A HISTORY OF THE

HUNTSVILLE DIVISION

15 OCTOBER 1967 - 31 DECEMBER 1976

United States Army
Corps of Engineers
...Serving the Army
...Serving the Nation

A History of the Huntsville Division,
U.S. Army Corps of Engineers
1967 - 1976

Prepared

by

James H. Kitchens, III

6 September 1978
HUNTSVILLE, ALABAMA

Dedicated To
Past and Present Employees of the
Huntsville Division, U.S. Army Corps of Engineers.

VITA

James Hosea Kitchens, III, was born in Austin, Texas, on 16 November 1942, the eldest son of Mr. and Mrs. James H. Kitchens, Jr. A long-time resident of Louisiana, he attended public school in Baton Rouge and Alexandria and graduated form Ruston High School, Ruston, Louisiana, in 1960. Having graduated with a B.A. in History from Louisiana Polytechnic Institute in 1965, he entered the Graduate School of Louisiana State University in the fall of that year to study European History. He earned a M.A. from L.S.U. in August 1967 and the Ph.D. in December of 1974. During 1970-1971 he was a Temporary Instructor in the Department of History, the University of Alabama in Huntsville, and in September 1975 he rejoined the Department as Adjunct Assistant Professor. In April 1978 Kitchens was appointed to the Department of History, the University of Alabama in Birmingham, as Assistant Professor of History, where he will teach Western Civilization and courses in Early Modern Europe.

PREFACE

The requirement for a history of the Huntsville Division, U.S. Army Corps of Engineers originated in a communication of 22 December 1976 from the Office of the Chief of Engineers to the Division, by which it was directed to proceed with the preparation of a history of its activities from its inception to date. The directive maintained that this history should be prepared by "a professional and competent historian," by preference from without the Division organization, and that it should generally conform to similar histories prepared or being prepared by other divisions and districts. The essay that follows is the outgrowth of this directive. During early January 1977 the Division staff conducted contractual discussions with the author toward the preparation of a history. On 11 February a "Proposal for a History of the Huntsville Division, US Army Corps of Engineers" was submitted for the Division's approval, and on 15 February 1977 Purchase Order DACA87-77-M-1096 was executed to produce the text. The Prologue was completed on 15 July 1977 and the final draft in early September 1978.

The Huntsville Division History takes its place as one of a loose series of official or quasi-official unit histories of the Corps' divisions and districts. It is intended to provide the reader with a narrative history of the U.S. Army Engineer Division, Huntsville (USAEDH) from its authorization and mobilization in October 1967 through the calendar year 1976. In conformity with the OCE directive of December 1976 and good historical methodology, I have attempted to create a document that serves official purposes but is unclassified. It is intended primarily for readers within the Corps of Engineers--especially those of the Division itself--but it is accessible to, and should be useful for, the public at large. My philosophy throughout has been to provide a lucid, reliable, and readable assessment of the Division's mission assignments and how it operated to fulfill them between 1967 and 1976.

These Division missions were diverse and complex, dictating that this essay should combine conventional chronological reporting with a topical approach in the latter sections. From 1967 until late 1971, the Division was exclusively dedicated to one mission, making a chronological treatment of the period natural. During the years 1972-1976, however, the Division was engaged in three or four missions simultaneously, and for reasons of clarity I have thought it better to adopt a topical description for each of these. Regardless of organizational form, I have tried to strike a happy medium among functional, technological, constructional, engineering, managerial, financial, and administrative elements.

The first and largest mission of the Huntsville Division was the construction of ballistic missile defense facilities in the SENTINEL and SAFEGUARD programs. Because the Division's origins were directly attributable to the BMD deployment decision of 1967, and because that mission was a highly technical one still generally mysterious to many readers, I have included a Prologue explaining something of the technical background, national policy, and climate of opionion bearing on the period up to mobilization in 1967. The ABM Treaty of May 1972 essentially foreclosed the mainstream of BMD work with the completion of only one site in North Dakota, but from about this time on the Division was required to undertake other missions in which technical and managerial expertise were at a premium. These later assignments involved contractual support for the USPS' Bulk Mail Centers, management of modernization of the facilities of the Army's munitions production base, and engineering responsibilities in conjunction with ERDA and NASA. Though short in years, a history so diverse and complex has necessitated that personalities be subordinated to a picture of the Division functioning as a unit and as a team dealing with its challenges. Nevertheless, I have endeavored to notice changes in command, fluctuation in manpower levels, shifts in key personnel, and the achievements of outstanding individuals. In all cases I have preferred a general synthesis of events to an unmanageable--and, I think, inappropriate--morass of minutiae.

The methodology employed in this study has been quite conventional, with one exception. During the spring and summer of 1977 the relevant documents were collected, surveyed, and analyzed in traditional fashion. A chapter-by-chapter outline based on preliminary research had been provided in my initial Proposal, and the composition was a matter of filling in this basic skeleton as required. The interested reader will find more information about the sources utilized in the annotation appended to the Bibliography. In addition to the usual documents, a fortuitous set of circumstances, including continuous residence in Huntsville and office space on Division premises, have also tended to facilitate intensive exploitation of oral history techniques. During the project the author was able to continuously consult with Division personnel and to question them at length on any conjectural or controversial points. The individuals contacted ran the gamut of Divisional specialities and activities; those interested will find their names and positions listed in appropriate footnotes and in the Bibliography. Their gracious and unstinting cooperation in the interview process has, I am sure, immeasurably eased the digestion of difficult documentary material and greatly enriched the finished product.

The final draft has also profited enormously from the guidance of the Division's Historical Committee. This committee was constituted on 5 July 1977, when eight members of the staff were chosen to review drafts as they were submitted and to offer critical comments or suggestions as required. To Gaines P. Gravlee, Engineering Division; Russell M. Hill, Engineering Division; James I. Hardy, Construction Division; James W. Reynolds, Procurement and Supply Division; Dewey A. Rhodes, Jr., Personnel Office; Gerald D. Dupree, Office of Comptroller; and Marie R. McGahee, Office of Counsel, I wish to extend sincerest thanks for encouragement and assistance so generously extended.

In the compilation of the manuscript I have incurred many other debts of gratitude, some of which may be acknowledged but none of which can be adequately repaid. Above all my thanks go to Public Affairs Officer, George G. Stewart, who chaired the Historical Committee, supervised the work, and remained counselor and good friend through it all. I also wish to thank Marie Spivey, Librarian of the Corps of Engineers Waterways Experiment Station, for lending documents not available elsewhere; to Col. John Lillibridge (USA, Ret.), Grand Forks Area Engineer, for furnishing a taped commentary on his experiences in North Dakota; and Marie McGahee, Office of Counsel, for help beyond the call of duty among the records of the Office.

