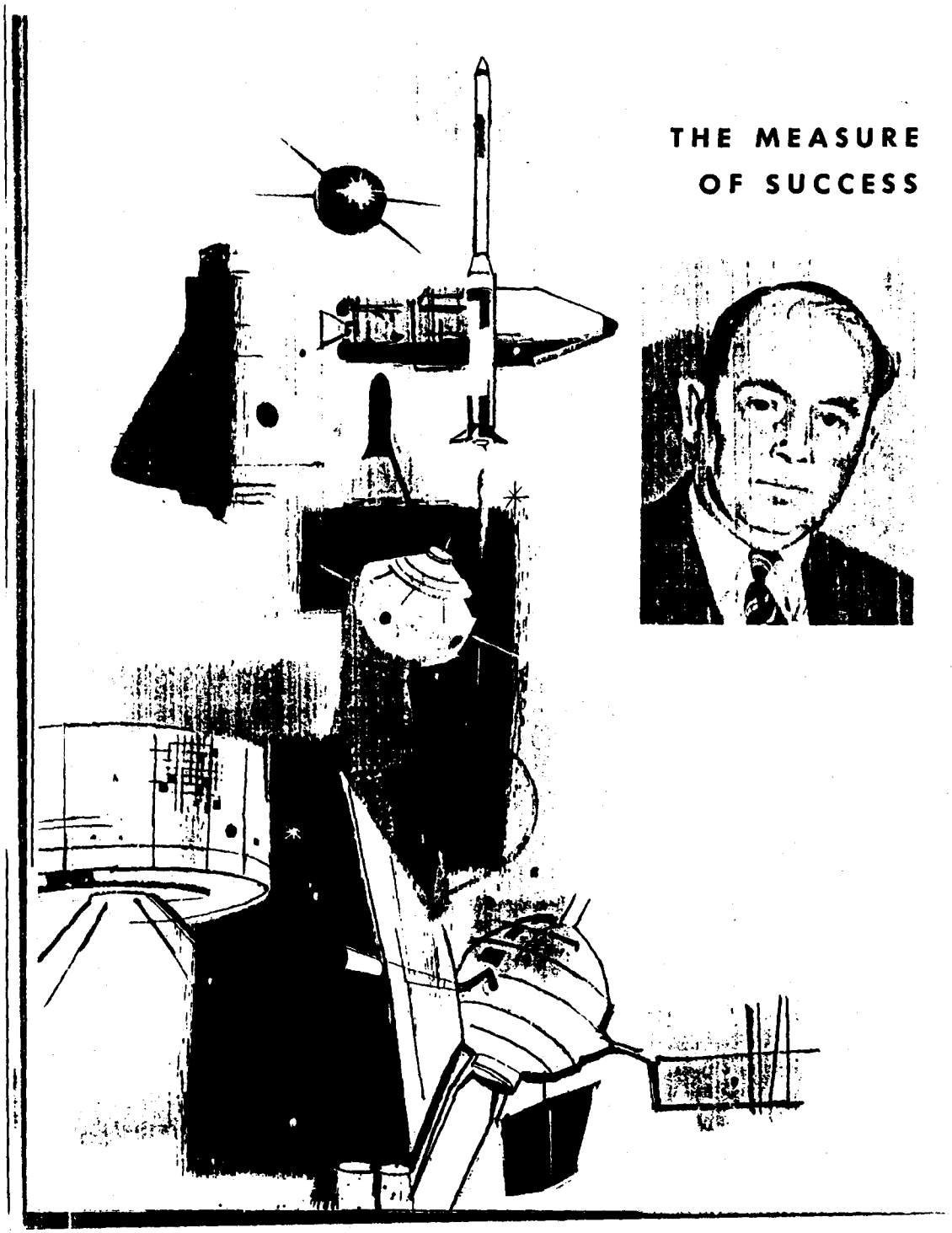
". . . it is vital that we pay urgent attention to the construction of high thrust boosters designed for space purposes. The development of large scale engines of solid, liquid, and nuclear types should proceed rapidly and concurrently.

". . . we must devise techniques for re-entry from deep space with controlled, precise recovery assured.

