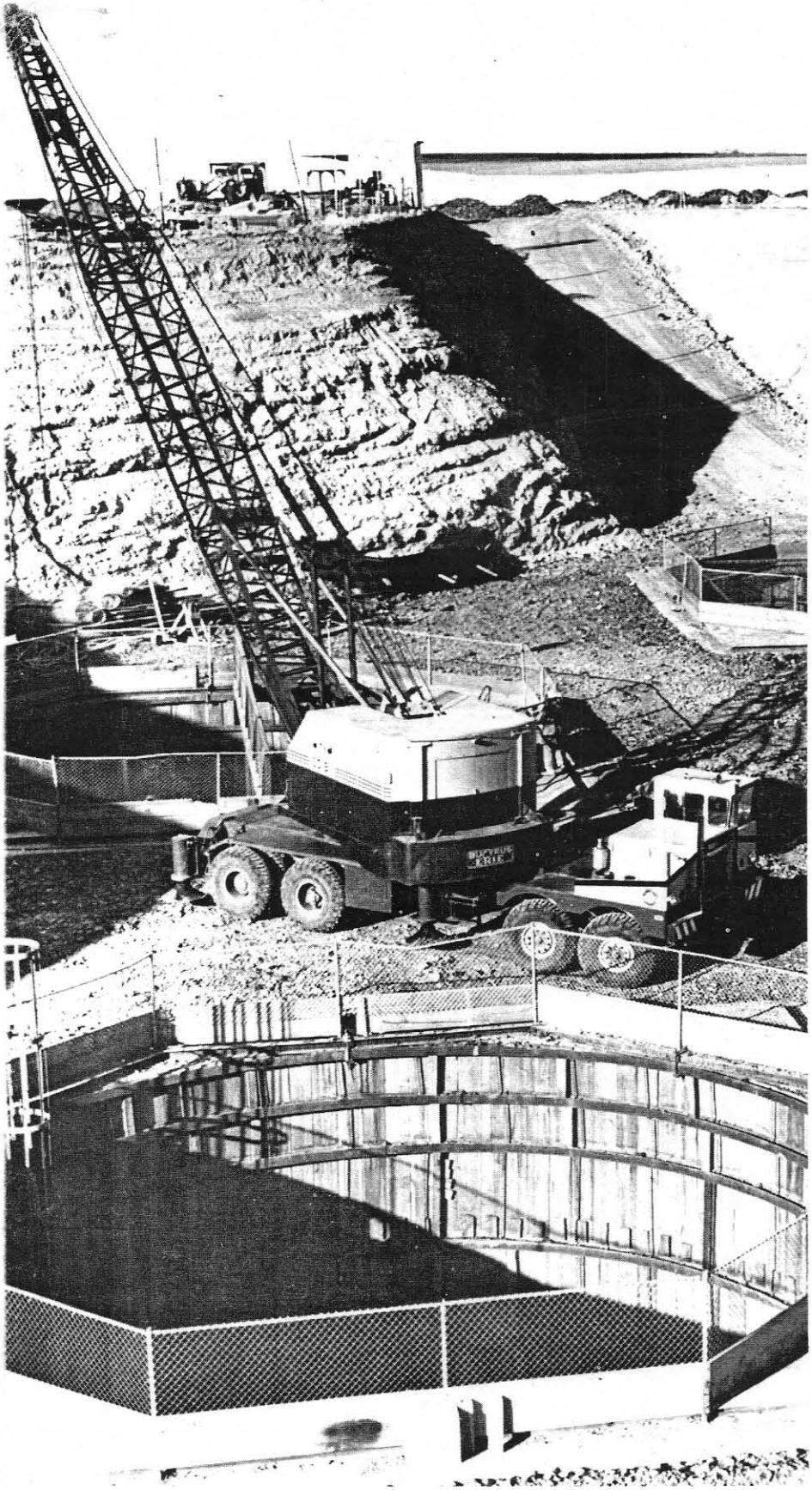


# ICBM SITE ACTIVATION

by Harry E. Goldsworthy

*Construction activity at a Titan site, Larson AFB, WA. The 90-foot missile was raised by an elevator to ground level for fueling.*

ONE day in the summer of 1957, U.S. radar in Turkey plotted the first successful flight of a Russian ICBM. A few weeks earlier an attempt to launch an Atlas, the United States' first entry in the ICBM race, had ended in a spectacular failure. In October of that year, the Soviet Union used an ICBM to boost the first man-made satellite, *Sputnik*, into an earth orbit. The first full-range firing of an Atlas did not take place until November 1958, more than a year later, and by that time the words "missile gap" formed a catch phrase that was appearing with regularity on the front pages of newspapers. It had become a political issue, and by mid-1960 Presidential hopeful John F. Kennedy was playing heavily on the growing Russian missile superiority, warning the Senate that ". . . we are gambling with our survival . . . . " As the debate gained in intensity, it became apparent that the U.S. ICBM program was in trouble.

The ballistic missile program in this country began in earnest in July 1954 and was given top national priority in late 1955 when it became clear to the White House that the Russians had a substantial lead in missile development. Ground was broken for construction of the first operational missile site near F. E. Warren AFB, Wyoming, in June 1958. One year later, 10 Atlas and 5 Titan sites were under construction, but work at all sites was behind schedule. The lead at F. E. Warren AFB had slipped as much as six months. Political pressure had extended from Washington, D.C., to the field, and construction contractors were placing the blame for delays and cost growth on the missile manufacturers and their military bosses. The U.S. Army

Corps of Engineers, with responsibility for construction, and the Air Force were pointing fingers at one another, at the contractors, and at the unions. These disputes were receiving wide publicity and there were rumors of a Congressional investigation.

