ADC HISTORICAL STUDY NO. 31 ~~SECRET~~

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A HISTORY OF THE DEW LINE 1946 - 1964

by THOMAS W. RAY

JUNE 1965

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Though great care has been taken to free the present study from errors of fact and interpretation, such errors may have been committed. Readers are therefore cautioned not to make the present study the basis for official action.

MAP OF DEW LINE STATIONS

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NOTE: Whenever the notation (HRF) appears in a footnote in the present study, the document cited is in the Historical Reference File in the ADC Historical Division.

ILLUSTRATIONS

Early Hopes and Frustrations, 1946-1949. In late 1954, USAF negotiated a contract for construction of a Distant Early Warning (DEW) Line of radars across the arctic wastes of North America. While a relative latecomer on the air defense scene, the DEW Line project had antecedents traceable to 1946. In that year, a similar scheme had been hatched by Army Air Force planners, but was subsequently discarded because of post-World War II Congressional economies. In 1948 following release of a USAF plan named SUPREMACY authored in 1947 to chart air future defense growth, ADC complained bitterly because it omitted a string of land-based [illegible] warning radars along the farthest reaches of North America. Such a network was essential, ADC contended, if the nation was to be immunized from sneak raids. Practically all [illegible]

North American continent should be ringed with early warning facilities -- the top with land-based radars from Alaska across Canada into Greenland and the sea flanks with AEW and picket ship radar stations. Russian was fully capable of launching destructive fleets of aircraft of the B-29 style across the North Pole for bombing strategically important U.S. industrial targets and SAC bases. A DEW Line twisting across arctic wastes, about 2,000 miles north of the U.S.-Canadian border, offered from three to six extra hours advance notice of attack -- valuable time that could be well spent in four ways: (1) dispersing SAC bombers to survive the initial onslaught; (2) positioning fighter aircraft where they could best intercept enemy bombers: (3) diverting civil air traffic from critical areas; and (4) implementing civil defense measures.

The picture thus depicted by ADC was not vivid enough at the time, however, either for USAF or the country at large. In 1948 the U.S. had a monopoly of the world's atomic weapons; no country would dare risk total obliteration at the hands of SAC by attacking with conventional weapons. ADC's plans for expanding SUPREMACY, therefore, came to naught. But SUPREMACY, with or without ADC's improvements, failed to win Congressional endorsement. A substitute plan was adopted by Congress in 1949, calling generally for a smaller number of radar sites inside U.S. boundaries for a modicum of warning of impending attacks. Advocates of a northern radar chain system were constrained to await more propitious times.[1]

Intermediate Measures, 1950-1954. Thus frustrated during 1948-1949, air defense planners, both at USAF and ADC level, focused attention on the next best thing. By piecing together separate AC&W programs in Canada and Alaska, the western hemisphere, particularly the upper half, might acquire some semblance of an early warning system.

Alaska presented no unusual difficulty. Being then a territory of the U.S. there was no problem concerning rights. Accordingly, one control center and ten radar stations, with USAF's blessings, were planned for completion sometime in 1952. Not until early 1954, however, did this cluster of radars situated around most of the perimeter of the Alaskan peninsula become operational under Alaskan Air Command.

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1. Hist of ADC, Jan-Jun 1951, pp. 55-60, 338-40, 360-64; USAF Historical Study No. 126, The Development of Continental Air Defense to 1 September 1954, pp. 69-70 (hereafter cited as USAF Hist Study No. 126); ADC Historical Study No. 10, Seaward Extension of Radar 1946-1956, pp. 1-2 (hereafter cited as ADC Hist Study No. 10); Mss Draft, ADC Historical Division, Canadian Monograph, "Chapter Two. The Genesis of the Radar Extension Plan," pp. 1-2.

Canadian military planners, who might have been straight-laced about it all, happily greeted U.S. overtures. The Canadians acknowledged the wisdom of planting AC&W units on Canadian soil for the mutual protection of both nations. They seemed not to mind coordinating locations of future Canadian sites with the growing U.S. radar network, so as to complement and project contiguous early warning coverage to the northeast.

But when the subject of costs was broached, the Canadians balked; whereupon the U.S. offered to finance two-thirds of the costs. Canada signed formal acceptance in 1951.

In all, 33 AC&W sites were built in Canada, 22 by the U.S. and 11 by Canada. Eighteen were manned by USAF personnel; 15 by Canadians. Of the USAF-operated sites, eight units were assigned to ADC, becoming operational by mid-1954. The other ten USAF-operated sites, deployed along northwestern Canada from Baffin Island across Labrador to Newfoundland, were assigned to the Northeast Air Command (NEAC). All but one of them were operational by June 1954. Besides these, ten permanent radars were erected in Greenland and Iceland to further extend radar coverage eastward.[2]

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2. USAF Hist Study No. 126, op.cit., pp. 59-61; Memo for Gen. Norstad from Maj.Gen. S.E. Anderson, DCS/P&O, "Proposed AC&W Systems," 17 May 1949 [HRF]; Ltr, ConAC to USAF,

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'- Mid-Canada Line. While this combined AC&W effort in Canada, Alaska, Greenland and Iceland patched together some measure of self-protection against Soviet bombers of the B-29 brand, it would not, according to intelligence estimates, cope with the threat envisioned for the 1956-60 time period. By late 1949, the Soviets had detonated their first atomic weapon. It would not take them long to progress in other areas besides in the wide-open technological race for better weaponry. Production of jet-powered Soviet bombers comparable to the B-47 were predicted for the late 1950's, with even speedier models in the offing. The faster the vehicle, the sooner must it be detected over North America to brace air defense forces for the coming attack. This meant advancing the early warning belt a notch or two farther northward.

To this end, the joint Canada-United States Military Study Group, in 1953, concurred with a 1952 Canadian plan to string a layer of radars across Canada at about the 54th

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[Cont'd] "Report on Visit to Canada, 5 & 6 Dec 1949," 12 Dec 1949 [HRF]; Ltr and Inds, ConAC to USAF, "Extension of the Permanent Radar Net of the Continental Air Defense System," 5 Jan 1950 [HRF]; Ltr, ADC to EADF, "Activation of AC&W Squadrons for Canadian REP Sites," 5 Dec 1951 [HRF]; Ltr, ConAC to USAF, "Recommended Final Deployment of Radars for the Interim Plan Plus First Augmentation," 26 Oct 1948 [HRF]; Hist of ADC, Jan-Jun 1951, pp. 343-46, 364-67; Hist of ADC, Jan-Jun 1952, pp. 50-54.

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or 55th parallel. The Mid-Canada line, as this was named, was subsequently approved, surveyed, sited and constructed, with 1957 set as the target year for its operation.[3]

The DEW Line Concept Resurrected. The same logic invoked to justify the Mid-Canada Line for quickening the early warning process, applied to the DEW Line concept as well. To insure several hours advance warning of attack by the ever faster bombers certain to evolve, it seemed only reasonable to thread the farthest reaches to North America with another string of radars, along the 69th or 70th parallel. The Mid-Canada Line, hundreds of miles rearward, would conveniently serve as a back-up surveillance line to detect whatever attacking aircraft happened to leapfrog the DEW Line unnoticed due to radar outages or other causes.

Actually, this recommendation, originally dating from AAF's 1946 proposal, was resurrected in 1952 as part of a package plan designed to tone up and modernize the whole air defense apparatus. Not long after the September 1949 revelation that the Soviet Union had developed an atomic capability of its own, USAF established a study group at MIT to

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3. ADC Hist Study No. 10, pp. 64-65; USAF Hist Study No. 126, pp. 65-66; Rpt, Project RAND RM-1031, "Distant Early Warning in the Defense of the United States," 24 Nov 1952 [HRF]; ADC Hist Study No. 24, p. 52.

survey the existing air defense structure for adequacy to meet the future atomic threat. One outgrowth of this effort was Project Charles. The report, dated August 1951, acknowledged the inadequacy of the then evolving air defense network, emphasized the vulnerability of the U.S. to surprise attack. Project Charles concluded that a few hours of extra warning time, combined with improved weaponry, would be of great help.

One year later, in August 1952, a report by the Summer Study Group of the Lincoln Laboratory, MIT, urged that a line of radars along the 70th parallel, connecting the Alaskan radars with those operated by Northeast Air Command, be built furnishing three to six hours of extra warning time. Tacked on to either end of this Distant Early Warning (DEW) Line, stretching from Greenland to Scotland on its eastern flank and from Alaska to Hawaii on its western, were to be a series of over-water stations flown by AEW&C patrols. An airborne target following the Arctic route from the Soviet Union to North America could no easily elude detection by so far-flung an early warning radar system.[4]

4. USAF Hist Study No. 126, pp. 62-64; ADC Hist Study No. 24, Air Defense and National Policy, 1951-1957, pp. 10-11 24-25; Rpt, Project RAND RM-1031, 24 Nov 1952 [HRF]

The Summer Study Group expressed the opinion that:[5]

> No defense, whether in depth or not, can come into effective operation until unequivocal information has been obtained that the enemy has begun his attack. The time necessary to bring the various types of defense into action varies. The additional effectiveness produced by extra warning time, while difficult to evaluate, is very great....
>
> The opinion of the Summer Study Group is that the most advanced, or 'outer DEW' line would be located as far away from the ZI as it can be put. Our geographical experts have examined northern Canada for sites that would be logistically accessible by means other than aircraft. These sites of the outer DEW Line would form a continuous line along which any aircraft flying at any feasible altitude above the terrain would be in the unimpeded line of sight of at least one station....These sites could be installed by expeditions of ships working in the ice-free season. Permanent manning is estimated at 10 persons per station. Station spacing varies from 75 to 125 miles.

Since a recent technological innovation could be exploited, namely a radar alerting system that sounded an alarm upon target pickup, costs and manning would be kept down to a reasonable figure. According to Lincoln Summer Study Group estimates, a DEW Line chain would cost about a third of a billion dollars, with annual maintenance costs approximating a hundred million thereafter. The end of 1954 was designated

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5. Verbatim notes from Final Report of Summer Study Group, Lincoln Laboratory, 1 Feb 1953, copied by Dr. C.L. Grant during preparation of USAF Historical Study No. 126.

as the conceivable target date when a DEW Line of radars could become initially operational, if launched, as recommended, on a "crash" project basis.[6]

Controversy and Approval. Little did the Summer Study Group suspect that USAF, which had initiated the study, would stand unequivocally opposed to its recommendations. USAF simply was not sympathetic to large expenditures for air defense purposes in 1952. Air Staff thinking underlined the deterrence philosophy that no nation, no matter how hostile would court destruction from SAC bombers by attacking the United States. Concerned lest funds funnelled into a DEW Line project would, in effect, be subtracted from SAC appropriations, USAF was decidedly cool to the whole idea of a DEW Line anytime soon. USAF argued that available equipment lacked the technological perfection requisite for Arctic operations. The DEW Line idea was disparaged as smacking of the discredited Maginot Line concept -- luring the nation into a complacency resting on a false sense of

6. USAF Hist Study No. 126, pp. 62-64; ADC Hist Study No. 24, pp. 10-11, 24-25; Rpt, Project RAND RM-1031, 1952 [HRF]; Notes from Final Report of Summer Study Group, 1 Feb 1953.

security. The Secretary of Defense was inclined to agree with USAF that no DEW Line was now needed.[7]

But the DEW Line concept, despite these and other impediments, refused to fade gracefully off stage. The Lincoln Summer Study Group report was reviewed by National Security Resources Board (NSRB), where it received cordial treatment and NSRB endorsement for further study by the National Security Council. Again the recommendations were amicably received, but failed to attain immediate NSC support. But, the NSC, sympathetic to improving America's air defenses, encouraged further examination of the issue.

