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USAF BALLISTIC MISSILE PROGRAMS

1962-1964

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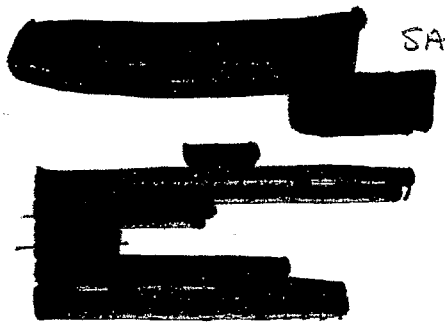

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by

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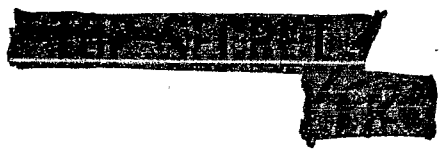
USAF Historical Division Liaison Office

April 1966



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FOREWORD

USAF Ballistic Missiles, Fiscal Years 1962-1964 covers a period in which Minuteman emerged as the principal Air Force contribution to the nation's strategic missile force and the older, obsolescent missiles were scheduled for early retirement. This history carries forward the story narrated in three previous histories prepared by the USAF Historical Division Liaison Office: Plans and Policies for the Ballistic Missile Initial Operational Capability Program; USAF Ballistic Missiles, 1958-1959; and USAF Intercontinental Ballistic Missiles, Fiscal Years 1960-61.

The current study deals with the planning for the retirement of the earlier missile systems, the emergence of Minuteman as the mainstay of the force, its planned modernization, and the planned acquisition of an improved Minuteman. Other topics discussed include the decision to use both modernized and improved Minuteman in the future Minuteman force, and the relationship between force objectives and strategy. A chapter on missile reliability outlines some of the obstacles to reliability, the solutions tried, and the measures taken to obtain accurate estimates of system reliability for use in the preparation of war plans. The history traces the course of re-entry system development and examines a proposed new mid-range ballistic missile program which was ultimately discarded.

Max Rosenberg

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C O N T E N T S

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I. CHANGES IN THE MISSILE FORCE

(U) Before 1961 the Air Force was engaged in a race to catch up with the Soviet Union in the field of intercontinental ballistic missiles (ICBM's), the emphasis being upon getting as many missiles as possible deployed in the shortest possible time. Afterward, as the nature of the Soviet threat and the "missile gap" became clearer, emphasis shifted from numbers of weapons to their reliability and flexibility. Accordingly, the Air Force re-examined the numerically impressive operational arsenal that it had so quickly assembled and determined which missiles should be retained, improved, or discarded.

(U) [redacted] What occurred between 1961 and 1964 was mirrored in the growth of the strategic missile force and the changes in its composition. In January 1962 Atlas was the only intercontinental ballistic missile in service, and at that time only 22 of them were on day-to-day (emergency war order) alert. Intermediate range missiles manned by Allied crews--Thors in Britain and Jupiters in Italy and Turkey--could supply added striking power. As time passed, however, the more important part of the missile striking force, the ICBM's, underwent rapid growth and transformation.[1]

(U) [redacted] Principal components of the expanding ICBM force were the Atlas and Titan squadrons that became operational between the summer

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of 1960 and the end of 1963. Missile characteristics and the date each squadron became operational are given below:[2]

Type	Squadron (SMS) & Base	No. Control Centers X No. Opl Launchers per Control Center.	Total Opl Launchers	Protection (psi)	Date Opl
Atlas D	564 Warren	2X3	6	Soft	Aug 60
	565 Warren	3X3	9	Soft	Mar 61
	549 Offutt	3X3	9	Soft	Mar 61
Atlas E	567 Fairchild	1X9	9	25	Sep 61
	548 Forbes	1X9	9	25	Oct 61
	566 Warren	1X9	9	25	Nov 61
Atlas F	550 Schilling	1X12	12	100	Sep 62
	551 Lincoln	1X12	12	100	Sep 62
	577 Altus	1X12	12	100	Oct 62
	578 Dyess	1X12	12	100	Nov 62
	579 Walker	1X12	12	100	Nov 62
	580 (redesignated 556) Platts-burgh	1X12	12	100	Dec 62
Titan I	724 Lowry	3X3	9	150-200	Apr 62
	725 Lowry	3X3	9	150-200	May 62
	850 Ellsworth	3X3	9	150-200	Sep 62
	851 Beale	3X3	9	150-200	Sep 62
	568 Larson	3X3	9	150-200	Sep 62
	569 Mountain Home	3X3	9	150-200	Aug 62
Titan II	570 Davis-Monthan	1X9	9	300-350	Jun 63
	373 Little Rock	1X9	9	300-350	Nov 63
	571 Davis-Monthan	1X9	9	300-350	Oct 63
	533 McConnell	1X9	9	300-350	Dec 63
	374 Little Rock	1X9	9	300-350	Dec 63
	532 McConnell	1X9	9	300-350	Dec 63

[redacted]

(U) [redacted] In February 1963 the first Minuteman wing, composed of three squadrons, joined the operational ICBM force. By the end of June of the following year, 12 squadrons were operational, each with 50 hardened and dispersed launchers. The launchers were designed to withstand overpressures of 300 pounds per square inch, and the launch control centers, one for every flight of 10 missiles, were judged capable of surviving 1,000 pounds per square inch.[3]

(U) [redacted] Besides the operational launchers throughout the nation, sites at Vandenberg AFB, Calif., used for testing and training also were part of the ICBM force. Located there were three strategic missile squadrons: 394th, Minuteman; 395th, Titan; and 576th, Atlas. Except for the Atlas D's of the 576th SMS, which were removed from operational status in May 1964, the squadrons possessed at least an emergency combat capability. As of June 1964, reaction times for the Vandenberg sites varied from 4 to more than 50 hours.[4]

(U) [redacted] The arrival of Minuteman--more flexible, safer, and judged more reliable than Atlas or Titan I--enabled the Air Force to begin discarding the least desirable of its ballistic missiles. By the end of June 1964 the intermediate range weapons were gone, Atlas D was being retired, and both Atlas E and Titan I were on the verge of retirement. Pending the completion of scheduled retirements and excluding the Vandenberg squadrons, the operational ICBM force on 30 June 1964 numbered 821 missiles: 18 Atlas D, one six-missile squadron having been retired; 27 Atlas E; 68 Atlas F, four sites disabled by accidents; 54 Titan I; 54 Titan II; and the 600 Minuteman missiles.[5]

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Retirement of the Liquid Oxygen Missiles

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Slow to react because propellants had to be loaded carefully just prior to firing and extremely vulnerable because they were positioned above ground, the IRBM's became marginal weapons when the faster reacting, hardened, and dispersed Minuteman and the mobile Polaris missiles began entering service. The United States at first intended to end its support of the British-manned Thors in 1964, when the deployment agreement expired. Britain, however, preferred an earlier phase out, and the missiles were withdrawn during the spring and summer of 1963. Withdrawal of the Jupiters from Italy and Turkey took place during the spring of that year, little more than 12 months after the last of them had become operational.[6]

(U) [redacted] The Air Force had rushed the intercontinental Atlas into service to forestall the anticipated missile gap. First to be deployed were the Atlas D's, located initially on gantry-type pads at Vandenberg AFB, and subsequently in unprotected above-ground "coffins"; this series relied on dispersion alone to survive attack. The Atlas E missiles were protected by earth-covered coffins designed to withstand overpressures of 25 pounds per square inch. As was true of Atlas D, this missile had to be raised from its horizontal storage position and fueled before launching. In contrast, the Atlas F missiles stood atop elevators housed within concrete

[redacted]

and steel silos. These underground silos, covered by massive doors, were designed to survive nuclear detonations generating overpressures of 100 pounds per square inch, permitting the post-attack launch of the missiles.[7]

(U)-[redacted] Atlas D required extensive modifications, but completion of these changes in April 1962 did not result in any marked increase in system reliability which, as late as November of that year, remained barely satisfactory. While the D series limped along, Atlas E, scheduled for some 250 modifications continued to suffer random failures of its guidance system and Atlas F also disclosed numerous shortcomings.* [8]

(U)-[redacted] Besides the defects in each of the three series, Atlas suffered from being powered by engines in which liquid oxygen was the oxidizer. Since this substance could not be stored within the missile, each launching was preceded by a transfer of the liquid from storage tanks to the missile, which was a delicate and hazardous task. The property that made liquid oxygen useful in propelling missiles was its ability, in combination with kerosene, alcohol, or hydrazine, to sustain intense combustion. This very quality, however, made the substance extremely dangerous, and a chance spark or "combustion instability" in the engine could cause a violent explosion.[9]

(U)-[redacted] Liquid fueled and, like Atlas F, mounted on an elevator within an underground silo, Titan I shared the disadvantages of using liquid oxygen in the presence of combustibles. Titan II differed radically from its near namesake in that it used storable propellants+ and therefore did

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*For a detailed discussion of missile reliability, see Chapter II.

+The fuel was unsymmetrical dimethihydrazine (UDMH), the oxidizer, nitrogen tetroxide.

not have to be fueled immediately before being launched. Thanks to this feature, the Titan II system had greater flexibility and was less vulnerable than either Atlas or Titan I. For example, Titan II's could be fired from within their silos.[10]

(U) [redacted] Air Force experience with the cantankerous liquid oxygen systems hardly inspired confidence in Atlas or Titan I, and the appearance of storable liquids and solid propellants was a welcome change. As the improved systems came into common use, an Air Staff study group, charged with examining the general topic of missile reliability, in the spring of 1963 recommended that Atlas D, Atlas E, and Titan I be retired from service at an early date. Although aware that these missiles did present a targeting problem to an enemy, the group advocated abandoning Atlas D, scheduled to serve until fiscal year 1967, as quickly as possible and, if the strategic situation permitted, eliminating Atlas E by the end of fiscal year 1967 and Titan I by the end of fiscal year 1968. SAC dissented only in that it wanted to retain Titan I into the 1970's; it was willing to be rid of Atlas D and E as early as June 1965, provided the money saved was spent on additional Minutemen. The Air Staff and Secretary of the Air Force Eugene M. Zuckert approved the group's recommendations, and the Air Force Chief of Staff, Gen. Curtis E. LeMay, forwarded them to the Joint Chiefs of Staff (JCS) for planning purposes.[11]

(U) [redacted] Out of these recommendations, which were subsequently revised following discussions within the JCS and Office of the Secretary of Defense (OSD), came an initial program that called for retention of Atlas D missiles

[redacted]

through fiscal year 1964, Atlas E through fiscal year 1966, and Titan I through fiscal year 1967. In May 1964, however, Secretary of Defense Robert S. McNamara, in his tentative force guidance for fiscal year 1965, decided to shelve both Atlas E and Titan I during that fiscal year and Atlas F during fiscal year 1968. The Air Force agreed that it would not appeal this decision and disappearance of the liquid oxygen missiles from the operational inventory seemed imminent. Under the McNamara program, the Atlas and Titan I inventory would be reduced during fiscal year 1965 from a peak strength, excluding the Vandenberg units, of 177 missiles to a mere 72 Atlas F, including four sites damaged by fire, and disappear entirely during fiscal year 1968.[12]

Minuteman Development and Deployment

[redacted] The first Minuteman flights--20 silo-based missiles located in the vicinity of Malmstrom AFB, Mont.,--became operational in December 1962. These missiles were designated LGM-30A or Minuteman A.