This was the situation that led Gen. Curtis E. LeMay, Air Force Vice Chief of Staff, to tour the missile sites in June 1960. He did not like what he found. It was obvious to him that the magnitude of the site activation project had been grossly underestimated. About 80 percent of the program cost came from activation of missile bases. Yet, although five years were allowed for missile development, the base builders got two. But of greater concern to General LeMay, with his penchant for direct action, was that he found management a hydra-headed monster. Lines of authority crossed and recrossed in an administrative maze. There was no single recognized authority at any level. Construction contractors were receiving conflicting instructions from as many as seven separate agencies. Decisions that should have been made on the spot were in process for weeks.

Site activation was the final phase in one of the largest, most complex projects ever undertaken by the Department of Defense, a program to close the missile gap by installing 132 Atlas, 108 Titan, and 1,000 Minuteman ICBMs in dispersed underground facilities. The Air Force Ballistic Missile Division (AFBMD) of the Air Research and Development Command (ARDC) was responsible for producing the missiles and activating the bases. The missiles were developed and produced by a consortium of "associate" contractors, each responsible for a component, or sub-system, such as propulsion, airframe, guidance, and reentry vehicle. There was one "prime" associate contractor for each missile type, with the role of integrating these components into a functional weapon system. Convair was the prime, or integrating, contractor for Atlas, Martin for Titan, and Boeing for Minuteman missiles.

The Air Force did not have qualified engineers to provide AFBMD with an adequate technical staff and thus Ramo-Wooldridge Corporation was hired to provide systems engineering and technical direction for the entire program. A System Program Office in AFBMD guided each missile project. This organizational concept

*Excavation of the first Titan site at Lowry AFB, CO.*

was being validated in 1960 by a series of successful missile launches at Cape Canaveral, but the construction of missile bases involved a different team and was in trouble. Specifications for the construction phase were developed by the missile contractors, converted into construction drawings by architectural engineering firms, and given to the U.S. Army Corps of Engineers who became responsible for building missile launch facilities (silos), launch control centers, and support facilities. The Corps of Engineers, in turn, contracted with specialized construction firms who drew upon the resources of hundreds of sub-contractors, suppliers, manufacturers, and service organizations.

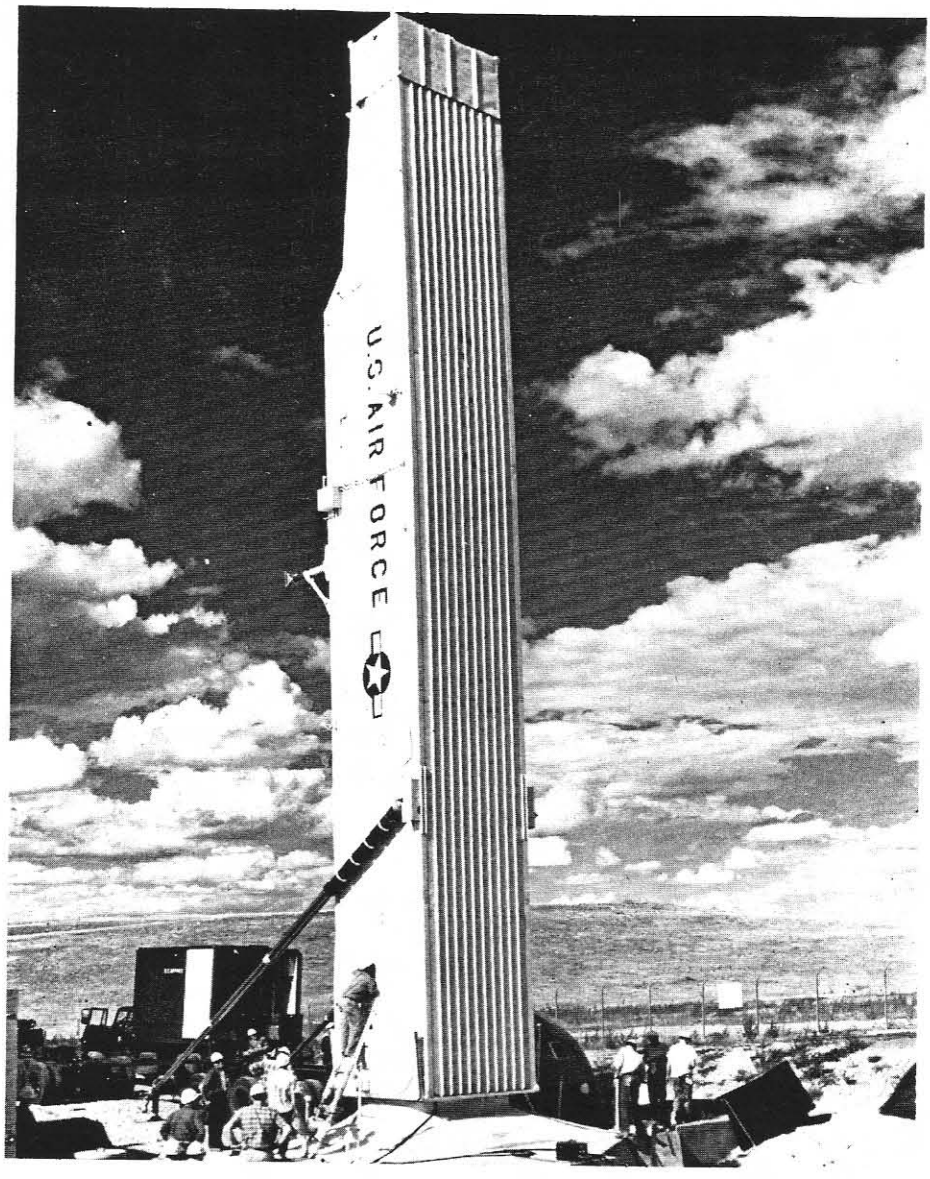
Under normal base-building practices the Air Force was out of the picture until called upon to accept the completed facilities. But, in reality, this was a development program, and traditional procedures would not work. Not only were specifications far more demanding than normal for the construction industry, but they kept changing as the result of the missile test program. The Corps of Engineers found themselves surrounded by representatives of AFBMD and their contractors, all intent on assuring that specifications critical to them were being met. There was no established authority at the construction site to resolve the disputes which developed.