About this time, in November 1952, RAND Corporation published the results of an independent study on the DEW Line. In essence, RAND agreed with USAF that times were not yet ripe for this Arctic venture. Such a project, according to RAND's viewpoint, must be contingent on a rise in air defense appropriations sufficient to actuate certain other air defense measures first: a low-altitude radar system for the U.S.; AEW&C and picket ship radar coverage off either coast;

7. Samuel P. Huntington, The Common Defense: Strategic Programs in National Politics (New York: Columbia University Press, 1961), pp. 296-87, 308-09, 326-30, 335; USAF Hist Study No. 126, p. 64; ADC Hist Study No. 24, pp. 25, 37-40.

Constructing a DEW Site on Baffin Island

and costly improvements to the internal radar structure. As to a DEW Line itself, RAND cautioned against any programming action whatsoever prior to a satisfactory demonstration of arctic-to-U.S. communications and resolution of certain other problems. In the following month, USAF contracted with Western Electric Company to erect two installations for conducting experiments along the suggested lines.[8]

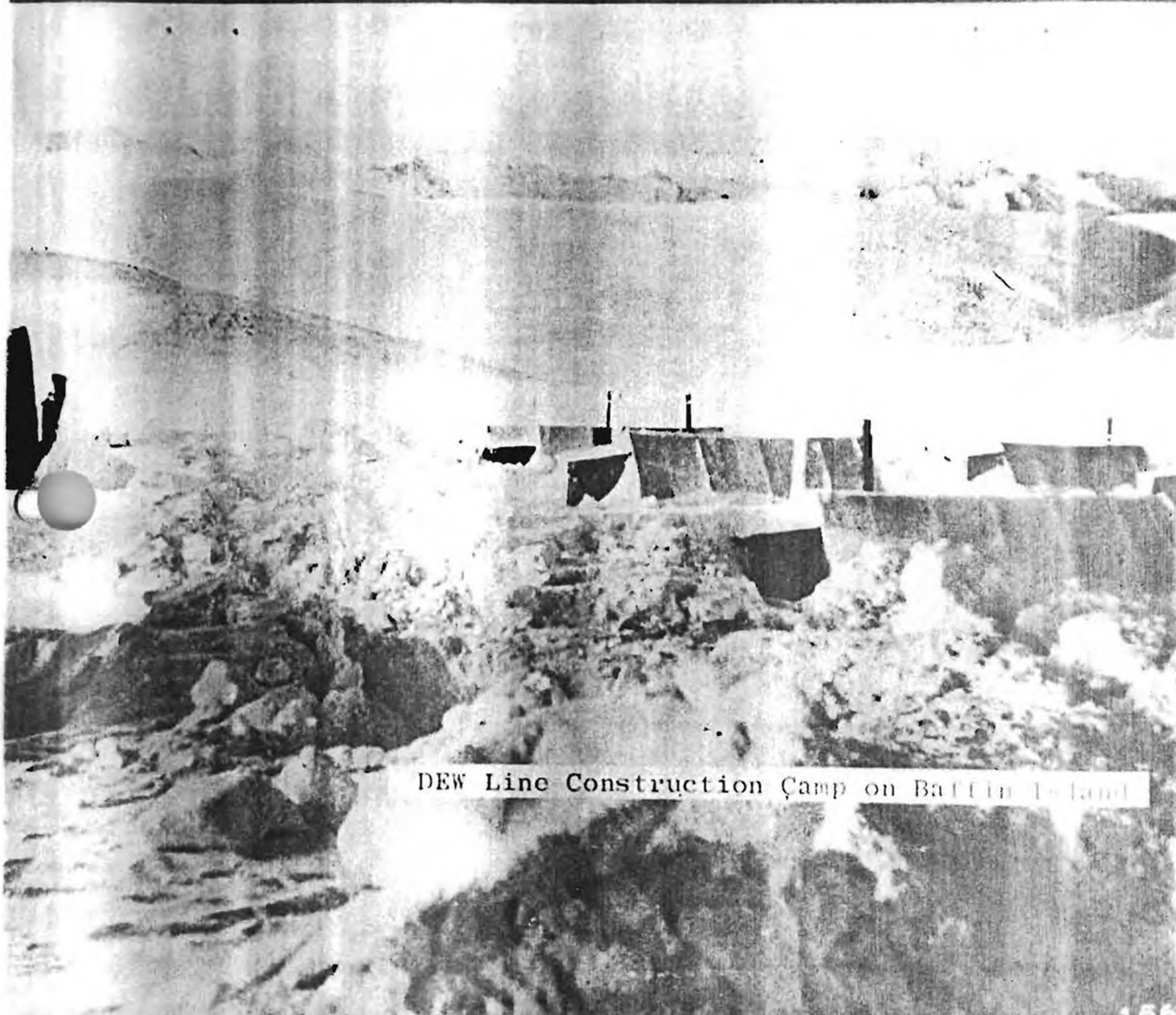
Things came to a head in 1953. The public was informed of the controversy early in 1953 by the Alsop brothers and other journalists. What amounted to a contest for funds and for proper timing (in terms of technological advance), was depicted by portions of the press as collusion between USAF and the Department of Defense to thwart construction of an effective air defense network, with the safety and well-being of the nation at stake. In July 1953, a report by a special committee appointed by the Secretary of Defense headed by Major General Harold Bull confirmed the Summer Study Group's findings. Some 18 to 25 billion dollars should be spent during the next five years, according to Bull Committee findings, for such things as automating air defense and constructing a DEW Line. The following month, the U.S. learned that the Soviet

8. Rpt., Project RAND RM-1031, 24 Nov 1952 [HRF], USAF Hist Study No. 126, p. 64; ADC Hist Study No. 24, pp. 26-29, 39-40.

would have to be used. Fortunately, two such systems had recently been devised, the Frequency Propogation Ionospheric (FPIS) and Tropospheric Systems (FPTS). Using radio frequencies in the VHF and UHF spectra which were characteristically immune to atmospheric disturbances, but hitherto restricted to line-of-sight transmissions, radio signals were bounced off the ionosphere or troposphere. By beefing up transmitter power and sending the signals via high-grain antennas, distances as far as 1,200 miles away were thus spanned. While UHF signals deflected from the tropospher would suffice for lateral communications between DEW stations, VHF signals deflected from the ionosphere, travelling almost four times farther would be exploited for keying DEW Line communications with elements in the rear.[10]

After extensive tests at its Barter Island experimental complex, Western Electric learned that the shelter best adoptable to arctic conditions, where temperatures ranged from 65 degrees below zero to 65 degrees above zero farenheit, was the "module" unit. The flat-roofed module, having dimensions of 19 x 28 feet, was configured from prefabricated plywood panels. When completely assembled in

10. USAF Hist Study No. 126, pp. 64-65; Hist of Alaskan Air Command, Jan-Jun 1956, pp. 140, 143-45.



DEW Line Construction Camp on Baffin Island readiness for occupancy, several modules were joined together in tandem, to form a train-like row. They were mounted on pilings driven snugly into the perma-frost a few feet beneath the surface, where the tundra remained perpetually frozen. Thus elevated several feet above ground, the module train escaped having snow stacked against its sides that otherwise might engulf it in drifts. Instead, blowing snow passed underneath, as well as above and around, it superstructure. Two or more modules thus fastened together in tandem multiplied available space for offices, recreation area, operations and maintenance facilities, eating and sleeping quarters, and whatever else enclosed space was needed. The module was expressly designed to withstand 125-m.p.h. winds, coatings of ice up to two inches thick, and upwards of 30 pounds per square foot of snow. Mounted on skids, several at a time could be towed by tractor over miles of snow into position. Ordinarily a row or two of them were situated so as to point into the prevailing winds to further reduce the hazards of drifting snows. Several fire-resistant and fire-eradication features were incorporated in the module's design, as well as a vapor barrier and, for those used for housing electronic equipment, an envelope of copper shielding.[11]

In addition to developing communications and perfecting the module, Western Electric tested radars designed exclusively for DEW Line usage (discussed in greater detail below). USAF electronics experts, by late 1954, were sufficiently impressed by their performance to approve their adoption. Meanwhile, Western Electric, beginning in mid-1953, accomplished low-level overflights of the DEW Line route to select likely DEW Line sites. Maps, hydrographic charts and RCAF photographs were studied with a view to pinpointing potential sites that, from the standpoint of strategic location and topography, were readily accessible to logistical supply routes via water, land and air, and best lent themselves to DEW Line Operations.[12]

In August 1954, in response to a recommendation by the Canadian-United States Military Study Group, a USAF-RCAF

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11. Hist of AAC, Jan-Jun 1956, pp. 145-46; Hist of NEAC, Jan-Jun 1956, pp. 162-63; Hist of AMC, Jul-Dec 1955, pp. 252-53; C&E Digest, Vol 8 No. 7 (Jul 1958), p. 1.

12. Hist of AAC, Jan-Jun 1956, p. 145; Permanent Joint Board on Defense (Canada-United States) to USAF, et. al., "Journal of Decisions, PJBD Meeting, October 1954," 25 Oct 1954 [HRF]

Military Characteristics Committee was established to develop DEW Line criteria mutually acceptable to both the United States and Canada. The committee re-affirmed the necessity of constructing a DEW Line; and in the summer of 1954, it, too, applied itself to the DEW Line location problem. With a view to achieving a minimum of two hours early warning of a bomber attack from every conceivable angle of the polar attack route, the committee generally endorsed a route crossing 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, then 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, carried to the Azores by Navy AEW&C aircraft and picket vessel patrols. Some thought was given to anchoring specially-designed, radar-equipped buoys at 30- to 50-mile intervals along the over-water DEW extensions to Hawaii and the Azores, instead of using AEW&C aircraft and picket vessels, but the idea died before reaching the experimental stage.[13]

13. Hist of ADC, Jan-Jun 1954, pp. 111-18; Hist of ADC, Jul-Dec 1954, pp. 32-34.

Overwater Extensions. Meanwhile, there cropped up certain proposed shifts to the DEW Line overwater extensions. USAF, suggested that the Eastward leg, instead of extending from Greenland to the Azores, cross from Greenland to Iceland, then by AEW&C and picket patrols, to Great Britain. To this, ADC strongly objected. According to ADC, continuation of DEW Line to the British Isles, would invite "spoofing" raids by Soviet bombers, to exhaust U.S. defenses by triggering false alarms and, in case of actual attack, to confound U.S. defenses so that genuine raids could slip past unnoticed.

The Navy, to whom was entrusted the task of sustaining both DEW overwater extensions, voiced preference for an eastern leg, or "Atlantic Barrier," like that advocated by USAF, extending all the way from Greenland across Iceland to Scotland. The Navy, moreover, desired to change the western extension, or "Pacific Barrier," that instead of patrolling from Kodiak Island, Alaska to Hawaii (as desired by ADC and approved by the JCS in January 1955), the Navy would patrol from Midway Island to Adak in the Aleutian Islands. An additional chain of USAF radars along the Aleutians would tie radar coverage to the existing Alaskan network, according to the Navy view.

In both instances, the Navy ostensibly got its way. In December 1955, the JCS authorized moving the Pacific Barrier to the Navy's Midway-Adak line. To fill the gap in radar coverage to the Alaskan network, a half dozen land-based radar sites were later authorized for construction in the Aleutian Islands. One concession requested by CINCAL, the substitution of Umnak for Adak as the terminus for the Aleutian radar chain, was granted by the JCS in June 1956. As a target date, July 1958 was set for beginning full-time patrols of the Pacific Barrier. Four ship stations were to be manned while a like number of AEW&C aircraft shuttled back and forth.