Birmingham, Alabama — James H. Kitchens, III

6 September 1978

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PROLOGUE

The Huntsville Division, U.S. Army Corps of Engineers, came into existence on 15 October 1967 as an organization exclusively dedicated to the task of designing and constructing the facilities needed for the deployment of the Army's SENTINEL Ballistic Missile Defense System. Unlike other Corps divisions and districts, Huntsville Division had no other military engineering functions, no civil works responsibilities, and no geographic boundaries. In this respect it was wholly unique within the Corps. Today, nine years after its mobilization, the Division remains an organization possessing qualities unparalleled within the Corps. Though its missions are now manifold, the Division's highest priority remains the design and construction of United States ballistic missile defense facilities. This and other factors have preserved its universal geographic competence. Because it was the Division's birthright, and because of the singularly complex technical, military, political, and diplomatic considerations surrounding ballistic missile defense, this Prologue offers a backdrop to the genesis of the SENTINEL System and the formation of the Division.

The United States' decision to deploy the antiballistic missile system that later became SENTINEL, the SAFEGUARD, first became public knowledge on 18 September 1967 when Secretary of Defense, Robert S. McNamara revealed it in an afternoon speech to United Press International editors and publishers in San Francisco, California. At that time the decision by President Johnson was only a few days old, and the immediacy of the presidential action put the Secretary in an awkward position. Originally he was to have presented the case for non-deployment of such an ABM system, a policy which he personally advocated and one which all Administrations had consistently followed before 1967. At the last minute, however, President Johnson had suddenly decided to go ahead with construction, and McNamara was caught in the shifting gears of policy change.[1] Hence, he devoted most of the first thirty minutes and nineteen pages of his speech to relations with the Soviet Union and to the futility of trying to build an impenetrable shield which would guarantee the protection of the American population against a massive Soviet attack. The chief difficulties with such a "thick" ABM system were not, he said, in the immense cost, but in the certainty of a corresponding Soviet reaction which would result in no appreciable improvement in security for America. "Instead," he continued, "realism dictates that if the Soviets elect to deploy a heavy ABM system, we must further expand our sophisticated offensive forces, and thus preserve our overwhelming assured destruction capability."

Then McNamara abruptly turned to the Chinese. "China has," he noted, "been cautious to avoid any action that might end in a nuclear clash with the United States -- however wild her words -- and understandably so. It would be insane and suicidal for her to do so, but one can conceive conditions under which China might miscalculate." That possibility was magnified by the recent Chinese thrust towards a workable ICBM. That being the case, "there are marginal grounds for concluding that a light deployment of U.S. ABM's against this possibility is prudent." Such a "thin" deployment would be relatively inexpensive--about $5 billion--and would be far more effective against a weak Chinese threat than a larger system would be against the Soviets. The Secretary thought there would be other advantages, too. It would reinforce the credibility of American Asian policy at a critical time by deterring Chinese nuclear blackmail. It would also have the secondary benefit of adding some defensive coverage to MINUTEMAN ICBM sites, coverage which would increase the offensive worth of these missiles. This protection could later be expanded if needed and if found feasible. Finally, such a limited ABM system would shield the United States against an accidental launch by any other nuclear power. Having reviewed these considerations, the Secretary concluded, "we have decided to go forward with this Chinese-oriented ABM deployment, and we will begin actual production of such a system at the end of this year."[2]

McNamara's September 18th speech to the journalists gave no further details about the future ballistic missile defense (BMD) sytem, possibly because few specifics had then been decided. The Secretary only hinted at cost and said nothing at all about the number of sites, the type of facilities and installations, the schedule of deployment, or the nature of the system's weapons. He had not even referred to the system-to-be by name, and as more information percolated out from official sources over the next few weeks, it was usually called the Deployment Model 1-67 System. Not until 3 November 1967 did Department of the Army General Order No. 48 officially christen the infant system SENTINEL, a name it would keep until early 1969 when a change in the mode of deployment brought with it the label SAFEGUARD.[3]

The path leading to the Johnson Administration's decision to deploy the SENTINEL Ballistic Missile Defense System stretched back over twenty-three years to the last months of World War II and the first use of long-range rockets for military purposes. From the late 1930's German scientists and engineers in particular had been alert to the possibilities of developing large liquid fuel rockets for various uses in peace and war. With the coming of war in 1939, the military potential of rockets began to get more attention and resources, even though those designs tested showed many problems, not the least of which was a dangerously mercurial temperament. With deterioration in the Axis cause in 1943 and early in 1944, Hitler and his generals pressed hard for the employment of "miracle weapons" to save the Third Reich. Among the most novel and terrifying, though not necessarily the most effective, of these secret weapons was the V-1 "Buzz Bomb," a missile powered by a ramjet engine that began to strike England from Dutch and French bases in 1944. Because of their slow speed and raucous flight, "Buzz Bombs" were relatively easy to identify and deal with. This was not the case with the V-2, a true liquid fueled rocket with a one-ton warhead, gyroscope guidance, and a range of about 180-190 miles. The V-2 attained a velocity of several thousand miles per hour and an altitude of many miles before plunging to earth without warning. The first of these missiles was fired against Paris on 6 September 1944, and two days later London was struck by the opening explosions of an erratic but terrifying barrage of over 1,100 V-2s that would last almost to war's end. With the V-2s long range and hypersonic speed, the major characteristics of the modern ICBM vehicle were first achieved and operationally tested.[4]

The second major element in the modern ICBM also came into existence as a result of the Second World War. The first nuclear explosions used in anger at Hiroshima and Nagasaki helped end the conflict, and it did not require much imagination to envision the staggering consequences of marrying the atomic bomb to a missile delivery system. After World War II, both American and Soviet scientists were well aware that this, the "ultimate weapons system," was within reach, but creating it took more than a decade. For their part, American technical and military men basked in the luxury of a substantial technological lead and placed their reliance on the United States' nuclear monopoly and a superior strategic bomber fleet. The Soviet Union, gambling on a great leap forward to achieve parity, worked hard on building an A-Bomb and powerful load-lifting rocket motors. Both sides were faced with enormous technical obstacles: reliability, effective guidance systems, nose cone protection against reentry heating, accuracy, and above all the great weight and bulk of early warheads. Nevertheless, in August 1957, the Soviets successfully fired a rather inaccurate intercontinental ballistic missile capable of carrying a single nuclear bomb. The first American ICBM, the ATLAS, flew four months later. Thus the contemporary ICBM age can be said to have fully dawned by the beginning of 1958. Later developments such as solid fuel boosters, launching silos, and mutiple warheads can be considered as refinements in the state of the art rather than as major breakthroughs.