General LeMay found the division of responsibility unacceptable, not only at each construction site but also at the intermediate headquarters. He wanted one man that he could look in the eye and say, "You are responsible. Get it done." He took prompt and decisive action. On 9 July, he directed that there be a single manager at each site responsible for the entire cycle from site selection to turnover of the completed system to the Strategic Air Command (SAC). Then he assigned the responsibility for site activation to AMC, except for the sites at Offutt AFB, Nebraska, and F. E. Warren AFB, Wyoming, and the test facilities at Vandenburg AFB, California, where work had progressed too far to justify transfer of responsibility. The field commands moved rapidly and on 11 July, Maj. Gen. O. J. Ritland, Commander AFBMD, and Brig. Gen. Don Coupland, Commander of AMC's Ballistic Missile Center (BMC), signed a Memorandum of Agreement implementing General LeMay's directive.

Concurrently, General LeMay reassigned Maj. Gen. Thomas P. Gerrity, from the Oklahoma City Air Material Area, to BMC as Commander, with clear instructions that he was the man in charge of the ICBM Program. In his years in SAC, AMC, and as Director of Procurement and Production in the Pentagon, General Gerrity had become known as a man who got things done. Next, General LeMay directed his personnel staff to hand pick eighteen colonels who had demonstrated drive and administrative skill. These officers were to be the single managers at each missile site, and within a few days they received orders re-assigning them to BMC with duty station at a specific missile construction site. They also received a message dated 21 July 1960 which read:

> I want it thoroughly understood that I hold each site commander personally responsible for successful activation of his site and its turnover to SAC in an acceptable operational condition at the earliest possible date. This includes responsibility for construction. *LeMay*

Now General LeMay had one man at BMC and one man at each site whom he could hold responsible.




*Transporter-erector demonstration near Malmstrom AFB, MT. The huge tractor-trailer, largest vehicle ever designed for regular highway use, was developed by the Boeing Company to transport the missiles to and from underground launchers and place them in the silos.*

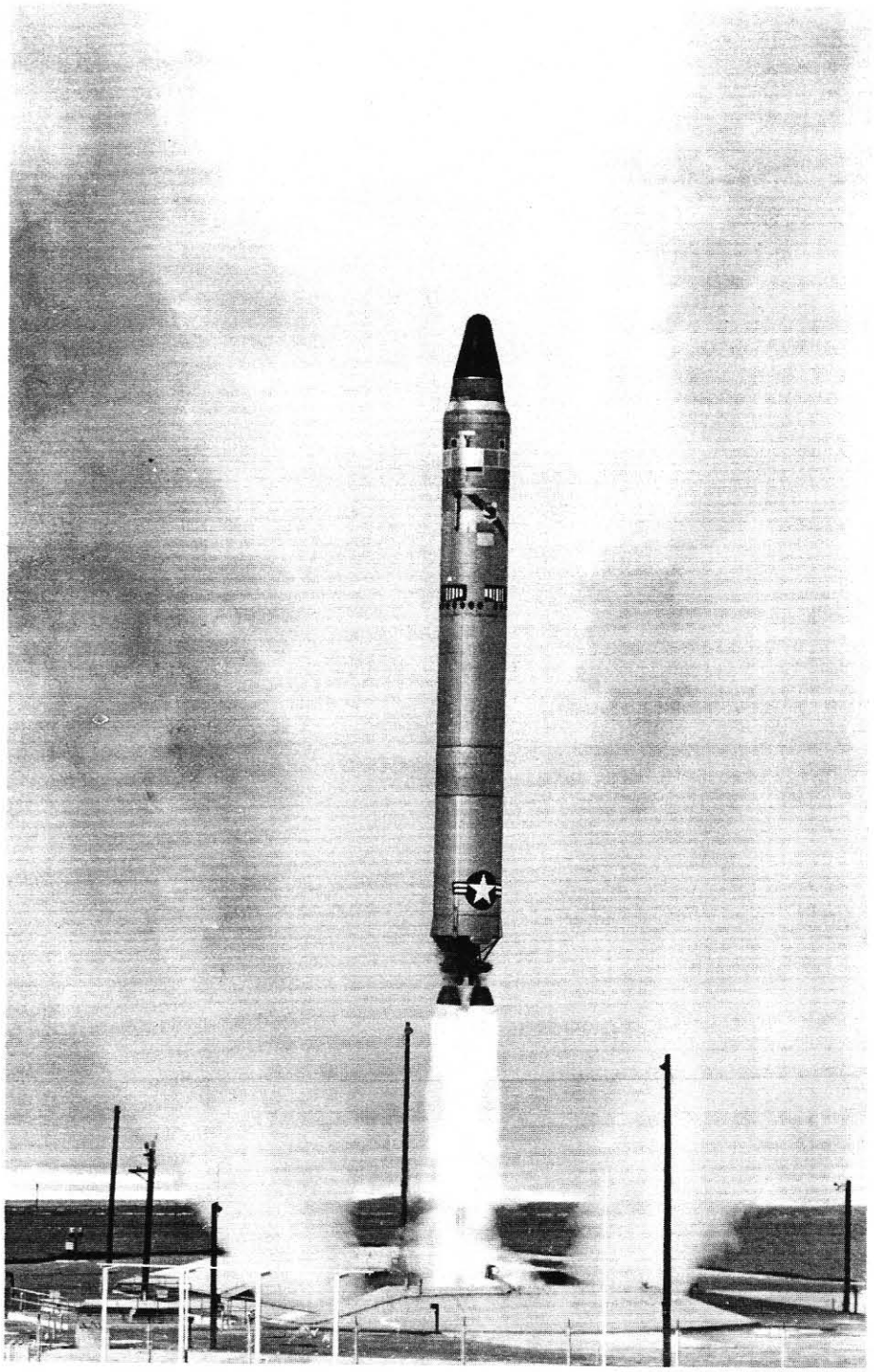
When the LeMay directive reached the field, two of the eighteen colonels selected were in place. Col. Vernon Hastings at Offutt AFB and Col. Edwin Swanke at F. E. Warren AFB were the AFBMD Field Office Chiefs at those sites. Fifteen others moved into location within days. The eighteenth, selected for the first Minuteman site at Malmstrom AFB, Montana, was not reassigned until September, a few weeks prior to scheduled ground breaking at that site. Five additional Minuteman sites were activated over the next three years but these sites were commanded by colonels who had completed the activation cycle at other locations.