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In spite of difficulties caused by defective safety wires in the re-entry vehicles and troubles with equipment at the launch site, the wing's 150 Minuteman A missiles were in place and operational before the end of July 1963.[13]

(U) [redacted] Although originally intended to be a spartan system, Minuteman became a more sophisticated and costly weapon even as the first

*Minuteman I wings employ the LGM-30A and 30B missiles. Minuteman II, which has substantially greater range, uses the LGM-30F. For the characteristics of these missiles, see page 17.

[redacted]

wing became operational. The cause was a modification program adopted because of a concern over the danger of inadvertent or uncontrolled launch and of system inflexibility. After the Kennedy administration took office in January 1961, a committee headed by James C. Fletcher, president of the Space Electronics Corporation and a member of the President's Scientific Advisory Committee, reviewed the strategic missile programs, including Minuteman, and submitted its recommendations to the Director of Defense Research and Engineering.[14]

(U) [redacted] Although the Air Force maintained that existing safety measures were adequate to prevent unauthorized launches, the Fletcher committee recommended modifying the launch system to provide a more positive form of control. OSD agreed and in October 1961 the contractor set about making the necessary changes. The safety feature incorporated in the Minuteman system was a continuous tone, generated in the launch control center that prevented the 10 missiles controlled by the center from being launched. Not until the launch control center stopped this tone could a missile be enabled--that is, given the equivalent of a preparatory command--and then, upon receipt of a valid launch signal, sent hurtling toward its predetermined target.[15]

(U) [redacted] The Fletcher Committee also favored increasing the flexibility of the Minuteman system, even though this meant increasing system complexity. According to the original Minuteman plan, all 50 missiles in a squadron were to be launched, either in succession or in salvo, an arrangement that reflected the concept of Minuteman as a simple, reliable weapon of massive

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retaliation. In contrast, the Fletcher committee now recommended installing a selective launch mechanism whereby some missiles within each flight could be dispatched against critical targets and others withheld for later strikes. OSD again agreed, and selective launch was added to the first four Minuteman wings.[16]

(U) [redacted] Added along with selective launch was another innovation, endorsed by the Fletcher committee, that would enable missile technicians to shift from one previously selected target to another, provided that the second was within 10 degrees right or left of the primary azimuth. Dual targeting also was approved by the Office of Secretary of Defense and became part of the system beginning with the second wing.[17]

(U) [redacted] The ability to withhold and retarget individual missiles was, of course, of little use unless the weapons and their launch control centers were reasonably certain to survive an enemy attack. Minuteman, it early became apparent, was not likely to survive for long since its emergency power sources, both at launcher and at launch control center, were located above ground. With the destruction of these generators, the system reverted to storage batteries but these had a life of only six hours. To remedy this weakness, the Directorate of Civil Engineering recommended hardening the emergency power source for launch control centers to 1,000 pounds per square inch and the source for launchers to 300 pounds, while the Air Force System Command's Ballistic Systems Division (BSD) advocated 300 and 25 pounds per square inch, respectively, for the generators. On the recommendation of the Designated Systems

[redacted]

Management Group (DSMG), Secretary Zuckert on 17 November 1961 chose the lesser hardening course as proposed by the Ballistic Systems Division.[18]

(U)-[redacted] Not all these changes affected each of the four wings already approved by the end of 1961. Although the modified launch control system was incorporated in the first wing, dual targeting did not appear until the second, and protection for emergency generators was not increased until Wing III.[19]

(U)-[redacted] Looking back upon the decisions that had so greatly increased the flexibility and complexity of Minuteman, the Designated Systems Management Group called attention to a "drastic and unpromulgated change in national strategic military policy." According to DSMG interpretation, the plan supported by the Air Force to acquire large numbers of simple weapons reflected a national strategy of massive retaliation, within which Minuteman was an inflexible element designed solely to react quickly to a Soviet attack. Systems other than Minuteman were to provide flexibility. By late 1961, however, with Minuteman being modified to become a more sophisticated system, a new strategy of selective response was adopted by the Kennedy administration. Under such a strategy, retaliation--instead of being instant and overwhelming--could be delayed and would depend upon the nature of the attack upon the United States and its allies.[20]

(U)-[redacted] Although the Air Force accepted revisions in the Minuteman system, regardless of their strategic implications, SAC continued to advocate the deployment of a simple Minuteman in large numbers. Gen. Thomas S. Power,

[redacted]

Commander-in-Chief of SAC (CINCSAC), urged that the Air Force defend its earlier concept and try to keep the system as unsophisticated as possible, using the money that might have been spent on innovations to buy still more weapons. He added that he had opposed dual targeting and selective launch and complained that he had not been consulted on the decision to extend survivability.[21]

[redacted] While the Minuteman system was moving toward greater complexity, the Air Force was studying the possibility of extending the range of the missiles destined to be deployed in the second wing. A succession of advances in propulsion, guidance, and warhead development enabled the Air Force to incorporate the improvements in Wing II missiles.

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(U) [redacted] The second Minuteman wing combined the B missile and dual targeting with the "soft" emergency generators that were characteristic of Wing I. Subsequent wings, however, would boast extended survivability as well as dual targeting and a longer-range missile. By the end of 1963 SAC had accepted, besides the first wing at Malmstrom AFB, the second wing at Ellsworth AFB and was in the process of declaring operational a third wing at Minot AFB, N.D. All construction for Wing IV, based on Whiteman AFB, Mo., was complete, and facilities for Wing V at Warren AFB, Wyo., were 90 per cent finished.[23]

(U) [redacted] Although construction proceeded smoothly in comparison to earlier missile sites, the Air Force did encounter various problems. For

example, the poor road net around Whiteman AFB would have required extensive construction if the planned dispersal pattern were followed. To keep costs down, the Air Force was forced to modify the original plan, relocating launchers so that the silos could, insofar as possible, be served by existing roads. At Warren AFB a housing problem had to be solved before that base could effectively support the fifth wing.[24] In addition, Secretary Zuckert approved deepening by 10 feet the silos in the fifth wing. This change, which was to cost no more than $3 million, would accommodate the new re-entry vehicle under development.[25]

(U) Other difficulties appeared after construction was completed. The alarm system located at the unmanned silos proved erratic, and the resulting false alarms kept security detachments hurrying from their quarters to the widely dispersed launchers. By February 1964, however, this problem was being alleviated if not solved. Another difficulty was the tendency of silo doors to jam under heavy accumulations of snow and ice. To correct this defect, the Air Force increased the power of the mechanism that actuated the door and installed a scraper to prevent ice from sealing it shut. Cost of the door modifications was placed at $8.3 million for five wings.[26]

(U) While the basic Minuteman system was thus evolving, work was started on an improved system that would feature a more powerful missile, as well as further refinements in targeting and launch equipment. In November 1961, shortly before the first Minuteman A missiles began entering service, Secretary Zuckert approved, as the next objective in the Minuteman program, an increase of 2,000 nautical miles beyond the range of

Minuteman B and a reduction of the CEP to .75 nautical miles. The desired accuracy was later revised to a CEP of .5 nautical miles.[27]

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This latest variant, together with its launch facility and other related equipment, formed the Minuteman II weapon system that would enter service with Wing VI at Grand Forks, N.D. Minuteman II also contained features derived from the work of the Fletcher committee. The improved version was capable, for example, of engaging any of eight preset targets, whereas Minuteman I, as deployed in Wing I, was restricted to a single target, or, in Wings II through V, to either of two targets. Also, Wing VI would be somewhat better protected than the earlier wings, since the emergency generators at the launchers were designed to survive overpressures of 300 pounds per square inch and those at the launch control centers 1,000 pounds per square inch.[29]

[redacted]

(U) [redacted] To obtain full advantage from the capacity of LGM-30F to store eight targets, the Director of Defense Research and Engineering (DDR&E), Dr. Harold Brown, in April 1962 expressed interest in developing a means of selecting among these targets by remote control. Secretary Zuckert initially recommended against such an undertaking because of cost, complexity, and the likelihood that it would delay the entry of Minuteman II into service. Subsequently, however, the Air Force agreed to adopt remote control selection, with the eight targets stored within LGM-30F being chosen from any of the five launch control centers within a squadron.[30]

(U) [redacted] The quest for increased flexibility continued, however, and Secretary of Defense McNamara in April 1963 requested that the Air Force study the possibility of "reprogramming Minuteman based on indirect bomb damage assessment." The Air Staff, however, found such indirect bomb damage assessment impractical on two counts: the device proposed to perform this function could do no more than signal the arrival of the re-entry vehicle in the general area of the target; and both the receiving stations needed to pick up its signals and the computers required to interpret them would be vulnerable to enemy attack. The Air Force did support installation of a so-called "missile-away recorder" that reported missiles successfully launched and the status of those that remained in their silos.[31]

(U) [redacted] Two other changes through which OSD hoped to enhance system flexibility were the installation of devices to permit time-on-target fire--the launching of several missiles to detonate at precisely planned times on selected targets--and emergency launching of the missile by an airborne launch

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control center (ALCC). The first of these modifications, approved during 1963 for eventual incorporation in all wings, would permit the massing of fires, for example, against a defended or particularly dangerous target to increase the probability of penetration and destruction. The second of the changes, the ALCC, would provide a means to launch those missiles surviving an attack, even though the underground launch control centers had been disabled. As of June 1964, DDR&E was maintaining close coordination with the Air Force and, among other things, was reviewing Air Force management plans, design criteria, statement of work, and test plans.[32]

(U)— Late in 1962 the Secretary of Defense again questioned the effectiveness of the safeguards against accidental or unauthorized launch of Minuteman missiles. The use of a continuous tone to prevent launch had one major disadvantage: if the launch control center were destroyed or the tone otherwise interrupted, all 10 missiles served by the center could be launched upon receipt of the proper signal. Secretary McNamara suggested that this possible danger could be eliminated by requiring a positive action at the control center, rather than interruption of a signal, to permit launching.[33]

(U)— The Air Force not only defended the adequacy of the existing launching controls but pointed out that the interrupted tone had been selected "not upon the assumption that the missiles, once enabled, would be fired without competent orders, but rather upon the basis that the enemy should not be tempted to concentrate on the command and control "system."[34] McNamara, however, did not accept this reasoning. On 10

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August 1963 he directed the Air Force to begin study and preliminary development of further safeguards, using $5 million in OSD emergency funds.[35]

(U) [redacted] Out of this and other studies came the proposed Improved Encoded Launch Enable System (IELES), one aspect of which was approved for Minuteman. The new feature, called the Launch Enable Execute System (LEES), permitted the issuing of encoded commands to individual missiles. McNamara included funds for LEES in the Wing VI allocation and indicated that in the future he would release money to equip the earlier wings.[36]

(U) [redacted] As the Minuteman II was thus taking shape, the Air Force began having second thoughts about the system's ability to survive attack. A study prepared in late 1963 warned that the wing support bases were the most vulnerable element of the Minuteman system. Usually located at airfields that themselves were attractive targets, these bases were soft and therefore unlikely to survive a nuclear strike. Should the supporting facilities be destroyed, missile maintenance would be limited to that which could be performed within the squadron at the silos; and this, the study disclosed, would be inadequate to sustain a lengthy alert. If 135 Wing II missiles were maintained under these circumstances, the study predicted that after 15 days only 77 would be ready for immediate launch, and after 30 days the number would drop to 23. As of June 1964, the consequences of this study could not be predicted.[37]