It is axiomatic in military history that as soon as a new weapon comes into the hands of the offense, the search for protective countermeasures begins on the part of the defense. This was as true of the ballistic missile as of the sling, the crossbow, the flintlock, or the submarine. Even before V-2 missiles began to fall, Allied intelligence officers were busy trying to puzzle out the nature and possible uses of the ominous unidentified cigar shapes on their aerial photographs of Peenemunde and other sites. The mysterious double explosion of the first missiles and the subsequent collection of bits and pieces made the nature of the V-2 perfectly clear, while at the same time driving home the apparent hopelessness of trying to cope with the hypersonic speed and unheralded arrival of the missile. In 1944, for example, the General Electric Company was awarded a contract under Project THUMPER to research and develop a high altitude antiaircraft missile that would be effective against the V-2. G.E.'s 1945 report realistically concluded that defense against ballistic missiles by such means was beyond the scope of contemporary technology. The Allies' initial helplessness remained until war's end, the common opinion among the learned being that the only defense was capture of the launching sites themselves. This proved true: the first ballistic missile defense was, in fact, nothing more than the seizure of German launching facilities.[5]

The situation prevailing at the end of World War II remained essentially unchanged for a decade. Despite the seemingly insurmountable problems surrounding early missile defense, a search for solutions began with the end of the war and continued at a snail's pace during the 1940's and early 1950's. In large measure, the progress that was made during this period was theoretical and conceptual, since the United States was still absorbing the lessons of the German experience and accumulating basic data about the behavior of radars, rocket engines, airframes, guidance systems, fuels, and the environment of the exosphere. In these areas American expertise was considerably aided by expatriate German scientists and engineers brought to this country by Operation PAPERCLIP; with their help, surplus V-2s and later designs such as REDSTONE were test flown at White Sands, New Mexico, to provide the United States with the necessary elements of advanced rocket technology.

Perhaps the major development in ballistic missile defense during the late 1940's was the realization that the "collision intercept" philosophy represented by far the most promising solution--probably the sole one--for stopping incoming missiles. By the end of World War II, the use of missiles against fast high flying aircraft was practical, and since this antiaircraft scenario most closely resembled the requirements of any ballistic missile defense system, BMD thinking quite naturally gravitated towards it. In 1945, the U.S. Army placed extremely important milestone contracts with Bell Telephone Laboratories (BTL) and Western Electric Company (WECo) for design of high altitude antiaircraft missiles and control mechanisms under the label Project NIKE. The original NIKE contracts were renewed throughout the 1950's, resulting in the production and deployment of NIKE-AJAX, a radar-directed antibomber missile intended for strategic defense of the United States. The success of NIKE-AJAX promoted an improved second-generation weapon called NIKE-HERCULES, similar to AJAX but nuclear tipped. Though limited to countering jet bombers, NIKE-AJAX and -HERCULES production and deployment was a significant step forward towards a workable defense against missiles because experience with these systems produced a wealth of information about the operational potential, as well as the limitations, of defensive missiles. And while the Army was developing its NIKE-AJAX and -HERCULES, the Air Force and the Navy were also engaged in rival GAPA, BOMARC, and TALOS projects. This interservice competition probably stimulated the overall growth of missile technology, but it also spawned duplication of cost and effort. In 1958 Secretary of Defense McElroy directed that in the future the Army would have charge of most aspects of air defense missiles.[6]

Serious efforts to turn antibomber systems into antimissile systems were greatly stimulated during 1954 and 1955 when it became evident that not only did the Soviets possess the A-Bombs, but that they were also rushing development of an intercontinental missile to deliver it. The implications of Soviet progress seemed to be amplified by American experiments with the H-Bomb, particularly the "Shrimp" shot of March 1954. Benson Adams, expert in ballistic missile defense, notes that this explosion "completely revolutionized ICBM design, for it showed that the [H-Bomb] warhead could be married to the ICBM without the necessity of designing the missile and its huge propulsion system around a large unsophisticated (A-Bomb) warhead."[7]

Confidence in American security began to erode under the impact of improving Soviet capability and loss of the nuclear monopoly, and in March 1955 the Army asked BTL to re-examine the feasibility of missile defense in the light of recent developments. After eighteen months of study, BTL reported in October 1956 that missile defense was now within the realm of possibility, and in February 1957 the Army Rocket and Guided Missile Agency issued prime research and development contracts to BTL and WECo, with subcontracts to Douglas Aircraft, RCA, and Goodyear Aircraft for basic research on a missile defense system. Drawing on their past experience in the field, these companies returned a design proposal for the first true antimissile missile system. It was to be called NIKE-ZEUS after the Greek deities of Victory and the Chief of the Olympians. The ZEUS proposal was accepted, and in 1958 the Ordnance Technical Committee of the Army authorized ZEUS as a full-scale development program. Project ZEUS would span the next four years and bring forth the world's first workable ABM system.

The three principal elements in the NIKE-ZEUS System were generally the same as those of all future BMD systems down to and including the SAFEGUARD of 1969: radars for target acquisition, tracking, and antimissile guidance; a computer for data processing; and antimissile missiles for interception and destruction. In the operation of the mature ZEUS, a long-range ZEUS Acquistion Radar (ZAR) continuously scanned the heavens and first detected incoming objects several hundred miles out. A Decoy Discrimination Radar (DDR) was then designated to track the objects, feeding information into an associated computer which tried to determine which of the objects were genuine warheads and which were inert dummies or decoys. Target Tracking Radars (TTR) then automatically took over and continuously furnished precise trajectory data into a second computer, which worked out a projected intercept point. When within range, a killer ZEUS would be fired, to be command guided out to its target by a separate Missile Tracking Radar (MTR). The mastermind of the system was the Target Intercept Computer (TIC), which solved guidance and control problems by digesting information about incoming objects and feeding it back to the ZEUS as soon as possible. ZEUS itself was a third generation antiaircraft rocket whose booster and two stages gave its nuclear punch a reach of 100 miles.[8]

As might be expected of any such pioneering effort, the ZEUS System had limitations. It was complicated, and all four of its radars were mechanically slewed. Like spectators' heads at a tennis match, each antenna had to be physically rotated to follow an object. Because of these design limitations and others, one set of tracking radars could follow only a few reentry vehicles at a time, generating a severe "traffic handling" problem. ZEUS' only answer was to use several sets of radars and computers to control one battery of two dozen missiles. Nor could the ZEUS radars discriminate between decoys and armed warheads until the slowing effect of denser air in the lower atmosphere had helped sort out heavy projectiles from lighter ballons, chaff, fragments, tankage, and other penetration aids. Thus the system was prone to overwhelming saturation by simultaneous threats. By the time ZEUS' computer was able to tell foe from fake, the intercept range had become too short to prevent the defense from being hoist with its own petard.