THUS was born the Site Activation Task Force (SATAF) concept and organization, a collection of detachments from the major commands involved in the

site activation effort. The SATAF Commander was held ". . . responsible for the successful activation of his site. . .," but his command authority was limited to a handful of administrative people in his immediate office. He was given "operational control" over four separate detachments, one from AFBMD, one from the AMC Air Material Area (AMA) designated as the Logistic Support Manager for the missile system involved, one from the AMC Contract Management Region (CMR) covering the geographical area in which the missile site was located, and one from AMC's Ground Electronic Engineering and Installation Agency (GEEIA). Although held responsible for construction, the SATAF Commander was instructed that his official relationship with the Corps of Engineers officer administering the construction contract was one of "surveillance." It was a "task force" in the classic military sense, and the melding of this diversified group of military and civilians into a cohesive force capable of guiding the work of twenty or more contractors and subcontractors employing several thousand workers was a challenge in leadership and management. They were exploring strange territory from the first step, implementing a giant stride in technology under tremendous pressure. And they were already three to six months behind schedule.

During this time the Army Corps of Engineers, responding to the same pressure, created the Ballistic Missile Construction Office (BMCO) in Los Angeles. Brig. Gen. Al Welling was placed in charge as their single point of authority over construction and was located adjacent to General Gerrity's headquarters. BMCO placed a Corps of Engineers officer on each site as Area Engineer with complete on-site authority.

The SATAF concept, as displayed on an organizational chart, appeared straightforward. In practice, it had to undergo some maturation. Except for Colonels Swanke and Hastings, none of those selected as site commanders had even a basic background in ICBMs or construction, a fact not lost on the AFBMD officers who had been struggling with the problems in the field and were inclined to go to their old bosses in BMD for help and direction. Then, too, the relationship between the SATAF Commander and the Area Engineer was a sensitive one. The SATAF Commander was acutely aware that he was being held responsible for construction; however, while the Corps of Engineers officer was listed on the organizational chart as his Deputy for Construction, there had been no delegation of command authority. There were elements of an internecine struggle here, too. Some ARDC people felt that the construction was so unique and with such critical tolerances that it was an extension of development, and, therefore, the construction contracts should be awarded and administered by the Air Force rather than the Corps of Engineers. Fortunately, the high standards of teamwork and dedication displayed by Generals Gerrity and Welling were not lost on their field personnel. It became clear that the job was so immense and so vital to the nation that there wasn't time for struggles of prerogative.

