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STUDY S-467

THE EVOLUTION OF U.S. STRATEGIC COMMAND AND CONTROL AND WARNING, 1945-1972 (U)

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the Department of Defense felt increasingly burdened by the huge costs to which they had committed themselves in NSC Paper 162. The National Security Council, in deciding that the air defense system should be expanded and improved, had recognized that this decision would result in the expenditure of several billion dollars. At the time, however, there was the general feeling that money was no object, that this was a task that must be accomplished regardless of cost. As a result, a number of very expensive projects were quickly approved--DEW Line, SAGE, Texas towers, airborne early warning, additional ground radar, gap-filler radar, advanced interceptors, and BOMARC. During 1954 and 1955, the costs for these systems were not excessive because most of the items required were still undergoing development.

(U) By 1956, it was becoming possible to write firm contracts for the actual hardware involved and the costs of the various systems began to command more attention. When the total cost of the improved air defense system became apparent, it was obvious that the proposed expenditures would be too great in terms of current defense budgets. Nearly every aspect of the air defense program was to suffer reduction during 1956 as a result of the shortage of funds. Beginning with the budget for FY57, cost-cutting exercises became commonplace in the Department of Defense, the USAF, and the ADC. And Congress, which had not quibbled about costs in the years since the beginning of the fighting in Korea, began to show increasing interest in the matter.[7]

B. THE DEW LINE

1. Background--The Changing Soviet Threat

(U) The major addition to the aircraft control and warning system in the 1954-60 period was the construction of the DEW Line--an undertaking for which original planning had begun as early as 1948.[8] While the combined AC&W effort in Canada, Alaska, Greenland, and Iceland patched together some measure of warning capability against Soviet bombers of the B-29 type, it would not, according to intelligence estimates of the early 1950s, cope with the threat envisioned for the 1956-60 time period. Production of jet-powered Soviet bombers comparable to the B-47 was predicted for the late 1950s, with even speedier models in the offing. The faster the vehicle, of course, the sooner it would have to be detected over North America to brace air defenses for the coming attack. It seemed only reasonable to ensure additional warning by moving the air defense system even farther north and using the Mid-Canada Line and the others as backup.

2. Construction of the DEW Line

(U) ~~(C)~~ On February 1954, President Eisenhower formally approved the DEW Line project, for which the Air Force was made the agency of implementation. Much has been written regarding this unprecedented technological feat. Suffice it to say here that the line was to be built along the extreme boundary of the North American Continent, several hundred miles north of the Arctic Circle. With a view to achieving a minimum of two hours early warning of a Soviet supersonic bomber attack from every conceivable angle of the polar attack route, the joint US-Canadian planning committee generally endorsed a route across North America from Herschel Island to Padloping Island, Canada. On the western end, the DEW Line would become integrated with the radar network ringing Alaska, and thence extended from Kodiak to Hawaii by way of airborne and seaborne patrols furnished by Navy AEW&C aircraft and picket ships. Eastward, the DEW Line would be pushed into Greenland proper, then from Cape Farewell, Greenland, would be carried to the Azores by Navy AEW&C aircraft and picket vessel patrols. Certain changes in the seaward extensions were proposed by the US Navy and were eventually accepted: instead of Kodiak to Hawaii, the Navy proposed Midway Island to Adak in the Aleutians; and in the Atlantic, Greenland to Scotland in addition to the Azores. Also, a DEW West Aleutian segment, consisting of six sites approximately 100 miles apart, was eventually added.

(U) (C) The main DEW Line sites numbered 57, spaced along the 69th parallel about 50 miles apart. The FPS-19 was to be the main search radar, with a detection range up to 160 nautical miles, at altitudes as high as 70,000 feet. The FPS-19 was limited at low altitude, however, and the FPS-23 continuous wave (CW) radar was created to fill the low-altitude gaps. Both radars were equipped with automatic alarming devices, both aural and visual.

(U) Construction of the DEW Line started in the spring of 1955 and ended in early 1957, which was an achievement of epic proportions when the natural obstacles are considered. On 13 August 1957, the Air Force formally took possession of the DEW Line from the Western Electric Company, the contractor for the project. While two-thirds of the decade of the 1950s had thus been consumed in planning, experimenting, engineering, and erecting the main segment of the DEW Line, the rest of the decade was spent operating and further testing DEW stations, simplifying procedures, realigning jurisdictional responsibilities, and stretching the DEW Line's reach, eastward and westward.