As to the Atlantic Barrier, a compromise was reached. In February 1956, the JCS approved both routes; the Navy's route to Scotland, and ADC's route to the Azores. It was a modified version of the latter, ironically, that the Navy first patrolled, sending out picket vessels and AEW&C aircraft from 1 July 1956 on. Four picket vessel stations and four AEW&C stations sufficed to cover a line extending from Argentia, Newfoundland to the Azores, all of which were operating in July 1957.[14]

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14. Hist of ADC, Jan-Jun 1954, pp. 111-18; Jul-Dec 1954, pp. 32-34, 36; Jan-Jun 1955, pp. 45-47; Jul-Dec 1955, pp. 74-76; Jan-Jun 1956, pp. 39-40; Jan-Jun 1957, pp. [illegible]

DEW Line Radar Development. Simultaneous with this clarification period for DEW Line overwater extensions (1954-1957), the mainland route for DEW Line proper took shape first on paper, then in material construction. By the end of 1954, Canada had authorized construction of DEW Line sites on Canadian soil. In the autumn of the same year, the Locations Study Group was organized on the advice of the USAF-RCAF Military Characteristics Committee. In collaboration with Western Electric Company, the Locations Study Group settled on a DEW Line land route in November 1954 running cross-continent from Cape Lisburne, Alaska, to Cape Dyer, Baffin Island, ruling out once and for all Western Electric's proposal that the eastern terminus end some 350 miles south of Cape Dyer, at Resolution Island. The JCS approved this route in January 1955. Several weeks earlier, in December 1954, Western Electric had been awarded a letter contract naming it the prime contractor for actuating the entire line of DEW land stations stretching some 3,000 miles across the northern perimeter of North America. The final contract was consummated in July 1955. In a package plan, Western Electric was given charge of designing,

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[Cont'd] 1958, pp. 88-91; Hist of NEAC, Jan-Jun 1956, pp. 175-85; NORAD Hist Summary, Jul-Dec 1958, pp. 87-90.

FPS-19 Search Radar in Plastic Radome

engineering, procuring, [illegible] tructing, installing and [illegible] the DEW Line equipments and facilities by mid-1957. Air Materiel Command was designated [illegible]'s administrative agency for the project.[15]

The Distant Early Warning Project Office (DEWPO) was established in New York City early in 1955, under AMC's jurisdiction, to work with Western Electric on DEW Line construction progress. Western Electric completed all field siting work on the Canadian stations by 10 June 1955, whereupon it proceeded with siting the Alaskan stations.

Main DEW Line sites numbered 57, spaced along the 69th parallel at about 50-mile intervals. Designed to throw up a high, thick, unbroken coast-to-coast radar screen capable of sifting out all comers from 50 feet over water (or 200 feet over land) to 65,000 feet altitude, up to 160 miles away, the 57 sites depended on two basic tools, the FPS-23 and FPS-19 radars. Both were engineered with a view to operating in temperatures ranging from 100 degrees to -65 Fahrenheit and to withstand winds up to 150 miles per hour.

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15. Ltr and Incls, USAF to ADC, "Implementation of the DEW Line," 21 Jan 1955 [Doc 109 in Hist of ADC, Jan-Jun 1955]; ADC Hist Study No. 10, pp. 64-67; Hist of ADC, Jul-Dec 1954, pp. 34-35; Jan-Jun 1955, p. 45; Jul-Dec [illegible]; Hist of AAC, Jul-Dec 1955, pp. 173-74.

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Of the two, the L-band FPS-19 search set, produced by Raytheon, was the work horse. Intended expressly for DEW Line operations, the FPS-19 included an antenna system comprised of two parabolic reflectors, each measuring 36 feet in length by 11 feet in height, affixed back-to-back on a pedestal that revolved a full 360 degrees. Each reflector contained its own multi-channel radar transmitter feed apparatus, so that one antenna created a high-angle, the other a low-angle lobe of radar coverage. The FPS-19 operated on frequencies between 1220 and 1350 megacycles per second, at 450 watts average power. Besides a detection range up to 160 nautical miles, the FPS-19 incorporated the unique automatic Radar Target Alarm (Radalarm) system that warned, both visually and audibly, when targets approached within range, alleviating the need for stationing scope operators on continuous duty. Targets were displayed on PPI scopes integrated into the operator's console. For sake of protection from winds, snows and ice, the dual antenna assembly, elevated 50 feet in the air, was covered by a plastic radome. While theoretically able to detect larger targets of B-29 size as high as 70,000 feet, the FPS-19, like other conventional radars, was limited to line-of-sight detection. This meant that targets flying at very low

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at frequencies varying between 475 and 525 megacycles per second, at one kilowatt power output, the Motorola-made FPS-23 system promised to fulfill DEW Line criteria for detecting all low-flying targets crossing its path, at altitudes as low as 200 feet over land and 50 feet over water. Both the FPS-19 and FPS-23 radar systems were powered by banks of diesel generators clustered nearby. So that neither system would be susceptible to actuation by flocks of migratory birds crossing the line, both radars were rigged to ignore targets flying at speeds under 125 m.p.h.[17]

Station and Personnel Authorizations. To exploit the FPS-19 and FPS-23 radars to best advantage, the 57 approved DEW sites were divided into three types: Main, Auxiliary, and Intermediate stations. As envisioned in 1955, the DEW Line, during its formative years, would be divided into a Western sector under Alaskan Air Command's operational control, and an Eastern sector under NEAC's operation control, with CONAD/ADC and RCAF the primary benefactors. Authority

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17. RADC, RADC-TR-56-103, Supp 1 to Ground Radar Sets, Systems and Related Components, Feb 1957, pp. 42-48 [HRF]; Hist of AAC, Jul-Dec 1955, p. 182; Hist of ADC, Jan-Jun 1954, p. 115; Hist of ADC, Jul-Dec 1956, p. 63; Hist of RADC, ARDC, Jul-Dec 1957, pp. 56-61.

to man the DEW Line with civilian contract personnel was granted by the Secretary of the Air Force in August 1955.

The six largest stations, designated Main stations, were spaced about 500 miles apart at (west to east) Point Barrow (designated POW) and Barter Island (BAR), Alaska, Cape Parry (PIN), Cambridge Bay (CAM), Hall Beach (FOX), and Cape Dyer (DYE), Canada. Here were concentrated the chief centers of activity, where the most equipment and largest contingent of personnel were positioned for round-the-clock manning of the Main station data centers. For the six Main stations acted as focal points for the operation, administration, maintenance and communication of the entire DEW Line -- the other stations in between comprising satellite stations existing chiefly to funnel data to the Main stations.

Each Main station was outfitted with both the FPS-19 search set and an FPS-23 fluttar receiver. Besides radars, the Main station literally bristled with communications devices. Conventional VHF and UHF transmitters and receivers enabled voice ground-to-air communications with pilots flying within range of the DEW radars. Multi-channel voice and teletype lateral communications were made possible with adjacent stations by use of AN/FRC-45 UHF (755-985 megacycles) tropospheric scatter equipment. Most important as regards

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communications from the standpoint of the nation's security, was the IS-101 VHF (30-50 megacycles) ionspheric scatter equipment, which facilitated multi-channel rearward teletype and voice communications to one of several special rearward communications centers integrated in the Mid-Canada Line and in Alaska, from whence it was immediately passed on to NORAD/ADC and RCAF particularly, as well as to AAC and NEAC. Since it was in Main Station data centers where airborne targets were processed (that is, plotted and correlated against available ground-filed flight plans), a sizeable operations and support crew was called for. To operate, maintain and service the radars and communications of each Main station, and perform other requisite functions, a complement of 45 to 50 civilians was authorized (called radicians" -- a contraction of radio, radar, electro-mechanical technicians), together with a small staff of officers to manage the data center. At each of the four Canadian Main stations, one of six assigned officers belonged to the RCAF, the other five, to USAF. The other two Main stations in Alaska were assigned six USAF officers each. To accommodate this large a body of personnel and equipment, two module

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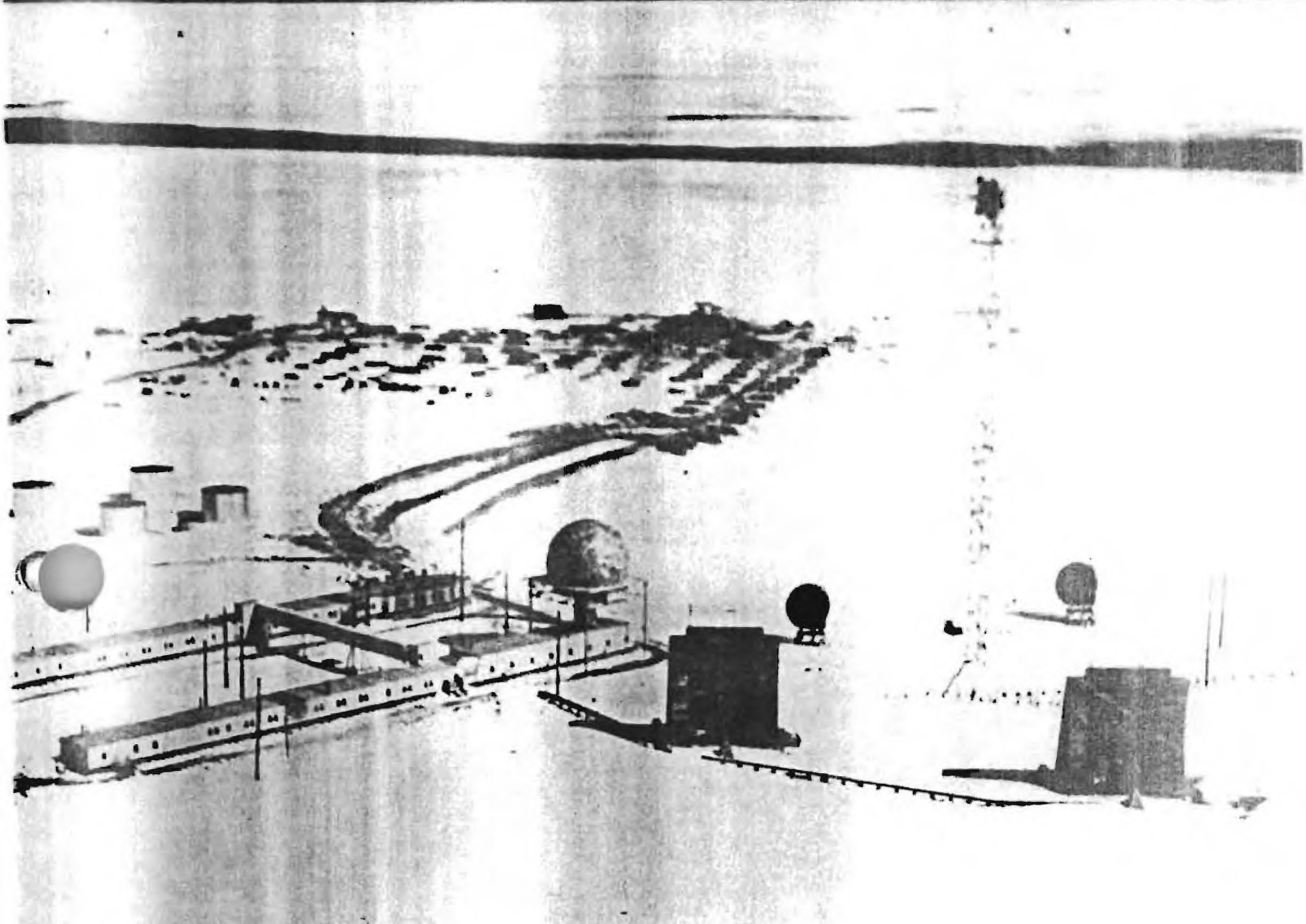

Panoramic View of DEW Line Main Station

trains were to be erected, containing about 25 interlinking modules per train, and interconnected by a crosswall.[18]

Next in importance (after the six Main stations) were 23 Auxiliary stations, staggered at about 100-mile intervals and likewise equipped with the FPS-19 search set and FPS-23 receiver. Communications, however, were limited to ground-to-air VHF and UHF radio for voice communications with aircraft and to UHF tropospheric scatter AN/FRC-45 equipment for lateral communications with other DEW stations. Some 16 to 18 civilians attended to the duties of the Auxiliary station, which above all included informing Main stations of airborne targets picked up by radar. A train of about 25 modules sufficed to house personnel and equipment. Finally, sandwiched midway between the Main and Auxiliary stations, were interspersed 28 four-to-five-man Intermediate stations, equipped solely with the FPS-23 fluttar transmitter and lateral voice communications via FM mobile radio. Five modules sufficed to accommodate the handful of men and equipment assigned. Altogether, the DEW personnel force

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18. Hist of ADC, Jul-Dec 1955, p. 72; Jul-Dec 1956, pp. 62-63; Jan-Jun 1957, pp. 83-84; 1958, pp. 73-74; Hist of AAC, Jul-Dec 1955, pp. 175-77, 193; Jan-Jun 1956, p. 146; Ltr and Incl, Early Warning Operations Working Group to ADC, "Distant Early Warning Operations Plan," 3 Oct 1955 [HRF]; Hist of AMC, Jul-Dec 1955, pp. 245-46; APGC, APGC-TR-58-137, Dec 1958 [HRF]; C&E Digest, Vol 8 No. 7 (Jul 1958), pp. 2-7.

authorized for all 57 stations approximately 36 officers and 800 civilians.[19]

DEW Line Construction, 1955-1957. DEW Line construction starting in the spring of 1955 and ending in early 1957, constituted an achievement of epic proportions. Because of the short duration of time available each year for construction purposes, owing to the severe climate and the general inacessibility of sites, the factors of timing and of supply-route locations were especially critical. To squeeze in the most amount of work during two brief work seasons, logistic supply and transport routes were carefully considered, then planned and charted in minute detail. Supplies subsequently converged on the DEW Line from practically every conceivable direction, via water, land and air. By ship, supplies were sailed eastward and westward, respectively, from the Pacific and Atlantic. By rail and truck they moved northward to Waterways, Alberta, thence, by barges on Mackenzie River, they were floated northwestward to six sites. Also by rail,supplies were transported to Churchill, Canada, from whence they were airlifted northward to several points.