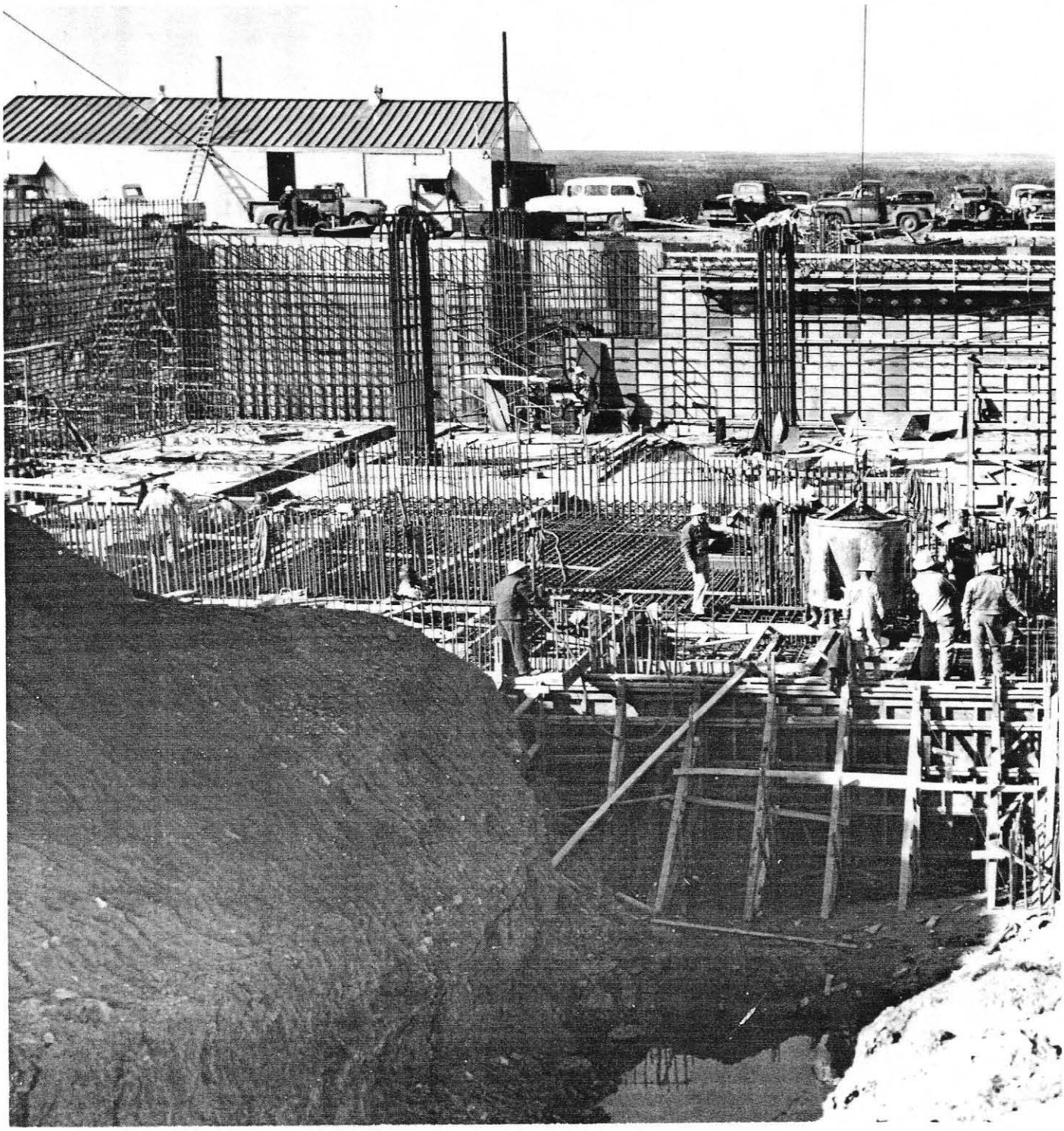


*The heavyweight of SAC's large ICBM force, Titan II is launched directly from its underground storage silo. Smoke and flame shoot from the exhaust vents as the missile starts on its intercontinental-range flight. The Titan II plays a vital role in the U.S. Air Force deterrent force.*

The sixteen colonels newly assigned to the program were pilots who had spent their careers with combat aircraft units. They were entering alien territory, and their immediate reaction was one of bewilderment over the magnitude and complexity of the job. For example, the Titan I site at Lowry AFB, Colorado, involved six missile complexes separated by about 30 miles. Each complex had three missile launch silos, a

control center, a power house, three fuel storage tanks, antenna silos, water storage tanks, three equipment terminals as well as exit and entrance silos — all underground and hardened against nuclear attack. Over 700,000 cubic yards of earth had to be excavated for construction and then refilled. They were to pour 96,000 yards of concrete and use enough structural steel to build 13 naval destroyers. The Minuteman I site at Malmstrom AFB, Montana, posed different but no less severe problems. The Minuteman, a three-stage solid-fuel missile, was much smaller than the Atlas or Titan, and its launch silos were tiny by comparison. But there were 150 of them plus 15 launch control centers scattered over 15,000 square miles. The missiles were designed to stand in unmanned silos on constant alert, ready for instantaneous launch on command from their launch control center. The unattended silos had to be interconnected with the control centers by a redundant system of buried cable for transmission of status information and launch commands. This required 1,800 miles of trench across difficult terrain, a major task by any standard especially during a Montana winter. Following the "brick and mortar" construction, the facilities had to be crammed with an incredible array of sophisticated electronic and mechanical equipment. Once the equipment was installed, it had to be checked to be sure that it

*An Atlas ICBM site at Forbes AFB, KS, showing construction of the control center.*