(U) (C) Responsibility for the DEW Line had first been parceled out among several USAF commands, but was later to gravitate more and more to the ADC's control. Operational responsibility, prior to the DEW Line's completion, had been vested in the Alaskan Air Command for the western portion, and the Northeast Air Command for the eastern. When NEAC was deactivated in 1957, operational control was assigned to the ADC, and exercised by the 64th Air Division (Defense), which the ADC inherited from NEAC as of 1 April 1957. Next, the ADC on

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15 February 1958 assumed operational control of the main segment in its entirety under the aegis of CINCNORAD. For its part, the Alaskan Air Command was limited by the USAF to operational control of the Alaskan and Aleutian radars, which comprised the land portions of the DEW western extensions.

(U) (S) The DEW Line rearward communications--in their way as important as the initial radar detection--at first left much to be desired. NORAD complained that the preponderance of DEW Line communications traffic over the four main circuits of the Colorado Springs COC arrived garbled. A number of reasons were postulated as the cause: the absence of "repeat-back" radio facilities, of VHF backup equipment, of coordinated efforts among the 16 separate companies involved in transmitting messages between DEW main stations and Colorado Springs, and the lack of a published manual standardizing and systematizing procedures. In fact, so bad was the network connecting the Barter Island main station with Anchorage that no operational transmissions were passed over it during the last months of 1957.

(U) (S) The next few months saw a major campaign to improve DEW Line rearward communications. These efforts were increasingly successful until at last the NORAD COC, once troubled with receiving as much as 98 percent of DEW Line transmissions in garbled form, by the end of 1958 received DEW Line data relatively free from this bothersome defect.

(U) (S) A major test (code name RED SEA) was conducted 1 May through 2 September 1958 to determine the operational capability of the DEW Line. All told, 12 SAC aircraft of the B-52 and KC-97 varieties penetrated the DEW Identification Zone (DEWIZ) in 73 separate flights, at altitudes ranging from 2,000 to 45,000 feet. Not one slipped by the chain of FPS-19 search radars unnoticed. Seventy-two of the 73 flights were reported rearward, 71 of which were appropriately received by personnel manning the COCs at NORAD and the RCAF Air Defense Command.

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(U) (S) This is not to say that the test showed the system to be free from problems. Some lax operators reported nothing, and their targets were reported by others. As a result, it was recommended that a better training program be instituted for civilian operating personnel. Some of the worst difficulties, however, involved the automatic alarm systems of the FPS-23 and FPS-19 radars. During the test, both alarm systems triggered more false alarms than actual ones. In the case of the FPS-23, at times as many as four false alarms per minute went off, to the point that the operators lost confidence in the system. As for the FPS-19 search set, while it performed excellently in general, its alarm system actuated some 9,750 alarms in all, of which only 14 percent were assessed as genuine. Cloud formations, ice flows, and electronic interference, among other things, were believed to be the causative agents responsible for the false alarms. Once again, major development programs were set in motion to isolate the problems and secure solutions to them.

3. DEW Line Extensions

(U) On 1 April 1959, the Aleutian sites became officially operational, operated largely by USAF rather than contractor personnel like the remainder of the DEW Line. Joined on one side by the AAC's land-based radars ringing the Alaskan Peninsula, and on the other by the Navy-operated Pacific Barrier, the three systems in combination extended DEW Line coverage to Midway Island.

(U) (S) During the construction phase of the Aleutian segment, the Navy's Pacific Barrier, which began operations on 1 July 1958 with four DEW picket stations and four AEW&C stations, compensated for the lack of radar coverage by patrolling from Midway to Kodiak Island. When the Aleutian stations became operational in April 1959, the Navy's Pacific Barrier assumed its regular Midway to Umnak coverage, estimated to comprise a distance of some 2,840 miles--practically the length of the DEW Line proper. The number of DEW picket stations, increased from four to five in 1958-59, was later reduced to two. Indeed, the Navy Department, for reasons of economy, in late 1960 sought to abolish the entire Pacific Barrier by early 1961, but the Secretary of Defense turned down the request.