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19. Hist of ADC, 1958, p. 74; Hist of AAC, Jul-Dec 1955, pp. 175-82, 193; Jan-Jun 1956, p. 146; Jan-Jun 1957,

For sake of expediency, Western Electric divided DEW Line construction into the Eastern, Central and Western sections, each subcontracted to a different firm. The Western section, mostly in Alaska, was subcontracted to two companies working in combination: Johnson, Drake and Piper, and the Puget Sound Bridge and Dredging Company of Seattle. The contract for construction of the Central section, mostly along northcentral and northwestern Canada, was awarded to the Northern Construction Company and J. S. Stewart, Incorporated (of Vancouver, British Columbia); while that for construction of the Eastern section across Canada's northeastern rim went to the Foundation Company, Limited (of Montreal, Quebec). Apart from the resources of these DEW construction companies, facilities of the U.S. Air Force, Navy, and Coast Guard, Alaskan "bush" pilots, the Canadian Coast Guard, RCAF, and certain Canadian icebreakers conducted exploratory trips in the spring of 1955 through long stretches of uncharted Arctic waters, so that safe water routes could be mapped and cleared of obstacles. From July 1955 until ice again formed in September 1955, ships flocked to DEW sites bearing thousands of tons of supplies.

[Cont'd] pp. 95-96; Hist of NEAC, Jan-Jun 1956, p. 171; ADCM 400-2, Distant Early Warning Line Logistics, 2 Feb 1959 [HRF].

altitudes, especially beneath 5,000 feet, conceivably might slip by undetected until comparitively close to an FPS-19.[16] To compensate for the FPS-19's low-altitude shortcomings, the FPS-23 continuous wave (CW) radar was created. The FPS-23 filled in the low-altitude gaps, to spot low flying targets and sound the appropriate alarm.

The FPS-23 fluttar system differed markedly from conventional pulse-generating radars. Transmitter and receiver, instead of being packaged into a single combined assembly, were separated by distances of about 50 miles. At one DEW station the FPS-23 transmitter antenna (about 20 feet high by six feet wide, elevated from 100 to 400 feet above ground, depending on terrain), generated a steady stream of continuous wave beams picked up by a receiver (equally as large and as high) at the next DEW station. Whenever an aerial target penetrated the electronic field thus energized, frequency changes resulted attributable to the Doppler effect which triggered an automatic alarming defice. Functioning

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16. ADC, Dir of C&E, Air Defense Command's Ground Radars, n.d., p. 17 [HRF]; RADC, RADC-TR-56-103, Supp I to Ground Radar Sets, Systems and Related Components, Feb 1957, pp. 28-34 [HRF]; Hist of AAC, Jul-Dec 1955, p. 181; Hist of ADC, Jul-Dec 1956, pp. 62-64; Hist of AMC, Jul-Dec 1955, pp. 246-47; Hist of RADC, ARDC, Jul-Dec 1957, pp. 54-56; APGC, APGC-TR-58-137,"Employment and Suitability Test of the Distant Early Warning (DEW) Line (Project Red Sea)," Dec 1958 [HRF].

Beforehand, advance construction parties arrived either by small ski-plane or, where topography allowed, by snow tractor, to improvise airfields, first by clearing a patch large enough for a comparatively small C-46 or C-47 transport to alight, carrying a D-4. Once the D-4 tractor was on hand intact, a landing strip was carved out 6,000 feet in length, to accommodate TAC C-124 Globemasters.[20]

All told, 127,000 short tons were delivered by sea-lift in 1955, despite the fact that waterways between Point Barrow and Herschel Island experienced the worst ice conditions on record. Convoys of ship transports embarked from Seattle, Washington on the west side, and from Halifax, Nova Scotia on the east, then swarmed as close to DEW stations as they could with their supply-ladened bottoms. Earlier that same year, prior to, and in anticipation of first arrivals by sea, 1,183 USAF flights, and 5,074 flights by common carriers were accomplished, resulting in delivery of thousands of tons of supplies and numerous personnel by 1 June 1955. Something like 50,000 tons of material were transported

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20. Hist of AMC, Jul-Dec 1955, pp. 240-46; 1OC and Incl, ADC, DCS/O to ADOPR, "Journal of Meeting of PJBD, Canada-United States, 18-19 Oct 1954, RCAF Staff College, Toronto," 21 Jan 1955 [HRF]; Hist of ADC, Jul-Dec 1956, pp. 61-62; Hist of AAC, Jul-Dec 1955, p. 191; Jan-Jun 1956, pp. 147-48.

by air in 1955, causing total DEW Line tonnage to mount over 189,000 short-tons altogether, including 8,000 tons arriving by barge, and 4,000 tons hauled by "cat-trains" (comprised of snow tractors and sled trailers).

Next year, the water, air and land carriers practically repeated the previous year's performance by spiriting supplies totalling 167,183, short tons to DEW Line facilities. Construction progressed smoothly, as revealed by Western Electric's mid-1956 report -- indicative also of the size of logistics involved:[21]

> Over 9.000 tons of insulated aluminum and steel panels have been provided for 57 garages and 16 hangars. Over two thousand tons of reinforcing steel and 28.500 tons of cement will be used for foundation and slab construction. Over 9.800 tons of prefabricated insulated plywood panels were delivered and are being used in the assembly of more than 1,200 building modules. Twenty-three 250,000 gallon, ninety-two 65,000 gallon and ninety-six 20,000 gallon tanks have been procured and shipped to Arctic sites for the storage of fuel oil. These utilized over 2,600 tons of steel.

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20. Hist of AMC, Jul-Dec 1955, pp. 247-51; Hist of NEAC, Jul-Dec 1956, p. 106; Hist of AAC, Jul-Dec 1956, pp. 184-92.

21. Rpt, Western Elec Co, 30 Jun 1956, Sec 9, p. 6, quoted verbatim in Hist of NEAC, Jan-Jun 1956, p. 164; Hist of NEAC, Jul-Dec 1956, pp. 101-09; Hist of AAC, Jan-Jun 1956, pp. 152-54.

To support the construction phase and one year's operating requirements of POL, the Western Electric Company furnished approximately 19,000,000 gallons (77,900 tons) by Naval convoy and 490,000 gallons (2,170 tons) by barge down the McKenzie River during the summer of 1955. In addition, the contractors, to support their construction needs, procured approximately 3,730,000 gallons (15,287 tons). During the 1956 season Western Electric Co. expects to ship 19,800,000 gallons (110,000 tons) of POL products required to complete construction work and to support operations for approximately two years.

One hundred fourteen antennas and towers ranging from 25' to 75' in height, sixty towers ranging from 100' to 400' in height and sixteen 60' x 60' antennas have been purchased. These involve over 6,700 tons of steel.

By the end of 1956, all DEW stations situated in the Western and Central sections had achieved a beneficial occupancy status, joined several weeks later, in early 1957, by those in the Eastern section. While amounting to a colossal record -- 57 DEW stations installed in half the time a project of this magnitude would ordinarily take -- it was not accomplished without its tragedies. Some 25 fatalities resulted from aircraft accidents during the DEW Line construction phase, 15 in 1955, and the other 10 in 1956. DEW Line financial costs, all in all, figured about $350,000,000 for 113,000 purchase orders, $200,000,000 of which was spent, as a matter of policy, with Canadian firms.[22]

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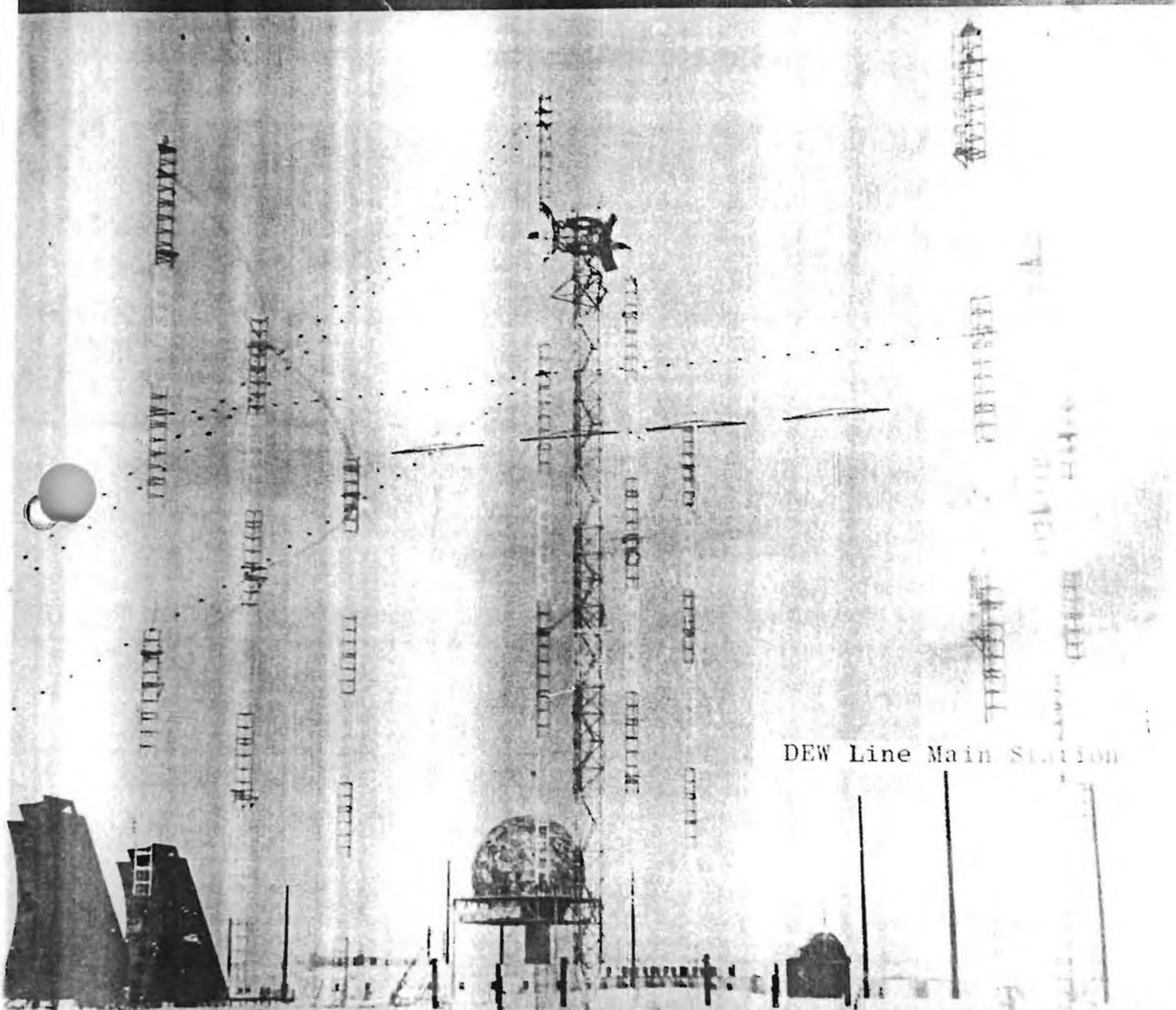
22. Hist of ADC, Jul-Dec 1956, p. 62; Hist of NEAC, Jul-Dec 1956, p. 109; Soundtrack to Film SFP 570, Western Elec Co, DEW Line, 1957 [HRF].