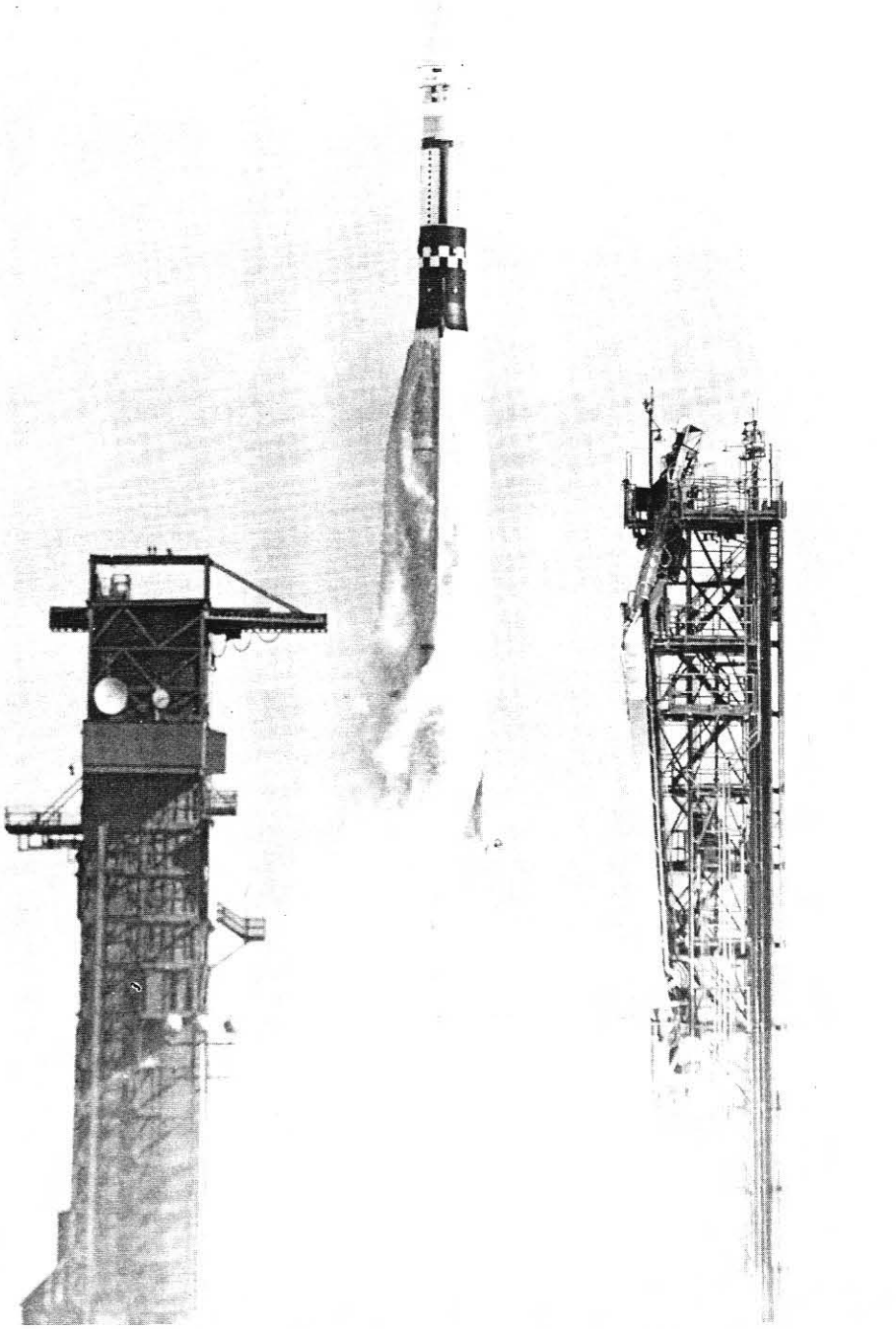


worked properly. First individual components were tested, then groups of components tested together, and finally all interrelated systems demonstrated. As the final step, the missiles were installed and the total system tested in simulated missile launches.

The SATAFs were manned with quality people. In each case the Corps of Engineers assigned a hand-picked officer as Area Engineer and gave him a group of highly qualified construction specialists to supervise the contractor's work. A BMD officer, who had grown up with the missile involved, was assigned as Deputy for Engineering with a staff of Air Force engineers to interpret design specifications, provide technical engineering assistance, assure configuration control, and approve technical demonstration of the completed system. AMC personnel were assigned to support the SATAF and to develop a logistic system for the operational missile wing. A detachment from the appropriate Contract Management Region was on hand to administer Air Force contracts. GEEIA specialists supervised the installation and checkout of the complex communications systems. In the case of Minuteman sites, a Geodetic Survey Squadron was required.

It should be noted that a fundamental organizational change in the Air Force took place on 1 April 1961 when ARDC and AMC were replaced by the Air Force Systems Command (AFSC) and Air Force Logistics Command (AFLC). The responsibility for site activation was given to AFSC and delegated to the Ballistic Systems Division (BSD) which replaced BMD. General Gerrity and all personnel then assigned to BMC were transferred to BSD. At the SATAF level, the organizational change made little difference.

THE assignment of General Gerrity as the single authority in the ballistic missile program, the organization by the Corps of Engineers of BMCO under General Welling, and the designation of the SATAF Commander as the point of authority at each site added to a significant step in correcting the ambiguous chain of command. But fundamental problems remained. To save time in the missile race, the Air Force had departed from the traditional successive steps of development, design, test, production, and operational use and telescoped these phases under a concept which became known as "concurrency." Before the first phase was completed, the second and perhaps the third had started. All of the silos for the Titan I, for example, were being built before the missile had been test flown. Minuteman facility drawings were in the hands of construction contractors before it had been proved that the missile could be fired from its underground silo.



*Atlas, America's first ICBM, now serves as a standard space booster (SLV-3). It has served as the launch vehicle in the Mercury, Ranger, Mariner, and PRIME lifting body re-entry programs and was also the launch vehicle for the Agena target craft in the Gemini manned flight program.*

The concept had a potential for cutting months out of the acquisition cycle, a potential that was realized, but it was risky and brought severe problems. Discovery of defects in the test program could initiate a chain of change orders to missile manufacturers and thence to construction contractors. Some involved millions of dollars and weeks of delay. For example, a test of the elevator that lowered the Titan I in the silo disclosed that the deceleration device allowed the fueled missile to descend so rapidly that it hit bottom and caused an explosion. The mechanism had to be redesigned and completed work in the silos torn out and redone. Design defects are to be expected in any development program, and thus the SATAFs set up procedures to process any changes immediately and assure that only essential work was accomplished.