(U) (C) Regarding the DEW eastern extensions, a USAF-Danish agreement was consummated on 19 March 1958 authorizing four sites in Greenland, to be separated by an average distance of 163 miles. Construction began in July 1958 and in October-November 1960 the Air Force accepted them, whereupon Western Electric commenced installing the electronic equipment. On 1 August 1961, the Greenland sites became operational. In the next month they were tested and all targets, whether employing chaff or not, were successfully detected and tracked out to a maximum distance of 200 nautical miles. Meantime, when the Greenland sites became operational, the Navy-operated Atlantic Barrier (which had worked four DEW and four AEW&C stations between Argentia, Newfoundland, and the Azores since July 1957) was switched to the Greenland-Iceland-United Kingdom (G-I-UK) configuration. Radar coverage thus extended from Greenland to Iceland, thence by water to the Faeroes Islands, and finally to Scotland.

4. Retrenchment and Contraction

(U) By late 1961, DEW Line operations had been stretched both ways to their utmost limit. They reached halfway around the world, from Scotland clear across the top of North America to Midway Island--close to 12,000 miles in all. The DEW Line thus lay fully manned and equipped: poised to detect, track, and report any bomber attacks aimed at North American targets. While refinements and improvements to the network continued, what was to follow in later years was for the most part retrenchment and contraction of DEW Line coverage.

(U) The chief reason, of course, was the shift in the enemy threat from manned bombers to ICBMs. The justification for DEW Line now became that of acting as a surveillance net calculated, simply by virtue of the differing speeds of aircraft and missiles, to delay manned bomber attacks planned to follow up an initial strike by ICBM weapons. While the ADC insisted that this modified role was essential to the nation's safety, it was considerably less than "the first line of strategic defense" status formerly enjoyed by the DEW Line.

(U) The DEW Line's changed role was perhaps best put by Secretary of Defense Robert S. McNamara:

> The surveillance, warning and control network constructed during the 1950s was oriented to manned bomber attack through the northern approaches over Canada and around the flanks through the Atlantic and Pacific Oceans.... But [during the 1960s], in any deliberate, determined attack upon the United States, we can assume that the enemy would strike first with his missiles and then with his aircraft. Thus, the arrival of the missiles would, in itself, signal the attack long before the bombers could reach their targets. As a result, large portions of the existing surveillance, warning and control system constructed during the 1950s are either obsolete or of marginal value to our overall defense.[9]

(U) As the 1954-60 period had begun, so it ended for the US aircraft control and warning system--in dissension, ambivalence, and yet a continued deep concern over US vulnerability to Soviet strategic attack. Just what, on the other hand, were the principal motivating forces for the direction taken in the US aircraft warning system is not easily answered. The massive initial efforts resulting from the October 1953 decision to expand US warning and air defense capabilities, of course, were clearly a reaction to the suddenly heightened perception of a dire Soviet strategic-nuclear threat to the United States. But the other forces that then began to act almost immediately upon the incipient warning system--i.e., the growing demands for economy by both the Congress and the Department of Defense, the severe technical requirements for equipment operating in an unprecedentedly rigorous environment, and the lack of either a political or military constituency for air defense and warning that could compete with the strategic forces for national resources--can be only indirectly related to the weapons, forces, and actions of the US strategic adversary. At the end of the decade, the changing threat--the anticipated "missile gap"--appears once again to have heightened the influence of a specific strategic interaction with the Soviet Union.

C. SEMI-AUTOMATIC GROUND ENVIRONMENT (SAGE)

1. Origin of SAGE

(U) Development of SAGE began in 1953 when the Air Force contracted with MIT's Lincoln Laboratory to set up an experimental automatic air defense command and control system on Cape Cod, Mass. Several long-range radar stations and gap-filler stations were netted into a small direction-center operation built around the Whirlwind I computer, With this test system, MIT scientists worked out the techniques of converting radar sightings to digital bits and feeding them back over special communication lines for storage in the computer. Programs were then devised that enabled the commander to draw from the computer the up-to-date picture he needed to make his battle decisions.

(U) By 1954, the experimental project had evolved into what seemed the answer to the data transmission and display problem. In January of that year, the National Security Council decreed that SAGE should be installed with all practicable speed and thereafter kept current with threat developments. On this authority, the Air Force ordered equipment and drafted plans for computerizing the continental US portion of the system.[10]

1963; many of its radars were counted as superfluous and the remainder were maintained as a "tactical holdback line" to deter enemy bomber penetrations until after missiles were detectable, i.e., to delay enemy bombers in a mixed missile-bomber attack for three or four hours. The early warning function itself was assumed by BMEWS, and the remnants of the DEW Line became more tactically oriented toward the antiaircraft surveillance and defense functions of the SAGE system, the Backup Interceptor Control (BUIC) stations, and the projected Airborne Warning and Control System (AWACS).[2]