Despite all these drawbacks, the ZEUS System did work for one warhead at a time. This was shown on 19 July 1962 when a ZEUS fired from Kwajalein Island actually intercepted and theoretically destroyed an ATLAS-D ICBM fired from Vandenburg AFB, California, 4,800 miles away. Before the end of 1962, two more ICBM's, one of which employed decoys, had been intercepted. These tests were milestones in the evolution of ballistic missile defense, for they convincingly demonstrated what some skeptics had doubted, that "a bullet could hit a bullet."

Still, the ZEUS System existing in 1962, while workable, did not yield a performance commensurate with the estimated $10 to $14 billion cost of production and deployment to guard twenty-five cities.[9] Thus, with the concurrence of the Congress, Presidents Eisenhower and Kennedy and their scientific advisers refused to ask for ZEUS production. Instead, they began a traditional American BMD policy of funding more research and development while resisting requests for deployment. In retrospect, then, the real historical meaning of ZEUS lies not in its operational record but in the progeny which it spawned. For in ZEUS one can clearly see the granddaddy of SENTINEL -- all the basic requirements for a BMD system were there except protection against nuclear weapon effects, and even such terminology as "ZAR" closely resembled the later SENTINEL'S "PAR." What ZEUS needed most in 1962 was further improvement and simplification in its radars, that is, a combination of target tracking functions with interceptor flyout guidance to increase the discrimination, speed, and reliability of the whole system.[10]

The NIKE-X System which followed ZEUS after 1962 went far towards remedying its predecessor's shortcomings by introducing a vastly improved radar and a combination of two missiles intended to overcome the deficiencies of ZEUS alone. Under Project NIKE-X, Sylvania researchers developed a multiple function radar system which could discriminate and track incoming enemy missiles while also tracking and steering outgoing interceptors. These advanced radars substituted a new concept called the phased-array technique for the old heavy and slow mechanically slewed dish antennas hitherto employed. Phased-array radars generated many radar beams simultaneously and electrically shifted them, enabling the device to scan the horizon in a matter of microseconds. The invention of phased-array was a quantum step forward, because at one fell swoop it immensely increased the radar system's discrimination ability while making it possible to house the antennas and attendant equipment in a hardened concrete building, the ground plane of the antennas forming in effect part of the flat building face. In this way phased-array solved the traffic handling problems of ZEUS and allowed increased protection against nuclear attack.

The second major addition under NIKE-X was a short-range but ultra-high acceleration missile called the SPRINT. SPRINT was a solid fuel rocket built by Martin-Marietta capable of reaching its terminal velocity of many thousand feet per second a few moments after popping out of its underground silo launcher. It had a range of aboute twenty-five miles. The weapon was complementary to the new radars in enhancing the performance of the entire system. Extensive testing over the Pacific during the ATLAS program had shown that atmospheric slowdown filtering was the most effective means for eliminating decoys from a flock of targets, and with SPRINT could be withheld until after enemy objects reentered the atmosphere, where the denser air acted as a natural and unavoidable brake on decoys, giving them a different flight path and thus quickly unmasking their counterfeit nature.

To do NIKE-Xs thinking, a highly reliable ultra-high speed data processing system was a must. Yet the performance parameters of such a computer had always been regarded as formidable, if not impossible. Required was a multi-processor unit that could handle 30 million instructions per second with a failure rate of less than eight "fits" in the basic logic circuits per billion hours of operation. No commercial computer available or planned could approach these performance and reliability criteria, but in 1963 BTL enlisted the help of Sperry Rand Corporation to tackle the problem. By 1967 the prototype of such a UNIVAC computer was operating at BTL's Whippany, New Jersey, laboratory, with plans afoot to install a second model at Meck Island in the Pacific.

As developed by 1966 the NIKE-X System had two phased-array radars, one a very powerful Multifunction Array Radar (MAR) for long-range detection, acquisition, and discrimination, the other a short-range Missile Site Radar (MSR) for close-in conduct of the battle with ZEUS and SPRINT missiles. The only holdover from NIKE-ZEUS was the DM15c ZEUS missile, and by 1967 this too began to be phased out in favor of the DM15X2, later called the SPARTAN. SPARTAN was a Douglas-built two stage rocket with a range of 400 miles, a three-to-five megaton warhead, and a capability for exo-atmospheric intercepts. To take full advantage of SPARTAN's range, in 1967 the MAR was in the process of being refined into the Perimeter Acquisition Radar, or PAR, for surveillance up to 1000 miles. Finally, by 1967 thought was being given to putting all radars in hardened concrete buildings for protection from nuclear effects. Research on this and other aspects of NIKE-X facility construction was going on at the Advanced Technology Branch, Military Construction Engineering Division, of the Army Corps of Engineers in Washington, D.C., and the NIKE-X Branch, Engineering Division, of the Mobile District. Though still embryonic, the NIKE-X of early 1967 employed the modus operandi and all the necessary technology that became the SENTINEL System a few months later.[11]

The brief description of the NIKE-X just given indicates that by 1967 considerable technological progress had created the possibility of a feasible, rather than a merely workable, BMD scheme. The repercussions of this change were very great, because the technological accomplishments of NIKE-X expanded the questions surrounding BMD from the narrow realm of technical and military considerations into political, fiscal, social, and diplomatic areas. As NIKE-X showed its practicality, the Johnson Administration more than ever had to weigh what variety and combination of BMD ought to be deployed, how to integrate any type of BMD into the overall national defense posture, what the cost would be, and the possible effects of various deployments on American-Soviet relations. And it had to assess these factors amid growing American involvement in Vietnam, heightened tensions in the Middle East, domestic discontent, the emergence of a Chinese nuclear threat, and substantial improvement in Soviet strategic capabilities. In short, the big BMD question became "should we deploy?" rather than "can we deploy?". It was not an easy question to answer.