[redacted] In summary, the changes approved by OSD, mainly in the interest of flexibility and the improvements made in missiles and warheads resulted

in the creation of two Minuteman systems, whose principal differences in design were as follows:

	Minuteman I			Minuteman II
	Wing I	Wing II	Wings III-V	Wing VI
Missile	LGM-30A	LGM-30B	LGM-30B	LGM-30F
Range	4910 nm	5500 nm	5500 nm	6600-7500 nm (The latter with a lower yield warhead.)
CEP				
Warhead MT				
Launch Facility Hardness	300 psi	300 psi	300 psi	300 psi
Launch Control Hardness	1000 psi	1000 psi	1000 psi	1000 psi
Launch Control Emergency Generator Hardness	soft	soft	300 psi	1,000 psi
Launch Facility Emergency Generator Hardness	soft	soft	25 psi	300 psi
Survivability	6 hrs	6 hrs	9 weeks	9 weeks
Targeting	single	dual	dual	eight

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Termination of the Mobile Minuteman Program

(U) [redacted] The two basic Minuteman systems described above became the heart of the USAF strategic missile force. As noted, these weapons depended for survival on protected underground launch facilities that were separated one from another to reduce the damage from a single nuclear burst. The Air Force's initial plans, however, had also called for the development of mobile Minuteman missiles launched from specially built railroad cars. Mobility was the essential attribute of this proposed system, for it was believed that an aggressor would find it all but impossible to knock out enough of the missile trains to prevent prompt and devastating retaliation.

(U) [redacted] Obtaining the necessary mobility, however, was far from simple. Weight was a problem. The missile car, among the heaviest pieces of railroad equipment ever proposed, would require solidly anchored sidings for firing positions. Another difficulty was communications. High frequency radio, initially suggested for the command net, was not reliable in the mountainous regions where it was proposed the missile trains would operate. Despite these obstacles, during 1959-1960 contractors succeeded in devising plans for missile and launch control cars.

(U) [redacted] While these designs were being worked out, the Kennedy administration early in 1961 reviewed the entire Minuteman program. Out of this review came a decision to hold the mobile program in abeyance while increasing the number of hardened and dispersed missiles. The fate of the mobile version was not yet decided when fiscal year 1962 began.[38] Although the President did not commit himself to the program, Secretary McNamara, following a BSD

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briefing held in the fall of 1961, left the impression that he favored beginning production. McNamara did not, however, indicate any need for haste in deploying the mobile missiles.[39]

(U) [redacted] The Designated Systems Management Group concluded that, since the Defense Secretary attached no overwhelming urgency to the program, an improved mobile Minuteman could be devised in time to enter service in June 1964. The refined version would have a circular error probable of 1 to 1.4 nautical miles, be capable of storage on trains for as long as three months, and possess a range of 5,500 nautical miles. Secretary Zuckert directed that a proposal for a 300-missile force be sent to the Office of Secretary of Defense, but he indicated that the Air Force might settle for one-third that number.[40]

(U) [redacted] While the Air Force was preparing its arguments in support of mobile Minuteman, funds to sustain the program began running out. Research and development, being conducted at the rate of $5 million per month, was scheduled to end before 1 January 1962 unless additional funds were provided. The Air Force assumed that the program would survive, at least on a sustaining basis, but this assumption proved erroneous. On 14 December 1961 Deputy Secretary of Defense Roswell L. Gilpatric announced cancellation of mobile Minuteman.[41]

(U) The program perished because the Secretary of Defense judged that the benefits from the new system were not worth the cost of development and deployment. The proposed rail-mobile system, according to Secretary McNamara, faced an extensive period of research and development that would inflate the cost per missile, for a force of "reasonable size,"

to "several times the cost of the fixed base version." McNamara also noted that missile trains, if successfully developed and deployed, would be "susceptible to sabotage" and subject to many difficult operational problems, such as"protection from fallout, safety, etc." [42]

(U) Unconvinced by this reasoning, General Power continued to urge the adoption of mobile Minuteman. On 28 February 1962 he recommended reinstatement of the "virtually untargetable" mobile system in order to provide a "hedge against any Soviet improvement or breakthrough in ballistic missile accuracy and ASW /antisubmarine warfare/ capability" that might jeopardize both the hardened and dispersed Minuteman sites and Polaris submarines. He maintained that the mobile system, once deployed, would constitute a better protected and less costly reserve striking force than Polaris. General LeMay, to whom Power had addressed his appeal, replied by stating his support of the Air Force position that fixed-base Minuteman should have priority, even to the extent of deferring work on the mobile version.[43]

(U) Despite the Chief of Staff's support of the hardened and dispersed Minuteman, General Power in April proposed reviving the other version, citing in his support a statement by Gen. Bernard A. Schriever of the Air Force Systems Command that mobile Minuteman could become as accurate as the fixed-base weapon. General LeMay assured Power that Secretary McNamara was aware of Schriever's opinion. Mobile Minuteman, he continued, had been discontinued because the advanced status of Polaris and hardened Minuteman, together with the favorable estimates of their survivability, had influenced the Secretary against continuing development of the mobile version. Accuracy

was not the issue.[44]

(U) Again in November 1963 General Power recommended reinstatement of the mobile program, this time because of the threat to missile sites from the Soviet Union's "dramatic capability in earth-based weapons and high payload space potential with obvious military intent."[45] A subsequent study by the Air Staff's Directorate of Plans concluded, however, that under existing conditions mobile Minuteman would add little to the ability of American strategic weapons to survive attack.[46] Reinstatement of the program seemed highly unlikely, at least in the immediate future.

Minuteman Force Objectives and National Strategy

(U) In May 1963 Secretary McNamara, in discussing the procurement of Minuteman II, noted that it provided greater destructive power than "the larger force of unimproved Minutemen that could be bought for the same cost." This greater capacity for destruction, McNamara maintained, was due in large part to Minuteman II's greater targeting flexibility. He said further that this feature could improve force effectiveness if the improved Minuteman squadrons were located in Minuteman I wings and used to engage those targets that might have escaped destruction by the older missiles. He warned the Air Force that he would not consider further increases in the total Minuteman force until he was sure the service was making the best use of the weapons already available.[47]

(U) Consistent with this policy of using existing resources to the fullest was the OSD plan to place Minuteman II missiles in silos built for earlier models. Even though LGM-30A, the missile unique to Wing I,

[redacted]

was scheduled for retirement, the plan would perpetuate duplication within the overall program, since for a time there would be the integral Minuteman I (using LGM-30B), Minuteman II (using LGM-30F), and a hybrid--called modernized Minuteman--that combined the LGM-30F missile and other features of Minuteman II with modified launch facilities originally designed for LGM-30B.[48]

(U) [redacted] Such disparity did not appeal to General Power, who suggested relying exclusively on modernized Minuteman instead of having in effect, two kinds of Minuteman II. Both the Air Force Council and the Air Staff Board recommended against this suggestion on the grounds that, since the total number of missiles probably would remain the same for several years, it was imperative that the Air Force build the striking force that promised the greater effectiveness, efficiency, and flexibility. Locating Minuteman II squadrons in modernized wings was judged the best way to attain these characteristics for the entire Minuteman force.[49]

(U) [redacted] As noted earlier, the Air Force at the outset had considered Minuteman a weapon capable of instant retaliation and for that reason had sought a large force. In July 1961 the Air Force had obtained approval for four wings, a total of 600 missiles, and was seeking authorization for another wing of silo-based missiles and a wing of mobile weapons. These additions would have raised the number of Minutemen to 900, but the mobile system was cancelled, reducing the immediate objective to 800 hardened and dispersed weapons.[50] The Air Force's ultimate goal, established in July 1962, was 1,950 missiles, a force intended to be 90 per cent effective in

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damaging unprotected targets and 65per cent effective against hardened missile sites.[51]

(U) [redacted] However, the OSD program as approved in the spring of 1963 consisted of only 950 missiles--800 Minuteman I's and 150 Minuteman II's. Still hoping for a larger force, the Air Force--reducing its total goal somewhat--asked OSD to support a 1,400 Minuteman program: it requested 300 additional Minuteman II's in fiscal year 1967 and another 150 in fiscal year 1968. Secretary of Defense McNamara, in contrast, outlined a force of 1,200 missiles: 800 Minuteman I's and 400 Minuteman II's. This smaller force, moreover, would grow less rapidly, 50 missiles being added in fiscal year 1967, 100 in fiscal year 1968, and 100 in fiscal year 1969. The Air Force countered by proposing that attainment of its 1968 goal--1,400 missiles--be postponed until fiscal year 1969 so that fewer weapons would be purchased each year. The counterproposal was not accepted; in November 1963, McNamara issued planning guidance based on his own force objective.[52]

(U) [redacted] Secretary Zuckert promptly asked McNamara to reconsider this decision, which limited the fiscal year 1967 Minuteman force to 1,000 missiles, 100 fewer than the Air Force had requested in its revised submission. His request was rejected. The Secretary of Defense replied that he could see no great difference between 1,000 and 1,100 missiles, since in either case the Minuteman force would be able to destroy about the same percentage of the total number of strategic nuclear targets. The true effectiveness of the force, he continued, would depend not on numbers alone

but upon the flexibility of targeting to be derived from the emplacement of Minuteman II squadrons in Minuteman I wings and from the modernization of the Minuteman I system.[53]

(U) [redacted] Within a year of this exchange of views with Zuckert, McNamara imposed a new ceiling of 1,000 missiles on the Minuteman program, a limitation that tentatively applied through fiscal year 1973. This decision caused further debate among civilian and military leaders within the defense establishment. Opposing views were expressed by Secretary McNamara, whose May 1964 guidance called for 1,000 missiles, and General LeMay, who advocated increasing the total from 1,000 to 1,250 during fiscal year 1968 and stabilizing the force at 1,500 from fiscal year 1969 through fiscal year 1973. The middle ground was occupied by the Chief of Naval Operations, Army Chief of Staff, and Commandant of the Marine Corps, who as members of the JCS had agreed that 1,100 Minutemen should be operational in fiscal year 1968, with the number increasing to 1,200 the following fiscal year and remaining at that level through 1973. Whatever their differences concerning force levels, all favored the orderly modernization of Minuteman I and the introduction of Minuteman II.[54]

(U) [redacted] In explaining his conviction that 1,000 Minutemen were force enough, Secretary McNamara listed two requirements that determined retaliatory strength. These were "assured destruction capability" and "damage limiting" forces. The former involved the capacity to destroy the enemy's centers of government and a large percentage of his population after absorbing a well planned and skilfully executed surprise attack. "Damage

limiting" forces, in McNamara's view, constituted the additional strength that would be justified for attacks on counterforce targets, assuming that such strikes could actually reduce the damage done to the United States to an extent that would justify the added cost of maintaining this strength. A thousand Minutemen, the Secretary maintained, could provide adequate assured destruction; the need for additional damage limiting forces and their proper strength was under study.[55]