DEW Line Main Station

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Meanwhile, earlier in 1956, the JCS directed USAF to survey sites and negotiate agreements for the four bases across southern Greenland to comprise part of the Eastern extension to the DEW Line. Funding was scheduled for FY 1958 with an early 1960 target date for operational use. On the other side of DEW Line proper -- that part comprising the Western extension -- a chain of six sites was approved for the Aleutian Islands.

A contract for the maintenance and actual operation of DEW Line proper. was awarded to the Federal Electric Company a subsidiary of the International Telephone and Telegraph Corporation, in a letter contract dated 12 March 1956. Payment for this service was to be on a cost-plus-fixed fee basis. On 30 April 1956, the training of Federal Electric employees was contracted for, whereupon a training program was formally inaugurated at Western Electric's experimental facility at Streator, Illinois. In the spring of 1957, with DEW Line, for the most part, completed, Federal Electric employees familiarized themselves with their new responsibilities at the 57 stations in DEW Line proper, as systems calibrations, tests and checks were conducted by Western Electric. Hundreds of flyovers were flown at various altitudes and speeds to verify accuracy of radar detection and tracking equipment and reliability of communications. Over 1,000,000 tests were performed to prove out the system to Western Electric's satisfaction. As of 31 July 1957, the DEW Line was sufficiently readied for transfer to USAF, although not all tests had been accomplished. While contractor tests had ended by this time, USAF second-phase APGC tests were purposely postponed until 1958, owing to the absence of completed landline connections to the NORAD/ADC Combat Operations Center at Colorado Springs, among other things.[23]

Operations, Improvements, Tests and Plans, 1957-1960. On 13 August 1957, the Air Force formally took possession of the DEW Line from the Western Electric Company. While most of the decade of the 1950's had thus been consumed in planning, experimenting, engineering and erecting the main segment of the DEW Line the rest of the decade (insofar as DEW Line was concerned) was spent operating and further testing DEW stations, simplifying procedures, realigning jurisdictional responsibilities, and stretching the DEW Line's reach, eastward and westward.

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23. Hist of NEAC, Jan-Jun 1956, pp. 175-85; Hist of NEAC, Jul-Dec 1956, p. 101; Hist of AMC, Jul-Dec 1955, pp. 259-60; Hist of AAC, Jan-Jun 1956, pp. 147-48, 155-70; Jul-Dec 1956, pp. 177-85; Jan-Jun 1957, pp. 95-103; Sound Track to Film SFP 570, Western Elec Co., DEW Line, 1957 [HRF]; CONAD Hist Summary, Jul 1956-Jun 1957, pp. 63-64.

DEW Line responsibilities had first been parceled out among several USAF commands, later to gravitate more and more under ADC's control. Operational responsibility, prior to the DEW Line's completion, had been vested in Alaskan Air Command (AAC) for the western portion, and Northeast Air Command (NEAC) for the eastern. When NEAC was inactivated in 1957. operational control was assigned to ADC, exercised by the 64th Air Division (Defense) which ADC inherited from NEAC effective 1 April 1957. Next, ADC, on 15 February 1958, assumed operational control of the main segment in its entirety under the aegis of CINCNORAD. Certain funding responsibilities for DEW Line expenses were assigned to ADC, as well. For its part, Alaskan Air Command was limited by USAF to operational control of the Alaskan and Aleutian radars comprising the land portions of the DEW western extension.[24]

Logistic support was originally handled by Air Materiel Command which in turn had centralized this activity at its depot in Rome, New York (ROAMA). During the construction period, AMC stockpiled more than one full year's supply of spare parts, fuel, and other essential equipment for delivery

24. Hist of ADC, Jan-Jun 1957, pp. 82-83; Hist of ADC, 1958, pp. 71-73; NORAD Historical Summary, Jan-Jun 1958, p. 55; NORAD Historical Summary, Jul-Dec 1959, p. 85.

to the DEW Line, and was responsible thereafter for annual reshipments by water and air. Frobisher and Ladd Air Force Bases, which had constituted the two main staging areas for DEW Line supply and support, soon proved inadequate to the task because of overcrowded conditions. To facilitate logistic supply, therefore, DEW Line Main, in 1958, was subdivided into western, central and eastern sections, administered by a DEW Line office at Fairbanks, Edmonton and Montreal, respectively, with an auxiliary office for the eastern section at Frobisher Bay. Three supply consolidation points were established, west to east, at the McChord AFB (Washington) and the Ogden (Utah) and Rome (New York) depots. A logistics central control point was established at Paramus, New Jersey, headquarters of the Federal Electric Company, the operations and maintenance contractor. Here were centralized the records, reports and inventories pertaining to DEW Line support, as well as the paper work connected with supply requisitioning.

The function of acting as USAF's agency for contract administration of the DEW Line, heretofore vested in Air Materiel Command, was transferred to ADC effective 15 February 1958. The 4601st Support Group (DEW) was activated at Paramus, New Jersey, 1 April 1958 to represent ADC in this matter. While AMC continued serving as the main USAF supply source for DEW Line, Federal Electric Company was empowered

One of the DEW Line Main Stations in Canada to procure supplies for emergency purposes, subject to ADC's approval, when not available in time from AMC sources. Annual resupplies were calculated by Federal Electric, submitted to the 4601st Support Group (redesignated 4601st Support Wing on 1 October 1959) for review and approval, then requisitioned, with ensuing support action carefully monitored by the 4601st. Representing ADC, the 4601st exercised operational supervision of Federal Electric's DEW Line activities, too.

So successful proved the supply arrangement that the DEW Line, once hampered by numerous outages caused by lack of parts, soon enjoyed a 99 per cent rate of equipment in commission. The maintenance aspect was further improved during 1959, when Depot Level Maintenance (DLM) facilities, situated at BAR and FOX for servicing half of DEW Line each, grew to full capacity. While they served to repair and overhaul vehicles, diesels and certain other ground-powered equipment, another facility at Montreal handled repairs and calibrations of communications and electronic components, teletype and test equipment.[25]

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25. ADCM 400-2, Distant Early Warning Logistics, 2 Feb 1959 [HRF]; Hist of ADC, 1958, pp. 74-75; Register and Defense Times, 15 Oct 1960, p. 34; Hist of ADC, Jul-Dec 1959, pp. 47-49.

Considerable deliberation and planning, meanwhile, had been focused on operational concepts contrived to effect positive identification of aircraft flying over the Polar route. One method in particular, the customary flight-plan matching process (long exploited by ADC's ZI network of radars), offered the most promise. An elaborate system based on this and other techniques was drawn up and published as the USAF-RCAF Operations Plan, dated 1 June 1956. According to this plan, pilots of aircraft flights originating in Europe or the Orient, destined for North American airfields via the Polar route, filed before take-off a flight plan charting the flight path and estimated time of arrival over certain check-points enroute. These were teletyped to one of three Air Movement Identification System (AMIS) centers in North America: the DOT Area Control Centers at Goose Bay, Labrador, and Edmonton, Canada, and the FAA Air Route Traffic Control Center at Anchorage, Alaska. In turn, the AMIS center notified pertinent DEW Main Station data centers of the impending flight. Once each flight penetrated the DEW Identification Zone (DEWIZ) within range of DEW Line radars, its course was tracked, and its position and time were duly correlated against estimated data contained in the ground-filed flight plan. If within plus or minus one hour, and 100 miles, of estimates and certain other conditions were met, the flight was classified as friendly. Among the other conditions were periodic position reports transmitted by the pilots to appropriate DEW stations, employing voice radio operating on a predetermined frequency. Additional authenticating information unique to the flight might be disclosed via air-to-ground communications, as well. It was later decided (in January 1960) that pilots flying within five minutes time and 20 miles miles laterally, of estimates would not be compelled to make periodic position reports, while flights under 150 knots would not require identification action at all. Military flights might further be identified by triggering an IFF interrogator at a DEW Line station, which actuated an IFF responder in the aircraft.

With a view to achieving detection and identification rates in the 95-98 per cent class, the USAF-RCAF Operations Plan also contemplated usage of the sealed envelope technique. But in this matter, the Operations Plan was not unopposed. Each pilot intending to fly the Polar route, according to this method, would be handed, prior to takeoff, a sealed envelope containing instructions for executing a certain type of predetermined maneuver. When penetrating the DEWIZ, the pilot would open the enevelope, and if so ordered, fly the maneuver and read aloud any code word or words prescribed. CONAD, however, opposed the sealed enevelope routine for several reasons, among which the most important were the complications and the excess costs involved. The JCS, on 24 May 1957, supported CONAD's viewpoint and the sealed envelope concept was discarded.

At any rate, target information on air traffic penetrating the DEWIZ was relayed rearward within five minutes time and, if remaining unknown, to ADC and CONAD/NORAD as soon as possible. Commercial air traffic crossing the DEWIZ, though sparse in comparison with the heavy flow penetrating U.S. coastal ADIZ's, included an appreciable number of scheduled flights by Scandinavian Airlines System (SAS). Besides its flights crossing the arctic heading for North American airfields, SAS, in 1957, pioneered the first scheduled air link between Europe and Japan via the North Pole route, which entailed one stop-over for refueling at Anchorage, Alaska, necessitating penetrations of DEW Line coverage.[26]