Production and deployment of the NIKE-X System had been pondered at the highest governmental levels for several years prior to the favorable decision of 1967. In the early 1960's, the Pentagon had usually recommended deployment, but Presidents Kennedy and Johnson consistently resisted it, believing that the estimated $30 billion cost did not promise a commensurate dividend in security against a sophisticated Soviet attack. They reasoned that even though NIKE-X had good discrimination and combat qualities, a massive attack would saturate the system, permitting enough warheads to get through to destroy too much of the population. That possibility was made even more probable by the predicted coming of multiple independently-targeted reentry vehicles, or MIRV's, then creeping up the near horizon of reality A MIRV gave each attacking missile a shotgun effect, multiplying its threat three to five times at little extra expense. An attack by MIRVed missiles would be able to saturate all but the heaviest BMD systems. The cost of a MIRV-proof net would be enormous, and it would have to come out of other defense needs and domestic programs. And even if such a very heavy defense were employed, the Soviets could enlarge their missile strike force to overcome it at relatively little cost. The United States would have to keep up by enlarging her forces, and the arms race would be accelerated at the expense of detente. The knowledgeable called this "the destabilization factor."

Until 1964 American policy had only to reckon with a Soviet threat, but in October of that year the international situation grew more complicated with the entry of China into the nuclear club. Though it would obviously be some time before a Chinese threat could materialize--she then had no missiles and few bombs--no one could accurately forecast the rate at which China could build an ICBM force. Nor could even the most experienced China-watchers tell how much of her sabre-rattling was genuine and how much bombast. As far as BMD policy was concerned, this meant considering construction of a "thin" network to handle any small-scale, irrational attack that might come about in the near future. Consquently, early in

1965 the Department of Defense began studying ways to counter the "Nth Power" threat by assembling various combinations of off-the-shelf NIKE-X components into an area defense system intended to put an umbrella over U.S. cities. The attractiveness of such a "thin" Chinese-oriented system grew after May 1966 when the Chinese exploded their first H-Bomb and grew still more after late 1966 when their first primitive nuclear-armed missile flew. An, interest in BMD was further heightened after 11 November 1966 when it was revealed that the Soviet Union was deploying a BMD of its own around Moscow. No American action was immediately forthcoming during 1966 to counter these changes on the international scene. But a strong sense of urgency about a BMD decision was building, sharpened by current Soviet moves and improvement in China's arsenal.[12]

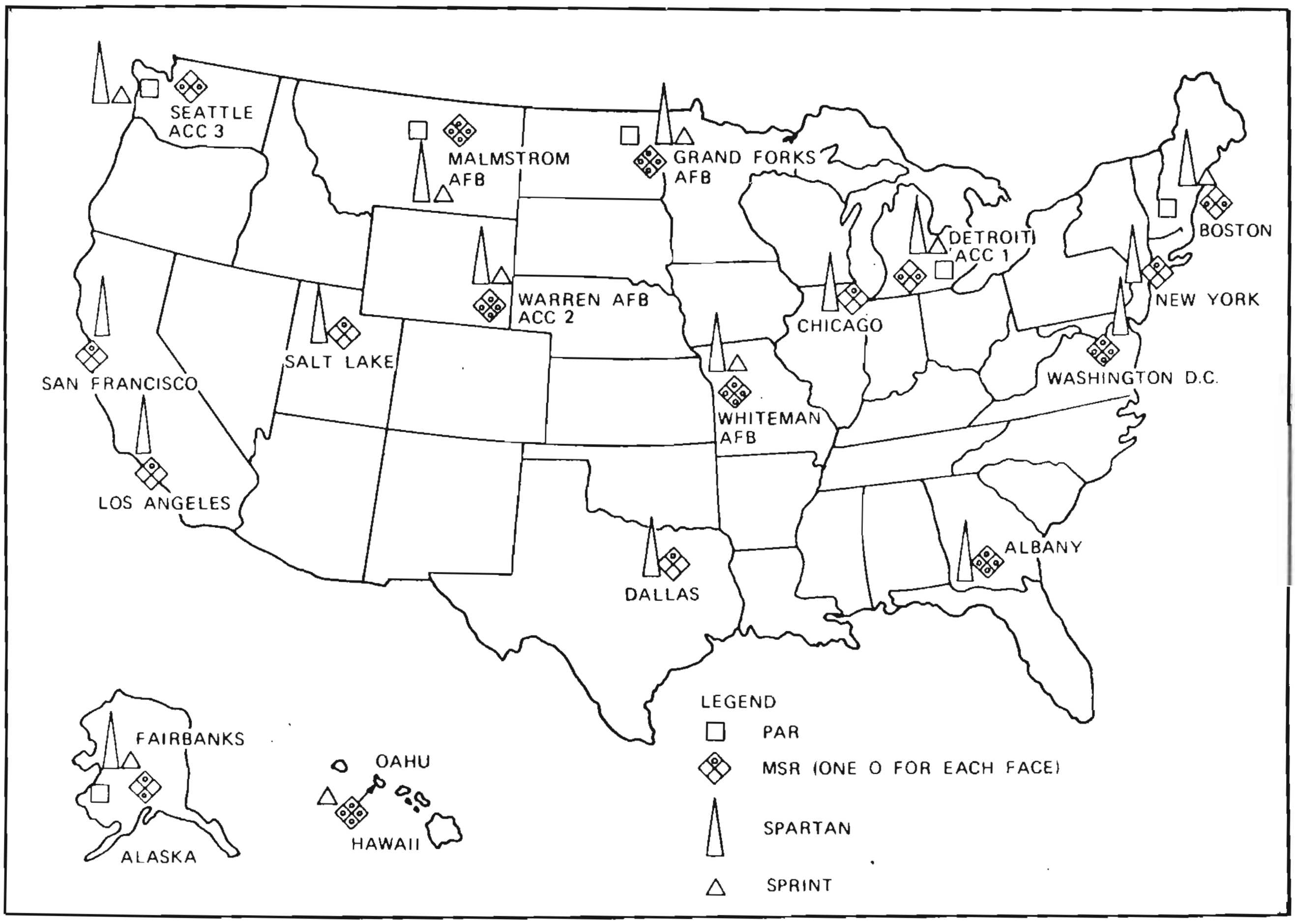
While the major American BMD effort remained devoted to research and development until 1967, some preparation for the eventuality of deployment had been undertaken. Throughout 1964, 1965, and 1966, the NIKE-X Project Office at Redstone Arsenal worked up a series of contingency plans and understandings with BTL and WECo for contracting mass production of NIKE-X weapon systems parts. On 5 June 1965, the Department of the Army approved a NIKE-X Project Office plan to manage the deployment of a NIKE-X System. The plan envisioned a NIKE-X System Manager at Department of the Army level who would execute a deployment order through a sizeable NIKE-X field organization under his direct command, with the assistance of major Army commands and agencies. Implementation of the Army's 1965 plan began in March 1966 with the assembly of a personnel cadre. In October 1966 Lt. Gen. Austin W. Betts was appointed to act as NIKE-X System Manager in addition to his other duties. About the same time, the NIKE-X Project Office and the NIKE-X Engineering and Service Test Office of the Army Materiel Command were placed under the operational control of the System Manager to assist him in the field.[13]