There was another severe and continuing problem which the SATAFs were able to bring under control. Missile silos and launch control facilities had to be "hardened" or made resistant to nuclear shock. All installed equipment had to be shock-mounted and electrical components, such as guidance systems, protected from penetration of electromagnetic radiation which is generated by nuclear attack. These requirements demanded standards of construction completely new to the industry. The "brick and mortar" work had to be of exceptional quality and the points where the facilities mated with equipment provided by the missile producers had to meet precise specifications. Commonplace things, such as concrete floors had to be poured to a level of tolerance contractors had never encountered. Masons who were well pleased to place anchor bolts within a quarter of an inch of the specified point were told this was 50 times too far off the mark. Contractors accustomed to meeting tolerances measured in inches had to build facilities to mate with weapons hardware built to standards of thousandths of an inch. And of equal importance, all facilities for a given missile type had to be exactly alike. The Atlas facilities at Forbes AFB, Kansas, had to be identical to those at Fairchild AFB, Washington, or the missiles and equipment could not be installed.

Too often in the earlier stage of construction, equipment delivered to the completed facility just did not fit. This brought disputes over who was at fault and who had to bear the cost of corrective action. SATAFs were able to make very significant progress in correcting this problem when the Air Force Deputy for Engineering and the Army Deputy for Construction came to accept that there was just as much concurrency in the construction phase as in missile development. From that point they worked closely with the construction contractors, advising them as to the specifications and assuring that these specifications were being met before concrete was poured rather than after. Conflicts were settled by SATAF people on the spot and without administrative delays.

Cooperation of the Corps of Engineers allowed one action that contributed a great deal to the meeting of completion schedules. Under previously accepted practices, missile associate contractors were not to enter the facilities for installation of their equipment until construction was completed and accepted by the Air Force. When construction fell behind due to specification changes or other problems, missile equipment stacked up at the gate waiting installation. SATAF members were able to work out joint tenancy agreements under which the facilities were accepted in increments so that missile support equipment could be installed prior to completion of construction. Such a plan required compromises plus a great deal of trust and cooperation.

Perhaps the most frustrating problem involved the complex high-capacity systems required to transfer the liquid propellants, or fuel, from storage terminals into the Atlas and Titan I missiles. The propellants could not be stored in the missiles and had to be loaded aboard after the decision to launch by a sophisticated array of remotely controlled pumps and valves. Due to the sensitivity of the cryogenic fuel to hydro-carbon contamination, specifications required cleanliness comparable to that of a hospital operating room. Any sidewalk superintendent can appreciate the difficulty of enforcing this standard of cleanliness on an active construction site. Workers found it difficult to understand the necessity for such specifications as evidenced by the fact that inspectors once found the remnants of a ham sandwich in one malfunctioning valve. Many man days were lost before aggressive and constant surveillance by SATAF personnel solved this problem.

The nature of the site activation project invited labor union problems, and by mid-1960 work stoppages were causing schedule slippage and increased costs. This was a project without precedent and a natural breeding ground for jurisdictional disputes between the industrial unions of the missile manufacturers and the building trades unions of the construction contractors. The missile producers were being given wider responsibility than ever before. They made the equipment, defined construction specifications, installed the equipment, and demonstrated the completed system. This brought them head on against the construction and mechanical specialty contractors who traditionally had built military bases. In the first six months of 1960, the Atlas sites had lost over 20,000 man-days due to labor disputes ranging from cement masons and plasterers striking against use of ready-mix concrete to iron workers protesting because spot welding was being done by another union. At Offutt AFB, two rival unions argued for three days over which one had the right to pull wires through the last eighteen inches of electrical boxes.

SATAF Commanders had little control over the unions, but they put their labor relations advisors out in the field to anticipate potential labor disputes. When they detected a problem, the parties involved were contacted in an effort to work out a solution without work stoppage. They kept in close contact with local union leaders, appealing for their support and emphasizing the national security aspects of the project. Later the Department of Labor clarified the breakout of work by union and sent strong appeals to the presidents of the national unions for support. The Federal Mediation Service assigned a representative to each site, and these people worked effectively with the SATAF labor relations specialists in avoiding or minimizing work stoppage. The labor problem never was under complete control, but hard work minimized the impact on cost and schedules.

Day-to-day problems ran the gamut from a mountain lion which took up temporary residence in a missile silo in Montana delaying an acceptance test to sudden Rocky Mountain blizzards which halted work and trapped technicians on the job. Construction at Plattsburg AFB, New York, was well along when an unexpected source of water flooded the silos. The problem proved so severe that consideration was given to abandoning the silos before the construction industry mobilized forces to come up with a solution. Organization of the SATAFs did not bring instant correction of all problems. It was a situation requiring a miracle a day, and some days the miracle did not happen. But General Gerrity, a strong leader and tireless worker, passed full authority and a free hand to his SATAF Commanders — along with the heat he was feeling from the Pentagon — and little by little the job began to pull together. The motivation of the SATAF members was very high and spread to the contractors and their workers. Contractors who had been complaining about ambiguous lines of authority and conflicting instructions found a single authority where they could get a decision. They also found someone watching their performance with specifications in one hand and a calendar in the other. Contractor foremen soon learned that if they didn't perform, the SATAF Commander was inclined to pick up the phone, in their presence, and call their company president with the request that they be replaced by someone who could get the job done.

SATAF Commanders experienced a phenomenon common to all sites. Their job never had been done before and thus there were no established disciplines to follow; but measurement of their success or failure was simple — completion of their site on schedule. They soon found that their "wartime" national priority brought support from all levels but no one ready to share the responsibility. They were free to do about anything they felt necessary for the success of their project, but when it came time to make key decisions, their pinnacle became a lonely one.