B. BMEWS

(U) ~~(C)~~ The basic ICBM warning system throughout the 1960s was BMEWS (474L), the system of long-range, ground-based radars covering the northern approaches to the continental United States. Sensors were located in Greenland (Thule), Alaska (Clear), and the United Kingdom (Fylingdales Moor), with Thule first operational in September 1960, Clear in June 1961, and Fylingdales in January 1964. Capable of detecting ICBMs out to a range of some 3,000 miles, BMEWS could provide close to 15 minutes minimum warning, together with a rough count of the number of warheads and their approximate impact time and area, directly to NORAD headquarters and immediately thence to warning displays at the NMCC, ANMCC, and SAC as prime users.

(U) ~~(S)~~ Warning from BMEWS was critical to the survival of the bomber force, which depended on airborne escape (rather than concealment, mobility, hardening, or other forms of protection), and the 15-minute BMEWS warning time became the standard for ground alert aircraft at SAC. In the early 1960s, when SAC kept half the B-52 force on so-called 15-minute ground alert, it could launch as many as 14 percent of the alert aircraft within 8 minutes, from a "normal" (for SAC) DEFCON 4 posture, and as many as 43 percent from a higher DEFCON 2 posture. It could also launch the entire alert force in as little as 11 minutes, with a single minute in the peak phase allowing as many as 200 aircraft to become airborne.[3] During the years when manned aircraft were by far the predominant element in the retaliatory force, this potential warning contribution was invaluable: it could promise a second-strike capability even by this otherwise relatively soft and vulnerable weapons system.

(U) ~~(C)~~ Warning from BMEWS also enabled SAC to exploit the unique capability of bombers to launch under positive control, even in ambiguous or equivocal circumstances, without precommitment to strike--a "launch-on-warning" and recall option that was not available in the case of missiles. Warning could provide useful time in which to count down missiles to minimum holds and shorten their reaction times, but it did not add the option of a contingent launch. Warning enhanced the capabilities of manned bombers, therefore, and the continued utility of bombers in the strategic force was directly linked to the continued effectiveness of warning support.[4]

(U) ~~(C)~~ For a short period in the early 1960s, there was some inclination to judge the criticality of BMEWS and the worth of other early warning systems primarily in terms of bomber survival. The 15-minute ground alert posture for bombers was apparently considered at first as a stopgap measure until the retaliatory forces could be restructured around missiles (like Polaris and Minuteman) that did not depend so heavily on warning and quick reaction and could therefore "ride out" an attack.[5] In the same way and for the same reason, as the relative proportion of bombers in the strike force declined, it was expected that the relative value of warning systems might also decline.[6] Bombers remained a very substantial portion of the strike forces throughout the 1960s, however, as the JCS counseled from the beginning. (Although the JCS did not use the word "triad" at the time, they consistently defended the continued need for manned bombers in the strategic mix.[7]) In 1968, manned bombers, mostly B-52s except for a small number of B-58s, still constituted some 945 of the 2,650 major strategic offensive delivery systems in the operational forces, more than one-third of the strategic triad, for which even short warning times were of vital importance.[8]

(U) (S) Moreover, as the JCS also argued on many occasions, warning was a requirement not only for the protection of strike forces but also to provide maximum opportunity to formulate an appropriate "national reaction," that is, for decisions.[9] The utility of warning to support the command and control process was increasingly emphasized during the 1960s, even after its contributions to the protection of population and industry were virtually dismissed and those to retaliatory force survival were considerably downgraded.

(U) (S) As a comprehensive warning system against missile attack, BMEWS had serious shortcomings, primarily in geographic coverage and in the amount, quality, and timeliness of the information that it provided. It could be deliberately spoofed, blacked out, or attacked, of course, but such events could be treated as potential indicators of attack and could easily interfere with surprise. It could be bypassed, at less potential cost and risk, by extended-range or low-angle ICBMs, for example, by SLBMs, or even (as the Soviets showed when they began testing the capability in the late 1960s) by orbital systems.[10] Minor improvements in BMEWS coverage and effectiveness were made during the 1960s, naturally, but more was required. It proved necessary to augment BMEWS with additional warning systems and to adopt a multiple approach to the missile warning problem. None of the other systems became a full-fledged alternate or successor to BMEWS, and in fact none of them even came into operation until the late 1960s and early 1970s, but they were largely developed during the 1960s, together with BMEWS, into the interlinked warning network of the subsequent 1970s.