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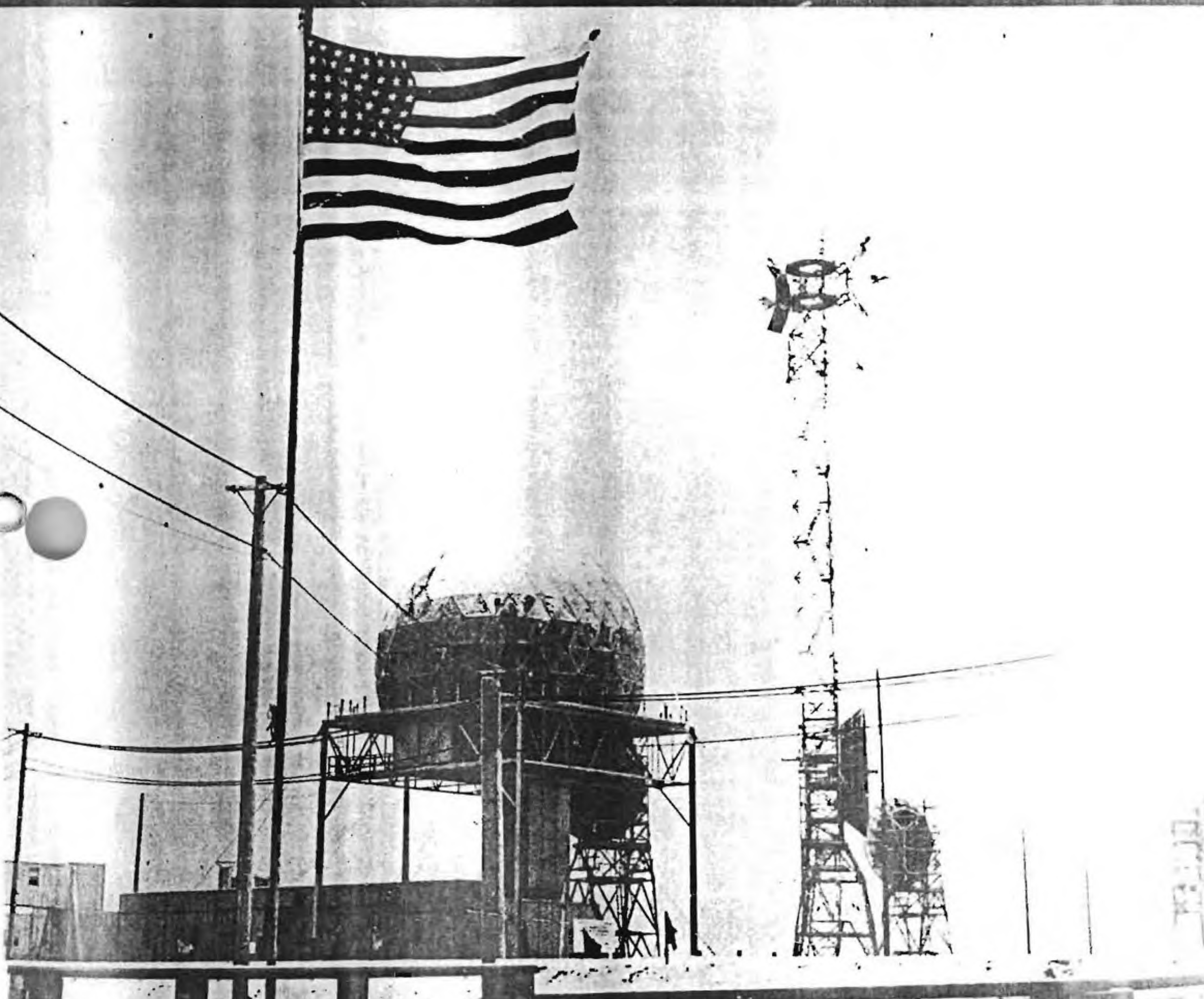
26. Hist of AAC, Jul-Dec 1955, pp. 180-81; Hist of ADC, Jul-Dec 1955, pp. 72-73; Ltr and Incl, Early Warning Operations Working Group to ADC, "Distant Early Warning Operations Plan," 30 Oct 1955 [HRF]; Western Elec Co., DEW Line Training Manual, Dec 1957, pp. 31-51 [ADC Tech Library]; CONAD Hist Summary, Jul 1956-Jun 1957, pp. 64-65; Msg ADOOP-EM 307, ADC to 4601 Spt Wg, Paramus, N.J., "DEW Ops Plan 3-59," 29 Jan 1960 [HRF]; The World Almanac and Book of Facts for 1958 (New York, New York World-Telegram, 1958), p. 784.



Close-Up of DEW Line Main Station

Rearward Communications. DEW rearward communications -- vital as these were to the nation's safety -- at first left much to be desired. NORAD complained of how the preponderance of DEW Line communications traffic arrived garbled over the four main circuits at the Colorado Springs COC. A number of reasons were postulated as the cause. Absense of "repeat-back" radio facilities, of VHF back-up equipment, of coordinated efforts among the 16 separate companies involved in transmitting messages between DEW Main stations and Colorado Springs, together with lack of a published manual standardizing and systematizing procedures: for having botched rearward communications somewhere enroute. 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. Improvements in the White Alice Alaskan communications system on the one side, and in the Pole Vault communications network (connecting Baffin Island with Newfoundland) on the other, were found to be in order, besides improvements to the interior service.

It was found profitable to assign AT&T Denver Toll Test Center as the single agency responsible for monitoring all rearward DEW Line communications. Monitoring machines were promptly installed that accelerated the narrowing down and trouble-shooting processes entailed in correcting outages and keeping DEW communications intact. Repeat-back facilities were installed; White Alice circuitry was augmented; communications traffic surveys were conducted periodically; and Bell Telephone System practices were adopted and codified for trouble reporting, testing and controlling circuitry, and restoring outages. All in all, these and other improvements to the rearward communications network effected dramatic changes for the better. The NORAD COC, once troubled with receiving as much as 98 per cent of DEW Line transmissions in garbled form, at last received DEW Line data relatively free from this bothersome stigma.[27]

Project Red Sea. By mid-1958, communications had improved enough to warrant conducting the final DEW Line systems test, performed under APGC auspices. This was the employment and suitability test, designated Project Red Sea, conducted from 1 May through 2 September 1958. The test was designed to:[28]

> ...determine the operational capability of the Distant Early Warning (DEW) Line System to effectively detect, identify, and report surveillance

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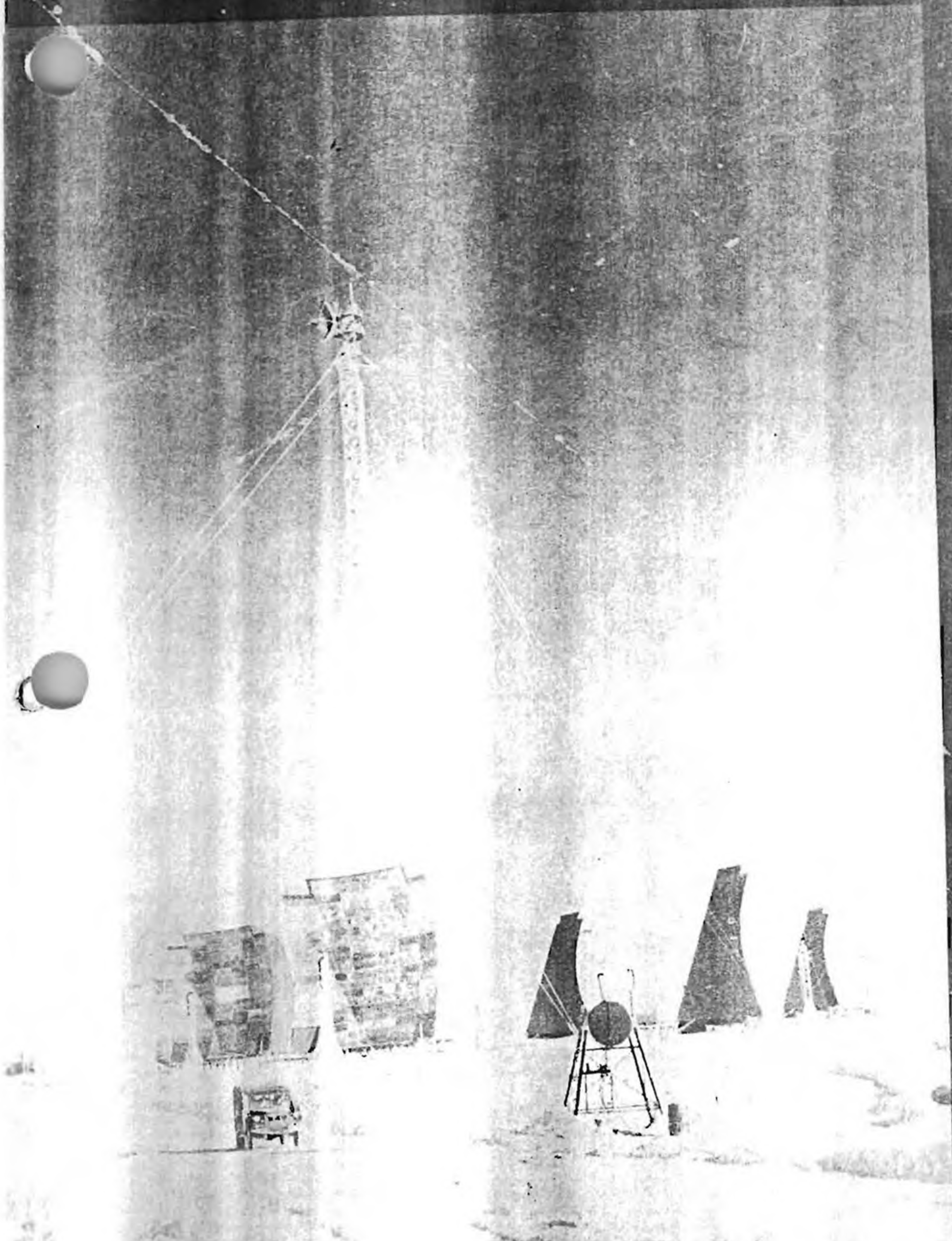
27. Hist of ADC, 1958, pp. 77-81; NORAD Historical Summary, Jul-Dec 1957, pp. 48-51; NORAD Historical Summary, Jan-Jun 1958, pp. 52-54; Hist of ADC, Jul-Dec 1960, pp. 35-39.

28. Rpt, APGC-TR-58-137, Employment and Suitability



Main Station [illegible] and Communications information to the North American Air Defense and Royal Canadian Air Force/Air Defense Command Combat Operations Centers, and the adequacy and effectiveness of communications and electronic maintenance in support of the operational mission.

The portion of DEW Line proper spanning the Cambridge Bay to Hall Beach Main Stations was singled out for the test. Counting the Auxiliary and Intermediate stations in between, the units involved numbered 13 -- not an unlucky number this time, in view of the test's outcome. All told, 12 SAC aircraft of the B-52 and KC-97 varieties penetrated the 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 sets unnoticed. Seventy-two of the 73 flights were reported rearward, 71 of which were appropriately received by personnel manning the COC's at NORAD and RCAF/ADC.

That the test resulted, to all intents and purposes, in a near perfect detection record followed by a 97 per cent rearward reporting rate did not mean the system was pronounced free of serious flaws. Indeed, certain Federal Electric console operators were found to be so lax that they had

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[Cont'd] Test of the Distant Early Warning (DEW) Line, (Project Red Sea), Dec 1958, p. 111 [HRF].

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imprudently neglected to report any of their targets. Had it not been for reports on these same targets coming from operators at adjacent sites, the targets might well have passed through the system unreported. Since high-flying targets during the test were picked up by as many as four FPS-19's simultaneously, these omitted reports happened not to affect the end result this time. They stressed a need, however, to enforce ironclad rules making such reports mandatory.

But, if anything spoiled an otherwise unblemished record, it was the performance of the FPS-23 Doppler detection set. To be sure, only 79 per cent of 49 known flight penetrations of the Doppler System were actually detected by the FPS-23 network; and not all of these were laterally relayed to Main Station data center controllers for action. Lateral communication circuits, on the other hand, proved excellent when properly used, as did those circuits of the rearward communications net. The FPS-23 alarm system, to make matters worse, triggered more false alarms than actual ones.

Except for the FPS-23 set, DEW Line equipments generally demonstrated an ample capacity to perform up to standard. Civilian operating personnel, according to APGC's findings, should be afforded a better training program. Both the formal training at the Streator, Illinois facility (lasting 10 to 13

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weeks), and the on-the-job training at DEW Line assignments, lacked sufficiency. Although the FPS-19 search set had performed excellently, the FPS-19 radalarm system, like that of the FPS-23, generated more false alarms than real ones. Some 9,750 FPS-19 alarms were actuated in all, only 14 per cent of which were assessed as genuine. Cloud formations, ice flows and electronic interference, among other things, were surmised as the causative agents responsible for false alarms.[29]

A flurry of activities followed the publication of Project Red Sea results, in order to rectify short-comings. Obviously, something had to be done for the FPS-23, if it was to make a meaningful contribution to the system. Actually, ADC had been cognizant of FPS-23 shortcomings ever since its installation and a corrective program was in the formative stages by mid-1958. Much of the FPS-23 detection difficulties were attributable to its penchant for tripping false alarms -- so much so, in fact, that Federal Electric personnel tended to lose confidence in the system and were apt to ignore its

29. Hist of ADC, 1958, pp. 81-88; Rpt, APGC-TR-58-137, Dec 1958 [HRF]; NORAD Historical Summary, Jul-Dec 1958, pp. 76-77; Rpt, APGC-TN-58-39, APGC, Evaluation of Human Factor Aspects of Maintenance and Operation of the Distant Early Warning Line, Dec 1958 [HRF].

aural and visual warnings. Consequently, legitimate targets properly detected might get through. As many as four false alarms per minute had been known to go off -- enough, certainly, to discourage the most trusting soul. Weather conditions, propagation anomalies, power supply variations, electronic disturbances from adjacent transmitters -- all contributed to precipitating false alarms in the FPS-23 alarm system. Western Electric technicians helped reduce those caused by the latter problem in 1958, by readjusting FPS-23 antenna angles. Nevertheless no ready-made solution was at hand to correct its other susceptibilities and the false alarm problem continued hanging fire as investigation followed investigation.