(U) To the Air Force, the progressive reduction of McNamara's force objectives were proof that the counterforce strategy, championed by the Air Force and adopted by the Kennedy administration, was headed into discard. Early in 1963, Secretary McNamara had endorsed the counterforce idea, testifying before a Senate committee that the United States required "an ability to (1) strike back decisively at the entire Soviet target system simultaneously, or (2) strike back first at the Soviet bomber bases, missile sites, and other military installations associated with their long-range nuclear forces to reduce the power of any follow-on attack and then, if necessary, strike back at the Soviet urban and industrial complex in a controlled and decisive way." This was the essence of the Air Force's counterforce doctrine. Air Force planners believed that such a strategy would, as McNamara said, give the Soviet Union an alternative to attacking American cities. "Whether they would accept it in the crisis of a global war," cautioned the Secretary, "no one can say." But in spite of this uncertainty, the administration at the time favored maintaining this option.[56]

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(U) [redacted] Later in 1963, Gen. Maxwell D. Taylor, Chairman of the JCS, warned that as the Soviet Union increased the protection of its land-based missiles and deployed additional missile-carrying submarines, the vulnerability of its strategic forces would diminish until counterforce targeting became impossible. General Taylor therefore directed the joint staff to "determine the condition when counterforce targeting will cease to be remunerative." General LeMay, however, objected that these instructions were, in themselves, an unwarranted judgment on the future of counterforce planning. As a result, the Taylor directive was toned down until the Air Force could accept it as the starting point for an impartial investigation.[57]

(U) In February 1964, while the study of future counterforce targeting was still underway, Secretary McNamara told a Senate Appropriations Subcommittee that, although a strategy aimed exclusively at the destruction of cities would be "dangerously inadequate," the United States, even though it struck first, could not "count with any assurance on destroying all or almost all of the Soviet Union's hardened missile sites even if we were to double or triple our forces." The solution, he continued, was the damage-limiting strategy, which would require more missiles than a cities-only strike force but fewer than one capable of striking first and destroying all the enemy's strategic forces.

(U) In spite of differences of opinion as to the exact size of a damage-limiting force, there was, McNamara reported, "general agreement that it should be large enough to insure the destruction, singly or in combination, of the Soviet Union, Communist China, and the Communist satellites, as national societies, under the worst possible circumstances of war

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outbreak that can reasonably be postulated, and, in addition, to destroy their war-making capability so as to limit, to the extent practicable, damage to this country and our allies."[58]

(U) [redacted] The Air Force, with General LeMay as its principal spokesman, continued to urge that the prime objective of American strategic retaliatory forces remain the enemy's military forces and not his so-called "national society." To this end, the general advocated maintaining a limited first-strike capability that would "degrade substantially," though not necessarily destroy, the enemy's ability to inflict damage on the United States and its allies, a "degradation" that would result from attacks on purely military targets. He admitted that attacks on population centers might become necessary, but even so, the main strategic objective would remain the destruction of military targets.[59]

(U) In LeMay's view the objective was not mere killing, and for this reason he was wary of basing force objectives on a desired percentage of enemy war-making potential destroyed or on a percentage of the enemy populace wiped out--two common methods of measuring damage to a national society. "Our problem," he told a House subcommittee, "is not one of killing our opponents. Our problem is to keep our opponents from killing Americans and our allies." Killing the enemy, he declared, was simpler and required "a lot less missiles than if we are trying to protect ourselves."[60]

(U) The fate of the counterforce strategy was at this time uncertain. Although Secretary McNamara seemed unwilling to rely exclusively on a small, "cities-only" retaliatory force, he appeared uncertain whether a

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larger force could justify its cost by actually limiting damage to the United States and its allies. His eventual decision would be shaped to some extent by the studies of counterforce targeting that had been set in motion by General Taylor.

Costs of the Operational Missile Force

(U) Costs of the ballistic missile systems as a general rule far exceeded initial estimates. One reason for this cost inflation was the concurrency concept by which the Air Force accelerated its efforts to get its weapons in place as quickly as possible. The concurrency approach, adopted in light of estimates of growing Russian missile strength, called for the speedy development of the missiles, the construction of launch sites, and training of launch crews, all within a very narrow and overlapping time frame.

(U) [redacted] However, almost simultaneous with the hurried deployment of the liquid fueled ICBM's, the Air Force found the missile systems required extensive post-development modifications--and more money--to improve their reliability. Similarly, site construction costs also rose beyond original estimates when changes were introduced into the program to provide survivability through dispersal and hardening. In the autumn of 1961, for example, the Director of Civil Engineering advised Secretary Zuckert that Atlas construction costs had exceeded the original budget by about $125 million, Titan I by $80 million, and Titan II by $66 million. In the case of Atlas, the increase stemmed from a major change in the character of the program: a shift from nine squadrons, five of them hardened to 25 pounds per square

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inch, to 13 squadrons (12 operational and one training and test, though with an operational capability), with six squadrons built to withstand pressures of 100 pounds per square inch. The mounting cost of Titan II could be attributed to increased hardness, but the Director of Civil Engineering could see "no good reason" for the rising cost of Titan I, except that the system had "really been plagued by changes."[61]

(U) ~~(S)~~ At the time this report was being made, total obligating authority for the fiscal year 1962 Atlas program was $644.8 million, down $246.2 million from the previous year, while the 1962 Titan program amounted to $903.9 million, in contrast to fiscal year 1961's $1179.5 million.[62] Since site construction and procurement of initial equipment were nearing completion, further reductions in the annual programs were bound to occur. Atlas declined to $456.4 million for fiscal year 1963 and $239 million for fiscal year 1964, while Titan dropped to $872.9 million for 1963 and $368.7 for the following fiscal year.[63]

(U) ~~(S)~~ Secretary McNamara's decision in May 1964 to hasten the retirement of all liquid oxygen missiles meant a further slash in Atlas and Titan spending. The early phase out of Atlas E and F and Titan I promised a "cost avoidance" of some $144 million.[64] As a result total Atlas obligating authority for fiscal year 1965 was fixed at $97.1 million.[65] Similarly, approval for the early retirement of Titan I brought a reduction in Titan obligating authority from $147.5 million and $100.3 million, the amounts originally approved for fiscal years 1965 and 1966, to $127.2 million and $73.8 million.[66]

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(U) [redacted] Like Atlas and Titan, Minuteman I was the object of modifications that increased system costs. In the case of Minuteman I, these were due for the most part to a shift in strategic thinking from massive retaliation to selective response, a change that led to the adoption of expensive measures to improve flexibility and provide greater protection against both the effects of hostile attack and the possibility of unauthorized launching. Rising costs were not, however, due exclusively to decisions by OSD. Within the Air Staff, the Acting Director of Plans admitted that "inadequate Air Force cost estimating procedures" were "partially responsible" for the gap between estimate and expenditure.[67]

(U) [redacted] Modifications, together with inaccurate estimates, soon erased anticipated savings of $122.5 million for fiscal years 1963 and 1964. By November 1962 the Air Force realized that projected Minuteman I costs would exceed programmed funds by $416.4 million.[68]

(U) [redacted] The Air Force immediately turned its attention to eliminating this deficit, and in February 1963 Secretary Zuckert reported that the projected deficit had been reduced below $275 million "through adjustments made in the FY 63 and 64 programmed funding."[69] This reduction was due in part to the diversion of funds made available because of cancelations and deferrals. The recently canceled Skybolt, for example, was counted upon to furnish $36.4 million, while postponement of funding Mk-12 re-entry vehicle research could make $5.1 million available during the current fiscal year.[70] The Secretary of the Air Force in April and May 1963 sent McNamara a list of recommended reprogrammings that would

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make good the remaining deficit, $92.8 million for fiscal year 1963 and $27.4 million for the following year. After obtaining Air Force assurance that Minuteman force objectives had not been imperiled, Secretary McNamara approved the recommendations.[71]

(U) [redacted] After fiscal year 1963, during which the authorized program amounted to $1879.3 million, Minuteman total obligating authority began a year-by-year decline.[72] Site construction rapidly approached completion, the A missiles were deployed, and deployment of the B model was well under way. The advent of the F missile--part of the Minuteman II system--and the decision to incorporate it in a modernized Minuteman system compelled the Air Force to modify the sites at which it would be based, and this task prolonged Minuteman costs. In the summer of 1964 OSD and the Bureau of the Budget indicated that $90.8 million would be made available to begin these modifications, which were scheduled for completion in 1970.[73]

(U) [redacted] Once all of Atlas and Titan had been deployed and most of the Minutemen I were in place, the Air Force tried to compare the costs of individual operational missiles of these various types. Taken into account in the Air Force computation were: major equipment and initial spares; associated ground equipment and initial spares; other equipment and related costs; installation and checkout; and site acquisition and construction. According to this formula, the cost per missile of operational Minutemen was $5.0 million, Titan (both types) $26.5 million, Atlas D $18.5 million, Atlas E $15.3 million, and Atlas F $17.5 million.[74]

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(U) [redacted] Research and development now focused on Minuteman II. Its research, development, test, and evaluation costs, as estimated in September 1962, would amount to $491.1 million from fiscal 1963 through fiscal 1968. By the end of January 1964, however, the estimated RDT&E costs had reached $854.7 million and the program been extended into fiscal year 1969. Among the factors that contributed to this increase were added hardness for both launch control centers and launchers, transfer of Mk-11A and Mk-12 re-entry vehicle development to the Minuteman program,* and addition of the Launch Enable Execute System.[75]

(U) [redacted] The increase in RDT&E costs was typical of the Minuteman II undertaking; total obligating authority was increasing, year by year. The fiscal year 1964 program, which exceeded the previous year's authorization by about $600 million, amounted to $762.8 million, and the figure for fiscal year 1965 was $1320.9 million.[76]

(U) [redacted] Whatever its current or potential value, Minuteman II inevitably would become obsolete, and the Air Force already was looking ahead to that eventuality. During the summer of 1963 OSD authorized $8 million, of which $6.65 million was released to the Air Force, for studies that would serve as the basis for the development of an advanced intercontinental ballistic missile. The early studies proved inconclusive and, though the Air Force desired an advanced ICBM (later designated the Improved Capability Missile), it was not yet decided whether this would be an entirely new system or a further improvement of Minuteman.[77]

*See Chapter III.

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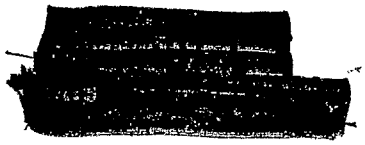
II. MISSILE RELIABILITY

(U) One of the most serious problems to confront the Air Force was missile reliability. To what extent could the new intercontinental missiles, developed in the briefest possible time and with a minimum of testing, be depended upon to fire as programmed, leave the launching pad, and reach the target? What planning factors should be used for missile reliability in the preparation of war plans? Answering these closely related questions promised to be difficult and time-consuming.