One of the first actions of the new System Manager was to prepare and issue Letters of Instruction to each of the major Army commands and agencies which could have a role in any future deployment. One of these directives went to the Army Corps of Engineers on 2 December 1966, assigning the Corps the heavy responsibility for design and construction of NIKE-X facilities should the system be deployed. The Chief of Engineers began working up a plan to mobilize a special new Corps of Engineers NIKE-X Division to carry out his potential mission. The plan, published in May 1967 as the "Corps of Engineers NIKE-X Mobilization Plan," provided a complete initial game plan for mobilizing a NIKE-X Division to design and construct the facilities required in a NIKE-X deployment. The Engineers' NIKE-X Division was to serve the NIKE-X system Manager's mission exlusively. In fact, when SENTINEL was ordered deployed in the fall of 1967, the NIKE-X Division immediately became the Huntsville Division.[14]

A second action of General Betts after December 1966 was to work up a series of repesentative deployment models, thereby providing a common basis for planning by all agencies. The first deployment model proposed was "Plan 1-67 Area/Hardsite Defense" comprised of a mix of weapons and facilities keyed to a "thin" area defense aimed primarily at a Chinese threat and having a $5 billion cost ceiling. The deployment was to be completed in fifty-four months, which meant using off-the-shelf NIKE-X parts. During the first six months of 1967, BTL and WECo evaluated this model and presented several interim reports to Secretary McNamara. On 5 July 1967, the Secretary of Defense got a final briefing on this deployment model, as well as on alternatives which would provide defense against more sophisticated Soviet threats, including the Fractional Orbit Bombardment System known as FOBS. Following the briefing, McNamara asked for a thirty day study of the emerging Chinese Communist threat and of an ABM deployment to counter it that would also incorporate modular growth options for Soviet ICBM's and SLBM's. Dr. John Foster, Director of Defense Research and Engineering, established a committee known as the "Montgomery Committee" which held its first meeing on 11 July. On 15 August, the Montgomery Committee returned a generally favorable report indicating that what was then being called "NIKE-X DEMOD 1-67" consituted an adequate basis for proceeding with deployment.[15]

About this time a series of events on the international scene won the case for commencing production of NIKE-X. In June 1967, the Chinese renewed their nuclear program with another H-Bomb shot, while in the Middle East the Soviet Union gave the Arab side heavy logistical and moral backing in the Six Day War. Throughout the year both the Chinese and Soviets had vociferously denounced the American buildup in Vietnam. Perhaps in part because of the Six Day War, perhaps because of Vietnam, the Soviets showed themselves reluctant to talk about arms limitations in general and BMD in particular, despite several invitations from the Johnson Administration to do so. This Soviet posture was further emphasized during and after the Glassboro Conference of June 1967, where Premier Kosygin took a "hard line" against limited arms talks with the United States. On 8 September 1967, Secretary of State Dean Rusk gave the Soviet Union a last chance notice to either take up negotiations about missile defense or face the consequences of American deployment of a BMD. When no favorable response was forthcoming within the next eight or ten days, President Johnson decided to approve deployment of a ballistic missile defense system. On the spur of the moment, Secretary of Defense McNamara was handed the task of announcing the decision to the journalists and publishers in San Francisco.[16]