Nearly as bad was the FPS-23 graphic display system that presented target information as pen recordings on electrographic paper. At best, this process was barely readable. Bell Laboratories perfected a substitute apparatus called the Doppler Spectrum Analyser (DSA), which enabled the operator to follow an airborne target as it passed through the Doppler beams. By the end of 1958, ADC had endorsed its adoption, with a view to installing the new device in early 1959. But indications were strong that at least 12 months would elapse before they could be manufactured, and that another eight months would be consumed in delivering and installing them, prolonging the time of their implementation into the 1960's.[30]

A sure way to dispose of FPS-19 radalarm troubles -- equally guilty of flooding the surveillance system with false alarms -- was to do away with the need for one. Both the FPS-19 radalarm and FPS-23 alarm systems, as mentioned above, were designed expressly to alleviate round-the-clock scope watching. In theory, the alarms, both by visual and aural means, would warn of an aircraft penetration without technicians having to be on constant PPI scope duty. When in practice, the alarm part of the system failed to work as expected, around-the-clock FPS-19 scope watches might be inaugurated to circumvent dependence on the alarms. Exactly this was asked of Federal Electric by ADC in late 1958. The company quickly complied, beginning in January 1959. Federal Electric also saw the wisdom of immediately revising and improving its training programs, when faced with two APGC reports roundly disparaging its erstwhile efforts at training. Also, ADC directed the 4601st Support Wing to monitor closely

30. Rpt, APGC-TR-58-137, Dec 1958 [HRF]; Rpt, APGC-TN-58-39, Dec 1958 [HRF]; Hist of ADC, Jan-Jun 1959, pp. 70-72; NORAD Historical Summary, Jul-Dec 1958, pp. 76-77.

Federal Electric's managerial and supervisory practices along DEW Line.

A personnel change was foisted on ADC from a different quarter about this same time. Scarcely had the Red Sea tests ended, when Mr. George Pearkes, Canadian Minister of National Defense, visited DEW Line. Upon returning home, the Defense Minister recommended that RCAF officers be assigned a greater share in the manning of the DEW Line. The minister was entirely within his rights in asking this for by the terms of the original agreement of 5 May 1955, it was clearly stipulated that:[31]

> Canada reserves the right, on reasonable notice, to take over the operation and manning of any or all of the [DEW Line] installations [on Canadian soil]. Canada will ensure the effective operation, in association with the United States, of any installations it takes over.

As things stood when the Canadian minister recommended the change, there were six military positions at each of the six Main Station data centers. At the four located in Canada, USAF officers occupied five of the six slots, with one RCAF

31. Ltr and Incl, Canadian Embassy to U.S. Secy of State, "Statement of Conditions to Govern the Establishment of a Distant Early Warning System in Canadian Territory," 5 May 1955, Appendix N to ADCM 400-2, Distant Early Warning Line, 2 Feb 1957, pp. 106-11 [HRF]; Hist of ADC, Jan-Jun 1959 pp. 72-75; NORAD Historical Summary, Jul-Dec 1958, pp. 78-79.

officer filling the sixth. The Canadian Department of Defense sought to reverse this ratio so that five RCAF officers and one USAF officer would staff the four Main Station data centers in Canada. Upon studying the matter, ADC could see no advantage in doing this, and said so to USAF near the end of 1958. But efforts by ADC to dissuade USAF and NORAD from complying with Canadian wishes were to no avail. USAF, on the last day of 1958, acknowledged its willingness to make the change and in January 1959, all parties agreed to staff the four data centers involved with seven persons, five of whom would be RCAF officers, and two, USAF officers. An RCAF squadron leader would act as the DEW Sector commander. One of the two USAF officers would serve as a director; the other would act as liaison officer between the Federal Electric Company and the 4601st Support Wing. The change was effected in February 1959.[32]

Another disappointment to ADC cropping up at this time concerned the DEW Line radar improvement program. While the FPS-19 search set, as demonstrated by Red Sea tests, performed excellently against the existing manned

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32. C&E Digest, Apr 1959, p. 22; Hist of ADC, Jan-Jun 1959, pp. 72-75; NORAD Historical Summary, Jul-Dec 1958, pp. 78-79; Msg ADOOP-EM 594, ADC to USAF, 21 Nov 1958 [Doc 103 in Hist of ADC, Jan-Jun 1959].

bomber threat, it was not expected to cope with the future threat. For this purpose, the FPS-19 search set was to be displaced in the early 1960's by a radar capable of detecting and tracking targets over 200 nautical miles away, flying up to 100,000 feet in altitude. The FPS-30 "Advanced Sentinel," developed by Lincoln Laboratories and built by Bendix, was the search set designed to fulfill these parameters. According to programs, the FPS-30 was to replace the FPS-19. Since the high-altitude envelope offered by the FPS-30 would overlap considerably at 100,000 feet, it was decided to replace only every other FPS-19 with an FPS-30, making 14 in all.

Also, to further cope with the advanced threat of the 1960's (including high-flying bombers and air-breathing missiles), ADC requested USAF to authorize the installation of a modified FPS-26 frequency diversity height finder, at the alternate DEW stations earmarked to receive the FPS-30. Fourteen FPS-26 sets not only would add a height finding capability to DEW Line, but also would "burn through" enemy ECM to provide an accurate count of the number of aircraft comprising any given raid.

But USAF harbored other notions regarding this matter. At the same time that USAF approved the FPS-30 in December

1958, it flatly rejected the FPS-26 height finder. Instead of the FPS-26, it was subsequently learned that USAF favored the FPS-58 raid assessment radar then undergoing tests by ARDC. ADC, too, soon came to appreciate the FPS-58 as the better choice, because of its superior raid assessment capability. Accordingly, ADC made plans in the spring of 1959, subject to USAF approval and funding, to install one FPS-58 at each Main and Auxiliary station, for a total of 29, plus another one at the Streator, Illinois training facility. The FPS-30 search and FPS-58 height radars, if and when funded, would be scheduled for installation early in the 1960's, with an operational date in the 1962-1963 time period. But, in late 1959, USAF got caught in a funding squeeze, with the result that all new radars planned for the DEW Line were discarded from ADC's program. In January 1960, ADC was officially notified by USAF that programming activity in support of improved DEW Line radars should henceforth be cancelled. The DEW Line would simply have to limp along as best it could with its existing radars.[33]

33. Hist of RADC, ARDC, Jul-Dec 1957, pp. 68-69; Hist of ADC, 1958, pp. 75-77; Hist of ADC, Jul-Dec 1959, pp. 50-53; Hist of ADC, Jan-Jun 1959, pp. 65-70.

Completion of DEW Extensions. Although denied these coveted improvements to its major middle section, the DEW Line still enjoyed some bright moments at either of its ends. Both extensions, the Aleutian and the Greenland segments, together with the Navy contribution, gradually assumed shape. As noted above, construction of additional radar sites at both ends had been authorized since 1956. To recapitulate, the DEW East extension was authorized four surveillance sites across Greenland; the DEW West extension; and six surveillance sites across the Aleutian Islands. The six Aleutian sites were to operate one FPS-19 search set apiece, and the four Greenland sites, one FPS-30 search set each. Neither side would operate FPS-23 fluttar radars, since terrain features in the Aleutians and Greenland made low-altitude penetrations unlikely.

In 1956-1957, the usual surveying teams and mapping parties conducted on-site investigations in the Aleutians and in Greenland. As with DEW Line proper, Western Electric was designated prime contractor for both the Greenland and the Aleutian segments. Upon completion, the Greenland segment was to be operated and maintained by a civilian contractor similar to DEW Line Main with ADC acting as USAF's agency for contract administration. The Aleutian segment on the other hand, was to be peopled largely with USAF personnel under control of Alaskan Air Command, working as elements of the 714th ACW Squadron.

Building first got started on the DEW West Aleutian segment, where construction crews were pounding hammers at all six "stretchout" stations by August 1957. The sites involved, west to east, were first, Nikolski, then Driftwood Bay 106 miles away, followed by Sarichef 93 miles from Driftwood, Cold Bay another 92 miles farther, Port Moller 105 miles beyond Cold Bay, and finally Port Heiden 100 more miles away. The Cold Bay station acted as the Main station; the other five as Auxiliary types. King Salmon, Alaska, 141 miles east of Port Heiden, served as the support base for the six sites, all of which were placed under Alaskan Air Command's jurisdiction, effective 23 January 1959. Between 10 February and 26 March 1959, SAC B-47's and a chartered Twin-Bonanza airplane flew "raids" penetrating the Aleutian segment's area of responsibility to test the performance of its FPS-19 search sets and assigned USAF operators. Fifty-five B-47 flights ensued between 1,000 and 45,000 feet, together with several Twin-Bonanza flights at 500 feet. All flights were detected and successfully tracked, with Alaskan

Air Command receiving 94.5 per cent of the reports relayed to it. On 1 April 1959, the Aleutian sites became officially operational. Joined on its one side by AAC's land-based radars bringing the Alaskan peninsula, and on its other by the Navy operated Pacific Barrier, the three systems in combination extended DEW Line coverage westward to Midway Island.

During the construction phase of the Aleutian segment, the Navy Pacific Barrier, which began operations 1 July 1958 with four DER picket stations and four AEW&C stations, compensated for the lack of radar coverage by patrolling from Midway to Kodiak Island. Upon completion of "stretchout" and accomplishment of an operational status in April 1959, the Navy Pacific Barrier assumed its regular Midway to Umnak coverage, estimated to comprise a distance some 2,840 miles long -- practically the length of DEW Line proper.

DEW picket stations, hiked from four to five in 1958-1959, were later reduced to two. Indeed, the Navy Department in late 1960 sought to abolish, for economy's sake, the entire Pacific Barrier by early 1961, but the Secretary of Defense scotched this proposal in March 1961, ordering continuation of the Barrier for some time to come.[34]

34. Hist of ADC, Jul-Dec 1960, pp. 28-29, 39-40; NORAD Historical Summaries, Jul-Dec 1957, pp. 53-56; Jan-Jun

Regarding DEW East, a USAF-Danish agreement was consummated on 19 March 1958 authorizing four sites in Greenland. Months before the agreement was signed, a fifth station originally contemplated for Kangek Island in south Greenland was dropped from the planned program because of funding limitations and geographical obstacles to its erection. Construction on the four Greenland sites commenced in July 1958. Positioned across the Greenland Ice-Cap along the 67th parallel, the four stations -- separated by an average distance of 163 miles -- were situated (west to east) at Holsteinsborg (Qaqatoqaq), Ice-Cap Site No. 1, Ice-Cap Site No. 2 and Kulusuk Island. All four acted as auxiliary stations under the Cape Dyer, Baffin Island Main Station occupying the easternmost site of DEW Line proper. Support for the Greenland stations emanated from Sondrestrom Air Base. In October-November 1960 the Air Force accepted them, whereupon Western Electric commenced installing the electronic equipment.

[Cont'd] 1958, pp. 57-61; Jul-Dec 1958, pp. 84-87; Jan-Jun 1959, pp. 48-50; Jan-Jun 1961, pp. 44-45; C&E Digest, Vol IX, No. 4 (Apr 1959) pp. 44-47; Bell Tele Lab, for Western Elec Co, Operational Evaluation Tests of the DEW Line Aleutian Segment, 1 Sept 1959 [ADC Tech Lib]; USAF Rpt, Operational Survey of the Aleutian Segment, DEW Line and Rearward Communications of the DEW Line, 30 March-15 April 1960, ca. Apr 1960 [Doc 30 in Hist of ADC, Jul-Dec 1960].