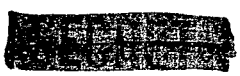
The Reliability Problem

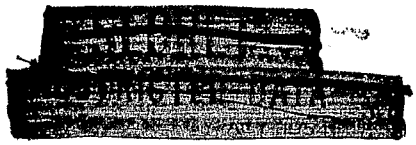
(U) The low reliability of the first operational missiles quickly became apparent, but there was no ready solution to a condition that stemmed in large measure from the missile design itself. The Atlas system, for example, contained some 40,000 identifiable parts, many of them components of delicate electronic subsystems. The complexity of the system imposed a staggering burden on maintenance men and operational crews. Difficulty of maintenance, plus the caution necessary in fueling the missile before firing, prevented Atlas and Titan I from attaining the 15-minute reaction time required by SAC. In contrast, somewhat modified, the same missiles proved suitable as boosters for launching satellites, a role in which fast reaction was not a prime consideration and technicians had many hours to carefully check and recheck the numerous valves, fittings, and switches.[1]



(U) [redacted] But there were other reasons for the poor reliability of the early missiles. As noted earlier, because of the critical need for operational intercontinental ballistic missiles, the Air Force had resorted to the technique of concurrency to compress the time from drawing board to launching pad by beginning each phase of the program as quickly as possible, with one phase overlapping an earlier one that was still in progress. In this way, according to Air Force plans, the operational missiles, sites, ground equipment, skilled maintenance men, and trained crews all would be ready at the same time. Although this practice did save time, it also increased costs, often resulted in unrealistic training, and turned out weapon systems that, though theoretically operational, still might require extensive alteration and refinement. The Strategic Air Command thus found itself involved in extensive training, testing, and modification programs while at the same time trying to keep as many missiles as possible on alert.[2]

(U) [redacted] Given a comparatively simple weapon, such as Minuteman, deficiencies that had gone undetected through the accelerated development cycle, could be quickly corrected and, as experience was gained, the missile could attain a satisfactory reliability. With the complex Atlas, however, correcting these flaws and improving reliability were infinitely more difficult. This was evidenced by Golden Ram, a post-development Air Force effort to incorporate all the changes necessary to make Atlas D a reasonably reliable system. This project combined tests of the integrated subsystems with full-fledged operational tests in order to evaluate not only the missile and its related equipment, but the crews that operated it,





and the various procedures adopted for its operational use. Had the pace of development been less frenzied, system evaluation could have been completed and the necessary modifications made before the missile became operational. As it was, Golden Ram disclosed hundreds of shortcomings in the weapon system itself and in the maintenance procedures that were being followed.[3]

(U)- This experience with Atlas D was sobering to all concerned. In December 1961, after eyeing the lengthening list of problems associated with Titan I, General Power warned that the Air Force could not "afford to repeat the Atlas D route of prolonged multiple failures and difficulties." The Air Force could not, he told General Schriever, Commander of the Air Force Systems Command, "stand another Golden Ram."[4]

(U)- Although there was no exact repetition of Golden Ram after each missile system entered service, the Air Force did continue to encounter problems that had escaped detection during research and development. The accepted method of dealing with these was a special modification program (called "update") which might be simple or complex depending on the difficulties encountered. Update became a routine aspect of the missile program, although the Air Force on occasion had to accelerate the modification schedule and engage in so-called "pre-update."

(U)- By August 1962, for example, SAC was having unexpected difficulty keeping Atlas F on alert. This system, in fact, was proving less reliable than Titan I, which had so worried General Power, or either Atlas D or E. Rather than postpone modification until the update scheduled for September

1963, SAC and the Air Force Systems Command combed the list of proposed changes compiled as a result of previous testing and selected for immediate modification 54 items that affected either safety or system reliability. These became the subject of Clean Sweep, a pre-update program. Interrupted by the Cuban crisis of October through December 1962, Clean Sweep succeeded in correcting many of the mechanical shortcomings that had plagued Atlas F.[5]

(u) In spite of Clean Sweep, Atlas F crews continued to find evidence of corrosion and to experience trouble with the air conditioning system that cooled the guidance and flight control components. Routine update, which began early in 1964, attacked these problems but a year had elapsed since the system was declared operational and it still continued to be plagued by hardware deficiencies.[6] Nor were all of Atlas F's troubles confined to missile components. During construction of launch complexes, cracks appeared in the 32 steel rods, each five inches in diameter and 20 feet long, that supported the elevator and other equipment inside the silo, and these supports had to be removed and further tempered.[7]

(u) The principal defect that affected Titan I reliability was a tendency toward engine contamination. During 1962 inspectors found bits of metal and fiber in eight engines. Alterations to protect the missiles against future contamination coincided with routine system improvement work that lasted from autumn 1963 until spring of the following year.[8]

(u) A unique Titan I problem arose at a complex near Larsen AFB, Wash., which was located not far from an extensively irrigated farming region. Irrigation in the area kept the water level near the surface and

soon after completion the Titan silos began leaking. When efforts to pump out the water proved futile, engineers attempted to seal the holes through which the water was entering. Although these repairs failed to prevent all the seepage, they reduced the flow of water sufficiently so that the flooding could be controlled and the affected silos were thus kept in operation.[9]

(U) [redacted] Titan II research and development had been slowed by uncertainties in engine performance, but the most serious obstacle to reliability did not appear until after the weapons were in place in their silos. Tiny leaks appeared in the fuel tanks until, during the autumn of 1963, all but three Titan II's had to be taken off alert for emergency repairs. Source of the problem turned out to be nitric acid--formed by the action of the silo's humid atmosphere on the hydrogen tetroxide used as oxidizer--which caused corrosion and eventual leaking. So serious was the problem that the Air Force directed the installation, prior to the scheduled update, of dehumidifiers inside the silos.[10]

(U) [redacted] Minuteman also encountered difficulties but these were not nearly as severe as those that plagued Atlas and Titan I. The first two flights from Vandenberg AFB were only partially successful. Investigation disclosed that the guidance computer had failed as a result of the passage of electrical current between the re-entry vehicle and the guidance system.[11] Malfunctions also occurred in the engine nozzles. A short circuit in ground equipment at Malmstrom AFB caused a first stage nozzle control unit to overheat and explode within the silo, and tests of Wing II missiles resulted in redesign of the third stage nozzle in order to

lower pressures inside the engine.[12] Despite these difficulties, which were more than offset by ease of maintenance and operational support, Minuteman soon would attain far higher reliability and a much better in-commission rate than the liquid oxygen systems.

Crew Training and Inspections

(U) [redacted] Intended to correct defects in missiles, launching sites, and related equipment, the updating program was but one phase of the intensive Air Force effort to achieve system reliability. Besides remedying mechanical defects within the system, the Air Force had to ensure that missile crews were adequately trained. Training, however, was handicapped by an unavoidable lack of realism. Because of the cost of each missile, most training had to be halted short of launching. Thus, the program inevitably focused on simulated launchings of various sorts and on enforcing maintenance practices designed to insure that the missiles would be ready if a launch order were received.

(U) [redacted] While the Air Training Command provided individual training, SAC assumed responsibility for operational readiness training, which served to produce combat-ready crews. Conducted for the most part at Vandenberg AFB, operational readiness training progressed from specialized individual training to integrated system training as personnel moved from classroom to missile site. Once a crew had completed this training and been declared combat-ready, it received two additional types of instruction. One, recurring training, was scheduled in six-month segments and covered subjects critical to fulfillment of the unit's mission.

The other, corrective training, was administered as needed to cure ailments that appeared during periodic inspections.[13]

(U) [redacted] Initially, after the liquid fueled missiles became operational, no unscheduled operational readiness inspections were held because crews were not sufficiently familiar with the new weapons and SAC was reluctant to remove more than a few missiles at a time from alert. To replace these inspections, General Power approved a system of "shakedowns" proposed by Lt. Gen. John E. Ryan, USAF Inspector General. Limited to one missile per squadron at any one time, a shakedown called for two consecutive successful countdowns of propellant loadings, along with completion of the checks necessary to determine that all subsystems were in working order. Ultimate purpose of the exercises was to identify the minimum actions necessary to maintain launch reliability. However, in attaining this objective the system of shakedowns produced new evidence that liquid oxygen systems had an inherently low countdown reliability. The follow-on operational readiness tests further substantiated this conclusion.[14]

(U) [redacted] Purpose of the operational readiness inspections was to determine wartime effectiveness under realistic operational conditions but without actually launching the weapon. Thus, for Atlas and Titan I, the heart of the inspection was the propellant loading exercise, while for crews of Titan II and Minuteman--both of which had storable fuel--the inspection involved performance of checks necessary to verify readiness to launch. Liquid oxygen missile inspections conducted after the Cuban crisis were extremely disappointing; all those made during January 1963 proved unsatisfactory.[15]

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(U) This intolerable situation convinced General LeMay that "an accelerated maintenance inspection program, including hardware exercises for both the Atlas and Titan systems, is necessary to determine the actual countdown reliability and to establish the proper interval for future exercises." He recognized that such a program would result in "approximately half of our 76 Atlas and Titan I missiles off normal alert for the first 30 days with a rapid increase in capability during the remainder of the exercise." In the event of international crisis, General LeMay assured the Chairman, JCS, the inspection program could be suspended and the missiles returned to alert.[16]

(U) Long Reach, the accelerated inspection program proposed by the Chief of Staff, was conducted from February through June 1963. By pinpointing needed modifications and improving maintenance procedures, it contributed to a slight improvement in the results of operational readiness inspections. Whereas only two of the eight units inspected during the first half of 1963 received satisfactory ratings, three of eight were judged satisfactory during the second half of the year. Long Reach, however, could not change the inherent complexity of Atlas and Titan I missiles, and this complexity made adequate maintenance almost impossible.[17]

(U) Both Titan II and Minuteman scored consistently higher on shakedowns than Atlas or Titan I. More important, Minuteman was doing extremely well in operational readiness inspections; Wing I passed its first inspection in December 1963 and in May of the following year Wing II attained a rating of outstanding.[18]

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Revision of the Operational Test Program

(U) Improved training, thorough inspection, better maintenance, and modification of missiles and other equipment helped improve the reliability of ballistic missile systems. All estimates of reliability, however, were based on a limited number of test firings. To be sure that these estimates, which were used in strategic planning, were reasonably accurate, it was essential that the actual firings represented an adequate sampling of the operational force and were conducted under realistic operational conditions.

(U) In January 1962 Secretary McNamara informed the JCS, Navy, and Air Force of his concern over the lack of valid operational reliability factors for all strategic missiles. The JCS responded by directing the Commander-in-Chief, Atlantic (CINCLANT) and CINCSAC to undertake two new types of tests "for the purpose of obtaining valid operational reliability factors under representative combat conditions." These factors were to be used in preparing the single integrated operations plan.