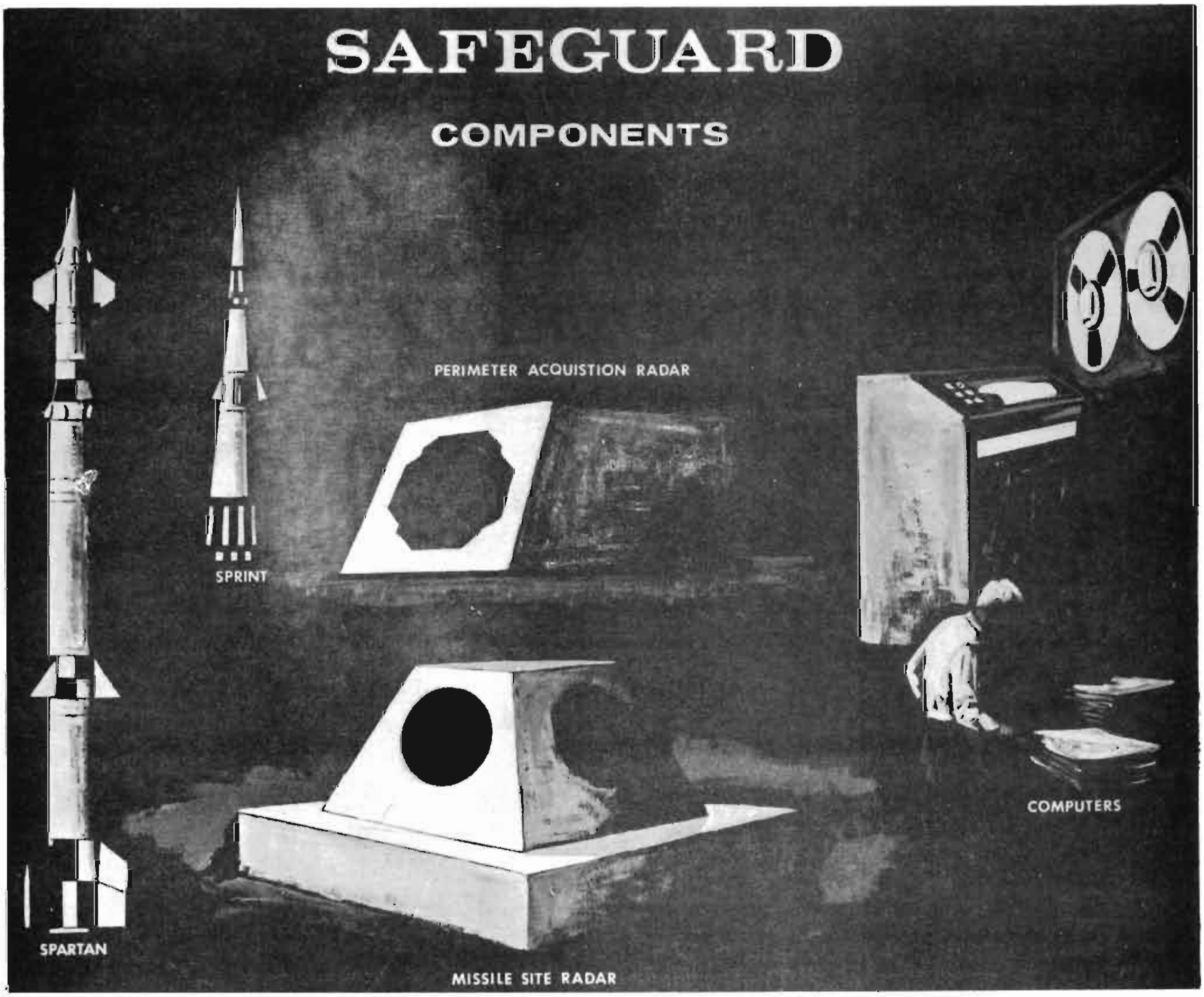
The placement of facilities in the SENTINEL System deployment unveiled by Secretary McNamara was never wholly revealed to the public, and in 1977 the details still remained locked in classified papers. Nevertheless, from later evidence, especially BTL's **ABM Research and Development at Bell Laboratories: Project History** and Congressional testimony given by Secretary of Defense Melvin Laird in 1969, the outline of DEMOD 1-67 projected by the Joint Chiefs of Staff in late 1967 can be deduced.[17] SENTINEL was to be a "thin" area defense system providing good protection for American cities and ICBM sites against Communist Chinese attack or an aberrant launch by any nuclear power. By adding more radar faces and missiles to certain installations, the System apparently could have been expanded to partially cope with Soviet ICBM's and/or submarine launched missiles.[18] The completed System would consist of seventeen sites: fifteen in the forty-eight contiguous United States and one each in Alaska and Hawaii. Five PAR's, each with one northward



pointing face, would be spread across the northern tier of states facing the Chinese ICBM threat corridors with a sixth PAR planned for Fairbanks, Alaska. Each of these six PAR's would also have a MSR associated with it; eleven other sites would have a MSR only. The Albany, Georgia; Washington, D.C.; and Oahu, Hawaii, MSR's plus the four MSR's deployed in the midwestern MINUTEMEN fields would each have four faces to provide 360-degree coverage. The remaining ten MSR's would have fewer faces. All of the sites except Hawaii would share a total inventory of 480 SPARTAN and 192 SPRINT missiles; the Hawaiian battery would have twenty-eight additional SPRINTS but no SPARTANS because of the small area to be protected. Certain sites would have SPRINTS located in Remote Launch Sites (RLS's) fifteen to twenty miles distant from the MSR to shorten flyout time and widen coverage. The combined oval "footprints" of defended areas encompassed the entire continental United States and most of Alaska and Hawaii.

It should be noted that the SENTINEL deployment described above would have offered some protection from Soviet attack, and from the beginning some opponents concluded that it was the opening wedge of a denser shield against the Soviet Union. An additional noteworthy feature of the deployment was that it was apparently scheduled to go forward as a whole, rather than to follow a step-by-step gradual enlargement contingent upon subsequent Soviet or Chinese moves. This approach would be revised with the SAFEGUARD program of 1969.

Weapon system in the SENTINEL were to be based on developed NIKE-X components, with PAR and MSR radars housed in hardened concrete structures close by.[19] Six powerful PAR's would give picket line



detection and discrimination out to about 1000 miles, but the PAR's were not to be armed with missiles. Instead, their data would be sent through redundant circuits to a nearby MSR, there to be integrated with that station's picture. Each MSR would be a tactical nerve center equipped with data processing equipment fed by its short-range radars, augmented in the six northern MSR's by input from nearby PAR's and each MSR could utilize the data thus gathered to fight a regional anti-ICBM battle with SPARTAN and SPRINT missiles. On a nationwide scale tactical BMD decision, directed by the National Command Authorities (civilian executive and Joint Chiefs of Staff), would be coordinated and orchestrated from Army Air Defense Command Headquarters located deep within Cheyenne Mountain near Colorado Springs, Colorado. Here a national battlefield picture could be maintained and analyzed at all times by means of data links to a central computer display observed by command staff. Training for SENTINEL duties would take place on actual equipment and simulators at a Central Training Facility collocated with the U.S. Army Air Defense School at Fort Bliss, Texas.[20]

At its inception the SENTINEL was a highly complicated and sophisticated piece of military engineering, undoubtedly the most sophisticated and complicated since the MANHATTAN Project of World War II. Even if its individual components and facilities had been completely proven, the complexity of the system would have aroused some concern about whether it could be tuned to work in concert. But in September 1967, SENTINEL's workability was more conjectural because every major weapon system element was still in a stage of research and development, and some parts had not even reached that stage.[21] A prototype MSR installation, for example, was then being built at the Kwajalein Missile Range, but it was not initially "powered-on" until 18 May 1968. Even so, this prototype had only two faces, and because its building was "soft," it did not fully reproduce an operational setting. A MAR-I radar had been well tested at White Sands, but it had never been hardened nor harmonized with the MSR at Kwajalein. Experience with NIKE-X had shown that commercial computers were inadequate for BMD purposes, and it was envisioned that SENTINEL would enjoy the software and hardware of a specially developed Central Logic and Control System from BTL. But only a laboratory prototype Central Logic and Control System existed in 1967. Finally, neither SPRINT nor SPARTAN were yet perfected: their NIKE-X antecedents had worked well, but research and development versions of the SENTINEL-type missiles were just being flight tested in 1967 and did not achieve their first intercepts until 1970. Finally, no experience had been obtained with operating or maintaining a nationwide network of BMD facilities.[22]