". . . it is essential that we equip ourselves with an ability to rendezvous in space and carry out the transfer of fuels, materials, and men from one space vehicle to another.

". . . we must put man in space in controllable, maneuverable vehicles. Essential to this requirement is a greatly expanded scientific and functional fund of knowledge in the field of bioastronautics."

—Lt. Gen. Howell M. Estes



THE MEASURE OF SUCCESS

In 1954 a group of forward-looking scientists, headed by the late physicist Dr. John von Neumann, set up the Strategic Missiles Evaluation Committee and spelled out, in top secret session, the specifications for an all-American ICBM.

Since then, the stringent requirements they optimistically laid down have been not only met, but exceeded. The Atlas intercontinental ballistic missile they envisioned has become an operational weapon system. The abbreviated development time period, postulated as a pre-requisite to national security in the 1960's, was compressed beyond their expectations. Range, payload, accuracy, and reliability parameters they thought possible have been bettered. The organization originally designated to direct the Atlas development has grown in scope and in stature, apace with the rapidly increased demands for its specialized capabilities. The measure of its success rests not with the Atlas alone, but with Thor and Titan and Minuteman as well, and with a score of specific space development accomplishments nurtured and advanced through Aerospace Systems management.

In the reach into space there is no room for complacency or for satisfaction with past achievements. The dynamic face of space is ever-changing. Challenges met lead to further challenges to be overcome.

The people responsible for national applications within the new environment are dedicated Air Force scientists and managers in research and development, production, procurement, construction, and a host of other specialities, teamed with their counterparts in industry whose resources of knowledge and experience are exceeded only by their thirst for fresh and provocative challenges. These are the people who find in failure and in disappointment the incentive to try again, and who are spurred by the stimulus of success to even greater achievements.

SPACE IS PEOPLE

America's unmanned aerospace systems require systematic manning. Ballistic missiles, space probes, satellites, ground support facilities: all are born, reared, and brought to operational maturity through the resourceful mind and talented imagination of man.

It takes people from all walks of life to make satellites and to make them work. Physicists, metallurgists and mathematicians; engineers, astronomers and machinists; thinkers and theorists; technicians of countless types: managers, researchers, comptrollers, and teachers; secretaries, statisticians, and administrators . . . all have their parts to play in the unfolding of space. Thousands of *people* belonging to the vast government-science-industry team captained by the Air Force Systems Command and its Aerospace Systems Headquarters have blended talents and skills to demonstrate that in terms of technical achievement, the sky is not the limit . . . not anymore.

STATISTICALLY

The Atlas development program alone exceeded in scope and in magnitude the famed Manhattan Project which produced the atomic bomb during World War II. Through fiscal year 1960 the Air Force Ballistic Systems and Space Systems Divisions were responsible for the management of nearly eight billion dollars invested in the nation's aerospace defense. During fiscal year 1962 the budget amounts to 3.9 billion, or approximately 50% of the Air Force Systems Command budget, 21% of the Air Force budget, 8.2% of the total Defense Department budget, and 4.1% of the Federal budget.

During a single year more than 150,000 visitors are received at the Aerospace Systems Headquarters in Los Angeles.

The combined strength of the Aerospace Systems Headquarters, its operational wings and groups, the personnel of the Aerospace Corporation, and the employees of Space Technology Laboratories working on ballistic missile contracts, adds up to some 10,000 people.

These people work in 35 buildings in the Los Angeles metropolitan area, as well as in facilities at Norton AF Base, at Vandenberg AF Base, at Edwards AF Base, and at Sunnyvale in California; in Florida, in Hawaii, in Alaska, and in states throughout the Union.

More than eighty per cent of the Air Force officers assigned to the Aerospace Systems Headquarters hold academic degrees. Thirty-seven per cent of the 180,000 people employed by industry at the associate contractor level alone are engaged in scientific or technical capacities.

Since the first Atlas flight test was attempted June 11, 1957, the Air Force has launched – through 10 October 1961 – a total of 273 ballistic missiles. Of these, 197 (or better than 72%) have performed successfully, 41 are rated as partially successful, and only 35 have been failures.

The earth . . . from 700 miles up . . . actual photos taken from the nose cone of an Atlas ICBM.