The FPS-30 search set and accompanying radome were of rugged construction, having to endure Greenland winds known to blow 150 miles per hour, and winter temperatures known to drop as low as -80 degrees Fahrenheit. Like the FPS-19, the FPS-30 radar contained an associated audio alarm system that sounded upon pick-up of an aerial target. The FPS-30, itself, was an L-band, medium-powered set capable of radiating both radar and IFF signals from its feedhorn. Constructed by Bendix Corporation, the FPS-30 operated in a frequency band between 570 and 630 mcs, at 400 kilowatts peak power. It could detect a target up to 200 nautical miles away, flying up to 100,000 feet altitude. Communications were established between the easternmost Greenland station (Kulusuk Island) and the Naval Operations Control Center on Iceland, where also several ground radars operated under CINCLANT's jurisdiction. It came as no surprise that the Federal Electric Company was awarded the operations and maintenance contract for the four Greenland stations. 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 to a maximum distance of 200 nautical miles away.

Meantime, when the Greenland sites became operational in August 1961, the Navy-operated Atlantic Barrier (working four DER and four AEW stations between Argentia, Newfoundland and the Azores since July 1957) was switched to the G-I-UK (i.e., Greenland-Iceland-United Kingdom) configuration. Two AEW positions were involved, one of which was manned on a random basis. Radar coverage thus extended from Greenland to Iceland, thence by water to the Faeroes Islands, finally to Scotland. A permanent Greenland ADIZ was negotiated with Denmark that dovetailed between the Iceland ADIZ on one side and DEWIZ on the other.[35]

Retrenchment and Contraction. By late 1961, DEW Line operations had been stretched both ways to their utmost limit. They reached half way round the world from Scotland

35. C&E Digest, Vol XI, No. 2 (Feb 1961) pp. 9-13; NORAD Historical Summaries, Jul-Dec 1957, pp. 53-56; Jan-Jun 1958, pp. 57-61; Jul-Dec 1958, pp. 87-90; Jul-Dec 1960, pp. 22-24; Jul-Dec 1961, pp. 36-37; Hist of ADC, 1958, pp. 88-92; Jan-Jun 1959, pp. 75-79; Jul-Dec 1960, pp. 28-29, 39-40; Jul-Dec 1961, pp. 49-56; ADC, Air Defense Command's Ground Radars, n.d., p. 27 [HRF]; ADC Operations Plan for Greenland Extension to the DEW System 10-60, 25 Mar 1960 [ADC Tech Lib]; Msg 64 ODC 27-I-168, 64 AD to ADC, 28 Sep 1961 [Doc 161 in Hist of ADC, Jul-Dec 1961]; ADC, Elec Sys Div, Weekly Activities Report 23-29 Mar 1962 [HRF]; ADC Rpt, ADOAC-ER to ADCCR, "DEW East Status Report for the Period Ending 15 December 1961," 21 Dec 1961 [Doc 154 in Hist of ADC, Jul-Dec 1961].

clear across the top of North America to Midway Island -- close to 12,000 miles in all. The last loose seams and remnants of the system had been tightly spliced to form a single, fully integrated network. DEW Line thus lay fully manned and equipped: poised to detect, track and report any bomber attacks aimed at destroying North American targets. While refinements and improvements to the network continued, what was to follow in later years, for the most part, was retrenchment and contraction of DEW coverage.

Perhaps the chief reason for this was the shift in enemy threat, from one comprised mainly of manned bombers, to one of ICBM's supported by later waves of manned bombers. DEW Line was simply never meant to cope with the ICBM threat, for which the BMEWS network was designed. The DEW Line, therefore, grew to assume a subordinate role -- that of acting as the surveillance net calculated, by virtue of its existence, to delay manned bomber attacks planned to follow up the initial shower of ICBM weapons. In being situated about 2,000 miles north of the U.S.-Canadian border, constant DEW Line surveillance, it was reasoned, would influence an enemy to hold back his bombers from crossing DEW Line until after his ICBM's were launched, so as not to alert the U.S. prematurely of the ICBM attack. When bombers did arrive in the Arctic region, DEW stations, therefore, could still serve to alert NORAD so that surviving elements of ADC's and RCAF's dispersed interceptor forces could be on hand to meet them. While this modified role was essential to the nation's safety, it was something less than the first line of air defense that DEW Line formerly enjoyed. As later stated by Secretary of Defense Robert S. McNamara:

> The surveillance, warning and control network constructed during the 1950's 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 1960's], 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 1950's are either obsolete or of marginal value to our overall defense.

Consequently, economies might plausibly be effected. The contraction that followed occurred at the DEW Line extremities under the Navy's charge and the retrenchment along DEW Line proper.[36]

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36. Secy of Def, Robert S. McNamara, Extract of Statement Before the House Armed Services Committee on the Fiscal Year 1966-70 Defense Program and 1966 Defense Budget, 18 Feb 1965 [HRF].

At the turn of the decade, hopes were high that important improvements would be made to DEW Line proper, little presaging what was in store for it in a few years' time. TACAN navigation aids were programmed and, eventually, installed at certain sites; Selection Identification Feature (SIF) equipment was incorporated at a number of stations; major additions were planned to improve lateral communications, including improvements to the DEW Drop Communications (between Cape Dyer and the BMEWS site at Thule Air Base), as well as modifications to multiply available FRC-45 (tropospheric scatter) UHF channels, to increase the capacity for lateral communications traffic. Crypto-security devices were programmed to safeguard DEW Line communications from enemy interception. All these alterations were planned to enhance DEW Line's ability to detect and communicate the air picture, and help to service friendly aircraft in need of aid. The rearward communications system was again tested, and checked out as 98 per cent reliable. Project High Look was conducted in the summer of 1961 to test the FPS-19 high altitude capability. And, surprisingly, the FPS-19 demonstrated a capacity to detect some targets as high as 200,000 feet up. An ORI of two DEW Line sectors the following summer equally showed off the FPS-19 to good advantage, although crews were still bothered by false alarms triggered by its radalarm system. Nine of 10 "faker" aircraft were detected. The tenth penetration, a low-level flight designed to test the FPS-23 doppler system escaped detection. The ORI team, to be sure, reported that[37]

> Doppler radars were not fully effective. Although performance readings indicated these radars were operating within acceptable standards, five faker aircraft penetrations and a number of friendly aircraft penetrations did not register.

ADC had been aware of FPS-23 deficiencies from the beginning, as mentioned above. Nothing seemed able to correct its numerous faults and shortcomings. When NORAD, in 1962, offered to raise its low-altitude requirement for DEW Line to 5,000 feet (in view of the shift of major threat to ICBM's) to enable ADC to rid DEW Line of at least some of its FPS-23's, ADC rejoiced at the opportunity. In fact, ADC

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37. Rpt, ADC, Operational Readiness Inspection of DEW Line Sectors Fox and Dye, 4601st Spt Wg (DEW) and 64 Air Division, 13 Jul 1962 [HRF]; Rpt, 4754 Rdr Eval Sq (Technical), Project High Look DEW Line AN/FPS-19 Radars, Jul-Aug 1961, Sep 1961 [USAF Historical Archives, AU]; Hist of ADC, Jul-Dec 1960, pp. 31-38; Jan-Jun 1961, pp. 34-39; and Jul-Dec 1961, pp. 44-49; NORAD Historical Summary, Jul-Dec 1962, pp. 29-30; Hist of 64 AD, Jul-Dec 1961, pp. 47-48, 51.

quickly joined in the chorus of voices crying to root out all FPS-23 radars, confiding to USAF in November 1962:[38]

> The fact is that the AN/FPS-23 has demonstrated virtually no operational usefulness and deletion efforts have been under way for some time. The recent relaxation of coverage criteria along the DEW Line partially reflects the NORAD recognition of the failure of the AN/FPS-23 in providing any useful coverage....Operation of the AN/FPS-23's should be discontinued as soon as possible.

Certain readjustments were made to the FPS-19 to enhance its capacity for detecting low-altitude as well as high-altitude targets; and negotiations were consummated with Canadian officials to iron out problems associated with the abolition of FPS-23 sites on Canadian soil. Finally, USAF ordered inactivation of the 28 FPS-23 Intermediate sites in July 1963. Twenty of the stations were in Canada; the other eight, in Alaska. When inactivated, effective 21 July 1963, the number of sites along DEW Line proper were halved from 57 to 29. Just twenty days before, effective 1 July 1963, ADC discontinued the 64th Air Division (Defense), which since 1957 had helped service DEW Line needs. The 64th's functions

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38. Msg ADOAC-EE 3241, ADC to USAF, 26 Nov 1962 [HRF]; Msg ADOAC-EE 2771, ADC to USAF, 17 Oct 1962 [HRF]; ADC, Electronic Systems Div, Weekly Activities Report, 19-25 Oct 1962 [HRF]; NORAD Historical Summaries, Jul-Dec 1962, pp. 27-28; Jan-Jun 1963, pp. 16-17.

concerning DEW Line [including ministering to the wants of the 4601st Support Wing (DEW) since 1 October 1960], were transferred to the 26th Air Division (SAGE) the day of its inactivation.[39]

This was not all. With DEW Line proper thinned down to half its original number of units, ADC was asked to calculate what number of FPS-19 sites might further be weeded out of the system, yet preserve capability enough to detect, within 50 per cent probability, a B-47-size bomber. Upon analyzing the matter, ADC admitted that, under these terms, eight of the six Aleutian FPS-19's coulc be scrapped, plus three of the six Aleutian FPS-19's. While ADC, as of April 1965, had not been told to forfeit any of these 11 sites, it remained to be seen whether or not the Command would be asked to part with any or all of them at some future date.[40]

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39. Msg ADOAC-EE 1500, ADC to 64 AD, 1 May 1962 [HRF]; Msg ADOAC-EE 2116, ADC to 64 AD, 9 Aug 1962 [HRF]; Msg ADOAC-EE 2386, ADC to CINCNORAD, 7 Sep 1962 [HRF]; Msg ADMLP 2201, ADC to USAF, 21 Jun 1963 [HRF]; Msg AFOAPDB 75683, USAF to ADC, 2 Jul 1963 [HRF]; NORAD Historical Summary, Jan-Jun 1963, pp. 16-17; Msg ADOOP-EI 2319, ADC to USAF, 17 Jul 1964 [HRF].

40. ADC, Elec Sys Div, Weekly Activities Reports, 26 Oct-1 Nov 1962 and 2-8 Nov 1962 [HRF]; NORAD Historical Summaries, Jul-Dec 1962, p. 28; Jan-Jun 1963, pp. 16-17.

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Far more certain was the fate of the Navy-operated DEW extensions attached to either end. Ever since 1960, the Navy Department had hankered to terminate, if not both its extensions, at least the Pacific Barrier. The Navy stood to profit by effecting sizeable economies in both money and manpower. But times being what they were, and the assessed threat being still postulated chiefly on bombers, this proposal, as mentioned above, was vetoed by the Defense Department. But in 1964, with the change in major threat discussed above, the times had ripened for just such a change. The Navy, accordingly, appealed to the JCS and the Defense Department to authorize the abolition of both the Pacific and G-I-UK Barriers. In December 1964, Secretary of Defense McNamara approved the Navy's proposal. Beginning in January 1965, a gradual phase-down commenced that, by September 1965, would spell an end to the Navy contribution to extending DEW Line coverage. With its four FPS-30 Greenland sites on one side, its six FPS-19 Aleutian sites on the other,, and its 29 FPS-19 sites in between along DEW Line proper, the DEW Line would be expected to continue grinding away at its appointed mission without benefit of airborne or seaborne assistance.[41]

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41. Msg ADOTT-C 00722, ADC to ADC Computer Programming System Training Office (APASTO), 5 Mar 1965 [HRF]; NORAD Historical Summary, Jul-Dec 1964, pp. 40-42.

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