SATAF members were on hand wherever the work was being done. Through an extensive system of radios and mobile telephones, they passed current information on progress and problems to the central control room. SATAF Commanders had only to step into the next room to get up-to-the-hour status. SATAF engineers were on hand to

interpret design specifications and mediate disputes between construction and missile contractors. Leased helicopters and light airplanes were available to rush technicians or parts to any trouble areas. Wasted motion was reduced, and the considerable talents of the force focused on the job. Soon the target dates were being met, then beaten. Operational sites were being turned over to SAC on or ahead of schedule. In a massive joint effort, contractors, workers, and the military were showing that they could take on the largest peacetime effort in history and produce on schedule.

THE first Atlas D wing at F. E. Warren AFB was operational on 7 March 1961, and all Atlas wings had been turned over to SAC by 20 December 1962. The first Titan I complex at Lowry AFB was turned over on 12 April 1962, and all Titan I squadrons were operational on 28 September 1962. The three Titan II wings were under SAC control by 31 December 1963. The first flight of 10 Minuteman missiles was put on strategic alert at Malmstrom AFB on 24 October 1962 coincident with the Cuban missile crisis. The force of 800 Minuteman I missiles was operational 15 June 1965. By December 1966, 150 Minuteman II missiles were in place at Grand Forks AFB and 50 missiles were added to the Malmstrom wing by May 1967 to complete the site activation project.

But the story does not end there. By June 1961, President Kennedy's Secretary of Defense, Robert McNamara, was indicating that the "missile gap" was gone, and pundits were wondering if there ever had been one. In retrospect, it seems that those who predicted a "missile gap" were using intelligence estimates of the Russian capability to build missiles, a capability they did not exercise. In any event, on 1 September 1964 the first Atlas missile sites were being inactivated and by January 1965 the Air Force was engaged in the largest disposal program since the end of World War II. On 25 June 1965 the last Atlas and Titan I sites were inactivated. The Titan II missiles were retained to give the U.S. a capability for large payloads. The smaller, solid-fueled Minuteman, which could be produced and maintained for a fraction of the cost of the complex liquid-fueled weapons, became the backbone of the ICBM force and, by the time the Atlas and Titan I missiles were phased out, 750 Minuteman missiles were operational. Inactivation of the Atlas and Titan I units brought the problem of disposing of 177 costly and complex underground facilities and over 200 missiles. There was little demand for ICBM silos and launch-control facilities, and thus disposal was difficult. The Air Force stripped the equipment from the facilities and was able to recover a significant percentage of the acquistion costs; some estimates ran as high as 70 percent. About twenty of the complexes were donated to educational institutions and research agencies. The remainder were turned over to the General Services Administration (GSA) for disposal. The missiles were stored for possible use as boosters in future space programs.

The life span of the Atlas and Titan I missiles was short and hectic. The "missile gap" which alarmed the nation and brought on an expensive crash program turned out to be a bad intelligence guess or a political contrivance. But the site activation program remains a testimony to the capabilities of the free enterprise system of this nation to respond to crisis and to the ingenuity and dedication of a giant task force of contractors, their labor force, and the military.

**NOTES**

The SATAF Commanders selected by General LeMay were: Col. Edwin A. Swanke, F. E. Warren AFB, Wyoming, Atlas D & E (Colonel Swanke was moved to the test sites at Vandenberg AFB, California, and replaced by Col. William E. Todd); Col. Vernon L. Hastings, Offutt AFB, Nebraska, Atlas D & F; Col. Thomas S. Jeffrey, Fairchild AFB, Washington, Atlas E; Col. William E. Ruark, Jr., Forbes AFB, Kansas, Atlas E; Col. Arthur W. Cruikshank, Jr., Schilling AFB, Kansas, Atlas F; Col. Ernest L. Ramme, Altus AFB, Oklahoma, Atlas F; Col. Hugh B. Manson, Dyess, AFB, Texas, Atlas F; Col. Robert I. Barrowclough, Walker AFB, New Mexico, Atlas F; Col. Calvin W. Fite, Jr., Plattsburg AFB, New York, Atlas F; Col. James H. Thompson, Lowry AFB, Colorado, Titan I; Col. Kenneth W. Northamer, Ellsworth AFB, South Dakota, Titan I; Col. William E. Sault, Beale AFB, California, Titan I; Col. Edward J. York, Larson AFB, Washington, Titan I; Col. Harmon E. Burns, Mountain Home AFB, Idaho, Titan I; Col. Strother B. Hardwick, Davis-Monthan AFB, Arizona, Titan II; Brig. Gen. Murray A. Bywater, McConnell AFB, Kansas, Titan II; Col. Julian M. Bleyer, Little Rock, Arkansas, Titan II; Col. Harry E. Goldsworthy, Malmstrom AFB, Montana, Minuteman I. Follow-on Minuteman sites were commanded by Col. Kenneth W. Northamer, Ellsworth AFB, South Dakota, Minuteman I; Col. Thomas S. Jeffrey, Jr., Minot AFB, North Dakota, Minuteman I; Col. William E. Todd, F. E. Warren AFB, Wyoming, Minuteman I; Col. William E. Ruark, Whiteman AFB, Missouri, Minuteman I; Col. J. H. Dacus, Grand Forks AFB, North Dakota, Minuteman II.

**Lt. Gen. Harry E. Goldsworthy,** USAF (Ret.) flew B-25s in the Southwest Pacific during WWII. Later he was involved in research and development, and activated the first Minuteman ICBM wing in Montana. He was Director of Production, HQ USAF from 1963 to 1967 and commanded the Aeronautical Systems Division, Wright-Patterson AFB, 1967-1969. At the time of his retirement on 1 Jan. 1973, he was Deputy Chief of Staff, Systems and Logistics, HQ USAF.