(U) The first of these tests, called Type III Operational Tests, were "to be conducted by the responsible operational command in as near an operational environment as possible" and had as the "main objective" the "determination of system readiness, reliability, and accuracy." Thus, the difference between prior tests and these operational tests was that the former were designed primarily to improve reliability and the latter to measure it. The second of the new tests instituted by the JCS was Type IV Continuing Operational Tests. The purpose of these was to "insure that the established readiness, reliability, and accuracy are preserved." [19]

(U) The Joint Chiefs' guidance formed the basis for CINCSAC's program to determine and maintain the reliability of all Air Force ballistic missile systems. Procedures were essentially the same for both Type III Operational Tests and Type IV Continuing Operational Tests, although there were differences to suit the characteristics of the system being tested. In general, however, the test began with countdown exercises at the operational site, after which the test missile would be shipped to Vandenberg AFB where the operational crew would actually launch the weapon.[20]

(U) As a result of the additions decreed by the JCS, the complete test cycle for a missile system now consisted of four stages. Research and Development, the first, was the old Category I and II subsystem development and integration tests. Demonstration and Shakedown, the second phase, corresponded to the old Category III Operational Tests. These were followed by Types III and IV, which became known as Operational and Follow-on Operational Tests respectively.[21]

(U) The number of launchings required to establish reliability and make certain that it was being maintained varied with the size of the inventory, the intended lifetime of the system, and also with the viewpoint of different organizations. General Power, who wanted overwhelming evidence of reliability, proposed an accelerated operational test program costing $103.9 million, lasting from fiscal year 1963 through fiscal 1965, and involving the expenditure of seven Atlas D, 22 each Atlas E, Atlas F, Titan I and Titan II, and 34 each Minuteman A and B missiles.[22]

(U) After General Power's proposal was presented to the Air Staff, a special ad hoc committee was formed to consider how to purchase adequate

reliability at the most reasonable cost. Out of its deliberations came a recommendation for some 800 launchings during fiscal years 1964 through 1970 at a total cost of $637 million. After this plan had been coordinated, the Chief of Staff in May 1963 approved a "missile reliability test program" utilizing 848 missiles through 1970.[23] As finally presented to the Secretary of Defense, the Air Force program extended through fiscal year 1969 and called for 751 launchings at a cost of $630.39 million.[24]

(U) [redacted] Subsequently approved by McNamara for planning purposes, the program specified that five missiles of each type would be launched during the demonstration and shakedown phase. Operational tests would number eight for Atlas E, 25 for Atlas F, 12 for Titan I, 25 for Titan II, 25 for Minuteman A, and 50 for Minuteman B and F. Scheduled follow-on operational tests for each type were six per year for Atlas E and Titan I, 12 per year for Atlas F and Titan II, an average of 13 per year for Minuteman A, 40 per year for Minuteman B, and 80 per year for Minuteman F. But, of course, with the withdrawal of the earlier models from the inventory, the launch program was modified eliminating operational testing of those models.[25]

Tests from Operational Sites

(U) [redacted] Closely related to the operational test reliability program was the proposed launching of missiles from operational sites. In 1958, when the ICBM was still under development, the Strategic Air Command recommended against launching Atlas or Titan from operational sites, but

the topic surfaced again after the Air Force had gained experience with these weapons and with Minuteman as well. Although the launch facilities at Vandenberg AFB were as nearly like operational sites as possible, certain additional or modified equipment had to be installed to insure safety, gather test data, and permit repeated use of the launch facility. General Power therefore came to the conclusion that firings from operational sites were necessary to determine system reliability.[26]

(U) Air Force headquarters, although favoring tests from operational sites, was reluctant to use existing facilities until the systems were more reliable. In May 1963 General LeMay approved a compromise: the siting of one future Minuteman squadron at some remote location where tests could be held without danger to population centers or risk of violating foreign territory. Secretary McNamara, however, dismissed this suggestion on the grounds that nothing could be done at some remote site that couldn't be done at Vandenberg. Neither McNamara, the JCS, nor the Air Force favored launching liquid fueled missiles from operational bases until there was greater likelihood of success.[27]

(U) Although the Air Force and JCS were initially reluctant to launch test missiles from operational sites--principally because of safety problems and such political considerations as the passage of missiles over foreign soil--planning continued into 1964. During November of that year, the JCS submitted to the Secretary of Defense a program utilizing operational silos. The plan involved only Minuteman, since the liquid oxygen missiles soon would be withdrawn from the inventory and Titan II, though

it would be retained, had not yet finished its operational testing. The JCS called first for the firing--actually accomplished early in 1965--of a specially modified Minuteman capable of no more than seven seconds of powered flight and a horizontal range of 7,000 feet. This would be followed by a launching that would pass over American territory exclusively and end in the Pacific and, possibly, by launching a missile that would travel over foreign territory.[28]

The Uniform Prediction System

(U) [redacted] The new operational test program could not immediately furnish the sort of strategic planning factors that Secretary McNamara desired. As the Air Force pointed out, missiles could not be rushed through the test cycle. The program, though soundly planned, would not yield immediate results, and for that reason doubts concerning missile reliability would persist for a time.[29]

(U) [redacted] But, meanwhile, realistic planning factors were needed since war planning could not be postponed to await the completion of operational testing. One solution proposed by McNamara was adoption of a method, the Uniform Prediction System, devised by the Weapons Systems Evaluation Group (WSEG), which assigned each missile system a reliability factor based on the amount of testing it had successfully undergone.[30]

(U) [redacted] The Air Force at first opposed this plan, arguing that operational tests would in time provide accurate data and that, for the present, CINCSAC and CINCLANT should retain responsibility for assigning temporary planning factors. CINCSAC, who also served as Director of Strategic Target

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Planning (DSTP), supported the Air Force position, which General LeMay summarized by declaring that the Uniform Prediction System would result in "more conservative factors, but not more valid factors." Validity, insisted the Air Force and its leaders, could come only as the result of operational testing.[31]

(U) [redacted] The Secretary of Defense indicated, however, that he was not questioning the ultimate value of the operational test program. He merely wanted an interim method of calculating the reliability of all ballistic missile systems. The JCS came to accept the need for such a method and therefore recommended adopting the Uniform Prediction System and the initial reliability and accuracy factors based on the WSEG study.[32]

(U) [redacted] Having accepted the Uniform Prediction System, the JCS--the Air Force Chief of Staff included--insisted that the factors derived from it be applied impartially. Thus, they balked at McNamara's suggestion, supported by General Power, that solid fueled missiles deserved a higher reliability factor than was due them at a particular point in the testing cycle. General LeMay warned specifically against any deviation from the chosen system that might inflate the reliability factors for Minuteman.[33]

Debate Over Missile Reliability

(U) Missile reliability as a political issue was not as important as the "missile gap" had been a few years earlier. But differences of opinion within the Air Force and debates involving Secretary McNamara and the 1964 Presidential aspirant Barry M. Goldwater did for a time pique

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the interest of Congress, although the legislators raised no great clamor and apparently were not of a mind to press an investigation.

(U) That Air Force opinion was divided came to light during hearings held by a Senate appropriations subcommittee in February 1964. Secretary Zuckert mentioned a "joint statement," allegedly approved by himself and General LeMay, which asserted that "our missiles, most particularly Polaris and Minuteman, can be depended upon to perform that part of the war plan our planners have assigned them." General LeMay, however, denied that he had approved the statement, which McNamara already had cited in support of his own favorable estimate of missile reliability. Zuckert sought to explain the contradictory Air Force position by declaring that his office had forwarded the statement to OSD on the assumption, since proved erroneous, that all points of disagreement with LeMay had been resolved to the satisfaction of both men.[34]

(U) In subsequent testimony before this subcommittee, General LeMay made it clear that his reservations concerning missile reliability stemmed from the nature of the weapon. "Like any machine," LeMay began, "they don't always work;" but he added that these normal failings could be detected through testing and repaired. "The more you exercise them," he continued, "the more you can find out what items are breaking down, and you beef them up and replace them, and you get better." With missiles, the problem lay in the high cost and irretrievableness of the weapon, which combined to reduce the number that could be tested. As a result, the general did not think "that you are ever going to get to the point

where you have the same confidence in the missile as you have in manned systems where you have a much larger sample." [35]

(U) Senator Goldwater questioned missile reliability in January 1964, about one month before General LeMay's testimony. "I do not feel safe at all about our missiles," said the senator, adding his "wish" that "the Defense Department could tell the American people how undependable the missiles in our silos actually are." When asked for details, he answered that the information was classified and observed that he probably would "catch hell for saying this." [36]

(U) [redacted] At about the time that Senator Goldwater was calling attention to the poor "dependability" of missiles, Secretary McNamara was beginning to employ that same term. In testimony before a House subcommittee, McNamara attempted to show that Minuteman was more dependable than the B-52. When given an opportunity to review the record, the Air Force objected vigorously to the comparison of radically different weapon systems except in a carefully defined situation and recommended that the Secretary amend his testimony to include certain attributes of the B-52--the ability to carry several weapons, for example--that he had not mentioned. McNamara, however, seemed intent upon devising a method of comparing the dependability of disparate systems, and in the autumn of 1964 he still was pursuing this project. [37]

III. PENETRATION AIDS AND RE-ENTRY SYSTEMS

(U) [redacted] The Air Force penetration aids research and development program, begun in 1958 and continued on a limited scale, gathered momentum during 1961 as the result of evidence that the Soviet Union was developing an anti-missile system. Among the agencies involved in this effort were the Ballistic Systems Division, the Designated Systems Management Group, and the Strategic Air Command. Their studies, besides leading to the acquisition of penetration aids for various missile systems, also contributed to a shift in emphasis from penetration aids to re-entry systems. This change enabled the Air Force to unify its approach to the job of piercing Soviet missile defenses.[1]

The Penetration Aids Program

(U) [redacted] Charged in 1961 with the task of deciding what aids were required for American missiles to penetrate Russian defenses, a Ballistic Systems Division panel suggested combining slender re-entry vehicles having small radar cross sections, decoys, and warheads with increased protection against the effects of defensive nuclear detonations. The likelihood of penetration to the target could also be increased, the panel subsequently suggested, by developing a maneuvering re-entry vehicle capable of frustrating attempts at interception based on the predicted trajectory of the incoming warhead.[2]

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(U) [redacted] For its part, the Strategic Air Command recommended a program based on "prudent" intelligence estimates and designed to keep pace with Soviet deployment of operational defenses and with improvements in these defenses. In the immediate future, SAC maintained, its Mk-11 re-entry vehicle, used with Wing I Minutemen, would escape detection by Soviet radar. Between 1965 and 1968, however, Soviet defenses seemed certain to improve and to increase in coverage, so that penetration aids would be required. SAC therefore recommended against mounting these aids on Atlas D or E, which probably would be the first missiles retired from operational service. Atlas F and Titan I, neither of which seemed destined for a long operational career, should be fitted with mounts that could, if Russian defensive progress so dictated, carry decoys. Since Titan II and Minuteman would be America's strategic mainstay during the late 1960's, SAC urged that the Air Force concentrate on equipping these systems with decoys and developing re-entry vehicles likely to escape detection by radar and to survive the effects of defensive nuclear weapons.[3]

(U) [redacted] To obtain more information on the problem, Secretary Zuckert directed his Assistant Secretary for R&D to form an ad hoc committee to review probable Soviet progress in the field of anti-missile defenses. The committee, after completing its study, reported in October 1961 that SAC's recommendations were valid. It recommended the Air Force focus its attention on those weapon systems that would have to penetrate a stronger Soviet defensive network: Titan II, with the Mk-6 re-entry vehicle and decoys; Minuteman, with Mk-11 and appropriate decoys; and

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the development--for use if needed--of penetration aids for Atlas F and Titan I. The committee favored abandoning work on penetration aids for Atlas D and E and Minuteman A and replacing the latter with Minuteman B missiles.[4]

(U) [redacted] The Office of Secretary of Defense in the meantime had expressed concern over the rising cost of the penetration aids program, which had increased from an initial estimate of $183 million to a proposed $232 million for fiscal year 1963. To reduce costs, Secretary Zuckert in February 1962 approved in principle a development program that concentrated on Titan II and the later-model Minuteman and did not exceed $183 million for fiscal year 1963.[5] The purpose was to acquire effective decoys and techniques "for the later (1966-1970) and perhaps truly critical time period."[6]