Reaction to the decision to deploy this embryonic SENTINEL was almost uniformly hostile outside the United States. Communist powers predictably denounced the System as another expression of imperialist warmongering, while even the British were miffed at not being consulted. The Canadian government refused to participate in the projected system, even though it was to be tied into the North American Air Defense Command. Within the United States, reaction varied from warm approval in some quarters through wide indifference to overt opposition. Mixed reactions were clearly evident in the Congress, where Senators Stennis, Anderson, Tower, and Hickenlooper applauded the decision while Senators Church, Clark, and Fullbright opposed it. Some considered the decision on its merits, but in the minds of many Americans, both within governmental circles and without, the question of BMD could not be separated from emotions about the broader problems of Vietnam, defense spending, or the influence of the so-called "military-industrial complex" in American life. In September 1967, the country as a whole was beginning to manifest deep-rooted divisions and gnawing antagonisms over many areas of public policy, especially foreign policy as exemplified by the Vietnamese War. Insensibly, the news of SENTINEL merged with greater controversies rivening American life, so that the infant BMD was born under a cloud of acrimony that gradually grew darker and stormier as its deployment matured.[23]

PROLOGUE FOOTNOTES

[1]This is the thesis of Benson D. Adams as presented in **Ballistic Missile Defense** (New York: American Elsevier, 1973), p. 161, n. 18. Adams' study is a scholarly and unbiased examination of the history of ballistic missile defense in the United States with emphasis on the Governmental policy associated with it until 1973. It should be the first reference for those seeking an overview of missile defense during the period down to and including the Modified Phase II SAFEGUARD of 1972.

[2]U.S. Department of Defense News Release No. 868-67, "Address by Honorable Robert S. McNamara, Secretary of Defense Before United Press International Editors and Publishers, San Francisco, California, September 18, 1967."

[3]USAEDH-PAO, "Historical Summary FY 1968," Vol. II, Exhibits of Supporting Documents, pp. 48-49. Henceforth cited as USAEDH-PAO, "Historical Summary."

[4]For the history of the German military rocket program during World War II, see David Irving, **The Mare's Nest; the German Secret Weapons Campaign and Allied Countermeasures** (Boston: Little Brown, 1965); James McGovern, **Crossbow** and **Overcast** (New York: W. Morrow, 1964); and Ernst Klee and Otto Merk, **The Birth of the Missile,** trans. T. Schoeters (New York: E.P. Dutton, 1965). A brief summary which includes performance of the V-2 rocket is in U.S. Senate, Preparedness Investigating Subcommittee of the Committee on Armed Services, **The United States Guided Missile Program,** 86th Cong., 1st Sess., 1959, pp. 5-6.

[5]Adams, **Ballistic Missile Defense**, pp. 17-31.

[6]**United States Guided Missile Program,** pp. 6-14, 62-63, 96.

[7]Adams, **Ballistic Missile Defense,** p. 11. Adams goes on to observe that the Soviets followed just the opposite policy than did the United States, that is, from the beginning, they farsightedly developed large booster rockets to cope with heavy loads and later reaped the benefits in terms of large military payloads and in space exploration.

[8]BMDSCOM, **ABM Research and Development at Bell Laboratories: Project History** Whippany, New Jersey: Western Electric Co., October 1975), pp. I/1-I/36. This valuable volume is a detailed unclassified history of BMD research and development of antimissile systems carried on by Bell Laboratories and Western Electric Co. from 1955 through 1975. It was prepared by Bell Laboratories on behalf of Western Electric Co., Whippany Road, Whippany, New Jersey, for the U.S. Army Ballistic Missile Defense System Command (BMDSCOM) under contract DAHC60-71-C-0005 and presented in October 1975. The bibliography contains lists of secret materials from which the study was made.

[9]Adams, **Ballistic Missile Defense,** p. 53. The figures are 1962 dollars.

[10]Ibid., pp. 24-58; U.S. Department of Defense News Release 188-69, "Ballistic Missile Defense--History Fact Sheet (March 14, 1969)"; U.S. Army SENTINEL System Command, "NIKE-ZEUS & NIKE-X Development," p. 1.

[11]Adams, **Ballistic Missile Defense**, pp. 63-141; SENSCOM, "NIKE-ZEUS & NIKE-X Development," p. 2; DOD News Release 188-69, "BMD History Fact Sheet (March 14, 1969)."

[12]Adams, **Ballistic Missile Defense,** pp. 125-141.

[13]SENSCOM, 'NIKE-ZEUS & NIKE-X Development,"' pp. 3-4.

[14]OCE, "Corps of Engineers NIKE-X Mobilization Plan," May 1967, pp. 1-2.

[15]Adams, **Ballistic Missile Defense,** pp. 130-142, 145-161; BMDSCOM, **Bell ABM Project History,** pp. I/44-I/45; SENSCOM, "NIKE-ZEUS & NIKE-X Development," pp. 3-4.

[16]SENSCOM, "NIKE-ZEUS & NIKE-X Development," pp. 3-4; Adams **Ballistic Missile Defense,** pp. 145-161.

[17]See testimony by Secretary of Defense Melvin Laird in the House of Representatives, Hearings Before Subcommittee of the Committee on Appropriations, **SAFEGUARD Antiballistic Missile System,** 91st Cong., 1st Sess., 1969, pp. 24-25 and **BMDSCOM, Bell ABM Project History,** pp. 3/1-3/10.

[18]The principal question surrounding the configuration of proposed SENTINEL facilities concerns the number of faces required for the PAR at Boston, Massachusetts. In 1977 the author was unable to obtain definitive information concerning the possibility that certain PAR's, Boston among them, were to have a subordinate face oriented towards Soviet submarine launched missiles. A changeover from a single face to a two face PAR may have been ordered during the course of design in 1968. The question of PAR configuration is more fully discussed in Chapter I.

[19]The degree of hardness, generally measured in terms of pounds per square inch of atmospheric "overpressure" produced by the blast, has never been declassified. The principal factors in calculating the overpressure are size of the warhead(s) exploded, distance from the target, and above-ground distance of the explosion.

[20]BMDSCOM, **Bell ABM Project History,** pp. 3/1-3/10; DOD News Release 188-69, "BMD History Fact Sheet (March 14, 1969)."

[21]USAEDH, "Anti-Ballistic Missile Engineering Criteria Manual for Tactical Site Selection," November 1967, includes in Appendix III some interesting early tentative designs for hardened NIKE-X facilities such as a two faced MAR Building with separate transmitting and receiving faces and a four faced MAR Building.

[22]DOD News Release 188-69, "BMD History Fact Sheet (March 14, 1969)."

[23]Adams, **Ballistic Missile Defense,** pp. 177-195.