(U) [redacted] Unlike Secretary Zuckert, the Director of Defense Research and Engineering favored the installation of penetration aids on Atlas F, an undertaking the Air Force wished to avoid, unless absolutely necessary, because of the costs. Rather than fit decoys on the entire 72-missile force, or otherwise modify it, Air Force headquarters proposed equipping only a part with penetration aids. The Secretary of Defense endorsed this proposal, directing that the devices be fitted to 25 to 50 percent of the Atlas F force, the exact fraction to depend upon the operational situation.[7]

(U) [redacted] The penetration aids under consideration at this time were aimed at escaping detection by defensive radar, either by presenting an exceptionally small target, by masking the incoming vehicle, or by a combination

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of both. Among the methods of distracting attention from the re-entry vehicle were the release of decoys having a similar radar image, the scattering of chaff to clutter the radar screen, or the use of electronic devices for that purpose. Also possible was the jettisoning of the stage to which the re-entry vehicle was attached, the so-called tank, in such a fashion that it would break up upon entering the atmosphere and, in effect, serve as chaff. A related penetration technique useful with re-entry vehicles having a small radar image was the random displacement, possibly using retro rockets, of the tank so that it would veer off when the vehicle was 20 to 50 miles from the target. In this way the tank, which had an unavoidably large radar profile and tended to follow the same ballistic track of the re-entry vehicle, could not be used as an offset aiming point for interception of the re-entry vehicle.[8]

(U) Besides discussing penetration aids, the Air Force was at the same time studying the best way to approach the problem of making reasonably certain that its missiles could pass through Soviet defenses. During the summer of 1961 a panel assembled by the Ballistic Systems Division recommended merging research into penetration aids with the study of re-entry technology and treating the two topics as aspects of an integrated re-entry system. The proposed re-entry system would include the vehicle and warhead, hardened for protection against the effects of defensive nuclear blasts, and whatever penetration aids were considered necessary.[9]

(U) At the time this recommendation was made the Air Force was pursuing a modest re-entry vehicle research program that centered upon two possible developments: an aeroballistic vehicle capable of re-entering

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the atmosphere at a shallow angle, utilizing aerodynamic lift, and then resuming its ballistic plunge toward the target; and a maneuverable vehicle. The former was intended primarily to extend the range of intercontinental missiles without increasing the size of the rocket; the latter was to confuse defenses and obtain the greatest possible accuracy. The cost of the undertaking was limited to $27.4 million in fiscal year 1962, but expansion was soon to come.[10]

(U) [redacted] In March 1962 General Schriever, AFSC Commander, advised the Chief of Staff that "the scientific community and high levels of OSD" were critical and concerned about the Air Force's "apparent lack of urgency, vigor, and management attention to the ballistic missile penetration problem." In response to this criticism, Schriever recommended adopting a ballistic missile re-entry system concept, under which the "attack element" of a missile system would be treated as "an entity which can be modified or replaced to meet the changing defense environment." The system approach would, according to General Schriever, provide for the "use of a broad technological base" and permit the "exploration of new ideas and methods at minimum cost and in a time frame consistent with requirements," accomplishing these objectives "with only minor effect on the basic payload carrier element thus preserving the integrity of the major cost items of the system and extension of the useful life of a system."[11]

The Advanced Ballistic Re-entry Systems Program

(U) [redacted] During the spring of 1962 Schriever's recommendation was studied and adopted by the Air Force. In September it was implemented

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as the Advanced Ballistic Re-entry Systems (ABRES) program. AFSC was made responsible for guiding, planning, and setting the technological goals of the program to insure the continued effectiveness of the ballistic missile force in spite of a growing defensive threat. Finally, in May 1963, the Director of Defense Research and Engineering designated the ABRES program as the Department of Defense program for advanced development of re-entry techniques and devices. As a DOD undertaking, ABRES would support both Navy and Air Force ballistic systems.[12]

(U) [redacted] Among the projects in the ABRES program was the development of an aeroballistic vehicle for Minuteman, preferably one capable of executing a final maneuver at the target. Should problems in terminal guidance and aerodynamics be solved, such a vehicle would be useful with almost all intercontinental ballistic missile systems. The potentially wide use of an aeroballistic vehicle prompted the Air Force to divorce the proposed system from Minuteman and to pursue research in terminal guidance and re-entry maneuvers independent of any particular ICBM.[13]

(U) [redacted] Besides conducting research into maneuvering vehicles as part of the ABRES program, the Ballistic Systems Division sought to acquire a re-entry system for the improved Minuteman. The quest became imperative when it appeared the Mk-11, used with Minuteman I, would be unable to withstand the stresses that would be placed upon it by the longer range LGM-30F missile. However, the Air Force finally decided to modify the existing Minuteman vehicle, working toward a Mk-11A that would prove satisfactory with Wing VI Minuteman, while simultaneously beginning development of the Mk-12, a new re-entry system.[14]

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[redacted] Of the two programs, Secretary Zuckert was far more enthusiastic about the Mk-12, the so-called "twin," which promised far greater versatility.

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Both were to be hardened against the effects of nuclear antimissile weapons and to carry chaff, decoys, and electronic countermeasures.[15]

[redacted] Such was the plan in the summer of 1962; by year's end, however, the above scheme had been abandoned. Instead, the Air Force proposed to develop two distinct Mk-12's, heavy and light.

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The Air Force intended the heavy vehicle for attacking hardened but undefended targets and the light one for penetrating enemy defenses to destroy soft, area targets.[15]

[redacted] In January 1963 Dr. Brown, DDR&E, approved beginning work on the heavy as well as the light version. Development, however, was slow in getting started and in April he urged giving precedence to Mk-12(L).

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*See Chapter IV.

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(U) [redacted] The Air Force, however, had begun to lose interest in the very model that Dr. Brown had come to favor. According to a summary prepared within the Air Staff, the principal reason for going ahead with development was that "if we attempt to cancel Mk-12(L) we are sure to lose Mk-12(H)." Nor could the Air Force defer work on the heavier vehicle, which had become mired in technical uncertainty, without risking its cancellation.[17]

[redacted] The overriding difficulty was the development of a light, powerful warhead for Mk-12(H).

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[redacted] Neither was satisfactory and development ground to a halt.[18]

[redacted] In the meantime, development of the Mk-12(L) was moving forward.

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[redacted] It appeared, moreover, that minor changes would permit use of this re-entry vehicle with improved versions of Polaris. In January 1964 the Air Force and Navy therefore agreed on a joint management plan for Mk-12(L). Under this arrangement, the Air Force exercised over-all executive management, while the Navy helped design and test the common system.[19]

(U) [redacted] Work on the Mk-12 was contemporaneous with the development of a modified Mk-11 better able to penetrate enemy defenses and suitable

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for use with both LGM-30B and LGM-30F. In spite of the emphasis on Mk-12, delivery of the first Mk-11A's, for service with Minuteman Wing V, took place in June 1964.[20]

(U) The ABRES program, besides benefiting from experiments conducted at the Eastern and Western Test Ranges, had its own test facility, a firing range with a launching site at Green River, Ut., and impact area at White Sands, N.M. Four-stage, solid-propellant Athena rockets carried scale models of re-entry vehicles which were tracked by radar. The first of a scheduled 77 launchings took place on 10 February 1964, but an electrical short circuit caused the missile to crash halfway to its intended impact area. A second launching also proved unsuccessful, in this case because winds threatened to drive the missile off course and forced its destruction. Finally, in July 1964, a test was carried out successfully.[21]

(U) In summarizing the achievements of the ABRES program, the Ballistics Systems Division cited advances in both technique and equipment. "Impressive progress" had been made, for example, in "reduction of radar observability by use of the slender body concept;" future re-entry vehicles would, in other words, present a less distinctive radar image. The Athena program was judged to have "confirmed the economy of subscale testing." ABRES was contributing to development of the Mk-12 system and to research into aeroballistic and maneuverable re-entry vehicles. "Significant progress" also was being made in "heat shield development, re-entry behavior, and chaff effectiveness."[22]

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(U) [redacted] Through fiscal year 1964 the total obligating authority for ABRES had amounted to $277.9 million. To continue the program, the Air Force sought $158.3 million for research, development, testing, and evaluation for fiscal year 1965 and $2.5 million for military construction. Requested for fiscal year 1966 were $170 million for the former and $9.8 for the latter.[23]

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IV. THE MOBILE MID-RANGE BALLISTIC MISSILE

(U) [redacted] The MMRBM program had origins in a requirement established by the Supreme Allied Commander, Europe, Gen. Lauris Norstad, who in 1960 recommended that such weapons be provided to defend NATO. Norstad's requirement was studied in some detail by various agencies of the U.S. Government, including the Air Force, Navy, JCS, OSD, and Department of State. On 16 December 1960, after the National Security Council had reviewed and approved the MMRBM concept, Secretary of State Christian A. Herter informed a NATO ministerial conference meeting in Paris that the United States was prepared to provide land and sea-based Polaris-type missiles to help meet future defense needs.[1]

[redacted] Earlier, in June 1960, the Air Force had asked OSD for funds to initiate development of a land-based mid-range missile. Although the JCS concurred in the requirement, because of disagreement how to meet it the Secretary of Defense deferred a decision.

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Preparing a Development Plan

[redacted] On 3 October Secretary McNamara announced his firm support for a land-based missile. "There is an urgent requirement," he informed

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Secretary Zuckert, "to develop a highly accurate and reliable mobile weapon with which theater commanders can destroy nuclear military forces which oppose them."

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[redacted] Based on this guidance, the Air Force prepared and on 31 October submitted to OSD a preliminary development plan which incorporated the characteristics delineated by McNamara. The Air Force requested an allocation of $27.8 million to begin development of the system.[3]

(U) [redacted] After OSD reviewed the plan, on 29 December 1961 McNamara authorized the Air Force to proceed with the program with certain revisions. He asked that the development plan be changed to provide for a missile suitable for both land or sea deployment, rather than for land usage only. In this connection, he specified that the Navy would participate in the program to insure that the MMRBM would be adaptable "to the surface ship mode." He approved using a two-star stellar inertial guidance system in the missile "in order to achieve a minimum CEP consistent with the sea environment for surface ship deployment." To begin development, McNamara released $6.5 million to the Air Force, stating that Congress would be asked to provide $100 million in fiscal year 1963 funds, half of which would be spent during that year.[4]

(U) [redacted] Seeking to save development funds, Secretary Zuckert asked the Air Staff to evaluate the practicability of developing a stellar inertial guidance system suited to both improved Minuteman and the mid-range weapon.

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The Designated Systems Management Group voiced doubts that a single device could be adapted to two markedly different systems and this opinion was borne out by studies made by the Ballistic Systems Division. Zuckert thereupon accepted the division's recommendation that distinct guidance systems be developed for each, but he also directed that common components should be used wherever possible.[5]

(U) [redacted] Although McNamara approved the development program, a delay developed during January and February 1962 when Dr. Brown directed the Air Force to institute a number of basic changes in its procedures before deciding on a specific MMRBM system. He asked that new studies be undertaken to define more completely system design, management procedures, schedules, and other program details. These studies were to be part of a Phase I or program definition phase, whose purpose was to make sure the projected system was feasible. Despite Air Force objections, which Secretary McNamara overruled, Phase I was initiated and lasted until June 1963.[6]

(U) [redacted] In the meantime, Air Force planners sought to define and justify how the MMRBM's would be employed in Europe. State Department personnel were briefed at their request on the entire concept and particularly on the command and control aspects. In a study on the MMRBM, the Air Force argued that reliance on a missile deterrent based in the United States was an "infeasible course" since prudence seemed to require "that greater care be exercised to avoid automatic escalation of any theater conflict into all-out intercontinental war." A suitable safeguard

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against this danger, the Air Force said, would be the mobile medium-range system, distinct and geographically separate from the American-based intercontinental missiles. Used in conjunction with Polaris submarines, such systems could do a better job of protecting NATO than could intercontinental weapons alone and do so with less risk of escalation.[7]

(U) [redacted] Unfortunately, certain political difficulties arose--such as NATO governments' generally negative attitude to the idea of basing the MMRBM on their soil, which led Defense and Navy officials to consider that ship-based missiles might be the only feasible deployment of the new system. Since the United States had already suggested to its Allies the possibility of forming multinational NATO fleet units, the Navy proposed to McNamara that the MMRBM would be well suited for use by such organizations and recommended it be given charge of the development program. McNamara, however, rejected the Navy proposal, apparently to avoid disrupting the Air Force's program definition phase, just getting under way.[8]

[redacted] The JCS, too, was examining the probable deployment of the mid-range missile, and in May 1963 it completed its study. The JCS endorsed the usefulness of the proposed weapon, citing a "world-wide requirement for MMRBM's, both land and sea-based."

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A Reprieve for the Program

(u) [redacted] General statements such as this could not, however, conceal the absence of any agreements by which a foreign power accepted the stationing of this missile on its soil. Testifying before a House subcommittee on defense appropriations, Secretary McNamara admitted that "we see no clear operational requirement for it and no definite deployment plan," but he said that he nevertheless was "personally...anxious that we pursue this development as an insurance program."[10] This "anxiety" was not contagious, for the House on 26 June 1963 accepted the recommendation of its appropriations committee to reduce by $100 million the $143.1 million that McNamara had requested for the mobile mid-range program.[11]

(u) [redacted] An Air Force request that the House action be contested was rejected by OSD. Instead, after discussing the matter, Secretaries McNamara and Zuckert agreed to proceed with development, using the appropriation for stellar inertial guidance research and the amount provided for the missile system proper--a total of about $58 million. In spending this amount, emphasis was to be placed on those subsystems that had innate value. Guidance, therefore, would receive $15 to $20 million, command and control $10 to $15 million, but MMRBM studies no more than $5 million.[12]

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(U) OSD willingness to accept the imminent reduction in the program was made apparent in late August by Deputy Secretary Roswell L. Gilpatric during an appearance before the Senate subcommittee studying the defense budget. In contrast, the Chairman of the Joint Chiefs of Staff on the same day testified that the weapon was needed and urged restoration of the money that the House had pared away. Sen. Carl Hayden, Chairman of the Appropriations Committee, and Sen. Richard B. Russell, Chairman of the Armed Services Committee, promptly asked Secretary McNamara if the House action had caused the planned reductions in the development effort and if, assuming the funds deleted by the House were restored, the Department of Defense would proceed with the next phase of development. The Secretary of Defense answered yes to both questions, whereupon the Senate approved the restoration of $60 million. In conference, however, the House succeeded in reducing this sum to $30 million, so that a total of $73.1 million finally was appropriated.[13]

(U) As a result of this compromise almost $100 million was available for work on the weapon and its major subsystems. For fiscal year 1964 the Air Force could count on $73.1 million appropriated for the program in general, $13.8 million for stellar inertial guidance development, and $6.9 million for military construction. On the basis of what Congress had made available at this time, Secretary McNamara expected about $110 million would be provided for fiscal year 1965 and, if deployment seemed likely, $200 million for fiscal year 1966.[14]

The Program Abandoned

(U) [redacted] Although funds were at last available, DDR&E in November 1963 hinted of troubles to come. "Uncertainties in MMRBM deployment" and "budget restraints anticipated during the years ahead" had persuaded him that a modified program "designed for minimum cost and risk by providing an adequate performance margin is more prudent even if it results in some loss of range." [15]

(U) [redacted] This willingness to abandon longstanding objectives, together with a slowness in releasing the funds Congress had made available, were, as the Air Force Systems Command pointed out, frustrating the efforts of contractors.[16] This frustration, in turn, was a symptom of impending collapse of the program. OSD had yet to approve a plan of deployment, and the absence of such a plan, combined with NATO disinterest, was cooling the enthusiasm of those legislators who favored developing the weapon. For example, Senator Russell, who just a few months earlier had helped keep the program alive, observed during Senate hearings held in February 1964 that "this MMRBM" left him "very, very cold." [17]

(U) [redacted] This sort of reaction dramatized the need for further evidence that the weapons had a useful role and, if developed, would be deployed. The JCS, as a result, directed the Joint Staff to study the "national requirement" for a mid-range weapon, as distinct from the NATO requirement. But after the study was completed, the services split over whether it actually had proved, as the Air Force said, that there was

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a need for the mobile missile. The study was returned to the Joint Staff for further work.[18]

(U) [redacted] In reporting that the study was being revised in the hope of its gaining acceptance by all the services, the JCS advised McNamara on 27 June 1964 that they would support whatever continuation of development was required to "preserve the option to proceed with it as a weapon system." It suggested that NATO's lack of enthusiasm for the mid-range missile might stem from misunderstandings about the proposed system, for the United States had been slow in releasing appropriate studies to the NATO partners. The JCS therefore recommended that McNamara make a determined effort to provide West European military and political leaders with adequate information on the characteristics and proposed operational role of the mobile mid-range weapon.[19]

(U) [redacted] While the JCS was attempting to establish a national requirement--an undertaking begun in February and not yet finished in June--the Air Force, at McNamara's request, attempted to sell the program to a Congress that had grown indifferent, if not hostile.[20] The absence of a deployment plan probably did most to disarm Secretary Zuckert's arguments in favor of continued development.

(U) [redacted] Of the $110 million requested for the fiscal year 1965 program, the House of Representatives was willing to provide only $75 million, an amount that the Senate slashed to $40 million and earmarked for development of a stellar inertial guidance system. Even though McNamara declared

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that this reduction would doom the program, the House accepted the Senate's revisions. On 31 August 1964 DDR&E formally advised Zuckert that the development of a mobile mid-range ballistic missile had been terminated. The effort to interest NATO leaders in the weapon was abandoned.[21]

NOTES

CHAPTER I

1. Rprt(S) of USAF Bal Msl Progs including Site Activation, as of 25 Jan 62, in OSAF 5-62, vol 1.

2. Chart based on Jacob Van Staaveren, USAF Intercontinental Ballistic Missiles, Fiscal Years 1960-1961 (AFCHO, 1964) (S-RD-NOFORN), pp 8, 38; USAF Current Status Rprts (S-NOFORN), Dec 61, May 62, Mar 64; D/Sys Acquisition, Summary Rprt on USAF Ballistic Missile Program (S-RD), 15 Feb 62, pp 15, 39-43, in AFCHO files.

3. Atch (S) to ltr, Acting D/Plans to DCS/Plans and Ops, 2 Nov 63, subj: Minuteman Prog Reappraisal, in D/Plans RL(64)49-3; Hist (S), D/Ops, Jan-Jun 64, pp 89-90.

4. Hist (S), 1st Strategic Aerospace Division, Jan-Jun 64, vol 1, pp 37-38.

5. D/Mgt Analysis, USAF Selected Statistics (S-RD), in AFCHO; Hist (S), D/Ops, Jan-Jun 64, pp 89-90, 92-93.

6. Hist (TS-RD), D/Plans, Jan-Jun 63, pp 157-59; Jul-Dec 62, pp 165-67; Hist (S), D/Ops, Jan-Jun 62, p 112; Jul-Dec 62, p 104.

7. Van Staaveren, pp 38-39; DOD Annual Rprt for Fiscal Year 1963 (U), p 249; Atlas F Weapon System (S), 3 Jul 64, in OSAF 145-64.

8. Hist (S), D/Ops, Jan-Jun 62, p 118; Atlas Sys Ofc, Atlas Program Status and Significant Activities (S), 19 Nov 62, in D/Plans RL(62)49-3; Hist (S-RD), D/Opl Rqmts, Jan-Jun 64, p 44.

9. Atlas F Weapon System (S), 3 Jul 64, in OSAF 145-64.

10. See Warren E. Greene, The Development of the SM-68 Titan (S-RD-NOFORN) (Hist Ofc, Dep Comdr for Aerospace Systems, AFSC, 1962).

11. Mins (S) of 61st DSMG Mtg, 17 May 63 in OSAF 175-3; Msgs (S) 93905, C/S USAF to SAC, 16 Apr 63, and AFIN 44482, SAC to C/S USAF, 22 Apr 63; CSAFM 298-63 (S) for the JCS, 7 Jun 63, subj: Accelerated ICBM Opl Test and Eval Prog, atch to JCS 1620/400, 8 Jun 63; ltr (S), Chief, Force Plans Div, D/Plans, 7 Jan 63, subj: Phase Out of Ballistic Msls, in D/Plans RL(63)49-3, sec 1.

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GLOSSARY

ABRES	Advanced Ballistic Re-entry Systems
AFB	Air Force Base
AFSC	Air Force Systems Command
ALCC	Airborne Launch Control Center
App	Appendix
ARPA	Advanced Research Projects Agency
Asst	Assistant
Atch	Attachment
BSD	Ballistic Systems Division
CEP	Circular Error Probable
CINCLANT	Commander in Chief, Atlantic
CINCPAC	Commander in Chief, Pacific
CINCSAC	Commander in Chief, Strategic Air Command
CJCS	Chairman, Joint Chiefs of Staff
CM	Chairman's Memorandum
C/S	Chief of Staff
CSAFM	Chief of Staff Air Force Memorandum
DCS	Deputy Chief of Staff
Dep SOD	Deputy Secretary of Defense
DDR&E	Director of Defense Research and Engineering
Dec on	Decision On
DOD	Department of Defense
DSMG	Designated Systems Management Group
DSTP	Director of Strategic Target Planning
Encl	Enclosure
Hist	History
ICBM	Intercontinental Ballistic Missile
IELES	Improved Encoded Launch Enable System
IRBM	Intermediate Range Ballistic Missile
JCS	Joint Chiefs of Staff
LEES	Launch Enable Execute System
Ltr	Letter
MMRBM	Mobile Mid-Range Ballistic Missile
MRBM	Mid-Range Ballistic Missile
Msl	Missile(s)
NATO	North Atlantic Treaty Organization

G L O S S A R Y (Cont'd)

Ofc	Office
OSAF	Office of Secretary of the Air Force
OSD	Office of Secretary of Defense
PCP	Program Change Proposal
Prog	Program(s)
PSPP	Proposed System Package Plan
R&D	Research and Development
RDT&E	Research Development Testing and Evaluation
Rprt	Report
SAC	Strategic Air Command
SAF	Secretary of the Air Force
SecArmy	Secretary of the Army
SecNav	Secretary of the Navy
SIOP	Single Integrated Operation Plan
SM	Secretary's Memorandum
SOD	Secretary of Defense
WSEG	Weapons Systems Evaluation Group

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